

HANDBOOK

SOCIAL AND ENVIRONMENTAL COMPLIANCE
IN BANGLADESH'S PLASTICS AND LIGHT
ENGINEERING INDUSTRY

Acknowledgements

The Handbook on Social and Environmental Compliance in Bangladesh's Plastic and Light Engineering Industries is developed through a collaboration of the Ministry of Commerce (MoC) and the World Bank Group (WBG). The initiative was funded by the Bangladesh Investment Climate Fund II program (a Department for International Development/UK Aid trust fund supported by the Government of the United Kingdom) of the International Finance Corporation (IFC), a sister concern of the World Bank Group. Throughout the groundwork phase, the handbook has drawn insights from a number of individuals, ministries, government agencies, industry associations, organizations and institutions from Bangladesh and abroad.

The overall guidance for the development of the handbook was provided by a core team at the MoC, headed by Mr. Obaidul Azam, Additional Secretary and Project Director, Export Competitiveness for Jobs Project. Inputs from other high level MoC officials were also taken from time to time as needed. The core team expresses its gratitude to the Ministry of Industries, the Ministry of Labor and Employment, and Department of Environment of the Government of Bangladesh for all their valuable inputs.

Technical guidance was also received from the WBG team, consisting of Hosna Ferdous Sumi, Private Sector Specialist; Thomas Farole, Lead Economist; Michael Olavi Engman, Senior Economist; Mrinal Sircar, Senior Consultant; M Shaker Bin Shams, Consultant and Rakibul Hasan, Consultant. Technical assistance was provided by the Consulting Service International Ltd. (CSI). The team remains thankful to all the individuals, organizations and institutions whose valuable inputs and insights have enriched the publication.



Table of content

Table of content	1
List of tables	5
List of figures	6
List of abbreviations	7
1 Introduction	12
2 Labor Standards	14
2.1 Licenses and Others	14
2.2 Forced Labor	16
2.3 Freedom of Association.....	17
2.4 Right to Organize and Collective Bargaining	18
2.5 Equal Remuneration.....	19
2.6 Discrimination	21
2.7 Minimum Age.....	23
2.8 Regular Employment.....	24
2.9 Working Hours	26
2.10 Wages and Benefits.....	27
3 Occupational Safety and Health – General Requirements	30
3.1 Health and Safety Committee	30
3.2 Emergency and Evacuation Plans.....	31
3.3 Health Examinations	34
3.4 Lighting.....	34
3.5 Housekeeping.....	36
3.6 Electrical Safety	38
3.7 Fire Safety	41
3.8 Machine Safety.....	44
3.9 Personal Protective Equipment (PPE)	46
3.10 Ventilation.....	47
3.11 Chemical Management	49
3.12 Noise Management	51
3.13 First Aid	52
3.14 Training	54
4 General Guidelines for Environmental Compliance	56
4.1 Waste Management.....	56
4.1.1 Solid Waste Management.....	57



4.1.2	Liquid Waste Management.....	58
4.2	Water Consumption	58
4.3	Air Emissions	60
4.4	Energy Consumption	61
5	Industry-Specific Compliance Requirements	63
5.1	Plastics.....	63
5.1.1	Occupational Safety and Health	63
5.1.2	Environmental Challenges	72
5.1.2.1	Waste Management	72
5.1.2.2	Air Emissions	78
5.1.2.3	Energy Efficiency	80
5.1.2.4	Product Safety.....	81
5.2	Engineering Works	84
5.2.1	Occupational Safety and Health	84
5.2.2	Environmental Challenges	88
5.2.2.1	Waste Management	88
5.2.2.2	Air Emissions	89
5.2.2.3	Energy Efficiency	91
5.2.2.4	Product Safety.....	93
5.3	Electrical Goods.....	94
5.3.1	Occupational Safety and Health	94
5.3.2	Environmental Challenges	95
5.3.2.1	Waste Management	96
5.3.2.2	Air Emissions	99
5.3.2.3	Energy Efficiency	100
5.3.2.4	Product Safety.....	100
5.4	Electronics	104
5.4.1	Occupational Safety and Health	104
5.4.2	Environmental Challenges	106
5.4.2.1	Waste Management	106
5.4.2.2	Air Emissions	108
5.4.2.3	Energy Efficiency	108
5.4.2.4	Product Safety.....	109
5.5	Batteries and Accumulators	112
5.5.1	Occupational Safety and Health	112
5.5.2	Environmental Challenges	118
5.5.2.1	Waste Management	118



5.5.2.2	Air Emissions	121
5.5.2.3	Energy Efficiency	123
5.5.2.4	Product Safety.....	123
5.6	Bicycles	126
5.6.1	Occupational Safety and Health	126
5.6.2	Environmental Challenges	127
5.6.2.1	Waste Management	127
5.6.2.2	Air Emissions	130
5.6.2.3	Energy Efficiency	132
5.6.2.4	Product Safety.....	132
5.7	Motorcycles and Automobiles	134
5.7.1	Occupational Safety and Health	134
5.7.2	Environmental Challenges	138
5.7.2.1	Waste Management	138
5.7.2.2	Air Emissions	140
5.7.2.3	Energy Efficiency	142
5.7.2.4	Product Safety.....	143
5.7.2.5	International Standards	145
6	Concluding remarks	148
7	References.....	149
8	Annex.....	153
8.1	Labor Standards	153
8.1.1	Guidelines for Corporate Businesses on Human Rights.....	153
8.1.2	Guidelines on Licenses.....	154
8.1.2.1	Procedure for Getting Fire License	154
8.1.2.2	Procedure for Getting Trade License	154
8.1.2.3	Procedure for Approval of Factory Layout Plan and Extension Layout Plan.....	155
8.1.3	Guidelines on Preventing Forced Labor	155
8.1.4	Guidelines on Ensuring Freedom of Association	159
8.1.5	Guidelines on Initiating a Collective Bargaining Process	161
8.1.6	Guidelines on Equal Remuneration	161
8.1.7	Guidelines on Discrimination	162
8.1.7.1	Guidelines on Discrimination at the Workplace	162
8.1.7.2	Guidelines for Establishing a Grievance Committee.....	163
8.1.7.3	National Guidelines for Dealing with Sexual Harassment	164
8.1.7.4	Good Practice for Dealing with Sexual Harassment	168



8.1.8	Guidelines on Minimum Age	170
8.1.9	Guidelines on Compliance with Regular Employment.....	171
8.1.10	Guidelines on Working Hours	171
8.1.11	Guidelines on Wages and Benefits	173
8.2	Occupational Safety and Health (OSH).....	176
8.2.1	Guidelines on Health and Safety Committees	176
8.2.2	Guidelines on Emergency and Evacuation Plans	177
8.2.3	Guidelines on Lighting.....	179
8.2.4	Guidelines on Good Housekeeping.....	180
8.2.5	Guidelines on Electrical Safety.....	181
8.2.6	Guidelines on Fire Safety	182
8.2.7	Guidelines on Machine Safety	183
8.2.8	Guidelines on Personal Protective Equipment (PPE)	185
8.2.9	Guidelines on Ventilation	186
8.2.10	Guidelines on Chemical Management.....	187
8.2.11	Guidelines on Noise Management.....	190
8.2.12	Guidelines on First Aid	191
8.2.13	Guidelines on Trainings.....	194
8.3	Guidelines for Environmental Compliance.....	195
8.3.1	Environmental Clearance Certificate	195
8.3.2	Waste Management	198



List of tables

Table 1: Worker-member ratio in safety committee	31
Table 2: Lighting and energy efficiency	35
Table 3: Emission level standards for direct discharges of effluents from industrial units or project waste	58
Table 4: Types of waste plastics	73
Table 5: Biodegradable plastics and their properties	76
Table 6: Waste management of ferrous and non-ferrous metals	88
Table 8: Action and suspension levels	117
Table 8: Composition of lead-acid battery scrap	118
Table 9: Emission standards for diesel driven vehicles during registration – light and medium duty	143
Table 10: Emission standards for diesel driven vehicles during registration – heavy duty	143
Table 11: Emission standards for petrol and CNG driven vehicles during registration – light and medium duty	144
Table 12: Emission standards for petrol and CNG driven vehicles during registration – heavy duty	144
Table 13: Euro emission standards applicable to motorcycles (≥ 150 cc)	145
Table 14: Emission standards for two-wheelers in India	146
Table 15: Korea motorcycle emission standards	146
Table 16: Monthly maintenance checklist	179
Table 17: Corrective actions and follow-up on lighting maintenance	180
Table 18: Electrical maintenance checklist	181
Table 19: General fire safety checklist	183
Table 20: General machine safety checklist	184
Table 21: Machine maintenance schedule (annual planning)	185
Table 22: PPE assessment checklist	186
Table 23: Air quality standards	187
Table 24: Incompatible chemicals	190
Table 25: Noise level standards (ECR 1997)	191
Table 26: Permissible noise exposure levels in the United States	191
Table 27: First aid content	192
Table 28: First aid box checklist	193



List of figures

Figure 1: Hierarchy of controls.....	44
Figure 2: Waste management hierarchy.....	56
Figure 3: Typical waste plastic reprocessing stream in low income countries	74
Figure 4: 5S and housekeeping	181



List of abbreviations

ABS	Acrylonitrile butadiene styrene
ANSI	American National Standards Institute
As	Arsenic
ASTM	American Society for Testing and Materials
BAT	Best Available Technique
BLA	Bangladesh Labor Act
BLR	Bangladesh Labor Rules
BIS	Bureau of Indian Standards
BNBC	Bangladesh National Building Code
BOD	Biological Oxygen Demand
BREF	Best Available Techniques Reference Document
BRTA	Bangladesh Road Transport Authority
BSCI	Business Social Compliance Initiative
BSI	British Standards Institution
BSTI	Bangladesh Standards and Testing Institution
BUET	Bangladesh University of Engineering and Technology
Cd	Cadmium
CDA	Chittagong Development Authority
CDI	Capacitor Discharge Ignition
CE	European Conformity
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CFC	Chlorofluorocarbons
CFL	Compact Fluorescent Lamp
CH₄	Methane
CKD	Completely Knocked Down
CNC	Computerized Numerical Control
CNG	Compressed Natural Gas
CO	Carbon monoxide
COB	Constitution of Bangladesh
COD	Chemical Oxygen Demand
COS	Cast-on-strap
CO₂	Carbon dioxide
CPRI	Central Power Research Institute
CPSC	Consumer Product Safety Commission



CSO	Civil Society Organization
CSR	Corporate Social Responsibility
Cr	Chromium
Cu	Copper
dB(A)	A-weighted decibels
DIFE	Department of Inspection for Factories and Establishment
DoE	Department of Environment
EC	European Council
ECE	European Commission for Europe
ECA	Environmental Conservation Act
ECC	Environmental Clearance Certificate
ECHA	European Chemicals Agency
ECR	The Environment Conservation Rules
EEA	European Economic Area
EEC	European Economic Community
EEE	Electronics and Electrical Equipment
EMP	Environmental Management Plan
EN	European Standards (actually: European Norms)
EPA	United States Environmental Protection Agency
EPB	Export Promotion Bureau
ETP	Effluent Treatment Plant
ETSI	European Telecommunication Standards Institute
EU	European Union
FCM	Food Contact Materials
FDA	United States Food and Drug Administration
FEA	Finite Element Analysis
FHSA	United States Federal Hazardous Substances Act
FSSC	Food Safety System Certification
Gm	Gram
GRAS	Generally Recognized as Safe
GS	Geprüfte Sicherheit (German for: Tested Safety)
GVW	Gross vehicle weight
GWP	Global Warming Potential
HAP	Hazardous air pollutant
HC	Hydrocarbons



HCFC	Hydrochlorofluorocarbons
HDPE	High-density polyethylene
HFC	Hydrofluorocarbons
HFO	Hydrofluoroolefin
Hg	Mercury
HOD	Head of Department
HR	Human Resources
IATF	International Automotive Task Force
IEC	International Electrotechnical Commission
IEE	Initial Environmental Examination
ILO	International Labor Organization
ISO	International Organization for Standardization
IUE	International Union of Environment Commission
IULTCS	International Union of Leather Technologists and Chemists Societies
JIS	Japanese Industrial Standards
KC	Korea Certification
Km	Kilometer
kWh	Kilowatt hour
L	Liter
LDPE	Low-density polyethylene
LED	Light Emitting Diodes
LGED	Local Government Engineering Department
Mg	Milligram
MoU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
MRSL	Manufacturing Restricted Substances List
NDT	Non-destructive testing
NFPA	US National Fire Protection Association
NO_x	Nitrogen oxides
ODP	Ozone Depletion Potential
OSH	Occupational Safety and Health
OSHA	US Occupational Safety and Health Administration
OT	Overtime
PC	Participation Committee
PC	Polycarbonate



PCDD/F	Polychlorinated dibenzo-p-dioxin and polychlorinated dibenzofuran
PA	Polyamid
Pb	Lead
PBA	Polyhydroxybutyrate
PBS	Polybutylene succinate
PCL	Polycaprolactone
PE	Polyethylene
PET	Polyethylene therephthalate
PHA	Polyhydroxyalkonates
PLA	Polylactic acid
PLC	Programmable Logic Controlling
PM	Particulate matter
PP	Polypropylene
PPE	Personal Protective Equipment
PS	Polystyrene
PU	Polyurethane
PVC	Polyvinylchloride
PVC-U	Polyvinyl Chloride - Unplasticized
RAJUK	Rajdhani Unnayan Kartripakkha
REACH	Registration, Evaluation, Authorization and Restriction of Chemicals
RoHS	Restriction of Hazardous Substances
RSL	Restricted Substances List
S	Sulfide
SA 8000	Social Accountability Certification
SDS	Safety Data Sheet
Se	Selenium
SKD	Semi-knocked Down
SO₂	Sulfur dioxide
SPM	Suspended Particulate Matter
TDS	Technical Data Sheet
TGA	Thermogravimetric
Tl	Thallium
TNA	Training Needs Assessment
UK	United Kingdom
UL	Underwriters Laboratories



US	United States
USA	United States of America
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e. V. (German for: Association of Electrical Engineering, Electronic Information Technology, and all associated companies)
VFC	Volatile Fluorocarbons
VHC	Volatile Hydrocarbons
VOC	Volatile Organic Compound
WPC	Worker Participation Committee
ZDHC	Zero Discharge of Hazardous Chemicals
Zn	Zinc



1 INTRODUCTION

The handbook presented intends to unfold the potential for improving social and environmental compliance, including Occupational Safety and Health (OSH), in the plastics and light engineering industry. Providing an operational translation of laws, regulations and standards, it describes the actions required to ensure that all operations along the supply chain, from the recycling to the processing and manufacturing of specific products, are consistent with national legislation and international environmental and social standards.

The handbook is based on a comprehensive value chain analysis of Bangladesh's plastic and light engineering industry, which has been carried out from October 2018 to January 2019. The following sectors were under review:

- Plastics
- Engineering works¹
- Electrical goods
- Electronics
- Batteries and accumulators
- Bicycles
- Motorcycles and Automobiles

The analysis focused on the manufacturing node of the supply chain as both industries lack strongly developed backward linked activities.

This document presents technical information and recommendations based on the current understanding of a range of laws, regulations and good practices. Given the diversity of the plastics and light engineering industries and the wide range of products, the handbook does not provide a complete overview of all hazards and potential remediations.

A good knowledge of the state of technology in plastics and light engineering is essential for reducing hazards at the workplace and improving processes. The Constitution of Bangladesh, the Bangladesh Labor Law and the Environment Conservation Act and Rules contrasted with international standards and conventions provide a reference for challenges related to labor rights, occupational safety and health, and the environment.

This manual is intended for practitioners². It identifies non-compliances – i.e. the scope for improvement – and comes up with preventive and corrective actions which are set into relation to social, environmental and economic implications. These recommendations refer to currently best available techniques (BAT) or good practices that are sustained by national labor laws and international standards. Social, environmental and economic benefits are highlighted for workers, enterprises and the public. If applicable and available, examples for concrete savings in different processes are given.

The value of this handbook is to provide guidance in making decisions that align with national laws and international standards. It is a non-binding document that offers preventive and responsive measures

¹ 'Engineering Works', including industrial tooling and machinery, was added to provide a more comprehensive picture of the challenges in the light engineering industry.

² All information given in this handbook are accurate at time of publication. For up-to-date information on national labor laws and environmental regulations as well as on international standards, visit the corresponding websites.



for compliance-related challenges. Technical guidance and trainings may be necessary to implement these recommendations.

The handbook is divided into four main sections (Section 2 to 5):

Section 2 addresses the labor standards relating to international labor conventions. The next section deals with general occupational hazards that workers are exposed to in manufacturing processes. Section 4 provides general guidelines for environmental compliance in manufacturing industries, focusing on waste management, water consumption, air emissions, and energy consumption. While these sections highlight common rules and regulations that are applicable to all manufacturing businesses in Bangladesh, special attention is paid to industry-specific requirements for compliance in Section 5. Here, the plastic industry and each of the light engineering sub-sectors are examined for occupational hazards and environmental challenges, maintaining a similar structure as in the general sections. Waste management (solid, liquid, and recycling activities if applicable), air emissions, and energy efficiency are complemented by the national and international requirements for product safety. Markets like the EU and the US set the highest safety standards in all industries and product categories and thus provide the reference for this handbook. Regional examples for select goods of the electrical, electronics, battery and motorcycle industry are based on India and South Korea. Awareness of product safety standards is crucial for improving the integration of the industries concerned in the global market. The handbook ends with concluding remarks and an annex that provides a variety of guidelines and checklists for practitioners to work with.

2 LABOR STANDARDS

Labor standards address the well-being of the workers in the workplaces. The ILO core conventions serve as the main reference for the protection of basic worker rights. Companies are expected to implement and respect the United Nations Guiding Principles on Business and Human Rights. These Guiding Principles require businesses to treat any human rights abuse as a legal compliance issue wherever they operate.

A proper organizational structure along with defined duties and responsibilities are the most important factors for an effective implementation of labor standards within organizations.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
No personnel has been assigned to implement social compliance standards (e.g. BSCI, SA 8000) or customer codes of conduct.	Assign one person in charge for social compliance. As the person in charge, implement the code of conduct.	Proper implementation of social compliance code and adherence to requirements Ensured better monitoring of social compliance	Customer code of conduct BSCI, SA 8000
Welfare officer is not appointed in factories with >500 workers	Appoint the necessary amount of welfare officers. Appoint at least one welfare officer in factories with a workforce >500 employees.	Compliance with legislation in Bangladesh Communication between workers and management will be more effective. Workers have the chance to talk about their personal issues.	Bangladesh Labor Rules (BLR) 2015 BSCI, SA 8000

For more information on the corporate responsibility to respect human rights, see Annex 8.1.1.

2.1 LICENSES AND OTHERS

Licenses, such as trade license, fire license or building/lay out plan, are mandatory for businesses in manufacturing industries. To obtain licenses and other permits, businesses are requested to apply to and be authorized by the corresponding Government authorities. All licenses and permits must be renewed before expiry. Running a business or manufacturing operation without valid licenses and permissions is treated as a violation of the national legislation.

In the following, challenges in obtaining licenses and how they can be overcome are described.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Fire license does not cover all units/buildings/floors.	Take care that all units, buildings and floors of the factory compound are covered by the fire license. Make an application to the fire service and civil defense authority for the fire license of the missing units / buildings / floors.	Compliance with legislation in Bangladesh. The risk of fines and litigation is reduced. The risk of interruptions and stagnation of production is reduced.	Fire Prevention Act 2003 BSCI, SA 8000



		Licenses required for loan application are available.	
		Sufficient firefighting equipment for all units / buildings / floors is available.	
Building layout and/or floor plan have not been approved by the government authority.	Provide the approved building layout and floor plans by the government authority. Apply for the building construction layout at the Rajuk/LGED/CDA and for the floor plan approval at the "Inspector of Factories".	Compliance with legislation in Bangladesh. The risk of fines and litigation is reduced. The risk of interruptions and stagnation of production is reduced. Licenses required for loan application are available. The workers' life safety is ensured.	Bangladesh Labor Act (BLA) 2006 BLR 2015 Bangladesh National Building Code (BNBC) 2006 BSCI, SA 8000
A valid factory license is not available.	Take care that you have a valid license as per government authority of Bangladesh required. Apply for the factory license at the Department of Inspection for Factories and Establishment (DIFE).	Compliance with legislation in Bangladesh. Factory is allowed to apply for other licenses (e.g. fire license, EPB license, bonded warehouse license). The risk of fines and litigation is reduced. The risk of interruptions and stagnation of production is reduced. Licenses required for loan application are available. Workers are provided insurance benefit (if any).	BLA 2006 BSCI, SA 8000
A group insurance that covers each individual staff member and worker is not available.	Cover each individual staff member and worker under a proper group insurance policy. Apply for the group insurance at any recognized insurance company.	Compliance with legislation in Bangladesh Financial security for dependents in case of deadly accident. Employees are attracted and retained by the group insurance scheme. The group insurance scheme promotes employee satisfaction.	Bangladesh Labor (Amendment) Act 2013 BSCI, SA 8000
A valid trade license is not available.	Take care that you have a valid trade license as per government authority required.	Compliance with legislation in Bangladesh. The factory is allowed to	Local Government Ordinance



Apply for the trade license at the concerned local government authority. i.e. Rajuk, City Corporation, Pourashava, Union porishod	<p>apply for other licenses (e.g. factory license, fire license, bonded warehouse license).</p> <p>The risk of fines and litigation is reduced.</p> <p>The risk of interruptions and stagnation of production is reduced.</p> <p>Licenses required for loan application are available.</p> <p>Workers are provided insurance benefit (if any).</p>	BSCI, SA 8000
---	--	---------------

Checklists of what is required to apply for a fire license, factory layout and extension layout plan, and trade license are outlined in Annex 8.1.2.

2.2 FORCED LABOR

According to the ILO, *"forced labor refers to situations in which persons are coerced to work through the use of violence or intimidation, or by more subtle means such as accumulated debt, retention of identity papers or threats of denunciation to immigration authorities."*³

All forms of forced labor are prohibited according to the Article 34 of the "Constitution of Bangladesh".

Many forms of forced labor can be observed in an organization: workers are not allowed to leave the workplace if they fail to complete their work target or quota; or they are not allowed to use the toilets; or workers have to work for a very long period to repay the loan or an advance taken against salaries.

How to deal with forced labor is presented below.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Employees are not allowed to leave the factory compound at any time they want after work.	Make sure workers are free to leave the factory compound at any time after their work.	<p>Compliance with legislation in Bangladesh.</p> <p>Free choice of employment is ensured.</p> <p>Productivity increases if workers enjoy free choice of employment with adequate payment and working hours.</p> <p>Firms do not need to invest in coercive capacity (e.g. surveillance, punishment).</p>	<p>Constitution of Bangladesh</p> <p>BSCI, SA 8000, ILO</p>

³ International Labour Organization 2014



		Firms prevent costs generated by strikes and rebellions against coercion (e.g. lost production and revenue).	
		Firms do not need to invest in avoiding state intervention (e.g. bribery, corruption, profit sharing).	
Workers are not allowed to leave the factory compound unless the daily target production is reached.	Employees have the right to leave the factory compound at any time they want after work. Overtime must always be voluntary. Do not hinder workers from leaving the factory after the working day, no matter how high the output was.	Compliance with legislation in Bangladesh. Free choice of employment is ensured. Productivity increases if workers enjoy free choice of employment with adequate payment and working hours. Firms do not need to invest in coercive capacity (e.g. surveillance, punishment). Firms prevent costs generated by strikes and rebellions against coercion (e.g. lost production and revenue). No need for firms to invest in avoiding state intervention (e.g. bribery, corruption, profit sharing).	Constitution of Bangladesh BSCI, SA 8000 ILO

For a checklist of how forced labor can be avoided, see Annex 8.1.3.

2.3 FREEDOM OF ASSOCIATION

Workers have the right to form and join unions or organizations of their own choosing with the objective of promoting or protecting the employees' interest (ILO conventions 87, 98, 135 and ILO recommendation 143, Bangladesh Labor Law and Article 38 of the Constitution of Bangladesh).

Under any circumstances, employers are not allowed to prevent workers from forming and joining unions or organizations and take disciplinary measures.

In an organization where 50 or more workers are employed, a 'Participation Committee' should be formed. The committee must comprise both employers' and workers' representatives. The workers' representative must be elected by the workers. The "Participation Committee" will work to promote mutual trust, understanding and cooperation between the employer and the workers.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
No valid and properly	Provide valid and properly elected	Compliance with legislation in	BLA 2006



elected union or workers' representative, i.e. participation committee (PC), is available and/or allowed.	union or workers' representatives. Document the election process.	Bangladesh. Freedom of association is ensured. Communication between workers and management is ensured. Disputes are settled by discussion, not by confrontation. Trust between management and workers is established.	BSCI, SA 8000 ILO
The PC has not been formed as per legal requirements.	Form a PC as stated in the Bangladesh Labor Rules 2015 (see Annex 8.1.4). The PC should be composed by not less than six and not more than 30 members, considering the number of employees. The worker's representatives of the PC should be elected by the workers. The worker's representatives of the PC should not be less than management representatives.	Compliance with legislation in Bangladesh. Valid negotiation between workers and management is ensured. Trust between management and workers is established if PC has been formed properly.	Bangladesh Labor (Amendment) Act 2013 BLR 2015 BSCI
PC meetings are not held on a regular basis.	PC members meet at least once in every two months. Document the meetings, discussions and outcomes/decisions.	Compliance with legislation in Bangladesh. The outcome of negotiation among workers and management will improve in the course of the time. Trust between management and workers is established as PC meets on a regular basis.	BLA 2006 BSCI
The PC is accused of being biased.	The PC is composed of at least as many workers' representatives as management representatives. The representatives of the workers and the management are expected to settle disputes by discussion.	Compliance with legislation in Bangladesh Disputes are settled by discussion between representatives of the management and the workers. Mutual trust and understanding for the decisions are achieved.	Bangladesh Labor (Amendment) Act 2013

Recommendations on how freedom of association can be achieved are provided in Annex 8.1.4.

2.4 RIGHT TO ORGANIZE AND COLLECTIVE BARGAINING



Collective bargaining is a negotiation process between representatives of the employer and the employees to promote and protect the employees' interest in matters of wages, occupational safety and health, and other issues.

In an organization, workers should be allowed to organize themselves independently and freely for the purpose of negotiations with the employer.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
A union or the workers' representative (e.g. PC) is not available to bargain with the factory management collectively and negotiate claims on the workers' behalf (e.g. wages, safety and health issues)	Allow a union or workers' representative to bargain with the management and negotiate claims of workers on their behalf regarding wages, safety and health, and other issues.	<p>Compliance with legislation in Bangladesh.</p> <p>The negotiation between workers and management on wages and safety and health issues, among others, is ensured.</p> <p>Both the employer and the employee act collectively and not individually in arriving at an agreement.</p> <p>Collective bargaining develops better understanding between the employer and the employees.</p> <p>The interests of both the employer and the employees are protected.</p> <p>Governmental interventions are kept at bay.</p>	<p>BLA 2006</p> <p>BSCI, SA 8000</p> <p>ILO</p>

How a collective bargaining process is initiated is presented in Annex 8.1.5.

2.5 EQUAL REMUNERATION

Workers should get equal wages for equal work, irrespective of gender, religion, race, political affiliations, etc. It should not be accepted by no means if the equal wage is not fixed or paid for equal work, which would lead to a violation of the Bangladesh Labor Law.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Equal remuneration for the same type of work e.g. between male and female workers is not ensured.	Give women and men equal pay for work of equal value.	<p>Compliance with legislation in Bangladesh.</p> <p>Equal remuneration for work of equal value is ensured for men and women.</p> <p>Offering the same pay scale for male and female workers can help a company avoid possible legal consequences.</p>	<p>BLA 2006</p> <p>BSCI, SA 8000</p> <p>ILO</p>



		<p>Companies that give equal pay to men and women may find an increase in productivity that comes from higher morale and employee commitment.</p> <p>Productive female workers may be more likely to remain with the organization if they believe they are being compensated fairly.</p> <p>Companies with a reputation for compensating men and women equally may have access to a larger talent pool when recruiting and hiring.</p> <p>Companies find it easier to recruit and retain a skilled workforce if they can select among equally skilled (and paid) male and female workers.</p> <p>A transparent pay structure gives employees the confidence that their pay is fair and non-discriminatory.</p>		
Women are often denied benefits, such as leave or maternity benefits.	<p>Make sure women are fairly treated in the grant of social benefits.</p> <p>Female workers must not receive less benefits than male workers.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Granting the same social benefits for male and female workers can help businesses avoid possible legal consequences.</p> <p>Companies that provide benefits equally to men and women may find an increase in productivity that results from higher morale and employee commitment.</p> <p>Productive female workers are more likely to be retained if they are treated fairly.</p>	BLA 2006	BSCI, SA 8000

For practical steps on how to achieve equal remuneration, see Annex 8.1.6.

2.6 DISCRIMINATION

Discrimination is defined in the ILO Convention No. 111 as “any distinction, exclusion or preference made on the basis of race, color, sex, religion, political opinion, national extraction or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation”.⁴ The Constitution of Bangladesh claims that all citizens are equal and are entitled to equal protection before the law.

In an organization, employees should not be discriminated against on grounds of race, creed, sex, marital status, political affiliation, national origin or sexual orientation. By law, employees must have equal opportunities for promotions, training, fringe benefits, and any other benefits.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Humiliating penalties and practices (e.g. fines, insults, inappropriate contact) are in place.	Humiliating penalties and practices are not allowed. No fine can be imposed to the workers for any kind of damage without following disciplinary procedures.	<p>Compliance with legislation in Bangladesh.</p> <p>The workplace is free from discrimination, sexual harassment and vilification.</p> <p>Workplace relations are smoother, with less conflict and disruption, and reduced employee turnover.</p> <p>The workers’ morale and motivation are increased as they are treated respectfully.</p> <p>Productivity is enhanced.</p> <p>Legal liability and costs are minimized.</p> <p>Corporate image as a responsible employer is enhanced.</p> <p>Diverse skills and experience of staff can be used more effectively.</p> <p>Clients respond positively to non-discriminatory workplaces, which may lead to market loyalty, enhancing continuity and profit.</p>	<p>BLA 2006</p> <p>BSCI, SA 8000</p>
Female workers are sexually harassed by fellow workers or managers.	<p>Develop a non-discrimination and anti-harassment policy that includes punitive actions.</p> <p>Publicly post the policy and provide</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Workers who have been sexually harassed are aware</p>	Constitution of Bangladesh

⁴ International Labour Organization 2001



	<p>trainings to raise awareness of the content.</p> <p>Make sure any incident of sexual harassment is reported to the grievance committee (see Annex 8.1.7.2).</p> <p>Make sure sexual harassment is not tolerated.</p>	<p>of their rights. They know how to file a complaint and see that their complaint is properly attended to.</p>	
Workers are unfairly treated (e.g. barred from recruitment or promotion, subject to slurs, lower wages, etc.) because of their ethnicity or origin.	<p>Treat all employees equally, irrespective of their ethnicity or origin.</p> <p>Provide a respectful work environment for all workers.</p> <p>Include ethnicity and origin in the recruitment policy.</p> <p>Make sure the recruitment process is clear and transparent for both employers and workers.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Workers from ethnic minorities and different origins are fairly and equally treated.</p> <p>The workers' well-being is ensured.</p> <p>All workers, including ethnic minorities and workers from different origins, are motivated and concentrate on their work accordingly.</p> <p>Productivity is ensured.</p>	Constitution of Bangladesh
Workers are unfairly treated (e.g. female workers may be less paid; female workers may be engaged more in overtime than male workers, etc.) because of their gender.	<p>Treat all employees equally regardless of their gender.</p> <p>Include gender equality in the recruitment policy.</p> <p>Make sure male workers are not favored over female workers, and vice versa.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Workers from all genders (female, male, transgender) are fairly and equally treated.</p> <p>All workers are motivated and concentrate on their work accordingly.</p> <p>Productivity is ensured.</p>	Constitution of Bangladesh
Workers are unfairly treated (e.g. barred from recruitment or promotion, subject to slurs, lower wages, etc.) because of their religion or beliefs.	<p>Treat all employees equally regardless of their religion.</p> <p>Provide equal opportunities for job candidates and employees based on merits.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Workers from different religions and beliefs are fairly and equally treated.</p> <p>All workers, including religious minorities, are motivated and concentrate on their work accordingly.</p> <p>Productivity is ensured.</p>	Constitution of Bangladesh

A company is advised to take the following steps to create a non-discriminatory working environment:

- Develop policies and procedures prohibiting discrimination.
- Assign responsible personnel to monitor, document, update and control implementation.
- Educate all your employees about discrimination.

- Encourage workers to respect each other's differences.
- Deal with any complaints of discrimination promptly and confidentially.
- Review the policy regularly to ensure that its effectiveness is maintained.

For more detailed information on the requirements for a non-discriminatory work environment, like how to establish a Grievance Committee as well as national guidelines and international good practices for preventing sexual harassment, see Annex 8.1.7.

2.7 MINIMUM AGE

A child cannot be employed for work; *“child means a person who has not completed his fourteenth year of age”*. With this definition, the Bangladesh labor law follows the ILO Convention No 182, which describes the worst forms of child labor. By no means, children are allowed to be employed in *“dangerous and unhealthy conditions that can lead to a child being killed, injured or made ill as a result of poor safety and health standards or employment conditions.”* Adolescents between 14 and 18 years can be employed under certain terms and conditions determined in the Bangladesh Labor Act (section 34-44).

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Age verifying documents are not available for each worker, e.g. in the personnel file.	Keep age verifying documents in the workers personal file, e.g. a copy of the personal identification, birth registration certificate, national identity card or passport.	Compliance with legislation in Bangladesh. Workers do not lose their job due to suspicion of age.	BLA 2006 BSCI, SA 8000
Underage workers are found doing repetitive factory work.	Stop hiring children below the minimum age. Remove children from tasks and environments that are considered dangerous for them but not for adults (e.g. heavy loads, night work, heavy machinery). Make sure children below the minimum working age have access to appropriate education. Encourage children of legal working age to combine their work with formal technical and vocational education and training.	Compliance with legislation in Bangladesh. The quality and productivity of adult workers is higher. Children miss the chance to acquire proper education if stuck doing poor quality jobs.	BLA 2006 BSCI, SA 8000
The working hours and special working conditions of adolescent workers are not established. The adolescent workers are engaged in dangerous or hazardous work (e.g. the use of chemicals).	Ensure that adolescent workers only work limited working hours, i.e. five hours normal working hours and one-hour overtime maximum per day. Provide formal description or policies. Give adolescent workers decent work which does not affect their health, personal development or	Compliance with legislation in Bangladesh. Adolescent workers get the opportunity to continue their education. Health and safety is ensured as adolescent workers do not engage in any kind of dangerous or hazardous work.	BLA 2006 BSCI, SA 8000



education.

For more information on how to comply with the requirements of minimum working age, see Annex 8.1.8.

2.8 REGULAR EMPLOYMENT

Regular employment focuses on the recognized employment relationship between employer and employees in line with the national law and international standards. Regular employment covers employment contracts, other legal required documents, subcontractor monitoring and monitoring of home workers, if applicable.

The following information is to be included in the working contract:

- Name of the employee
- Job title
- Date of commencement of employment
- Nature of employment i.e. part time, full time, casual, daily basis
- Total wages including wage breakdown
- Overtime (if any) and hourly rate
- The amount of notice period that is required to be given by both employer and employee to end the employment relationship.
- Leave entitlement

In addition to these requirements, make sure the following non-compliances are avoided:

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Personnel files are not available for all workers.	Provide personnel files for all workers.	Compliance with legislation in Bangladesh. Ensure job security. Financial security for dependents in case of deadly accident. A personnel filing system helps to give promotion or take layoff decisions. Personnel files keep track of activities such as trainings, vacations or conflicts, among others.	BLA 2006 BSCI, SA 8000
Personnel files are available for all workers but are incomplete.	Make sure that the personnel files at least contain: - Photograph of the employee - Copy of working contract with worker's acknowledgement	Compliance with legislation in Bangladesh. Job security is ensured. Financial security for dependents in case of a deadly	BLA 2006 BSCI, SA 8000



	<ul style="list-style-type: none"> - Service book - Copy of photo ID card - Leave records - Fitness certificate including proof of age - Employment application - Resume - Copy of certificates 	<p>accident is ensured.</p> <p>A personnel filing system helps to give promotion or take layoff decisions.</p> <p>Personnel files keep track of activities such as trainings, vacations or conflicts, among others.</p>	
Working contracts are not available for each worker.	<p>Make formal working contracts with each worker, including home worker.</p> <p>Provide working contracts to each worker.</p> <p>Add relevant terms in the employment contract (e.g. non-disclosure agreement, responsibilities of the employee, benefits, vacation and sick day policies, ownership agreement, method for resolving disputes, etc.).</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Job security is ensured.</p> <p>Financial security for dependents in case of a deadly accident is ensured.</p> <p>Terms added into the employment contract limit the reasons for an employee to leave the company.</p> <p>Employment contracts help attract the best workers into your company.</p> <p>Employment contracts allow more control of how employees work.</p>	<p>BLA 2006</p> <p>BSCI, SA 8000</p>
Photo I.D. cards are not provided to each worker.	Provide a photo I.D. to each worker.	<p>Compliance with legislation in Bangladesh.</p> <p>Job security is ensured.</p> <p>Identity in case of an accident is ensured.</p> <p>Employees having an I.D. card are an integrated part of the company and have access to the company's premises.</p> <p>Every employee feels part of the same business.</p> <p>Allows to keep track of an employee's in and out time.</p>	<p>BLA 2006</p> <p>BSCI, SA 8000</p>
Service book is not maintained for the workers.	<p>Maintain a service book for all confirmed workers, including the record of service, such as:</p> <ul style="list-style-type: none"> - Current designation - Wage/salary - Increments - Promotion - Disciplinary records (if any) 	<p>Compliance with legislation in Bangladesh.</p> <p>Job security is ensured.</p> <p>Transparency of the job history of workers is ensured.</p>	<p>BLA 2006</p> <p>BSCI, SA 8000</p>



Subcontractor monitoring is not in place.	Monitor all subcontractors to ensure social compliance and adequate working conditions.	Compliance with customer codes of conduct or standards is ensured. Risk of accidents at the subcontractor's factory is managed. Quality is ensured. Timely delivery is ensured.	Customer codes of conduct BSCI, SA 8000
---	---	--	--

For a checklist on the compliance with regular employment requirements, see Annex 8.1.9.

2.9 WORKING HOURS

The national laws, ILO conventions, and international standards make concrete references to the nature of working hours, which include regular working hours, the weekly rest day, overtime working hours, and public holidays, among others.

It is essential for employers to understand the toxic economic relation between excessive overtime and productivity:

- Excessive overtime causes stress and exhausted workers.
- Permanent overexertion leads to a loss of concentration, less accuracy, which results in fewer orders being completed in time.
- Low performance means low productivity and lower quality, with more rework and more downtime, less output, more accidents and illness, and more absenteeism, eventually producing a cost explosion with regard to materials, labor and utilities.

See also how the following non-compliances can be avoided and what is the pay-off to your company:

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
No time recording system for each individual worker is in place to measure the beginning and the end of a workday.	Implement a proper time recording system, which record each individual workers' beginning and end of a workday (in and out time).	Compliance with legislation in Bangladesh. Record of the workers' working time is kept.	BLA 2006 BSCI, SA 8000
Working time is not within the legal maximum amount of 60 hours per week including overtime, and on average and over the course of a year it is not within 56 hours per week.	Do not exceed the legal working time. The legal maximum amount is 60 hours per week including overtime. On average and over the course of a year the working time should not exceed 56 hours per week. Do not require an employee to work more than two hours of overtime per day. Pay for overtime working hours at an additional bonus with twice the	Compliance with legislation in Bangladesh. Workers are not exhausted; they get time to recover. Negative impacts on safety and health in the workplace are avoided. Absenteeism is reduced. Less overtime means better quality and higher productivity.	BLA 2006 BSCI, SA 8000



	basic salary.	Reworks and rejections are reduced. Less defective products ensure a sustained business volume. Employers do not have to pay extra costs for overtime payment. Overhead expenditure decreases.	
On average, workers do not have one day off after six consecutive working days.	Give all workers one day off after every six consecutive working days.	Compliance with legislation in Bangladesh. Workers have time to recover. Productivity is maintained. Absenteeism is reduced.	BLA 2006 BSCI, SA 8000
Female workers are employed in night shifts.	Ask for a written consent of each female worker in case they are working in shifts between 10 pm and 6 am. Ensure a safe way to and from work for female workers who are working between 10 pm and 6 am.	Compliance with legislation in Bangladesh. The safety of female workers is ensured. Female workers have more time to rest. Chances of sickness and absenteeism are reduced.	BLA 2006 BSCI, SA 8000 ILO

For a checklist of the documents required to comply with the regulations on work hours, see Annex 8.1.10.

2.10 WAGES AND BENEFITS

Wages and benefits payable to the employees are defined by the national legislations. They cover payment for overtime work, service benefits, gratuity, maternity benefits, and deduction from wages and leave benefits. Wages must be:

- Understandable to workers
- Paid in a currency or bank transfer
- Paid in timely and regular fashion
- Accurately calculated
- Paid in accordance with the contract at least equal to minimum or industry wage
- Paid with a pay slip in the local language

To prevent your company from wage violations, pay heed to the following recommendations and benefits:



Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Workers are not paid as per legal minimum wage.	Ensure the payment of the minimum wage for all workers.	<p>Compliance with legislation in Bangladesh.</p> <p>Workers receive at least the legal minimum.</p> <p>Payment beyond the minimum wage strengthens morale and motivation.</p> <p>Staff turnover is reduced; skilled workforce is maintained.</p>	<p>BLA 2006</p> <p>BSCI, SA 8000</p> <p>ILO</p>
Wages are not paid on time as legally required.	Pay wages within the first seven working days of the following month.	<p>Compliance with legislation in Bangladesh.</p> <p>Penalties for failing to pay wages are avoided.</p> <p>Timely payment of wages helps hire and retain skilled workers within company.</p> <p>Timely payment of wages indicates that employer is financially strong.</p>	<p>BLA 2006</p> <p>BSCI, SA 8000</p>
Workers do not receive pay slips with detailed information on relevant aspects, e.g. hours worked, pieces produced (if piece rate is applicable), amount of payment, supplements / bonuses, benefits, deductions etc.	Provide pay slips for each worker with detailed information on relevant details, e.g. hours worked, pieces produced, amount of payment, benefits, deductions, etc.	<p>Compliance with legislation in Bangladesh.</p> <p>Workers have detailed information about the hours worked, number of pieces produced, wage payment, overtime payment, any deduction and bonus (if any).</p>	<p>BLR 2015</p> <p>Minimum Wage Gazette Notification</p> <p>BSCI</p>
Monetary penalty system is in place for workers (risk of salary to decrease below the minimum wage level).	Do not impose monetary penalties without following labor laws.	<p>Compliance with legislation in Bangladesh.</p> <p>Workers are not scared but motivated if they know they will not face monetary penalties.</p>	<p>BLA 2006</p> <p>BSCI, SA 8000</p>
Employer does not contribute to statutory group insurance funds for each employee.	Pay the group insurance contribution/premium.	<p>Compliance with legislation in Bangladesh.</p> <p>The workers are not deducted any amount of money from their earnings regarding a contribution to statutory group insurance fund.</p> <p>Financial security for dependents in case of a deadly accident is ensured.</p>	<p>BLR 2015</p> <p>BSCI, SA 8000</p>



Annual leave is not ensured or granted for the workers.	Ensure annual leave as per legal requirement. Pay the workers the equivalent amount if they do not want to take the leave.	Compliance with legislation in Bangladesh. Workers have time to recover.	BLA 2006 BSCI, SA 8000
Maternity leave and benefits are not provided to pregnant female workers or new mothers.	Ensure maternity leave and benefits as per legal requirement.	Compliance with legislation in Bangladesh. Women who have maternity leave are more motivated to return to work after their child's birth. Employee turnover is reduced. Companies do not have to spend resources on finding replacement workers. Talented and skilled female employees are prevented from leaving the company.	BLA 2006 BSCI, SA 8000 ILO
Overtime payment is not provided to the workers.	Pay an overtime payment that is twice the basic salary rate per hour.	Compliance with legislation in Bangladesh. Extra earnings for extra work are ensured.	BLA 2006 BSCI, SA 8000
Absent deduction is made on gross salary instead of basic salary.	Make absent deduction on the basic salary only.	Compliance with legislation in Bangladesh. No extra money is deducted.	BLR 2015 BSCI, SA 8000

For more information on the requirements of compliance with wages and benefits, see Annex 8.1.11.

3 OCCUPATIONAL SAFETY AND HEALTH – GENERAL REQUIREMENTS

Occupational Safety and Health (OSH) is concerned to ensure safety, health and welfare of the workers at the workplace. According to the United Nations Declarations of Human Rights (Article 23, 1948), “everyone has the right to work, to free choice of employment, to just and favorable conditions of work”.

This section covers fire, electrical, machine, first aid, chemical and personal safety of the workers at their workplaces, amongst others.

3.1 HEALTH AND SAFETY COMMITTEE

According to the Bangladesh Labor (Amendment) Act 2013, a safety committee must be formed if fifty or more workers are employed in the factory. The safety committee must consist of equal representatives from the management and the workers. The committee is dedicated to continuously improving health and safety related issues.

Examples given below show how non-compliances can be overcome.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
No safety committee has been formed.	<p>Form a safety committee as per legal requirement.</p> <p>Ensure the safety committee meets at least once in every 3 months.</p> <p>The committee is in charge of training as well as risk and safety management in all relevant areas.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Safety committees improve the communication between management and workers, create a safer working environment, increase safety awareness, and enhance the employees’ morale.</p> <p>Safety committees strengthen the monitoring system, which improves risk management.</p> <p>Risks can be identified beforehand, and action can be taken before any unexpected situation arises.</p>	<p>Bangladesh Labor (Amendment) Act 2013</p> <p>BSCI, SA 8000</p>
The formation of the Safety committee is not in line with legal requirements.	<p>Make sure that the formation of the safety committee is in line with local laws.</p> <p>Document the formation process.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>All procedures, functions and responsibilities are clear to both employers and employees.</p>	BLR 2015

The basic requirements to form a safety committee are as follows:

- Where there are 50 or more workers regularly employed, a safety committee must be formed.



- For existing establishments, a safety committee must be formed within 6 months of the application of the Bangladesh Labor Rules 2015. For new establishments which started production after the application of the Bangladesh Labor Rules 2015, a safety committee must be formed within 9 months of the application of the Bangladesh Labor Rule 2015.
- The total number of the safety committee members should be not less than 6 persons and not more than 12 persons. The ratio of the members is determined by the number of employees (see Table 1):

Table 1: Worker-member ratio in safety committee

Number of workers employed	Number of members in safety committee
50 – 500	6
501 – 1000	8
1001 – 3000	10
3001 – more	12

For more information on how health and safety committees are formed, review Annex 8.2.1.

3.2 EMERGENCY AND EVACUATION PLANS

This section refers to the actions that should be taken to ensure safe evacuation in the event of an emergency such as fire, earthquakes or similar incidents.

The following non-compliances in terms of emergency and evacuation plans are frequently found in manufacturing industries. The corrective actions suggested below will address them effectively, with a sizable return for the company:

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Escape routes are not clearly marked.	Mark all escape routes clearly.	Compliance with legislation in Bangladesh.	BLA 2006
Floor marking, arrows and exit signs indicating the direction of emergency exits are insufficient.	Install and maintain sufficient arrows and exit signs, which are indicating the direction of emergency exits.	The workers can clearly identify escape routes and emergency exits. Companies reduce the risk of facing legal charges due to major injuries and loss of lives. Companies reduce the risk of paying compensation for major injuries and death.	BLR 2015 BSCI, SA 8000
Escape routes are not wide enough and are not free from obstructions.	Ensure the escape routes are 100cm wide and if this is not possible, they cannot be less than 75cm wide. Keep the escape routes always free from obstructions.	Compliance with legislation in Bangladesh. Escape routes are free from obstruction. Employees are aware that escape routes not be ob-	BLA 2006 BLR 2015 BSCI, SA 8000



	Train workers to keep escape routes always free from obstruction.	<p>structed under no circumstances.</p> <p>Companies reduce the risk of facing legal charges for major injuries and loss of lives.</p> <p>Companies reduce the risk of paying compensation for major injuries and death.</p>	
Exit signs are not visibly marked.	Mark exit signs clearly to ensure the visibility under extreme conditions, e.g. smoke or stressful emergency situations etc.	<p>Compliance with legislation in Bangladesh</p> <p>Visible exit signs help the employees to locate the nearest exit from a certain distance in the case of fire and smoke.</p> <p>Companies reduce the risk of facing legal charges for major injuries and loss of lives.</p> <p>Companies reduce the risk of paying compensation for major injuries and death.</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>BNBC 2006</p> <p>BSCI, SA 8000</p>
Exit signs are not connected with independent power supply.	Connect the exit signs with independent power supply or use an individual battery supported lighting system.	<p>Compliance with local law.</p> <p>In the case of power failure during an emergency, exit signs still are visible due to battery or independent power supply.</p> <p>Employees can see and locate the exits.</p> <p>Companies reduce the risk of facing legal charges for work-related injuries and loss of lives.</p> <p>Companies reduce the risk of paying compensation for major injuries and death.</p>	<p>BNBC 2006</p> <p>Fire Prevention and Extinction Rules 2014</p>
Evacuation plans are not posted on each floor / section.	Post evacuation plans on each floor/section.	<p>Compliance with legislation in Bangladesh.</p> <p>The workers are provided clear indications and have a better understanding of escape routes, nearest emergency exits, locations of the firefighting equipment, fire alarms, first aid kits, and staircases.</p> <p>Companies reduce the risk of</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>BSCI, SA 8000</p>



		<p>facing legal charges for major injuries and loss of lives.</p> <p>Companies reduce the risk of paying compensation for major injuries and death.</p>	
Emergency exits are obstructed, locked and not easily accessible.	Keep emergency exits always free, unlocked, and unobstructed. Ensure they are easily accessible.	<p>Compliance with legislation in Bangladesh.</p> <p>Workers can easily leave the factory floor in the case of an emergency.</p> <p>Companies reduce the risk of facing legal charges for major injuries and loss of lives.</p> <p>Companies reduce the risk of paying compensation for major injuries and death.</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>BNBC 2006</p> <p>BSCI, SA 8000</p>
Emergency exits do not open outwards.	Ensure that the emergency exits can be opened outwards. Escape must be always possible.	<p>Compliance with legislation in Bangladesh.</p> <p>Outward opening exits are much easier to open from inside; they ensure quick access for getting out of the factory floor.</p> <p>Companies reduce the risk of facing legal charges for major injuries and loss of lives.</p> <p>Companies reduce the risk of paying compensation for major injuries or death.</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>BNBC 2006</p> <p>BSCI, SA 8000</p>
Emergency lights are not installed with instant power supply or individual battery back-up systems.	<p>Install emergency lights.</p> <p>Equip the emergency lights with independent power supply.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>In the case of the power failure during an emergency, battery backup emergency lights ensure that the floors are not pitch dark.</p> <p>Employees panic less and are able to evacuate the floor in an organized way.</p>	<p>BLR 2015</p> <p>BSCI, SA 8000</p>
Fire and evacuation drills are not conducted as per the legal requirement.	<p>Conduct fire and evacuation drills once in every six months. It is conducted by the health and safety committee.</p> <p>Fire drills can also be conducted in the presence and with the help of the Fire and Civil Defense Authority.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>A well planned and regularly practiced evacuation drill identifies the weaknesses in the evacuation strategy.</p> <p>Working practices are adapted to the evacuation</p>	<p>BLR 2015</p> <p>Fire Prevention and Extinction Act 2003</p>



	Inform the Inspector of Factory and the Fire and Civil Defense Authority 15 days prior to the fire and evacuation drill.	strategy. New employees are familiarized with the evacuation procedure.	
	Document all relevant procedures and processes.		
Numbers of trained fire fighters are insufficient.	Increase the numbers of trained fire fighters as per the local legislations.	Compliance with legislation in Bangladesh Certified fire fighters can respond to fire incidents more effectively thanks to their training. This helps to contain the fire before it gets out of control.	BLR 2015 Fire Prevention and Extinction Act 2003 BNBC 2006

Five basic steps should be followed to develop an effective emergency response plan:

Step 1: Preparation of policies and procedures on emergency response

Step 2: Risk assessments

Step 3: Preparation of emergency plan

Step 4: Well-planned emergency drills

Step 5: Communication and training of employees/workers

For a more detailed explanation of each step, see Annex 8.2.2.

3.3 HEALTH EXAMINATIONS

Health examinations should be conducted for workers who are involved in dangerous and hazardous work, as per the Bangladesh Labor Rule 2015. The examinations should be conducted by a registered doctor and the expenses should be borne by the employer.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Health examinations are not carried out for all workers involved in dangerous and hazardous work.	Conduct health examinations by a registered physician for (at least) all the workers involved in dangerous and hazardous work. Conduct health examination at least once per year.	Compliance with legislation in Bangladesh. Health hazards and risks to workers are controlled and regularly monitored. Health and well-being of the workers are ensured.	BLA 2006 BLR 2015

3.4 LIGHTING

Inadequate lighting has a direct impact on the workers' health and concentration level, and, consequently, affects overall productivity and product quality. It is usually better to maximize the use of



natural lights, although in some cases artificial lights prove ideal. Lighting plays a crucial role for safety, health and output as is shown below:

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Lighting conditions are poor and insufficient.	Provide at least 350 Lux at the height of 1.0 meter from the floor. Use natural light as much as possible.	Compliance with legislation in Bangladesh. Sufficient lighting reduces the strain on the eyes and the risk of headaches and bad eyesight in the long run. Absenteeism with an impact on the production process is reduced. Sufficient lighting increases the concentration level. Sufficient lighting reduces the time to find the correct materials for production. Production cost is reduced as the percentage of rework and rejection is kept low. Product quality is improved. Lead time is reduced.	BLA 2006 BLR 2015 BNBC 2006
There is no system for regular maintenance of lamps and other sources of light.	Introduce and maintain a system of regular maintenance of lighting lamps and other sources of light.	Lights have a longer lifespan with sustained and higher performance (LUX). Energy costs are reduced.	BSCI, SA 8000

Table 2 indicates a striking difference in energy efficiency of LED-bulbs compared with CFL and traditional lamps.

Table 2: Lighting and energy efficiency

Energy efficiency	Light Emitting Diodes (LED)	Incandescent Light Bulbs	Compact Fluorescents (CFL)
Life span (average)	50,000 hours	1,200 hours	8,000 hours
Watts of electricity used	6 – 8 watts	60 watts	13 – 15 watts
Kilo-watts of electricity used	329 kWh/year	3,285 kWh/year	765 kWh/year
Lumens	800	800	800

To improve lighting-related energy consumption levels, an effective monitoring system should ensure that the lights in different sections are working properly. Regular maintenance of lighting increases the life span of the lights and provides better performance for a longer period.

Annex 8.2.3 presents sample checklists for monthly maintenance of lighting, corrective actions and follow-up.

3.5 HOUSEKEEPING

Housekeeping and cleanliness play an important role in the workforce's health and efficiency level. In every manufacturing industry, effective housekeeping is key to reducing injuries and improving productivity.

The Bangladesh Labor Act suggests that *"every factory shall be kept clean and free from effluvia arising from any drain privy or other nuisance"* and that *"there shall be effective measures to protect workers from dust and fume of such nature likely to be injurious or offensive to the workers"*.

The conditions encountered in factories require effective action:

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Production floor is not clean and clear of waste.	<p>Implement a system to ensure that the production area is cleaned on a regular basis.</p> <p>Introduce the 5S method⁵:</p> <ul style="list-style-type: none"> - Sort: separate unnecessary from necessary items and remove unnecessary items - Set in order/straighten: organize for better workflow and store items for easy retrieval - Shine: keep workplace clean, tidy and in good condition - Standardize: create standards to make sort, set in order and shine a habit. - Sustain: maintain 5S standards and implement initiatives to sustain 5S activities <p>Ensure cleanliness at the entire factory compound (factory floors, all workplaces, rest areas, etc.).</p>	<p>Compliance with legislation in Bangladesh.</p> <p>A tidy production floor reduces search time for materials, keeps downtime to a minimum, and improves efficiency levels.</p> <p>Productivity and product quality are improved.</p> <p>A tidy work environment reduces fire hazards as flammable materials are kept separate and in an organized way.</p> <p>A clean and tidy factory makes it easier to quickly evacuate the workplace during an emergency.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Aisles are narrow or obstructed and not clearly marked.	<p>Aisles need to be wide enough to accommodate workers and equipment comfortably.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Unobstructed aisles facilitate navigation and orderly movement throughout the factory.</p> <p>The workflow is improved, which increases productivity and efficiency levels.</p> <p>Floor markings are clearly</p>	<p>BLA 2006</p> <p>BLR 2015</p>

⁵ For more information, see Annex 8.2.4



		visible and not faded.	
Stairs lack handrail and are not well lit.	Install handrails and make sure they are firmly fixed. Ensure that any lights are replaced or repaired.	Compliance with legislation in Bangladesh. The illumination level is improved. The risk of accidents is reduced.	BLA 2006 BLR 2015
Drinking water facilities are not provided.	Provide adequate and sufficient drinking water facilities for workers in suitable places.	Compliance with legislation in Bangladesh. Adequate and sufficient drinking water facilities prevent workers from dehydration.	BLA 2006 BLR 2015
Quality of the drinking water is not tested.	Test the quality of the drinking water (physical, chemical and bacteriological parameters) on a regular basis by any institution which is recognized by the government. Test the quality of the drinking water at least once per year.	Compliance with legislation in Bangladesh. The quality of the drinking water is improved. Water-borne diseases are prevented.	BLA 2006 BLR 2015
Insufficient number of toilets for male and female workers.	Increase the numbers of male and female toilets as per legal requirement.	Compliance with legislation in Bangladesh. A sufficient number of toilets ensures for all workers easy access to the toilet facilities. The toilets are maintained in adequate sanitary conditions.	BLA 2006 BLR 2015
Toilets are not separated for male and female workers.	Separate toilets for male and female workers and mark it clearly.	Compliance with legislation in Bangladesh. Male and female toilets are easily identified by appropriate signs.	BLA 2006 BLR 2015
Toilets are found dirty and unhygienic.	Introduce and implement a system to ensure that the toilets are cleaned every day. Keep toilets always clean and sanitary.	Compliance with legislation in Bangladesh. Clean and hygienic toilets reduce the risk of transmitting infectious diseases The workers' well-being is ensured. Absenteeism is reduced.	BLA 2006 BLR 2015
Dining facilities are not available in establishments of more than 25 employees.	Provide dining facilities for factories with more than 25 employees.	Compliance with legislation in Bangladesh. Workers are able to take	Bangladesh Labor (Amendment) Act 2018



Ensure adequate drinking water facilities are available.

Ensure cleanliness of the dining room.

their food on the factory premises, which reduces their stress of walking home for lunch.

The workers' well-being is ensured.

For more information on housekeeping and 5S, see Annex 8.2.4.

3.6 ELECTRICAL SAFETY

Unsafe electrical wirings are a very common reason for fire incidents. To control and mitigate fire hazards, it is very important to have proper and safely insulated electrical wirings. Regular checks of electrical wirings by certified electricians increase safety. More recommendations and benefits are given below.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Electrical installations (e.g. distribution boards, fuse boxes, panels, outlets, wires, switches etc.) are not in good working conditions.	Inspect and maintain electrical installations on a regular basis.	Compliance with legislation in Bangladesh.	BLR 2015 BNBC 2006
	Ensure that all electrical installations can be used.	Well-protected electrical installations reduce the risk of electrocution.	
	Replace wooden distribution boards with non-flammable material, if any.	Proper installed electrical installations also mitigate the risk of fire incidents due to short circuits.	
	Change the broken fuse boxes, panels, and outlets.	Electrical hazards, one of the main reasons for fire, are under better control and thus reduced.	
	Replace torn wires and broken switches.	The potential for legal charges and compensation payments due to accidents are minimized.	
Distribution boards and switch boards were found open.	Document regular check-up procedures, processes, and outcomes of the inspections.	Electrical loads and distribution processes are under better control; hence, energy costs are reduced.	BLR 2015
	Implement a system to ensure that distribution and switch boards are maintained closed.	Compliance with legislation in Bangladesh.	
	Document regular check-up procedures, processes, and outcomes of the inspections.	Well protected electrical installations reduce the risk of electrocutions.	
Ebonite sheet inside the	Make sure that ebonite sheets are	Electrical hazards are under better control and thus reduced.	BLR 2015
		Compliance with legislation	



distribution board is missing.	is available for all distribution boards. Document regular check-up procedures, processes, and outcomes of the inspections.	in Bangladesh. Ebonite sheet mitigate the risk of electrocutions.	
Electrical insulations and wires are not properly fixed.	Take the initiative to properly fix all electrical insulations and wires. Document regular check-up procedures, processes, and outcomes of the inspections.	Compliance with legislation in Bangladesh. Well-protected electrical installations reduce the risk of electrocutions. Proper installed electrical installations also mitigate the risk of fire incidents due to short circuits. Electrical hazards are under better control and thus reduced. The risk of legal actions and compensation payments due to accidents are minimized. Electrical loads and distribution processes are under better control; hence, energy costs are reduced.	BLR 2015 BNBC 2006
Electrical wires are not properly insulated and/or insulation is broken.	Insulate the electrical wires properly to ensure electrical safety. Ensure the insulations are fully intact. Otherwise change broken insulations. Document regular check-ups, procedures, processes, and outcomes of the inspections.	Compliance with legislation in Bangladesh. Well-protected and insulated electrical wires reduce the risks of electrocutions. Proper insulated electrical wires also mitigate the risk of fire incidents due to short circuits. Electrical hazards are under better control and thus reduced. The risk of legal actions and compensation payments due to accidents are minimized. Electrical loads and distribution processes are under better control; hence, energy costs are reduced.	BLR 2015 BNBC 2006
High voltage/danger and warning signs are not posted at relevant working areas.	Post high voltage/danger and warning signs at all relevant working areas. Ensure that only authorized and	Compliance with legislation in Bangladesh. Visual warning signs increase the awareness of dangers	BLR 2015



	<p>caused by electrical installations and reduce the risk of electrocutions.</p> <p>Electrical hazards are under better control and thus reduced.</p> <p>The risk of legal actions and compensation payments due to accidents is minimized.</p> <p>Electrical loads and distribution processes are under better control.</p> <p>Energy costs are reduced.</p>	
<p>The factory does not have a system/process in place to check the electrical insulations and wirings on a regular basis.</p>	<p>Introduce and implement a system/defined process to check the electrical insulations and wirings on a regular basis.</p> <p>Document regular check-ups, corrective measures, and outcomes.</p>	<p>Compliance with legislation in Bangladesh. BLR 2015</p> <p>Regular and periodical checks of electrical installations and wirings allow for quick preventive and corrective actions to reduce the hazards that could cause major electrical incidents (e.g. electrocution, fire).</p> <p>Electrical hazards are under better control and thus reduced.</p> <p>The risk of legal actions and compensation payments due to accidents are minimized.</p> <p>Electrical loads and distribution processes are under better control; hence, energy costs are reduced.</p>
<p>There are no certified electricians available.</p>	<p>Appoint a certified electrician for the maintenance of the electrical insulations and wirings.</p> <p>Make sure that the electrician is certified by a governmental approved institution.</p>	<p>Compliance with legislation in Bangladesh. BLR 2015</p> <p>Electrical installations and wirings are properly handled and maintained by competent certified personnel.</p> <p>Electrical hazards are under better control and thus reduced.</p> <p>The risk of legal actions and compensation payments due to accidents are minimized.</p> <p>Electrical loads and distribution processes are under</p>



		better control; hence, energy costs are reduced.	
Electrical cords and cables cut across corridors and walkways.	Tape cords and cables securely to the floor and put them in such a way to reduce the risk of tripping.	<p>Compliance with legislation in Bangladesh.</p> <p>Tripping hazards on electrical cords and cables are avoided.</p> <p>Electrical hazards are under better control, reducing the risk.</p> <p>The risk of legal actions and compensation payments due to accidents are minimized.</p>	BLR 2015
Water is spilled close to electrical devices.	<p>Keep electrical devices away from water.</p> <p>Clean up spills immediately.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of electrical hazards (e.g. electrical shocks) is reduced.</p> <p>The risk of fire due to short circuit is reduced.</p>	BLR 2015
The tape of a taped joint is becoming loose.	<p>Replace it and refer to proprietary joints, which incorporate terminals or compression fittings suitable for stranded conductors, cable clamps, and sleeving to reduce the flexing of the cable where it enters the connector.</p> <p>Implement a system to detect joints and electrical cables that require repair or replacement.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>A properly insulated joint or connector does not present an electrical shock risk.</p> <p>Conductivity, insulation and mechanical strength are ensured.</p> <p>The risk of fire due to short circuit is reduced.</p>	BLR 2015

For more information on how electrical installations are maintained, see Annex 8.2.5.

3.7 FIRE SAFETY

Fire safety is one of the most crucial areas to ensure the safety of the employees. In order to ensure fire safety and reduce the risks of fire incidents, adequate and appropriate fire indicators and firefighting equipment must be provided, inspected and maintained.

Relevant non-compliances are opposed to adequate corrective actions that entail benefits to both employers and workers.



Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
The number of inspected fire extinguishers and firefighting equipment is insufficient.	Provide the necessary number of fire extinguishers and firefighting equipment as defined in the fire license.	<p>Compliance with legislation in Bangladesh.</p> <p>Sufficient adequate and appropriate firefighting equipment ensures a quick response to fire that is extinguished before it gets out of control.</p> <p>The risk of accidents is reduced.</p> <p>The risk of legal actions and compensation payments is reduced.</p> <p>The risk of damaging reputation is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>Fire Prevention and Extinction Act 2003</p> <p>Fire Prevention and Extinction Rule 2014</p>
<p>Fire extinguishers are not installed and marked properly.</p> <p>Fire extinguishers are obstructed.</p>	<p>Install and mark the fire extinguishers properly.</p> <p>Always keep all fire extinguishers and firefighting equipment free from obstruction.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The location of the fire extinguishers can be identified easily.</p> <p>Trained firefighters can easily identify the types of fire extinguishers and know which one to use.</p> <p>Fire extinguishers are easily accessible for use in the event of a fire and allow for a quick and effective response.</p> <p>The risk of accidents is reduced.</p> <p>The risk of legal charges and compensation payments is reduced.</p> <p>The risk of damaging reputation is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>Fire Prevention and Extinction Act 2003</p> <p>Fire Prevention and Extinction Rule 2014</p>
There is no functioning fire alarm system in place.	<p>Install an adequate fire alarm system.</p> <p>Provide an independent power supply for the fire alarm systems to ensure that the fire alarms are still operational in case of a general power failure.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>A functional fire alarm system ensures immediate warning to the employees to start evacuating the floors.</p> <p>The risk of accidents is reduced.</p> <p>The risk of legal actions and</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>Fire Prevention and Extinction Act 2003</p> <p>Fire Prevention and Extinction</p>



		compensation payments is reduced.	Rule 2014
		The risk of damaging reputation is reduced.	
The fire alarm system is not connected with independent power backup system.	Provide an independent power supply for the fire alarm systems to ensure that the fire alarms are still operational in case of a general power failure.	<p>Compliance with legislation in Bangladesh.</p> <p>Battery backup or an independent power backup fire alarm system ensure that the warning siren continues even in the event of a power failure.</p> <p>The risk of accidents is reduced.</p> <p>The risk of legal actions and compensation payments is reduced.</p> <p>The risk of damaging reputation is reduced.</p>	<p>Fire Prevention and Extinction Act 2003</p> <p>Fire Prevention and Extinction Rule 2014</p>
Smoke and heat detection systems are not installed.	Install an adequate number of smoke and heat detectors in all buildings, floors and sections as defined in the fire license.	<p>Compliance with legislation in Bangladesh.</p> <p>Smoke and heat detection systems immediately indicate sudden smoke and abnormal heat generation.</p> <p>The responsible persons can respond immediately to assess the situation and take preventive measures to avoid any bigger incidents.</p> <p>The risk of accidents is reduced.</p> <p>The risk of legal charges and compensation payments is reduced.</p> <p>The risk of damaging reputation is reduced.</p>	<p>Fire Prevention and Extinction Act 2003</p> <p>Fire Prevention and Extinction Rule 2014</p>
Smoke and heat detection systems were found inadequate and insufficient.			
The factory does not have a valid fire insurance.	Make sure the factory has a valid fire insurance.	<p>A valid fire insurance allows the management to claim insurance money.</p> <p>A fire insurance can recover losses caused by a fire incident and help resume business operations.</p>	<p>Fire Prevention and Extinction Act 2003</p>

For basic guidelines for improving the overall fire safety management, see Annex 8.2.6.

3.8 MACHINE SAFETY

Machine safety is a key requirement for the workers' personal safety. Exposure to occupational hazards can be controlled in various ways. The Hierarchy of Controls (see Figure 1) is based on the premise that controls at the top of the inverted pyramid are more effective than those at the bottom. It is most effective to eliminate or substitute the hazard, but normally also the most challenging way (e.g. initial cost) to ensure occupational safety. Engineering controls are part of the process to create a safe workplace as they are directed to isolate workers from the hazard. Appropriate safeguards usually based on a risk assessment help mitigate the adverse impact. Administrative controls seek to raise awareness and train workers on safe working methods. Along with the provision of Personal Protective Equipment (PPE) they are quite easy to initiate, though costly to sustain and thus less effective in the long run.

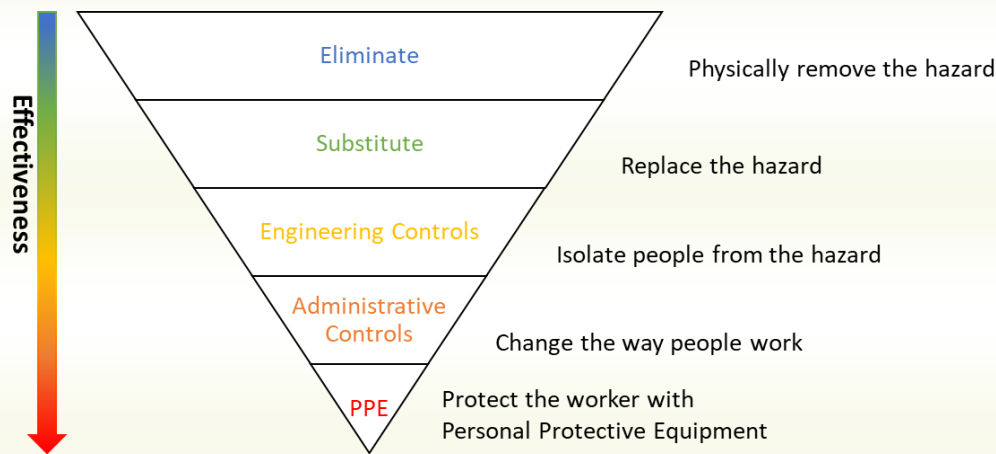


Figure 1: Hierarchy of controls

Source: Adapted from The National Institute for Occupational Safety and Health (NIOSH) 2015

If hazardous machinery cannot be eliminated or replaced, it is the employer's responsibility to ensure maintenance on a regular basis and provide adequate safety guards (i.e. engineering controls) to considerably reduce the possibility of injuries.

The following parts in machinery require appropriate guarding solutions:

- Point of operation (e.g. cutting, shaping)
- Energy transmission (e.g. pulleys, belts, connecting rods, cams, couplings, chains, cranks, gears)
- Moving parts (e.g. rotating, reciprocating, transversing, feed mechanisms, and auxiliary parts)

Movable guards should be interlocked with the machine control system so that the hazards covered by the guards will be effectively controlled when the guard is opened.

How to deal with various challenges to keep machines in safe and good working order is described below.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Adequate and appropriate safety guards are not	Provide adequate and appropriate safety guards at all machines with	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015



provided at machines with rotating or moving parts.	rotating or moving parts.	Safety guards on rotating and moving parts reduce the workers' risk of getting injured. The risk of legal actions and compensation payment is reduced.	
The steam boiler is not well protected.	Protect the steam boiler properly. Preferably, store the steam boiler in a separate area/building.	Compliance with legislation in Bangladesh. A well-protected steam boiler mitigates the risk of fatal incidents in the event of an explosion. Regular machine maintenance increases the operational efficiency. Breakdown time is reduced. The production process is not interrupted. The lead time is reduced.	BLA 2006 Boiler Act
The boiler operation license is invalid. A valid boiler operation license is not available.	Apply at Department of Boiler under the Ministry of Industry for the boiler operation license.	Compliance with legislation in Bangladesh. The boiler works properly as per the specifications.	Boiler Act
The boiler operator is not sufficiently trained and certified.	Appoint a certified boiler operator (competency certificate) from an appropriate authority. The boiler operators' competency certificate(s) are issued by the Department of Boiler under the Ministry of Industry only after the examination is successfully passed.	Compliance with legislation in Bangladesh. A competent certified person maintains and operates the boiler safely and efficiently. Regular machine maintenance increases the operational efficiency. The breakdown time is reduced. The production process is not interrupted. The lead time is reduced.	Boiler Act
The factory does not have a valid generator (captive power) operation license.	Apply to the appropriate authority for the generator (captive power) operation license. The license will be provided by the Bangladesh Energy Regulatory Commission.	Compliance with legislation in Bangladesh. The factory has a valid generator operation license. The generator works as per the specifications.	Bangladesh Energy Regulatory Commission Act 2003



For more information on how to ensure machine safety, see Annex 8.2.7.

3.9 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal protective equipment (PPE) is used as a last resort, whenever risks to health and safety cannot be adequately controlled in other ways. PPE protects the user against health and safety risks at work. It includes items such as safety helmets, gloves, eye protection, high-visibility clothing, or respiratory protective equipment, among others.

It is the employers' responsibility to provide adequate and appropriate PPE to the employees and to ensure in regular awareness trainings that they use them.

Effective PPE in factories requires remediating non-compliances through practical corrective actions that provide considerable benefits to both employers and workers.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Adequate and appropriate personal protective equipment (PPE) is not provided to the workers.	Avoid, if possible, health hazards and the need for PPE.	Compliance with legislation in Bangladesh.	BLA 2006
	If hazards cannot be avoided, provide adequate and appropriate PPE to all workers.	Adequate and appropriate PPE protects the user against health or safety hazards at work. The risk of long-term illness and the risk of fatal incidents are reduced. Adverse health risks and treatment costs due to long-term exposure to chemical substances are reduced. Absenteeism and its adverse impact on the production process is reduced. The risk of legal actions and compensation payments due to serious injuries is reduced.	BLR 2015
Workers are not using PPE at relevant working areas.	Avoid, if possible, health hazards and the need for PPE.	Compliance with legislation in Bangladesh.	BLA 2006
	If hazards cannot be avoided, introduce a monitoring system to ensure that the workers are using appropriate PPE at the relevant working areas.	PPE protects the workers from potential health hazards at workplaces. A monitoring system ensures that the workers use PPE whenever it is required. The section in charge or the supervisors act as role models by using PPE at relevant workplaces.	BLR 2015



		<p>The risk of long-term illness and fatal incidents are reduced.</p> <p>Adverse health risks and treatment costs due to long-term exposure to chemical substances are reduced.</p> <p>Absenteeism and its adverse impact on the production process is reduced.</p> <p>The risk of legal actions and compensation payments due to serious injuries is reduced.</p>	
The factory does not conduct trainings on the adequate usage of PPE.	Conduct trainings on a regular basis on the adequate usage, handling and storage of PPE to ensure its functionality.	<p>Compliance with legislation in Bangladesh.</p> <p>Regular and periodical trainings on the use of PPE increase the awareness of the relevance and benefits of using PPE.</p>	<p>BLA 2006</p> <p>BLR 2015</p>

For guidelines on the use of PPE and a PPE assessment checklist, see Annex 8.2.8.

3.10 VENTILATION

The formation of fumes and high concentrations of particles in the air can have a serious impact on the health of workers. Effective ventilation systems and temperature control are instrumental in minimizing respiratory and toxic hazards.

How ventilation improves indoor air quality and benefits health and productivity is presented below.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
The room temperature is not continuously measured and monitored.	<p>Install thermometers in the working areas to monitor the room temperature on a regular basis.</p> <p>Document the room temperature.</p> <p>Keep the temperature at a comfortable level.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Monitoring temperature gives an idea of high temperature zones on the production floor.</p> <p>Additional fans, open windows and exhaust fans keep the temperature at a comfortable level in the high-temperature zones.</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>BNBC 2006</p>
Room temperature is not acceptable at some or all areas of the production floor.	Install exhaust fans to keep the room temperature in acceptable conditions.	<p>Compliance with legislation in Bangladesh.</p> <p>The temperature is at a comfortable level.</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>BNBC 2006</p>



		<p>The risk of workers getting dehydrated due to sweating is reduced.</p> <p>Other health hazards, such as headaches, limiting the working efficiency, are reduced.</p> <p>The productivity of the employees is increased.</p> <p>Negative effects of sweat on production process and resulting rejection and re-work are reduced, and thus results in better quality and lower production costs.</p> <p>Sickness and thus absenteeism are reduced.</p>	
Proper ventilation is not provided in the production area.	Arrange for sufficient airflow to improve the ventilation in the production floor(s).	<p>Compliance with legislation in Bangladesh.</p> <p>Proper ventilation in the production floor helps keep the temperature at a comfortable level.</p> <p>The risk of health hazards, (e.g. dehydration, headaches) is reduced.</p> <p>Productivity is increased.</p> <p>Negative effects of sweating on production process are reduced. Rejection and re-work rates are reduced, while quality is improved.</p> <p>Sickness and thus absenteeism are reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>BNBC 2006</p>
Ventilation systems collect contaminants as they operate.	Check, monitor and maintain ventilation systems on a regular basis.	<p>Compliance with legislation in Bangladesh.</p> <p>Equipment malfunctions are reduced.</p> <p>Ventilation systems are more effective in ensuring adequate air quality.</p> <p>Heat-related illnesses are minimized.</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>BNBC 2006</p>

For more information on adequate ventilation and how to improve the air quality level, see Annex 8.2.9.



3.11 CHEMICAL MANAGEMENT

The use of chemicals in plastic and light engineering production processes may negatively impact on the workers' health and the environment. An effective chemical management system mitigates the potential for adverse effects on human health and the environment.

A sustainable chemical management system helps the organization ensure proper storage, handling, transfer and disposal of chemical substances, as will be laid out below:

Non-compliances	Preventive / Corrective Actions	Benefit	Required for
The chemicals used are not listed in an inventory.	List all chemicals in a chemical inventory.	An overview of all chemicals used in different production processes is given. An inventory serves for a baseline for evaluating compliance with (international) standards.	BLA 2006
Chemicals are not stored properly.	Store the chemicals as per instruction that is given by the manufacturer in the Material Safety Data Sheet (MSDS). Keep incompatible chemicals separately (see Annex 8.2.10, Table 24). Provide secondary containment for all chemicals.	The risks of violent reactions in case of mixing due to spillage is reduced. The risk of soil contaminations, human health hazards, and environmental hazards is mitigated. Due to proper storing, quick access to the required chemicals is ensured. Hazardous waste disposal is minimized.	BLA 2006
Chemicals are not labelled correctly and/or sufficiently.	Label all containers, including secondary containers, with the identity of the chemical(s) and a warning phrase or symbol indicating the chemical's hazard(s).	Due to proper labelling, the workers' awareness of safe handling, storage, health and environmental hazards of a specific chemical is increased.	BLA 2006
Chemicals have been found in plastic bottles.	Use appropriate containers for storing chemicals.	Due to an appropriate compatible container to keep chemicals, the risk of chemical reactions with the incompatible containers is reduced. Accidents while handling or working with the chemicals	BLA 2006



		are reduced. Hazardous waste disposal is minimized.	
Storage rooms are not adequately ventilated.	Adapt storage rooms and areas to provide proper ventilation and soil protection (especially for halogenated and non-halogenated organic solvents and waste containing these substances).	Safe storage is ensured. Due to proper ventilation in the chemical storage rooms, the exposure time of the workers and the impact on the workers' health is reduced.	BLA 2006
Chemicals have been spilled on the floor and/or workplaces.	Provide secondary containment. Ensure that MSDS for all chemicals used and stored on site are available and easily accessible.	Appropriate and adequate spill prevention kits reduce the risk of mixing incompatible chemicals. The risk of violent reactions is controlled. Major accidents such as explosions and fire are avoided. Spill prevention kits mitigate the risk of direct chemical contact with the workers and soil contamination.	BLA 2006
Documentation (MSDS) of chemicals are incomplete or insufficiently available.	Make all material safety data sheets (MSDS) available for all chemicals used and stored on site. Ensure the documents are available in the local language and be easily accessible to the workers.	Clear information on storage, handling, PPE, health hazards, environmental hazards and disposal procedures is provided. Due to visually posted information of MSDS, the workers' awareness and understanding of storage, handling, PPE, health hazards, environmental hazards, and disposal is enhanced.	Customer codes of conduct
Chemicals are improperly and inefficiently used; the overconsumption of chemicals produces more hazardous waste.	Use chemicals properly and efficiently. Consult with your chemical supplier on a more efficient use of chemicals.	Purchase costs are reduced. Production costs are reduced. Hazardous waste is minimized. Disposal costs are reduced.	BLA 2006

A list of chemicals that are incompatible with each other and guidelines for how to implement an effective chemical management system can be found in Annex 8.2.10 (Table 24).

3.12 NOISE MANAGEMENT

Noise from machinery and processes is an occupational hazard in many workplaces of the plastics and light engineering industries. To prevent noise-induced hearing loss the noise level must be kept within the acceptable limit as defined by The Environment Conservation Rules 1997. The following measures apply:

- Characterize the hazard accurately and identify affected employees
- Use engineering controls to reduce noise exposure
- Carry out audiometric evaluation to determine hearing loss
- Provide personal hearing protection devices
- Educate and motivate both management and workers to commit to preventing hearing loss
- Keep effectively record of noise prevention activities

In the following, it is presented how noise-related challenges can be addressed adequately.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
The noise level of industrial machinery and processes is beyond the acceptable limit.	Prevent noise generation at source.	Compliance with legislation in Bangladesh.	ECR 1997
	Maintain and replace old equipment.	The risk of workers losing their hearing abilities in the long run is reduced.	Noise Pollution Control Rules 2006
	Change operating speeds to avoid resonances.	Emissions of noise and vibration are reduced and controlled.	ISO 14001
	Place as much distance as possible between the noise source and those who may be affected by it.	Due to the reduction of noise, a major cause of stress, the risk of accidents is reduced.	
	Use adequate drives to prevent the transmission of vibration.		
	Install noise barriers.	Workers can concentrate better; productivity and product quality are ensured.	
	Silence exhaust outlets.		
	Check the noise level does not exceed the legal maximum of 75 dB(A).		
Noise levels are not measured and documented over time.	Provide workers with adequate PPE (e.g. ear plugs, ear muff).		
	Install a noise level measurement in all relevant areas or carry out a noise level assessment on a regular basis.	Compliance with legislation in Bangladesh.	ECR 1997
	Install sound barriers.	Noise assessments help control and manage the noise level within acceptable limits.	Noise Pollution Control Rules 2006
	Relocate high noise-prone working areas	Adequate actions are taken.	BSCI, SA 8000
	Keep a documentation of the daily noise level.	Adequate noise PPE is provided.	ISO 14001
	Ensure that adequate PPE (e.g. ear	Workers can concentrate	



plugs, ear muff) is used if the noise level exceeds 75dB(A).	better; productivity and product quality are increased. The risk of accidents is reduced.
--	--

For more information on how to control the noise level, see Annex 8.2.11.

3.13 FIRST AID

It is mandatory for employers to provide sufficient first aid and emergency treatment facilities to ensure quick response in case of an accident or indisposed employees at the workplace.

The following non-compliances are often found in factories and need to be addressed effectively.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
First aid kits are not sufficiently available.	Provide first aid kits in line with the local law. Provide at least one fully equipped first aid kit (see Annex 8.2.12) for every 150 workers.	Compliance with legislation in Bangladesh. Immediate and quick response is ensured. The risk of infections and other health related issues is reduced. The production process is not interrupted. The production costs are reduced.	BLA 2006
First aid kits are not fully and adequately equipped.	Keep adequate and appropriate contents in line with the legal requirements available in each first aid kit.	Compliance with legislation in Bangladesh. Proper first aid management with appropriate and suitable first aid kits are ensured. The risk of infections and other health related issues is reduced. The production process is not interrupted. Production costs are reduced.	BLA 2006 BLR 2015
Content of the first aid kit is expired and/or not usable.	Ensure the content of first aid kits is always durable.	Compliance with legislation in Bangladesh. The risk of infections and other health related issues is reduced. The production process is	BLA 2006 BLR 2015



		not interrupted. The production costs are reduced.	
Trained first aiders did not receive an experience certificate on first aid medication from registered medical officer.	Ensure first aiders are trained by registered medical officer on first aid and receive experience certificate.	<p>Compliance with legislation in Bangladesh.</p> <p>First aid procedures are conducted by trained and certified first aid personnel.</p> <p>Appropriate and effective first aid management is ensured.</p> <p>Quick response ensures fast treatment of the workers.</p> <p>The risk of long-term treatment is reduced.</p> <p>The risk of legal actions and compensation payments due to disability or death is reduced.</p>	Bangladesh Labor (Amendment) Act 2018
Insufficient number of trained first aiders.	Assign at least one trained first aider for each first aid kit, that is one trained first aider for every 150 workers.	<p>Compliance with legislation in Bangladesh.</p> <p>First aid procedures are conducted by trained and certified first aid personnel.</p> <p>Effective first aid management is ensured.</p> <p>The availability of certified first aid personnel is ensured for all working shifts.</p> <p>Quick response ensures fast treatment of the workers.</p> <p>The risk of long-term treatment is reduced.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	BLA 2006
A medical room is not available.	<p>Provide a medical room with adequate and appropriate equipment as per legal requirement.</p> <p>Note: Employers with 300 or more employees are legally required to provide a medical room.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>An adequately and appropriately equipped medical room is available.</p>	BLA 2006 BLR 2015
Full time doctor and one trained compounder,	Appoint one full time and one trained compounder, medical	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015



medical assistant or nurse are not appointed. assistant or nurse.

Note:

Employers employing 300 or more workers are legally required to provide a medical room.

Professional health personnel is available.

Quick response in the case of a serious accident that cannot be handled through first aid management is ensured.

The risk of long-term treatment is reduced.

The risk of legal actions and compensation payments due to disability or death is reduced.

For guidelines for effective first aid management, see Annex 8.2.12.

3.14 TRAINING

Training and capacity building development is one of the most important factors to establish labor and social standards in a firm or organization.

Training should be conducted on a regular basis, with topics covering crucial areas such as skill development, health and safety issues as well as other labor related issues. All training records must contain detailed information on training contents, the list of participants, and photos, among others.

Trainings have a considerable positive impact on personal and company development. The measures outlined below should be followed to establish an effective and systematic training culture in your company.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
The factory does not conduct systematic and regular training on health and safety issues.	Conduct a systematic and regular training on health and safety issues. The health and safety committee arrange and provide training on health and safety issues.	Trainings on safety and health issues are provided on a regular basis. The awareness of safety and health issues is increased. The overall safety standards of the workplace are gradually improved. Work related accidents are decreased. Human resources are optimally utilized. The productivity of the employees is increased. Team work and team spirit are improved. A culture of learning and continuous development	BSCI, SA 8000 Customer codes of conduct



		within the organization is established.	
		Technical and other skills are developed.	
Homeworkers are neither covered by training regulations nor do they receive regular training.	Introduce a system to ensure homeworkers are also included in training programs.	<p>Trainings on safety and health issues are provided to homeworkers on a regular basis.</p> <p>The homeworkers' awareness of safety and health issues is increased.</p> <p>The overall safety standards of the homeworkers' workplace are gradually improved.</p> <p>Work related accidents at the homeworkers' workplace are reduced.</p> <p>Human resources are optimally utilized.</p> <p>The productivity of the employees is increased.</p> <p>Team work and team spirit are improved.</p> <p>A culture of learning and continuous development within the organization is established.</p> <p>Technical and other skills are developed.</p>	BSCI, SA 8000 Customer codes of conduct

For more information on trainings, see Annex 8.2.13.

4 GENERAL GUIDELINES FOR ENVIRONMENTAL COMPLIANCE

The following guidelines are meant to assist plastic and light engineering manufacturers in minimizing their environmental impact by conserving resources and reducing waste. Managing environmental issues is an integral part of business. Compliance with laws and regulations and the use of management systems will help manufacturing firms improve both environmental and financial performance.

4.1 WASTE MANAGEMENT

Waste can be solid, liquid, hazardous or non-hazardous. Waste is considered hazardous if it is flammable, corrosive, or reactive (e.g. explosive) or if it contains a certain amount of chemicals that are regulated as toxic. In the light of the electronics industry being a part of this study, electronic- or e-waste is becoming more important. E-waste refers to broken electronic materials and components or discarded electronic products.

Waste management practices can be prioritized according to the waste management hierarchy (see Figure 2). The following principles apply:

- Avoid or minimize the generation of waste as much as possible.
- Where waste cannot be avoided but has been minimized, reuse and recover waste.
- Where waste cannot be recovered or reused, treat, destroy, and dispose of it in an environmentally sound manner.
- Limit the amount of waste sent for disposal.

Hence:

- ➔ Prevention is better than recycle/reuse
- ➔ Reuse/recycle is better than treatment
- ➔ Treatment is better than disposal



Figure 2: Waste management hierarchy

4.1.1 SOLID WASTE MANAGEMENT

Solid waste can be defined as any solid material that is discarded because it is no longer of any use. It can be generated from industrial, commercial or residential activities. In this study it can be classified as metal, plastic or organic waste.

Some insights into general aspects of solid waste and the way to manage it are given below.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Waste is kept in the production floor in non-demarcated areas.	Store the waste in demarcated areas before disposal through a licensed contractor. Secondary containment is advised for containers with liquids.	Compliance with legislation in Bangladesh. Waste is stored properly.	ECA 1995 ECR 1997 ISO 14001
A mix of different types of waste, such as metals (e.g. aluminum, copper, steel), plastics and other materials are kept in the production floor without segregation.	Segregate waste according to its nature of hazards into: - Hazardous waste - Non-hazardous waste Do not mix different types of hazardous waste with each other (see 3.11 and 4.1). Store the waste in demarcated areas before disposal through a licensed contractor who is authorized to recycle or eliminate the waste in a prescribed manner.	Compliance with legislation in Bangladesh. Adverse impacts on human health and the environment are mitigated.	ECA 1995 ECR 1997 ISO 14001
Hazardous and non-hazardous waste are kept in open space.	Designate a specific area for solid waste. Avoid storing incompatible waste in close proximity, so that there is no chemical reaction with each other (see Annex 8.2.10). Make sure the area is clearly marked with the waste it contains. Make sure the space is not exposed to the weather. Install proper ventilation to handle potential fumes and vapor of hazardous waste materials.	Compliance with legislation in Bangladesh. Waste is properly stored. Adverse impacts on human health and the environment are mitigated.	ECA 1995 ECR 1997 ISO 14001

A sample waste management policy is outlined in Section 8.3.2.

4.1.2 LIQUID WASTE MANAGEMENT

Liquid waste can be defined as wastewater, fats, oils or greases from industrial processes. Sanitary waste water generated by restrooms, showers, or food preparation areas will not be discussed in this edition.

Water used for cooling and lubrication purposes has been found a widely neglected non-compliance which is prevalent in all industries.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Effluents from cooling and lubricating machinery are discharged without treatment.	Test the water by DoE or other third-party testing institutes for contaminants. Pass effluents through ETP before discharge. In case water is found contaminated with heavy metal residue, water should be treated by an ETP before discharge.	Compliance with legislation in Bangladesh. Soil and groundwater contamination are avoided. Public health is not affected.	ECR 1997 ISO 14001

Table 3 provides reference values of emission levels for direct discharges of effluents after treatment, as constituted by The Environment Conservation Rules in 1997:

Table 3: Emission level standards for direct discharges of effluents from industrial units or project waste

Parameter	Emission levels (mg/L)		
	Inland surface water	Public sewerage system connected to treatment at second stage	Irrigated land
BOD ₅ at 20°C	50	250	100
COD	200	400	400
Suspended solids	150	500	200
Ammoniacal nitrogen NH ₄ -N (as N)	50	75	75
Total chromium (as Cr)	0.5	1.0	1.0
Sulfide (as S)	1	2	2

Source: The Environment Conservation Rules 1997

4.2 WATER CONSUMPTION

The consumption of water in the plastics and light engineering industries is considerably lower than in other industries (e.g. leather, textile). However, both industries rely on water that is used for different purposes, such as cooling, washing, lubricating, among others. A genuine approach to minimizing water consumption should focus on:

- changing behavior
- modifying and/or replacing equipment with water saving equipment
- increasing internal reuse



Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
No records about the use of water are available.	<p>Introduce a system to improve the use of water:</p> <ul style="list-style-type: none"> - Install water meters at every machine. - Set the baseline for recording the water consumption - Record the consumption of water - Determine the use of water by equipment and/or process - Identify consumption peaks - Calculate the average water use by department or process. - Prioritize processes by water use and determine where to focus water saving measures. - Identify where water is wasted and determine saving potential. - Identify where water could be reused. - Regularly check piping and identify leaks. 	<p>An efficient use of water is ensured.</p> <p>The cost for water per process is minimized.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
There is no system to collect and reuse rainwater.	<p>Implement a system to collect and reuse rainwater.</p> <ul style="list-style-type: none"> - Use the surfaces of warehouses and factory rooftops to collect and store rainwater in adequate tanks. - Filter and use the rainwater for industrial (e.g. cooling, cleaning) or sanitary purposes (e.g. toilet, hand wash). 	<p>Ground water is saved.</p> <p>Water consumption is reduced.</p> <p>The cost for water is minimized.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
There is no system for internal reuse of water.	<p>Use water from internal processes for cooling and sanitation.</p> <p>Use water from internal processes for cleaning.</p>	<p>Water is used efficiently</p> <p>Cost saving from reducing water use are ensured.</p> <p>The cost for water extraction is minimized.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Equipment is not modified with water saving mechanisms.	<p>Modify equipment to achieve water savings.</p> <p>Install trigger-operated guns on hoses so that operators can use less water during clean up.</p> <p>Change taps, nozzles and shower fixtures to high pressure, low volume alternatives.</p> <p>Add timers and/or pedals to assure water is used sparingly and effi-</p>	<p>Water is used efficiently.</p> <p>Cost savings from reducing water use are ensured.</p> <p>The cost for water extraction is minimized.</p>	<p>ISO 50001</p> <p>ISO 14001</p>

ciently.

Adjust flows to the minimum required to maintain performance.

Install sub-metering systems.

Install in-line strainers on sprayer heads.

Adjust pump cooling and water flushing to minimum required for operations.

Replace high-volume hoses with high-pressure, low-volume cleaning systems.

4.3 AIR EMISSIONS

Manufacturing industries, particularly those based on fossil fuels, are a major source of air emissions in Bangladesh. Air contamination can harm human health and the environment. Therefore, it is necessary to understand the variety of substances released to air to determine the actions that minimize the impact.

It is necessary to differentiate between fugitive emissions and point source emissions, the former of which are more difficult to be controlled.

Point Source Emissions:

- Exhausted into a vent or stack
- Emitted through a single point source into the atmosphere.

Fugitive Emissions:

- Not released through a vent or stack
- Examples: volatilization of acids from open vessels, particulate or lead emissions from different processes, or spills and materials handling

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Emissions to air of Suspended Particulate Matters (SPM), sulfur dioxide, carbon monoxide and nitrogen oxide is beyond the acceptable limit.	<p>Substitute raw materials by purer grade raw materials which reduce the formation of pollutants. For instance, low sulfur fuel has less pollution potential than high sulfur fuels,</p> <p>Modify processes by using improved techniques to control emissions at source. For instance, adjust the air intake of boiler furnaces, so excess fly-ash emissions at power plants can be reduced.</p> <p>Modify existing equipment. For</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Emissions to air are reduced and controlled.</p>	<p>ECR 1997</p> <p>ISO 14001</p>

instance, smoke, carbon-monoxide and fumes can be reduced if open hearth furnaces are replaced with controlled basic oxygen furnaces or electric furnaces.

Maintain equipment. Poor maintenance resulting in leakages of ducts, pipes, valves and pumps increase the emission of pollutants. Conduct routine checkups of seals and gaskets.

Use wet collectors (scrubbers) to remove particulate contaminants from the polluted gas stream by incorporating the particulates into liquid droplets. Common wet scrubbers are:

- Spray Tower
- Venturi Scrubber
- Cyclone Scrubber

Emission of air levels are not measured and documented over time.	Conduct assessments of the air emission level on a regular basis. Document the emission level.	Compliance with legislation in Bangladesh. Air emission assessments help control and manage the air emission level within acceptable limits. Through timely interventions the risk of illness-related downtime and adverse impact on production processes is reduced.	ECR 1997 ISO 14001
---	---	---	-----------------------

4.4 ENERGY CONSUMPTION

Energy is a large variable cost that is relevant for almost every industry. Some of the processes in the plastics and light engineering industries (e.g. recycling of ferrous and non-ferrous metals) are particularly energy-intensive. In the light of an unreliable energy supply and rising energy costs, it requires practical solutions to reduce the overall environmental impact and bring down the energy cost per operation.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
There is no system in place to record the energy consumption.	Introduce a system of energy consumption: - Identify the types of energy used - Identify areas of energy consumption	Energy consumption can be traced back to each machine. A variety of interventions (e.g. repair, maintenance, investment in new machin-	ISO 50001 ISO 14001



	<ul style="list-style-type: none"> - Set the baseline to record the energy consumption - Record the monthly consumption of each machine and in total - Set target reductions - Monitor the energy consumption 	<p>ery) help reduce energy consumption.</p> <p>Energy is saved; overall cost is reduced.</p>	
Provision of using natural lighting is not available.	<p>Introduce a system to maximize the use of natural light.</p> <p>Install an automatic daylight sensor.</p> <p>Install transparent sheet over the rooftop.</p> <p>Make sure day light is not obstructed by machines, screens or finished products.</p>	<p>The energy lighting cost is reduced.</p> <p>CO₂ emissions are reduced.</p> <p>Exposure to natural light increases well-being.</p> <p>Exposure to natural light has a positive impact on productivity.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Equipment that is not in use consumes a large amount of energy.	<p>Turn off or shut down idle processing equipment, lights, fans, air compressors, and other types of energy-consuming equipment when they are not in use.</p>	<p>Energy is saved.</p> <p>Cost is reduced</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Energy efficient practices are not in use.	<p>Use energy efficient light (i.e. LED) to save energy.</p> <p>Use timed lighting that turns off when office rooms are not being used or occupied.</p> <p>Replace incandescent light bulbs and compact fluorescent lamps (CFLs) with LED bulbs.</p> <p>Turn off lights and equipment when not in use.</p>	<p>The energy cost is reduced.</p> <p>Carbon dioxide emissions are reduced.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Renewable energy is not being used.	<p>Install solar panels on factory premises.</p>	<p>Energy sources are diversified.</p> <p>Carbon dioxide emissions are reduced.</p> <p>Cost savings for energy are achieved.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Old and fragile machinery with high energy consumption is used.	<p>Introduce and optimize automation systems in your machinery.</p>	<p>The energy cost is reduced</p> <p>Carbon dioxide emissions are reduced.</p>	<p>ISO 50001</p> <p>ISO 14001</p>

5 INDUSTRY-SPECIFIC COMPLIANCE REQUIREMENTS

Guidelines specific to each sector's requirements have been developed to improve safety and health standards in the plastics industry and sub-sectors of the light engineering industry. Non-compliances of each industry are presented by

- Occupational hazards
- Environmental challenges sub-divided into
 - o Waste management (recycling where applicable; solid waste, liquid waste)
 - o Emissions to air
 - o Energy efficiency
 - o Product safety, national requirements and international standards where applicable

Employers can use these guidelines to minimize risk and keep their workplace free from hazards.

5.1 PLASTICS

There is a variety of processes that convert polymeric materials into the desired final plastic product with a wide range of properties. Their impact on human health and the environment is manifold given that oil-derived polymers are not biodegradable.

5.1.1 OCCUPATIONAL SAFETY AND HEALTH

The main concerns for health and safety of the main processes will be highlighted below:

The **injection molding** machine injects molten resin pellets under pressure into a mold cavity of a metal die. Once the liquid resin cools, the plastic part solidifies inside and is then removed from the mold. The **blow molding** process is used to produce hollow items, either by extrusion blow molding or injection blow molding. Both processes contain a variety of hazards and have the potential to cause serious injury.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Injection molding machines are inadequately safeguarded, exposing workers to a range of mechanical hazards (point of operation, pinch points, nip points, rotating parts).	Equip operator's gate with electrical or hydraulic interlocks or a mechanical safety device to operate the machine only when the gate is closed.	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015
	Provide interlocked rear guard to prevent clamp from closing.	Injection and blow molding operators are protected from injuries (e.g. fatalities, amputations, avulsions, crushing injuries, fractures).	
	Provide interlocked top guard to prevent workers from reaching over the top of the machine into the hazardous area.	Down time caused by safety issues and injury related absenteeism is reduced.	
	Provide parts discharge guard to keep workers from reaching under the operator's gate into the hazardous area.	The risk of legal actions and injury related compensation payments is reduced.	



	Provide interlocked purge protection to cover the nozzle and purging area.		
	Provide injection barrel cover to protect from exposure to high voltage and high temperature.		
Workers carelessly handle injection molding machine.	<p>Avoid operating machines with missing or inoperable guards and inadequate machine maintenance.</p> <p>Implement guarding solutions.</p> <p>Make workers aware of the (mechanical) hazards.</p> <p>Provide training to understand the requirements for guarding machines.</p> <p>Provide workers with respiratory masks and heat resistant cotton gloves.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Workers are adequately protected from health and safety hazards.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Hot surfaces of blow molding machine cause burns.	<p>Protect hot parts against accidental contact, using guards or insulation.</p> <p>Place warning signs where hot parts are necessarily exposed (e.g. molds).</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries (e.g. burns) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Dangerous moving parts in the mold area are a potential hazard.	<p>Interlock guarding with drives.</p> <p>Install fixed guarding or distance guarding to prevent the operator from reaching the danger zone.</p> <p>Install a monitored, presence-sensing safety device (e.g. pressure-sensitive mat, electro-sensitive protective device).</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries (e.g. avulsion, amputations, burns) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Hand knife injuries cause serious harm to workers.	<p>Where possible, try to eliminate or reduce the use of hand knives by:</p> <ul style="list-style-type: none"> - redesigning the tooling or process to eliminate or reduce the amount of trimming 	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries (e.g. cuts) is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>



	<ul style="list-style-type: none"> - improving mold maintenance to eliminate or reduce flash - automated cutting - referring to different methods, like cryogenic deflashing or vibrating bath and pebbles - using safer cutting tools (deburring tool/scissors) <p>Specify the right knife</p> <p>Ensure spare knives and blades are available</p> <p>Avoid knives being left lying unattended. Provide safe storage.</p> <p>Provide workers with adequate PPE, like hand gloves, armguard and aprons to protect from slipping and penetration from a dropped knife.</p> <p>Make sure the workers use the PPE provided.</p> <p>Follow basic housekeeping rules to ensure safe use of knives and blades.</p> <p>Train workers on safe use of knives and PPE.</p>	<p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>
There are traps at cores and ejectors.	<p>If possible, keep guards closed while removing traps.</p> <p>If not possible, install a lockable mode selector facility that allows movement only of the core/ejector mechanisms (i.e. not the tools).</p> <p>In addition, take the following precautions against traps in the area:</p> <ul style="list-style-type: none"> - safe design of core/ejector mechanisms; - localized fixed guarding <p>If neither of these is practicable, additional safety systems such as two-hand controls, hold-to-run or limited movement should be engaged automatically.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Workers are adequately protected from health and safety hazards.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p>
There are traps at the material feed.	<p>Install either a fixed guard at the feed throat (usually a grid) or a distance guard (usually the hopper).</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Workers are adequately protected from health and safety hazards.</p>



		Down time caused by safety issues and injury related absenteeism is reduced.	
Pick-and-place device moves dangerously.	Interlock pick-and-place device with the operator's guard (front and possibly rear if cycle can be initiated from there). Provide supplementary fixed guarding if the pick-and-place device can be reached over the top of the interlocked guards.	Compliance with legislation in Bangladesh. Workers are adequately protected from health and safety hazards. Down time caused by safety issues and injury related absenteeism is reduced.	BLA 2006 BLR 2015
Injection and blow molding machines exceed the maximum permitted noise level of 75 dB(A).	Control noise by <ul style="list-style-type: none"> - using slow speed pumps - controlling release of exhaust air - mounting pumps and motors on anti-vibration mounts and incorporate flexible hoses in pipe lines. - enclosing hydraulic power packs - converting injector guards to acoustic guards - fitting low noise nozzles to blow guns etc. - providing workers with ear plugs/muff - making sure the workers use the PPE provided 	Compliance with legislation in Bangladesh. The risk of workers losing their hearing abilities is reduced. A major cause of stress is eliminated; the risk of accidents is reduced. Workers can concentrate better; product quality and productivity are ensured.	ECR 1997 Noise Pollution Control Rules 2006, ISO 14001

Extruder machines are used to produce brittle and hard materials, for instance, for tubes, pipes and coatings for electrical wire. Polymer pellets are melted and pushed, i.e. extruded through a two-dimensional die opening. After passing through different shapes and sizes, the molten part cools and is formed into the desired shape.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Workers may become entrapped at the feed nip during regular operation.	Provide a fixed guarding at the opening to prevent access to rotating screws. If hopper and/or feed throat is removable, interlock them with screw drive.	Compliance with legislation in Bangladesh. The risk of serious injuries (e.g. fractures, bruising) is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015



Workers may become entrapped at other openings in the barrel.	<p>Make sure the design does not allow access to dangerous screw movement.</p> <p>Provide fixed or interlocked guards.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries (e.g. fractures, bruising) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Hot surfaces may cause burns.	<p>Use guards or insulation against hot parts.</p> <p>Affix warning signs to exposed hot parts.</p> <p>Provide workers with heat resistant apron and cotton gloves.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries (e.g. burns) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Molten splash, at start-up with material in the barrel, may cause burns.	<p>Provide splash guards at the die.</p> <p>Provide workers with heat resistant apron, cotton gloves, and eye protection.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries (e.g. burns) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>	<p>ECR 1997</p>
Crammer feed system may entrap workers.	<p>Make sure the design does not allow access to dangerous screw movement.</p> <p>Provide fixed or interlocked guards.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries (e.g. fractures, bruising) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Workers are exposed to mechanical screen changer.	<p>Provide fixed or interlocked guards.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries</p>	<p>BLA 2006</p> <p>BLR 2015</p>



		(e.g. fractures, bruising) is reduced.	
		Down time caused by safety issues and injury related absenteeism is reduced.	
		The risk of legal actions and injury related compensation payments is reduced.	
Extruders present noise levels exceeding the legal maximum of 75 dB(A).	Control noise by - specifying low noise design - fitting silencers to drive motor air intakes and exhausts - enclosing drive motor - providing workers with ear plugs/muff - making sure the workers use the PPE provided	Compliance with legislation in Bangladesh. The risk of workers losing their hearing abilities is reduced. A major cause of stress is eliminated; the risk of accidents is reduced. Workers can concentrate better; product quality and productivity are ensured.	ECR 1997 Noise Pollution Control Rules 2006 ISO 14001

Thermoforming machines are using thermoplastic sheet or film. Workers are mainly exposed to hazards when starting new rolls, inspecting the product, removing scrap materials, or if the equipment fails.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Drape table at the base of the machine is moving.	Apply fixed guards. Interlock drape table movement control with access door.	Compliance with legislation in Bangladesh. The risk of serious injuries (e.g. fractures) is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Heater bank is not properly safeguarded, exposing workers to fire risk.	Provide guarding arrangements for preventing trapping by heater units. Interlock heater with opening of the guard.	Compliance with legislation in Bangladesh. The risk of serious injuries (e.g. burns) is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Material feed presents mechanical hazards for	Use fixed or interlocked guards at the intake to protect workers from	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015



workers.	getting hands into transmission machinery, nips, or brakes.	<p>The risk of serious injuries (e.g. cuts, fractures) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>
Hot surfaces may cause burns.	Provide guards or insulation to protect operators from accidental contact with hot surfaces.	<p>Compliance with legislation in Bangladesh. BLA 2006 BLR 2015</p> <p>The risk of serious injuries (e.g. burns) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>
Traps at the drape table, plug or clamp of the forming section are unprotected.	Use control guards (e.g. interlocking), so platen closure is initiated when guard is closed.	<p>Compliance with legislation in Bangladesh. BLA 2006 BLR 2015</p> <p>The risk of serious injuries (e.g. cuts, fractures) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>
Cutting/trimming units are unprotected.	<p>Prevent access to the blade through the discharge opening by:</p> <ul style="list-style-type: none"> - a safe design of the cutting device, or - a distance guard - a take-off device interlocked to the control system 	<p>Compliance with legislation in Bangladesh. BLA 2006 BLR 2015</p> <p>The risk of serious injuries (e.g. cut) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>

Plastic sheet and film **winders** form flat sheet material into rolls. The level of intervention by the workers varies with the type of the winding machines. Safeguarding is required to protect from mechanical hazards.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
-----------------	---------------------------------	---------	--------------



Workers are exposed to cutting injuries from contact with various knives and blades of winding machine.	Guard all machines at the sides to prevent the operator reaching in to dangerous parts.	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015
	Provide safeguards to the front face to avoid workers getting entrapped into rollers.	Health risks (e.g. entrapment, crush injury) are reduced.	
	Consider pressure mats as safety device.	Down time caused by safety issues and injury related absenteeism is reduced.	
	Provide workers with chemical resistant gloves and safety rubber boots.	The risk of legal actions and injury related compensation payments is reduced.	
	Make sure the workers use the PPE provided.		

Plastic sealing and cutting machines are used to produce packaging materials and bags.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Unguarded plastic sealing and cutting machine endanger safety of workers.	Safeguard with interlocking guards to prevent access to rotating and moving parts through infeed and discharge openings.	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015
		Health risks (e.g. bruising, avulsion) are reduced.	
		Down time caused by safety issues and injury related absenteeism is reduced.	
		The risk of legal actions and injury related compensation payments is reduced.	

Size reduction machines, like shredders, pelletizers or granulators, are required for shredding thermoplastics for reuse.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Workers access blades when rotor is under powered motion.	Make sure size of feed opening in hopper prevents access.	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015
	If granulator is fed by conveyor, - make sure conveyor acts as a guard - provide fixed guarding - use interlocked guarding	The risk of serious injuries (e.g. cut or bruising) is reduced.	
		Down time caused by safety issues and injury related absenteeism is reduced.	
	Make sure fixed guarding or interlocking guarding is used to prevent worker reaching through any opening in the feed hopper.	The risk of legal actions and injury related compensation payments is reduced.	
	Provide a fixed mesh guard or a removable mesh guard with guard locking for preventing workers		



	reaching through the discharge area.			
Blades move without power.	Provide rotor restraint where necessary.	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015	The risk of serious injuries (e.g. cuts) is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.
Process materials or machine parts are ejected from feed hopper opening or chamber.	Make sure the design of the feed hopper does not allow materials to be ejected. Provide protective flaps at the feed hopper.	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015	The risk of serious injuries (e.g. cuts, fractures) is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.
Workers get entangled with flexible feed material.	Use a mechanical feeding device. Use an elongated hopper for long stretches of materials. Feed in pre-cut, shredded, baled or bagged material.	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015	The risk of serious injuries is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.
There is movement of power-operated devices (e.g. feed hopper, screen plate cradle, other enclosing equipment).	Use an interlocking guard with guard locking to prevent such devices being operated while rotors are moving.	Compliance with legislation in Bangladesh.	BLA 2006 BLR 2015	The risk of serious injuries (e.g. cut or bruising) is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.
In-running nips of feed rolls, vee belt and pulley	Provide fixed guarding to prevent operator reaching the danger zone.	Compliance with legislation in Bangladesh.	BLA 2006	

drives are not properly guarded to protect workers from injuries.		The risk of serious injuries (e.g. cuts, fractures) is reduced.	BLR 2015
		Down time caused by safety issues and injury related absenteeism is reduced.	
		The risk of legal actions and injury related compensation payments is reduced.	
Size reduction machines (e.g. shredders, pelletizers, agglomerators, crumbers) exceed the legal maximum of 75 dB(A).	Control noise by <ul style="list-style-type: none"> - using feed conveyors to remove operators from higher noise areas - placing size reduction machines in separate rooms or buildings – provide for remote or automated feeding - lagging or damping the machine casing - forming sound trap in feed aperture or hopper - enclosing the machine - fitting segmental or helical cutters - using tangential feed - fitting resilient backing to knives - reducing rotor speed - providing workers with ear plugs / muff - making sure the workers use the PPE provided 	Compliance with legislation in Bangladesh. The risk of workers losing their hearing abilities is reduced. A major cause of stress is eliminated; the risk of accidents is reduced. Workers can concentrate better; product quality and productivity are ensured.	ECR 1997 Noise Pollution Control Rules 2006 ISO 14001

5.1.2 ENVIRONMENTAL CHALLENGES

All types of plastics are considered hazardous. Industries producing plastic materials and/or goods have a severe impact on the environment. Hazardous waste needs to be treated by an Effluent Treatment Plant (ETP). Hence, any industry producing plastic materials and products is classified as follows:

- Orange B: plastic products, PVC items
- Orange A: plastic and rubber goods (excluding PVC)
- Red: Production of plastic raw materials (PVC, PP/iron, polyester, etc.)

For more information on the requirements for being issued an Environmental Clearance Certificate (ECC), see Annex 8.3.1.

5.1.2.1 WASTE MANAGEMENT

Petroleum-based plastic products adversely impact on the environment. They often end up in either landfills or the ocean. A sound plastic waste management relies on multiple ways to protect human health and the environment.

RECYCLING

Recycling provides enormous opportunities for energy and cost savings. Effective filtration technology is required to bring recycled plastics, which are often composed of more than one polymer, to the level of primary material.

Waste plastics can be classified by their use in a specific economic sector (see Table 4):

Table 4: Types of waste plastics

Sectors	Polymers contained in the plastic waste
Packaging	PE, PP, PS, PET, etc.
Automotive	PP, PU, ABS, etc.
Electrical	PS, ABS, PP, etc.
Electronics	PC, PA, PBT, etc.
Building and construction	Foams: PU, expanded PS, mix of PS, etc. Pipes: PE, PVC, etc.
Agricultural (films)	PE

Source: European Commission – Integrated Pollution Prevention and Control, 2006

The following types of plastics are normally recycled:

- High- and low-density PE
- PET
- PP
- PS
- PVC

There are three methods of recycling plastics:

- Mechanical (material) recycling
- Chemical (feedstock) recycling
- Thermal recycling

Mechanical/material recycling changes thermoplastic waste materials (PE, PET, PP, PS) into secondary raw materials. Figure 3 shows how plastics can be recycled following a specific process in order to remove the reusable plastics from the waste streams and recapture the value inherent in the material.

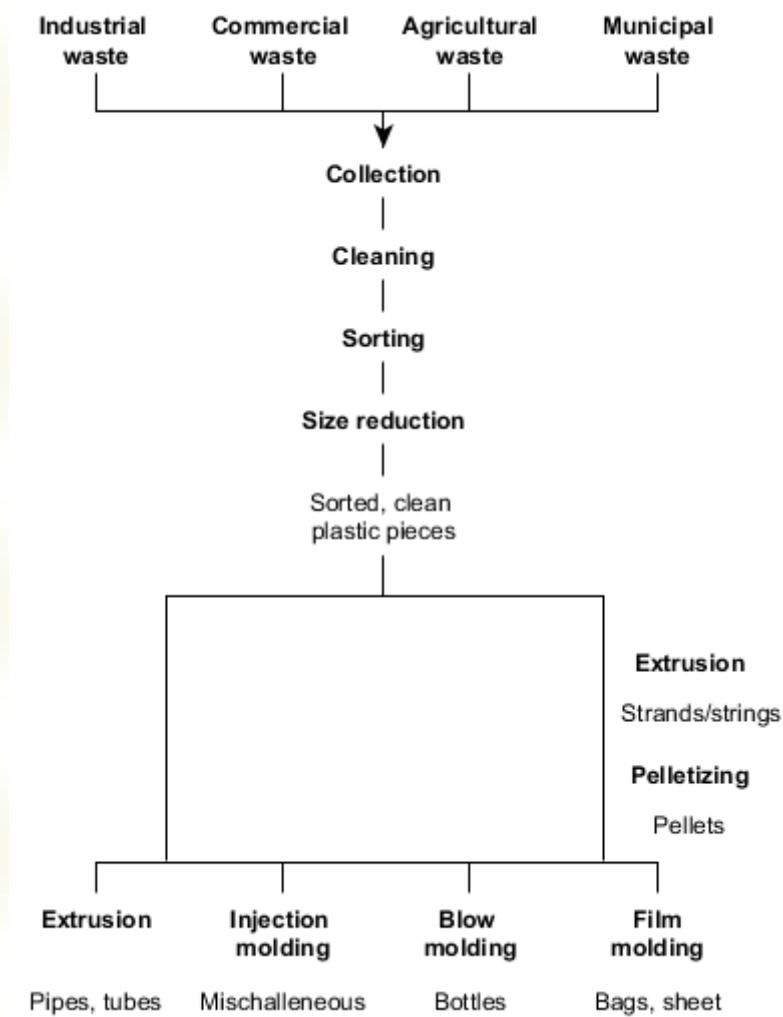


Figure 3: Typical waste plastic reprocessing stream in low income countries

Source: Adjusted from Lardinois and van de Klundert, 1995

All recycling processes involve benefits for the environment, while their implementation may come at a cost. The **mechanical recycling** process presented below is useful and economical for pure materials with little adhering residues.

Benefits	Limitations
Plastic waste is reproduced into useful products; the use of primary material is avoided.	Method only suitable for pure materials. Sorting of plastics with adhering residues is very costly and resource-intensive.
Cost for imported primary material is reduced.	Plastic recycling does not ensure good quality. Most plastics are reused in lower grade applications.
Energy usage is reduced. Water pollution and air pollution from landfilling is reduced	VOC are emitted to air, which is harmful for plant and animal life and human health. Carbon emissions of energy use contribute to global warming.
Recycling conserves natural resources (e.g. petroleum)	Potential health threats of recycled plastics lead to a

and energy for processing primary materials.

use that is at a disadvantage compared to plastics products made from primary materials.

Chemical recycling uses thermochemical processes to break down plastic waste to oil or gaseous products as raw materials for the chemical and plastics industry. The following methods can be used:

- Monomerization
- Use as blast furnace reducing agent
- Coke oven chemical feedstock recycling
- Gasification

Benefits	Limitations
Chemical recycling can be used for difficult to recycle streams (complex plastics), where mechanical recycling has failed.	High investment cost for waste recycling unit, treatment facilities, utility vehicles, and employee training.
Waste is turned into feedstock for the chemical/plastics industry, producing virgin-grade recycled material.	Breaking material down into separate components is highly energy-intensive. Polystyrene can be easily reduced to monomers; polyethylene requires more (intermediate) steps.
No contamination from original usage.	Lack of efficient collection and sorting processes. Informal collection system difficult to be scaled up.
More environment-friendly than energy conversion or incineration.	Sorting is extremely complicated given the myriad of combinations of dyes and additives that can be added to the basic resin and the variety of properties and melting points.
Allows for operations on a smaller, more local scale.	

Thermal recycling refers to the recovery of energy inherent in the plastics. The following methods are known to serve for recovering energy:

- Liquefaction
- Gasification
- Solid fuel made from waste
- Waste power generation
- Conversion to cement kiln fuel

Benefits	Limitations
Heat and exhaust gas generated can be used as new source of energy.	Incineration produces airborne toxic substances (e.g. dioxins). Residue ash contains lead and cadmium.

In addition to reducing oil usage, carbon dioxide emissions and the quantities of waste requiring disposal, recycling provides **opportunities** that are particularly interesting for any major business:

There is a **high potential for innovation** if recyclers and research jointly work on improving processes.

Businesses may benefit from the consumers' **increasing interest in more sustainable products**, while less resources are wasted. Recycled plastic components **support CSR activities** and tend to have a positive impact on **brand image**.

There are four mechanisms of how plastics can be degraded:

- Photodegradation
- Thermo-oxidative degradation
- Hydrolytic degradation
- Biodegradation

Most of the plastic waste is non-biodegradable and ends up incinerated or in landfills. **Biodegradable plastics** is defined as plastics which break down at faster rates than regular plastics. It can take three to six months to decompose fully. Local environmental factors, such as temperature, oxygen, or moisture, determine the duration of the degradation process.

As **bioplastics** are expanding in use, it is important for manufacturers to be aware of their properties and disposal requirements to ensure product safety (see 5.1.2.4). Bioplastics can be classified into three categories:

- Non-biodegradable and fully or partially bio-based (e.g. bio-based PET, bio-based PE)
- Biodegradable and petroleum-based (e.g. PCL)
- Both biodegradable and fully or partially bio-based (e.g. PLA, starch blends)

Biodegradable plastics, such as polyhydroxyalkonates (PHA), polyhydroxybutyrate (PBA), starch, polybutylene succinate (PBS), polycaprolactone (PCL), or polylactic acid (PLA) are often used as intermediate raw materials in the production of biodegradable plastic products. Their energy use during production is usually higher than for conventional PE and PP. Recent studies have found that PHA can be produced from wastewater. The main limitation, however, is that the cost of production is high.

Bioplastics that are biodegradable are designed for organic recycling in **industrial compost plants**. They are not intended to biodegrade in marine environment. Section 5.1.2.4 on product safety presents the standards for industrial composting.

Some biodegradable plastics and their properties are presented in Table 5:

Table 5: Biodegradable plastics and their properties

Biopolymer	Feedstock	Raw material	Properties	Substitute for
Starch based	Corn, potato, wheat, tapioca	Starch	<ul style="list-style-type: none"> - Low water vapor barrier - Poor mechanical properties - Bad processability - Brittleness 	PS
Cellulose based	Wood pulp	Cellulose	<ul style="list-style-type: none"> - Low water vapor barrier - Poor mechanical properties - Bad processability - Brittleness 	PP
PHA, PHB	Corn, potatoes, maize, tapioca, vegetable oils	Starch	<p>PHA:</p> <ul style="list-style-type: none"> - From stiff, brittle to semi-rubber-like <p>PHB:</p> <ul style="list-style-type: none"> - Better oxygen barrier properties 	PP, PE



			than both PP and PET	
			- Better water vapor barrier properties than PP	
			- Fat and odor barrier properties are sufficient for use in food packaging.	
Poly(lactic acid) (PLA)	Corn, sugar beet, potatoes, wheat, maize, tapioca	Lactic acid	- High tensile strength and modulus - Brittleness and low crystallinity lead to low thermal stability and limited applications	LDPE, HDPE PS, PET, PP

Source: Bioplastics Guide 2016

Compostable plastics are a sub-category of biodegradable plastics. All compostable plastics are biodegradable and must be certified by a third party according to international standards (see 5.1.2.4). National regulation should follow suit to provide suitable composting facilities.

Recently, two types of **biodegradable plastics** have been controversially discussed: oxo-degradable and hydro-degradable plastics.

- The degradation process of **oxo-degradable plastics** is initiated by a chemical process (oxidation and hydrolysis), followed by a biological process. The plastics can be programmed to degrade in whatever timeframe is required. Plastics will be broken down by bacteria and fungi but will leave microplastic traces in the environment.
- **Hydro-degradable** plastics start degrading by hydrolysis. Some hydro-degradable plastics have a high starch content. However, most of the hydro-degradable plastics are partly or entirely based on oil-derived intermediates.

It is noteworthy that **only compostable plastics decompose completely** and are thus unreservedly recommended. Given the risk of microplastics, it is strongly advised to not manufacture plastics following the oxo or hydro-degradable process. For a bioplastic to keep its environmental impact to a minimum, plastics require to be both **bio-based and biodegradable**.

For more information on standards for biodegradable and compostable plastics, see 5.1.2.4.

LIQUID WASTE

In the manufacturing of plastics, water is often used as process water. Consequently, an effluent treatment plant is a prerequisite for the plastics processing industry. The following challenges should be considered when producing plastics.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Effluents from cooling and lubricating machines may be contaminated with heavy metal residues.	Test the water by DoE or third-party testing institute for contamination. Pass the effluents through an ETP before discharge.	Compliance with legislation in Bangladesh. Water is properly treated and can be reused as a circulating water. Soil and groundwater are not contaminated. Public health is not affected.	ECR 1997 ISO 14001
During vulcanization of	Send the resulting condensate to	Compliance with legislation	ECR 1997



synthetic rubbers waste an ETP.
waters are produced.

in Bangladesh.

ISO 14001

Water is properly treated
and can be reused.

Cost savings are achieved.

Soil and groundwater are not
contaminated.

Public health is not affected.

5.1.2.2 AIR EMISSIONS

Emissions to air result from processing pellets, granules or powders with additives (e.g. pigments, fire retardants, fillers). Fume can cause serious negative effects on health, such as short-term irritations to eyes, nose and lung, or long-term respiratory diseases and cancer.

There is a wide range of **pollutants** at plastic processing and manufacturing facilities. The emissions can be classified as follows:

- **Volatile organic compounds (VOC)** and **hazardous air pollutant (HAP)** emissions resulting from the volatilization of free monomer or solvent in the primary polymer blend during processing;
- VOC and HAP emissions from secondary process materials, such as blowing agents, additives, and lubricants (mold release compounds);
- VOC, HAP, and **particulate matter (PM)** emissions from byproducts formed by chemical reactions or formed during heating of resins;
- PM emissions generated during raw material handling and finishing operations.

The extent of the emissions depends on the chemical composition of the raw materials (resins, additives) and types of production processes used. The diverse nature of these raw materials and manufacturing processes leads to various combinations of emission sources and pollutants.

- Primary emissions are generated at the equipment where chemicals are processed (e.g. blended, melted, heated, etc.) and the final product is produced.
- Secondary processes, such as storage tanks, equipment leaks, wastewater treatment, combustion sources, and cleaning and surface coating operations) additionally emit substances to air.

How to deal with non-compliances as observed in the factories is presented below.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Workers are exposed to fumes from plastic processing.	Check Material Safety Data Sheet (MSDS) of each plastic raw material.	Compliance with legislation in Bangladesh.	The Environment Conservation Rules 1997 ISO 14001
	Identify and mark all virgin and regrind materials unequivocally.	The risk of fume production is reduced.	
	Give operators all relevant processing data (e.g. temperature, residence time, changes from previous formulation)	Health risks are reduced.	
		Down time caused by safety issues and injury related absenteeism is reduced.	
		The risk of legal actions and	



	<p>Train operators in the way to</p> <ul style="list-style-type: none"> - purge, - deal with blockages, - ensure nozzles seat correctly, - handle alarm conditions which cause halt in processing <p>Check that (heat-sensitive) material is processed at the right temperature.</p> <p>Keep machines clean at all times.</p> <p>Implement a checking system for screw wear.</p> <p>Refurbish heater system.</p> <p>Ensure processes are well ventilated.</p> <p>Provide local exhaust ventilation wherever material manufacturers recommend it and your assessment confirms it.</p> <p>Local exhaust ventilation is required for the following processes:</p> <ul style="list-style-type: none"> - recycling of mixed grades of polymer at pelletizer unit - bag making at sealing heads where film regularly sticks and overheats - blown film lines with internal bubble cooling where fume-laden air needs to be ducted outside - burning out blocked dies and nozzles - older machines where process controls are less reliable <p>Regularly inspect and maintain machines and processes.</p> <p>Provide emergency procedures when processing heat-sensitive materials.</p> <p>Clearly explain and practice emergency procedures.</p>	<p>injury related compensation payments is reduced.</p>	
Styrene vapor exposes workers to health hazards.	<p>Provide good general ventilation.</p> <p>Provide local exhaust ventilation (e.g. hoods).</p> <p>Provide splash guards.</p> <p>Provide non-spill containers for</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Health risks (e.g. irritation to nose, throat and lungs) are reduced.</p>	<p>BLA 2006 Bangladesh Labor Rules 2015</p>

	working areas. Provide workers with respiratory masks and gloves. Make sure the workers use the PPE provided Specify the frequency for the workers to change PPE.		
Workers are exposed to fumes from winding machine.	Provide workers with respiratory masks, chemical resistant gloves, and safety rubber boots. Make sure the workers use the PPE provided.	Compliance with legislation in Bangladesh. The risk of long-term illness (e.g. allergy, asthma, bronchitis) is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 Bangladesh Labor Rules 2015
Workers are exposed to dusts and fine particulates from plastic dry processing machines and cutting operations. Along with the dust particles, fumes may be emitted.	Capture plastics dust, fumes and mists at the source. Use canopy hoods with clear plastic drop curtains or guards with flexible ducting. Isolate the process from the rest of the factory and protect the contained area. Filter ambient air if source capture is not possible. Provide the workers with appropriate PPE (respiratory masks). Make sure the workers use the PPE provided.	Fume concentrations in the factory is reduced. Fumes are under control and do not migrate to other work areas. Ambient haze caused by airborne pollutants is removed. Workers are protected from dust and fumes. The risk of long-term illness, and downtime is reduced.	BLA 2006 Bangladesh Labor Rules 2015

5.1.2.3 ENERGY EFFICIENCY

Rising energy prices weigh on the operating expenses of the plastics industry. Opportunities for savings in select processes are outlined below.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Plastic raw materials need to be dehumidified before use.	Invest in a bulk storage system, so new materials are contained and dehumidified before moving to the line.	Compliance with legislation in Bangladesh. Energy consumption is reduced. Labor downtime is reduced. Cost savings are achieved.	ECR 1997 ISO 14001

Change-over time for tooling is very slow. Lots of machinery is out of order or sits idle.	<p>Make sure there are sufficient operators in each shift who are experienced in changing molds.</p> <p>Proceed as follows:</p> <ul style="list-style-type: none"> - Outfit the change-over molds with the correct hoses, knock-outs, and bars - Maintain good housekeeping to find the equipment required for the change-over process. - Schedule the change-over early in the first shift. 	<p>Increased productivity during the day/week; less overtime is required.</p> <p>Energy is saved.</p> <p>Cost is saved.</p> <p>Energy needed for lighting and other equipment is reduced.</p>	<p>BLA 2006</p> <p>ISO 14001</p>
The compressed air system is ineffective, losing much of the energy required to heat and leakage.	<p>Replace compressed air-drying units.</p> <p>Repair compressed air leaks.</p> <p>Set air pressure at the level required by the system.</p> <p>Duct outside air to the compressor.</p>	<p>Energy is saved.</p> <p>Cost is reduced.</p>	<p>ECR 1997</p> <p>ISO 14001</p>
Barrel heater on the injection molding machine runs at full temperature when not in use.	<p>Reduce the temperature of the barrel heater when injection molding machine is not in use.</p>	<p>Energy is saved.</p> <p>Cost is reduced.</p>	<p>ECR 1997</p> <p>ISO 14001</p>
The energy use in extrusion processes is high.	<p>Optimize the extruder speed.</p> <p>Use fans instead of compressed air to cool equipment.</p>	<p>Energy is saved.</p>	<p>ECR 1997</p> <p>ISO 14001</p>
Injection molding equipment is not adjusted to the product being produced.	<p>Verify that the equipment parameters are optimal for the product being produced.</p>	<p>Cost is reduced.</p>	<p>ECR 1997</p> <p>ISO 14001</p>
Extruder, injection molding and blow molding machines are not properly insulated.	<p>Use thermal insulation systems (e.g. insulation blankets, jackets, etc.) to reduce heat loss and surface temperature.</p> <p>Make sure all hot parts of the equipment are fitted.</p>	<p>Energy is saved, heat loss is reduced.</p> <p>The risk of serious injuries (e.g. burns) is reduced.</p>	<p>ECR 1997</p> <p>ISO 14001</p>

5.1.2.4 PRODUCT SAFETY

In the following, the requirements for plastic products manufactured in Bangladesh and catered to both domestic and international markets are briefly presented.

NATIONAL REQUIREMENTS

There are currently no mandatory tests for plastics in Bangladesh. BSTI carries out the following tests:

- PVC pipe test



- PVC-U pressure pipes for portable water

More performance tests are being offered at local testing institutes:

- Hydrostatic test
- Acetone test
- Impact test
- Rupture test

For more information on testing requirements, it is recommended to contact BSTI.

INTERNATIONAL STANDARDS

Catering plastics to the export market requires manufacturers to comply with international regulations, such as:

- The **RoHS (Restriction of Hazardous Substances)** directive regulates the manufacture, import and distribution of Electronics and Electrical Equipment (EEE) within the EU, under which six hazardous metals (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, and polybrominated diphenyl ether) are banned from use. For more information on RoHS, please visit:
http://ec.europa.eu/environment/waste/rohs_eee/index_en.htm
- **REACH (Registration, Evaluation, Authorization and Restriction of Chemicals)** deals with the regulation of chemical substances and applies to all products manufactured, imported or sold within the EU. The European Chemicals Agency (ECHA) has established a database to find information on hazardous chemicals. For more information on REACH and ECHA, please visit:

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R1907&from=EN>

<https://echa.europa.eu>

Plastic that comes into contact with anything that is consumed by humans, like beverages and food, needs to meet higher standards than other forms of plastic. To ensure product safety and protect consumer health, these **food-grade products** need to pass a food contact test of:

- chemical substances migrating in substantial quantities into food, affecting food quality
- volatile organic compounds in food contact materials
- extractable and leachable heavy metals
- composition of metal material

Food contact test are required for food package materials and other materials or components which can come into contact with food. The European Food Contact Regulations and the US Food and Drug Administration (FDA) have very strict safety requirements:

- The EU regulation publishes lists of substances that are permitted for use in the manufacture of plastic **Food Contact Materials (FCM)**. It specifies restrictions on the use of these substances and determines what levels of dyes, additives or recycled plastic materials, among others, are suitable for food-grade products. For more information on FCM, please visit:

https://ec.europa.eu/food/safety/chemical_safety/food_contact_materials/legislation_en



- Companies in the US refer to substances **Generally Recognized as Safe (GRAS)**. For more information on GRAS, please visit:

<https://www.fda.gov/food/ingredientpackaginglabeling/gras/>

In addition to the regulations in international markets, the FSSC 22000 standard provides guidelines for a safe management of the food supply chain. For more information, please visit:

<http://www.fssc22000.com/documents/home.xml?lang=en>

The following standards address compostable plastic and are essential for accessing important international markets (e.g. EU, US):

- **ASTM D6400** by the American Society for Testing and Materials (ASTM) for the USA. For more information, please visit: <https://www.astm.org/Standards/D6400.htm>
- **ISO 17088:2012**. For more information, please visit: <https://www.iso.org/standard/57901.html>
- **EN 13432** and **EN 14995** by the European Committee for Standardization (CEN) provide technical specifications for the compostability of plastic products in the EU.

5.2 ENGINEERING WORKS

Suppliers of industrial machinery work with materials and technology, which entail substantial releases to atmosphere and water. Waste management and energy considerations are among the key factors that influence the sector's competitiveness.

Key processes that are considered as relevant for the entire light engineering industry will be presented.

5.2.1 OCCUPATIONAL SAFETY AND HEALTH

Industrial metalworking includes cutting, forming, and joining activities. A range of tools and equipment is required that may represent occupational hazards and jeopardize the environment.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Cutting, lathe, punching and grinding machines lack barrier guards.	Provide barrier guards and blade guards, where missing, to the cutting, lathe, punching and grinding machines.	Compliance with legislation in Bangladesh. Adequate safeguards reduce the workers' risk of getting injured. The risk of legal actions and compensation payments is reduced.	BLA 2006 BLR 2015
Working at height especially in engineering workshops is a major cause of work-related injuries.	Avoid work at height, where possible. If work at height cannot be avoided, use collective measures (e.g. scaffolds, nets, soft landing systems) to protect the workers at risk. Collective control measures take priority over personal control measures (e.g. harness). Conduct a risk assessment to prove low risk and short duration of the task. Only use ladders for work at height in situations where they can be used safely, i.e. where the ladder will be level and stable and can be secured properly.	Compliance with legislation in Bangladesh. The risk of serious injuries is reduced. Adequate safeguards reduce the workers' risk of getting injured. The risk of legal actions and compensation payments is reduced.	BLA 2006 BLR 2015
Wet or contaminated floors cause the workers to slip and trip.	Good housekeeping helps reduce the risk of slips and trips. Keep designated work areas and walkways free from tripping hazards, that is store materials, equipment, empty pallets, waste and packaging materials properly.	Compliance with legislation in Bangladesh. The risk of serious injuries is reduced. Good housekeeping is ensured.	BLA 2006 BLR 2015



	Keep floors properly maintained, e.g. free of potholes, protruding objects, and inadequately covered drains.	The risk of legal actions and compensation payments is reduced.	
	Keep floors free of leakages and spillages.		
Copper coils are held in place by friction between the base of the coil and the floor surface.	<p>Stack coils at the correct angle and properly separate them by pegs.</p> <p>Take extra care of larger diameter, narrow-width coils.</p> <p>Shrink wrapping does not increase the stability of a pack of narrow coil.</p> <p>Limit the amount of coil leant against each stand/upright. Avoid overstocking.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Coils are stacked properly and cannot slide or collapse.</p> <p>The risk of serious injuries is reduced.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Copper coils are not properly secured.	<p>Use chocks to secure copper coils.</p> <p>Chocks should be large enough to prevent a coil climbing up and over the chock.</p> <p>Chocks can be made of hardwood, steel or a composite material. Never use softwood.</p> <p>Frequently check chocks for wear and replacement.</p> <p>Place at least two chocks on each side of the coil, equally about its center line.</p> <p>Check the floor condition regularly to make sure that it is clean and free from contamination, e.g. by oil.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries is reduced.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Lifting equipment, like forklifts, overhead cranes, or mobile cranes need regular inspection.	<p>Check and inspect lifting equipment in accordance with manufacturer's recommendations on a daily basis before use.</p> <p>Get the equipment thoroughly tested at least once a year or in accordance with a written scheme of examination prepared by a competent person.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of accidents (e.g. falls) and serious injuries is reduced.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Lifting accessories such as chains, slings, ropes, fork-lift chains, vacuum lifting attachments, or magnetic lifting attachments are not checked	<p>Daily before use check the lifting accessories.</p> <p>Run regular checks in accordance with the manufacturer's recommendations.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of serious injuries (e.g. falls) is reduced.</p> <p>The risk of legal actions and</p>	<p>BLA 2006</p> <p>BLR 2015</p>



regularly.	Get the lifting accessories thoroughly tested at least every six months or in accordance with a written scheme of examination prepared by a competent person.	compensation payments is reduced.	
Materials with sharp edges is not properly protected and can result in cuts, abrasions, infected wounds, dermatitis, amputations, and fractures.	<p>Ask your supplier to remove or protect sharp edges on material and equipment, for instance, by fitting plastic covers or padding.</p> <p>Engineer out sharp edges that are produced during certain processes:</p> <ul style="list-style-type: none"> - Design tooling to minimize sharp edges - Dress or roll edges of metal strip - Grind or sand edges of large items - Protect edges before handling <p>Avoid handling materials with sharp edges by using trays, jigs, holders, tongs, hooks, baskets, hoists, trolleys, lift trucks etc.</p> <p>Minimize handling of materials with sharp edges by automating processes by using conveyor belts, feed and discharge chutes, automatic feeds and air ejection systems etc.</p> <p>Provide workers with safety helmet, boots, and gloves.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Good housekeeping is ensured.</p> <p>The risk of serious injuries (e.g. cuts) is reduced.</p> <p>The risk of absenteeism and loss of production is reduced.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
The metal parts making section causes noise levels beyond the permitted maximum of 75 dB(A).	<p>Control noise by</p> <ul style="list-style-type: none"> - replacing semi-automatic cutting, lathe, punching and grinding machines with automated machine/CNC machines. <p>Ensure the noise level is below the legal maximum.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of workers losing their hearing abilities in the long run is reduced.</p> <p>Due to the reduction of noise, which is a major cause of stress, the risk of accidents is reduced.</p> <p>Workers can concentrate better. Absenteeism is reduced; productivity and product quality are ensured.</p>	<p>ECR 1997</p> <p>Noise Pollution Control Rules 2006, ISO 14001</p>



Hot work processes, such as **welding**, are essential for many sub-sectors of the light manufacturing industry as well as for repair and overhaul. Adequate prevention is necessary to control occupational hazards and minimize the risk of injuries for workers.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Oversized welding cables and repetitive motion can cause fraying, tearing and breaking of the cable.	The cable must be adequately designed and sized to handle the maximum current. Make sure manual welding applications hold up to repeated movement over rough surfaces.	The flow of electricity is ensured; voltage does not need to be gradually increased to achieve good results, i.e. a consistent arc. Excessive resistive heat is avoided. The degradation of the cable is prevented. As damages are minimized, productivity is improved.	BLA 2006 BLR 2015
Welding leads with damaged insulation are in use.	Replace welding cables with damaged insulation or connectors. Avoid poor application of electrical tapes.	Mechanical strength, insulating quality and electrical conductivity are ensured.	BLA 2006 BLR 2015
Welding operators at the core assembly section work without using adequate PPE.	Provide welding operators with cotton gloves, safety goggles, boots and helmets, and safety shield. Make sure the workers use the PPE provided.	Compliance with legislation in Bangladesh. Adequate PPE protects the welding operators against health and safety hazards. The risk of long-term illness such as hearing impairment and the risk of fatal incidents are reduced. Absenteeism and its adverse impact on the production process is reduced. The risk of legal actions and compensation payments is reduced.	BLA 2006 BLR 2015
Welding operators work for extended periods of time in awkward body positions.	Provide work station for welders or use adjustable work tables.	Neck, hand and wrist injuries are reduced. Absenteeism and its adverse impact on the production process is reduced. The risk of legal actions and compensation payments is reduced.	BLA 2006 BLR 2015

5.2.2 ENVIRONMENTAL CHALLENGES

Industries producing industrial tooling, industrial machinery and carrying out regular engineering works rely partly on hazardous materials and processes. This results in the following categories for the application for an Environmental Clearance Certificate (ECC). The larger the businesses are, the greater is estimated their impact on the environment:

- Orange A: Industrial machinery and equipment
- Orange B: Engineering works of up to 10 hundred thousand taka capital
- Red: Engineering works above 10 hundred thousand taka capital

For more information on the requirements of an ECC, see Annex 8.3.1.

5.2.2.1 WASTE MANAGEMENT

Most of the waste materials in engineering consists of iron, aluminum, copper, brass, and other metals. Poor housekeeping and improper waste management is often the reason for health issues, occupational and environmental hazards, and a lack of productivity. Waste in the ferrous and non-ferrous metals industry should be dealt with as laid out in Table 6:

Table 6: Waste management of ferrous and non-ferrous metals

Reduce	- Order material efficiently to minimize waste
	- Measure and cut materials accurately
	- Plan mechanical and electrical runs to reduce material
	- Keep an inventory of all surplus materials to reduce over-supply at future job sites
Reuse	- Store cuttings in a central location for reuse
	- At project completion, remove surplus materials and take to next job or store off site
Recycle	- Sell scrap metals to dealers who recycle metals
	- Recycle and recover heat energy where possible
Disposal	- Refer to incineration and landfilling only as last resort

Source: Adapted from Canadian Construction Association 2001

Using recycled metals, such as copper or aluminum, to produce new materials reduces the energy use and CO₂ emissions thanks to lower melting points. Likewise, recycled steel saves substantial amounts of air pollution, water consumption and water pollution.

SOLID WASTE MANAGEMENT

Metal solid waste should be managed following the 'reduce-reuse-recycle' paradigm.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
-----------------	---------------------------------	---------	--------------



Metal and other waste is not properly separated.	Sort waste into different categories, according to their nature of hazard.	Compliance with legislation in Bangladesh.	ECA 1995
	Avoid mixing substances that react strongly with each other.	The treatment of homogeneous waste streams is easier.	ECR 1997
	Store the waste separately and dispose of it through a licensed contractor who is authorized to recycle or eliminate waste in a prescribed manner.	Adverse impacts on the environment are prevented.	ISO 14001

LIQUID WASTE MANAGEMENT

Water was found to be used as process water, which requires adequate treatment as presented below.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Effluents from cooling and lubricating machines may be contaminated with heavy metal residues.	Test the water by DoE or third-party testing institute for contamination.	Compliance with legislation in Bangladesh.	ECR 1997
	Pass the effluents through an ETP before discharge.	Water is properly treated and can be reused as a circulating water.	ISO 14001
		Soil and groundwater are not contaminated. Public health is not affected.	
Electroplating generates large quantities of wastewater containing heavy metal residues and sulfuric acids.	Treat effluent from the electroplating bath in ETP.	Compliance with legislation in Bangladesh.	ECR 1997
	Use improved filtration on plating tanks.	The generation of hazardous waste is avoided.	ISO 14001
		Hazardous wastewater is properly treated.	
		The frequency of purification treatment is reduced. Public health is not affected.	

5.2.2.2 AIR EMISSIONS

The ferrous and non-ferrous metal industries are one of the most pollutant industries in Bangladesh. Although recycling can have significant benefits for the environment, hazardous waste recycling of secondary steel, aluminum, copper, lead and other metal alloys causes significant air pollution.

The main releases to air in metal production and processing are:

- Dust
- Metal compounds
- Organic carbons (which can result in the formation of PCDD/F)
- Sulfur dioxide

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
-----------------	---------------------------------	---------	--------------



Suspended particulate matters (SPM), sulfur dioxide, and carbon monoxide are emitted to air from lathe and grinding machines.	<p>Prevent emissions from being generated at source.</p> <p>Maintain and replace old equipment or machineries.</p> <p>Install exhaust facilities.</p> <p>Do not use hazardous chemicals in the process.</p> <p>Provide workers with adequate PPE, such as respiratory masks, skin and eye protection.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Emission to air are reduced and controlled.</p> <p>The risk of illness is reduced.</p>	ECR 1997 ISO 14001
Water-based fluids of metal-working coolants produce sulfur odors from bacterial growth.	<p>Clean the machine and the sump on a daily basis.</p> <p>Replace the coolant every two to three days.</p> <p>Use high-quality coolant that separates easily from tramp oil.</p> <p>Remove accumulated oils on a regular basis.</p> <p>Circulate the fluid periodically when machines are idle.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of bacteria and fungus growing in coolant sump is reduced.</p> <p>The risk of biomass clogging filters and screens is minimized.</p> <p>The risk of illness due to foul odor is reduced.</p> <p>Workers can concentrate better. Absenteeism is reduced; productivity and product quality are ensured.</p>	ECR 1997 ISO 14001
Cutting processes may heat the metals to very high temperatures, producing metal fumes and visible haze in the factory floor.	<p>Check ventilation system and improve, if necessary (see Annex 8.2.9).</p> <p>Prevent fumes, vapor and dust at the point of source.</p> <p>Install a proper exhaust air system (e.g. downdraft).</p> <p>Make sure the fumes and dust are properly filtered.</p> <p>Provide workers with respiratory masks.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Long-term exposure to metal fumes is avoided.</p> <p>The risk of irritation of eyes, nose and throat is reduced.</p> <p>The risk of long-term illnesses (e.g. pneumonia, bronchitis, cancer) is mitigated.</p>	ECR 1997 ISO 14001
Electroplating activities produce fumes and vapor causing odor and irritation to workers and residents.	<p>Locate activity outside residential areas.</p> <p>Install a local exhaust ventilation system.</p> <p>Provide workers with respiratory masks and eye protection.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Long-term exposure to metal fumes and other toxic emissions is avoided.</p> <p>The risk of irritation of eyes,</p>	ECR 1997 ISO 14001

	Make sure the workers use the PPE provided.	nose and throat is reduced. The risk of long-term illnesses is mitigated.	
Workers are exposed to respirable silica during cleaning of castings made from sand.	Install a downdraft ventilated casting-cleaning workstation with a turntable for manipulating the casting.	The dust generated from the cleaning tools is directed away from the breathing zone. The exposure to harmful dust is reduced. The dust concentration levels in the air are reduced. The risk of illness is reduced. The risk of absenteeism and production downtime is reduced.	BLA 2006 Bangladesh Labor Rules 2015
Workers are exposed to dust during cutting, grinding, polishing, sanding, among other processes.	Use wet operations when possible. Maintain housekeeping to remove unwanted dust. Provide appropriate ventilation to reduce dust concentration levels in the air. Provide workers with appropriate PPE (respiratory masks). Make sure the workers use the PPE provided.	The exposure to harmful dust is reduced. The dust concentration levels in the air are reduced. Air-borne particles are filtered properly. The risk of illness is reduced. The risk of absenteeism and production downtime is reduced.	BLA 2006 Bangladesh Labor Rules 2015
Metalworking fluids (e.g. coolants, oil, lubricants) may cause adverse health effects.	Install a local exhaust ventilation system to prevent the accumulation or recirculation of airborne contaminants in the workplace. Provide splash guards or complete enclosure with ventilation, depending on the production value of the machine. Interrupt or reduce the flow of metalworking fluids when practical, e.g. when machine is not running. Protect workers with isolation booths or air-curtain exhaust ventilation.	Workers are isolated from the hazard. The workers' exposure to air contaminants is reduced. The risk of illness (e.g. skin diseases, respiratory diseases, cancer) is reduced. The risk of absenteeism and production downtime is reduced. Quiet time helps to remove solids more easily.	BLA 2006 Bangladesh Labor Rules 2015

5.2.2.3 ENERGY EFFICIENCY

Areas of potential savings in industrial tooling and metal operations include motors and auxiliary components (e.g. pallet changer, coolers, hydraulics, and automation components). Energy consumption normally varies during operations. Process adjustments are required to achieve savings.



Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Base load in non-productive phases is high.	<p>Shut down machines when not needed.</p> <p>Selectively deactivate auxiliary components that are temporarily not required.</p> <p>Note:</p> <p>Avoid switching off important auxiliary components (e.g. hydraulics, spindle cooling) that are prone to thermal displacement to prevent scrap.</p>	<p>Energy consumption is reduced.</p> <p>Cost savings are achieved.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
The use of asynchronous motors weighs on energy efficiency.	Use servo motors to reduce power use at zero speed.	Energy use is reduced.	<p>ISO 50001</p> <p>ISO 14001</p>
Inefficient production process produces large quantities of scrap material.	<p>Use CNC machinery to efficiently carry out production processes.</p> <p>Use CNC and PLC control systems to link events in the production process with outputs for controlling auxiliary components.</p>	<p>Waste is reduced.</p> <p>Energy use is reduced.</p> <p>Cost savings are achieved.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Not using cooling lubricants in the milling process increases scrap rate.	<p>Avoid dry machining in milling processes.</p> <p>Use cooling lubricants during milling operations.</p>	<p>Waste is reduced.</p> <p>Energy use is reduced.</p> <p>Cost savings are achieved.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Most of the machinery is manual or semi-automatic, lacking precision and control.	Upgrade to CNC machines for increasing accuracy and properly employing the use of energy.	<p>Energy use is reduced.</p> <p>Cost savings are achieved.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Spindle selection may impact negatively on energy consumption.	<p>Make sure spindle drive operates near rated power.</p> <p>Adapt spindles in speed and torque to the machine's range of operations.</p> <p>Note:</p> <p>Universal spindle design requires motor to run at low efficiency rates.</p>	<p>Energy use is reduced.</p> <p>Cost savings are achieved.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Frequent tool changes in milling operations increase the use of energy.	<p>If frequent tool changes are required, refer to regenerative supply modules.</p> <p>Use non-regenerative systems in processes with infrequent tool changes.</p>	<p>Energy use is reduced.</p> <p>Cost savings are achieved.</p>	<p>ISO 50001</p> <p>ISO 14001</p>
Thermal drift of feed axes is running on recirculat-	Minimize scrap with a closed loop.	Production waste is reduced; accuracy is ensured.	ISO 50001



ing ball screws.	Use linear encoders to increase accuracy.	Energy use is reduced. Productivity is maintained.	ISO 14001
Some applications, like grinders and mixers, do not run at full capacity.	Carefully control and monitor processes where motor must run at full speed. Turn off when processes are complete.	Energy use is reduced. Productivity is maintained.	ISO 50001 ISO 14001

5.2.2.4 PRODUCT SAFETY

In the following, the requirements for industrial tooling and machinery manufactured in Bangladesh and catered to both domestic and international markets are briefly presented.

International standards have not been identified.

NATIONAL REQUIREMENTS

The following tests are provided to the producers of industrial tooling and machinery:

- Mechanical tests (e.g. strength, hardness, tensile, elongation, compression, fatigue)
- Thermogravimetric (TGA) test for materials
- Material composition test

For more information about the tests that are mandatory for specific products, please contact BSTI.

5.3 ELECTRICAL GOODS

During the manufacturing of electrical goods (in this case: electrical cables, transformers), engineers and operators are exposed to a range of hazards in the workplace. How these hazards can be controlled, the risk of injury be reduced, and processes be improved will be presented below.

5.3.1 OCCUPATIONAL SAFETY AND HEALTH

A variety of cable making operations, such as wire drawing, insulating, twisting, or lathe, exposes workers to multiple hazards (see 5.2). It is therefore necessary to protect relevant parts in machinery with suitable guarding solutions. It is recommended to move from manual and semi-automatic to automated solutions that allow movable guards to be interlocked with the machine control system, thus effectively controlling access to the machinery.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
<p>Safeguards were missing at the following machines:</p> <ul style="list-style-type: none"> - Cable making - Wire drawing - Insulation - Twisting 	<p>Fully fence the wire drawing machines because of their rotating and moving parts to minimize the danger.</p> <p>Install magnetic safety switches to regulate access to danger zones.</p> <p>Apply barrier guards to the cable making, insulation, and twisting machines to prevent the operators from getting their hands, arms and legs drawn into the danger zone.</p> <p>Apply interlock arrangements to prevent the machine from operating unless a key is provided.</p> <p>Make sure there is sufficient space between the machines to avoid workers being caught in or struck by rotating and moving parts.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Adequate safeguards reduce the workers' risk of getting injured.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
<p>Lathe operators are not protected from being</p> <ul style="list-style-type: none"> - pulled into the machine if they are uncareful - hit by flying chips - struck by projected parts, materials or unsecured work pieces 	<p>Avoid wearing gloves, loose clothing, long hair, jewelry, or other dangling objects near lathe operations.</p> <p>Use brushes or tools to remove chips.</p> <p>Assess the need to manually clean rotating parts (e.g. emery cloth). Use tools if possible.</p> <p>Cover work-holding devices (e.g. chucks) and tool trapping space with fixed or adjustable guards.</p> <p>Install fixed or interlocked guarding</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Machines are properly secured.</p> <p>The risk of injuries for workers is reduced.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>

	<p>in vertical lathes to prevent access during automatic cycles.</p> <p>Provide chip and coolant shield to lathe operators.</p> <p>Provide lathe operators with cotton gloves, safety goggles, safety boots, and safety shields.</p> <p>Make sure the workers use the PPE provided.</p>		
Operators at core cutting and core slitting machines are not protected from cuts and rotating parts.	<p>Install movable guards to protect the workers from rotating parts and sharp edges.</p> <p>Provide cotton gloves, safety goggles, and safety boots to the operators.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Safeguards reduce the risk of injuries at the workplace.</p> <p>Adequate PPE protects the workers against health and safety hazards.</p> <p>The risk of long-term illness such as hearing impairment and the risk of fatal incidents are reduced.</p> <p>Absenteeism and its adverse impact on the production process is reduced.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Drawing, insulation, twisting, and lathe machines exceed the permitted exposure limit of 75 dB(A).	<p>Control noise by</p> <ul style="list-style-type: none"> - installing noise barriers, such as acoustic guards, to prevent workers in other sections from being affected by the noise level. - replacing old lathe machine with automated/CNC lathe machine to. <p>Provide operators with ear plugs / muff.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of workers losing their hearing abilities in the long run is reduced.</p> <p>Due to the reduction of noise, a major cause of stress, the risk of accidents is reduced.</p> <p>Workers can concentrate better; productivity and product quality are ensured.</p>	<p>ECR 1997</p> <p>Noise Pollution Control Rules 2006</p> <p>ISO 14001</p>

5.3.2 ENVIRONMENTAL CHALLENGES

For electrical goods, only the manufacturing of electrical cables is classified for an Environmental Clearance Certificate (ECC). Melted material and fumes emitted in copper recycling and processing requires needs proper treatment.

- Orange B: Electric cable

For more information on the requirements for an ECC, please see Annex 8.3.1.

5.3.2.1 WASTE MANAGEMENT

Polymers, flame retardants, and heat stabilizers, which may contain lead, are critical to electrical insulation, physical stability and fire-protection properties. However, they have been identified as materials of environmental concern. Metals in the environment are persistent and bio accumulate in the food chain. PVC, for instance, is a commonly used polymer in wire and cable products. It has a very good durability but is not biodegradable.

RECYCLING

Melting copper scrap for wire rod production is a hazardous process. However, if the melting is properly carried out, financial gains can be added to the benefits for health and the environment.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Open furnaces are used to melt impure copper scrap to separate the metals contained in it.	<p>The type of furnace and the process steps depend on the copper content of the secondary raw material, its size and other constituents.</p> <p>The following furnaces are suitable for melting low- and medium-grade material:</p> <ul style="list-style-type: none"> - Blast furnace - Mini smelter - Top-blown rotary furnace - Sealed submerged electric arc furnace - Ausmelt/ISASMELT furnace - Reverberatory and rotary furnace <p>Contimelt systems are used for high-grade copper scrap (> 99 % Cu).</p> <p>Take more detailed information from industrial furnace companies to choose the right type of furnace (and abatement system).</p>	<p>The off-gas volume is significantly reduced.</p> <p>PCDD/F emissions are reduced.</p> <p>Copper has been recovered and returned to the production process without loss of quality.</p> <p>Copper cathodes produced from recycled materials saves CO₂.</p> <p>Direct emissions from secondary smelters are four times lower than those from primary smelters.</p>	<p>BAT</p> <p>ISO 14001</p>
Open furnaces used for copper melting may cause burns and cuts.	<p>Install a semi-/closed furnace that is adequate to the factory's needs (see above).</p> <p>Use induction furnaces to cut</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Semi-/closed furnaces with a proper abatement system</p>	<p>BLA 2006</p> <p>BLR 2015</p> <p>BAT</p>



	<p>copper scrap into small pieces to increase the melting efficiency.</p> <p>Invest in off-gas cleaning systems (e.g. dry abatement like fabric filters, hoods).</p>	<p>reduce the risk of workers inhaling toxic fumes.</p> <p>Fumes are collected in the gas extraction system and removed in fabric filters.</p> <p>The risk of legal actions and compensation payments is reduced.</p> <p>Secondary copper is recovered in a sustainable way.</p>	
Non-metallic parts and metals other than copper are molten in the furnace.	<p>Separate large visible components manually.</p> <p>Separate ferrous metals by magnets.</p> <p>Refer to optical or eddy current separation of aluminum.</p> <p>Refer to fluids with a different density or air to separate different metallic and non-metallic constituents.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Waste is properly separated.</p> <p>Energy is saved.</p> <p>Toxic fumes are avoided.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>ECR 1997</p> <p>ISO 14001</p>
Different materials (e.g. scrap copper, primary copper, other scrap metals) were found unsorted in the production area.	<p>Implement 5S to ensure that the entire production floor is cleaned on a regular basis:</p> <ul style="list-style-type: none"> - Sort: separate unnecessary from necessary items and remove unnecessary items - Set in order/straighten: organize for better workflow and store items for easy retrieval - Shine: keep workplace clean, tidy and in good condition - Standardize: create standards to make sort, set in order and shine a habit. - Sustain: maintain 5S standards and implement initiatives to sustain 5S activities <p>Make sure that the entire factory premises, the production floors, and all workplaces are clean at all times.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>A clean and tidy production floor improves the employee's efficiency level as both search time for materials and down time are reduced.</p> <p>Productivity and product quality are improved.</p> <p>Flammable materials are kept in an organized way, which mitigates the fire hazard.</p> <p>A tidy production floor allows for quick evacuation during an emergency.</p> <p>Tripping hazards are minimized; the risk of accidents is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Furnace operators do not use adequate PPE to protect from burns and inhale of toxic fumes.	<p>Provide heat resistant safety boots, face shields, respiratory mask, heat resistant clothes, and cotton gloves to furnace operators.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Adequate PPE protects the operator against health or safety hazards.</p> <p>The risk of chronic illness</p>	<p>BLA 2006</p> <p>BLR 2015</p>



(e.g. respiratory diseases) and accidents (e.g. burns) are reduced.

Absenteeism and its adverse impact on the production process is reduced.

The risk of legal actions and compensation payments is reduced.

SOLID WASTE

Waste of electrical (and electronic) equipment often contains hazardous substances such as heavy metals (e.g. lead, cadmium, mercury, or hexavalent chromium, etc.) the use of which can be damaging to health and the environment. Particularly, recycling processes require appropriate technology and know-how to find sustainable solutions for the output.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Solid waste, such as spent linings, slag, lead ashes, and refractories, is generated during smelting metals.	Grind refractories to produce a castable mass for reuse. Separate metal content from material by milling and grinding. Reuse the spent linings and refractories for construction purposes or to produce refractory cement. Recycle the metal content by smelting.	Refractories are used. Waste sent for disposal is reduced.	BAT ISO 14001
Cable waste is discarded.	Separate the metal and the insulating material using jigging or a shaking table. Downcycle plastic waste (i.e. compounded PVC, HDPE, PE) and reuse for other products. Recycle the copper by smelting. Note: PVC is a compounded material and consists of plasticizers, (often lead-based) heat stabilizers, flame retardants, and other additives. The recycling process may be costly.	High copper grade and copper recovery are ensured. Waste sent for disposal is reduced. Cost savings are achieved.	BAT

LIQUID WASTE



Cables have a variety of sizes and uses, such as high-voltage cables or house wiring. The most common material used as a conductor is copper. Effluents are normally coming from cooling machines and lubricants using water-oil emulsions.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Effluents from cooling and lubricating the cable making machine may be contaminated with heavy metal residues.	Test the water by DoE or third-party testing institute for contamination. Pass the effluents through an ETP before discharge.	Compliance with legislation in Bangladesh. Soil and groundwater are not contaminated. Public health is not affected.	ECR 1997 ISO 14001
Process solids and contaminants from wire manufacturing are washed away without treatment.	Install a filtration system (e.g. gravity filter, vacuum filter, centrifuges). Integrate filter devices into pumps, tanks, heat exchangers, and control systems to filter particulates and contaminants. Pass the effluents through an ETP before discharge.	Compliance with legislation in Bangladesh. Soil and groundwater are not contaminated. Public health is not affected.	ECR 1997 ISO 14001

5.3.2.2 AIR EMISSIONS

The smelting of secondary copper and other metals may result in the escape of metal oxide fumes into the work area.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
PCDD/F gases are formed during foundries and smelting of secondary copper.	Possible methods to reduce the emissions of PCDD/F: - Active carbon technique - Improve combustion conditions (e.g. use pure oxygen, raise combustion temperature) - Incinerate off-gas and quickly quench the hot gas - Remove organic contaminants (e.g. machining oil, coatings) Note: This may increase energy use. Use clean, chlorine-free input materials. Provide respiratory masks to workers. Make sure the workers use the PPE provided.	PCDD/F and CO emissions are reduced. Health hazards and the risk of illness are reduced. Absenteeism and its adverse impact on the production process is reduced.	BAT ISO 14001
Sulfuric acid mist containing metals may evolve	Provide suitable ventilation to keep airborne concentrations low and	Compliance with legislation in Bangladesh.	ECR 1997 ISO 14001

during electrolytic refining. prevent irritation.

Mist emissions are reduced.

Health hazards and the risk of illness are reduced.

Absenteeism and its adverse impact on the production process is reduced.

5.3.2.3 ENERGY EFFICIENCY

Reducing energy use saves money and is beneficial for the environment. For the production of secondary material and the final product (e.g. cables), some process improvements for general equipment were already discussed in sections 4.4 and 5.2.2.3. Additional non-compliances and corrective actions are highlighted below.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Excess heat that is produced during the smelting or conversion stages to melt secondary materials is lost.	Send hot off-gas to waste heat boiler, where gas is cooled by generating steam.	Waste heat is recovered.	ISO 50001
	Note: Seek technical advice from machine suppliers to select appropriate technology for heat and energy recovery.	No additional fuel is required.	ISO 14001
		Steam can be used inside, for drying concentrate, or for other process units or electricity production.	BAT
Despite varying demands, motor applications run at fixed speed.	Install variable speed drives on motors, thereby adjusting the electrical supply to AC induction motors.	High degree of motor control is achieved.	ISO 50001
		Energy use is reduced.	ISO 14001
		Cost savings are achieved.	BAT
Electric heaters at extruders consume high amounts of energy.	Provide insulation around outer side of heater.	Energy use is reduced.	ISO 50001
		Cost savings are achieved.	ISO 14001
			BAT

5.3.2.4 PRODUCT SAFETY

In the following, the requirements for electric cables manufactured in Bangladesh and catered to both domestic and international markets are briefly presented.

NATIONAL REQUIREMENTS

BSTI carries out the following tests on or electrical goods (PVC insulated cable):

- Annealing test of copper wire
- Conductor resistance test
- Radial thickness of insulation test
- Tensile Strength at break of Insulation test
- Elongation at break of insulation in percent test



- Insulation resistance constant test
- High voltage test
- Flammability test

The following safety tests on cables are mandatory for the domestic market:

- Insulation test
- High voltage test

INTERNATIONAL STANDARDS

In electrical engineering, each country has its own regulations and standards, which are not necessarily aligned with each other.

The **International Electrotechnical Commission (IEC)** develops international standards for all electrical, electronic and related technologies. Adoption is voluntary, although they are often referenced in national laws or regulations around the world. For more information, please visit: <https://www.iec.ch/about/activities/standards.htm?ref=home>

The **American National Standards Institute (ANSI)** coordinates private sector, voluntary standardization systems in the **United States**. As opposed to **performance-based IEC standards**, ANSI standards define the specific features (e.g. thickness, paint) of the products. Any electrical product intended for the US American market must be tested and approved with regard to potential hazards such as flammability, electric shock or electromagnetic compatibility. Electrical safety is certified by ANSI-accredited laboratories like UL, ASTM or NFPA, which themselves have developed many standards that are widely acknowledged at federal, state and municipal levels. For more information, please visit:

<https://www.ansi.org/>

<https://ulstandards.ul.com/>

<https://www.astm.org/Standard/standards-and-publications.html>

<https://www.nfpa.org/NEC/electrical-codes-and-standards>

EU legislation restricts the use of hazardous substances in electrical and electronic equipment (**RoHS**). The objective of the Directive is to strengthen recycling and reuse of such products through a collection scheme that encourages consumers to return their e-waste free of cost. For more information on RoHS, please visit: <https://www.rohsguide.com/>

There are common **European Standards (EN)** for the European market, which are governed by three European standardization organizations:

- CEN (European Committee for Standardization); for more information, please visit: <https://www.cen.eu/Pages/default.aspx>
- CENELEC (European Committee for Electrotechnical Standardization); for more information, please visit: <https://www.cenelec.eu/>
- ETSI (European Telecommunication Standards Institute); for more information, please visit: <https://www.etsi.org/>

The **CE (European Conformity)** mark declares that the product meets the safety, health, and environmental protection requirements of the European Economic Area (EEA). All companies trading CE-marked products (e.g. electrical equipment) within the EEA are accountable to the same rules, regard-



less of whether they are imported or manufactured within the EEA. The CE mark is attached only to those products that are covered by the EC Product Safety Directives. For more information, please visit: https://ec.europa.eu/growth/single-market/ce-marking/manufacturers_en

Despite uniform requirements in the European Union, each country has different styles of house wiring and electrical sockets. Manufacturers have to produce slightly different versions that meet special national requirements. Product **type tests** run a typical design of a specific product through a series of tests. Future products that are built to the same or very similar design can be considered to comply with the same requirements and if tested in the same way would also pass. Test criteria are identical in each country and provide a benchmark against which products can be assessed (i.e. tested) comprehensively and objectively.

The BSI Kite mark, the UL mark in the USA or the VDE and GS (Tested Safety) marks are internationally recognized voluntary certification marks for electro-technical equipment.

In **India**, industries engaging in the recycling of electrical and electronic waste are classified as red. Electrical cables are left out of the industrial classification. For more information on the classification of industrial sectors in India, please visit: <http://www.indiaenvironmentportal.org.in/files/file/Classification%20of%20Industries.pdf>

The Indian **Central Power Research Institute (CPRI)** is a laboratory recognized by the Bureau of Indian Standard (BIS) that provides the following tests to the electrical cable industry:

- Testing of underground power cables and accessories like indoor and outdoor terminations and straight through joints XLPE cables up to 400 kV rating
- Paper insulated lead sheathed cables, up to 33 kV rating
- Elastomer insulated cables from 3.3 kV to 33 kV rating
- PVC insulated and PVC sheathed electric cables from 1.1 kV to 11 kV rating
- P.D. tests on CTs, Las, bushing up to 132 kV rating
- Tan delta measurements on CTs, bushing up to 220 kV rating
- Impulse tests on power cables, capacitors etc., up to 66 kV rating
- Field testing of XLPE cables; capacitance measurement, conductor resistance and sheath resistance measurements
- Pre-qualification tests on XLPE Cable system up to 400 kV rating

The CPRI laboratory also carries out fire reaction tests on electric cables, insulating and composite materials like PVC/XLPE cable insulation/sheath materials, fiber reinforced composite materials used for cable tray, channels, feeder pillar boxes, bushing, supporting insulators, energy meters, PVC conduit pipes, flooring materials, fabrics, and material used in aerospace, among others. The following tests are included:

- Limiting Oxygen Index (ignition property of plastics) as per ASTM D2863, NCD 1410, IS10810(P-58), IS 13501
- Temperature Index (temp withstand before ignition) as per ASTM D2863, IS 10810 (P-64).
- HCL (acid gas content in plastics) as per IEC 754-1.
- Zero Halogen Acid Test by pH and conductivity as per IEC 754-2.
- Smoke density (smoke evolved, light transmission, visibility under fire) as per ASTM D 2843, ASTM E 662, IEC 601034, IS 10810 (P-63) standards.



- Fire resistance test (circuit integrity under fire conditions) as per IEC 331.
- Flammability test (property of propagating fire) as per ASTM, UL, IS and Canadian standards.
- Heat release measurements using cone calorimeter

For a list of laboratories that are recognized by BIS, please visit: https://bis.gov.in/?page_id=1803

Electrical and electronic equipment in South Korea are subject to safety certifications. The **Korea Certification (KC)** mark ensures that the product complies with South Korea's product safety requirements. The following product categories require a KC mark:

- Cables and cords
- Electronic and electrical appliances
- Installation accessories and connection devices
- IT and office appliances
- Lighting
- Modems
- Power supply unit capacitors or filter components
- Safety transformers
- Ship's radar equipment
- Telephones

Only products that have been tested by an internationally accredited testing center and certified with the KC mark can enter the Korean market. The KC mark indicates that the industrial equipment and machinery are safe; it ensures consistent quality in the manufacturing process.

For a list of certified body testing laboratories in South Korea, please visit: <https://www.iecee.org/dyn/www/f?p=106:42:0::::>

The following laws and regulations are relevant for the electrical cable industry in South Korea:

- Act on the resource circulation of electrical and electronic equipment: <http://www.moleg.go.kr/english/korLawEng?pstSeq=54748>
- Act on the promotion of saving and recycling of resources: <http://www.moleg.go.kr/english/korLawEng?pstSeq=54749&brdSeq=33>
- Act on the resource circulation of electrical and electronic equipment and vehicles: <http://extwprlegs1.fao.org/docs/pdf/kor169190.pdf>
- Electric Appliances Safety Control Act: <http://www.kca.go.kr/web/img/eng/4%20ELECTRIC%20APPLIANCES%20SAFETY%20CONTROL%20ACT.doc>

For information on other South Korean laws, please visit: <http://www.moleg.go.kr/english/korLawEng>

5.4 ELECTRONICS

The focus of this section lies on processes to manufacture refrigerators that proved essential for occupational and environmental compliance. Some operations (e.g. welding, metalmaking) already have been mentioned elsewhere (Section 5.2) in more detail.

5.4.1 OCCUPATIONAL SAFETY AND HEALTH

Technical insulation of refrigerator cabinets and door elements require particular attention for meeting occupational and environmental standards.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
An automatically operating dispensing device inserts foam between the outer and inner cabinet for insulation. After foaming, a robot moves the cabinet to a conveyor belt, putting the workers at risk of being hit if they are uncareful.	<p>Put a sensor in the machine, so the device is automatically stopped in case the workers do not change their position.</p> <p>Introduce safe operating procedures for lifting and moving to prevent injuries. Instruct the workers to follow these procedures.</p> <p>Upgrade to more automated solutions that prepare, place, and secure refrigerator cabinets for the application of insulation foaming.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The sensor system prevents the workers from injuries.</p> <p>Safe operating procedures raise the workers' awareness of potential injuries.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
<p>Polyurethane foam insulation is using outdated foam expansion (blowing) agents (i.e. refrigerants), such as:</p> <ul style="list-style-type: none"> - CFC-11 - HCFC-141b - HCFC-R22 - HFC-245fa - and others 	<p>Refer to environment-friendly alternatives with high insulation performance, such as:</p> <ul style="list-style-type: none"> - FEA-1100 - Cyclopentane <p>Hydrocarbons (HC) also represent an energy efficient and low global warming alternative to hydrofluorocarbons (HFCs).</p> <p>Note:</p> <ul style="list-style-type: none"> - Insulation values of HC foams are slightly lower. - The flammability of hydrocarbons presents challenges to processing and handling. <p>The following refrigerants are allowed in the EU:</p> <ul style="list-style-type: none"> - CO₂ (natural, inexpensive, low GWP) - Hydrocarbons: Propane (R290), Isobutane (R600), Propylene (R1270), R-441A 	<p>The Global Warming Potential (GWP) is reduced.</p> <p>The Ozone Depletion Potential (ODP) is zero.</p> <p>Access to markets like EU and US is improved.</p>	<p>ISO 14001</p> <p>Greenhouse Gas Protocol</p>

- Hydrofluoroolefin (HFO)-based:
R-1234yf, R-1234ze(E)
→ slightly flammable
- Blend of HFO/HFC/CO₂: R-455A
→ slightly flammable

The following refrigerants are allowed in the USA:

- CO₂
- Propane, Isobutane, R-441A
- Blends of HFO/HFC: R-450A, R-513A → non-flammable
- HFO-based: R-448A, R-449A, R-449B → non-flammable

Note:

- Constantly inform about the technical progress that has been made.

The automated clamping process required for vacuum forming of refrigerator liners does not protect workers from moving parts.	Guard and interlock moving parts to avoid accidents. Provide a barrier guard to protect operators.	Compliance with legislation in Bangladesh. The risk of accidents is reduced.	BLA 2006 BLR 2015
The heating elements in vacuum forming are slow to warm up and respond.	Use heating elements (e.g. quartz instead of ceramics) that are quicker to warm up.	Accurate heat temperature control is possible. Faster cycle times and uniform heat penetration is ensured. Energy is saved.	BAT
The copper tubing is not properly bent, soldered and coated.	Metallic surfaces are soldered properly.	Leakage and corrosion are prevented.	BAT
The noise level during insulation foaming exceeds the permitted maximum of 75 dB(A).	Control noise by <ul style="list-style-type: none"> - installing sound insulating equipment on machinery - upgrading to more automated solutions for the application of insulation foaming - rotating workers to reduce the amount of time they are exposed to the sound source - scheduling very loud processes for when there are fewer workers on duty - ensuring the noise level is below the legal maximum. - providing workers with ear plugs/muff 	Compliance with legislation in Bangladesh. Sound insulation and adequate PPE protect workers against hearing impairment. The risk of long-term illness and fatal incidents is reduced. Workers can concentrate better. Absenteeism is reduced; productivity and product quality are ensured. The risk of legal actions and compensation payments due to serious injuries is reduced.	BLA 2006 BLR 2015 ISO 14001



	- making sure the workers use the PPE provided		
Workers lift and carry the assembled inner and outer cabinets without PPE.	Provide workers with hand gloves and safety shoes. Make sure the workers use the PPE provided.	Compliance with legislation in Bangladesh. The risk of accidents is reduced. The risk of legal actions and compensation payments due to serious injuries is reduced.	BLA 2006 BLR 2015

5.4.2 ENVIRONMENTAL CHALLENGES

Repair, assembly and manufacturing of electronics are classified into different categories that define the procedure for an Environmental Clearance Certificate (ECC). The manufacturing of refrigerators, air conditioners or air coolers using CFC or HCFC as refrigerants is damaging to the ozone layer and thus categorized red. Repairing of refrigerators is considered slightly less hazardous, while the assembling and manufacturing of electronic devices, such as TV and radio, are rated safe for the environment.

- Green: Assembling and manufacturing of TV, Radio, etc.
- Orange B: Repairing of refrigerators
- Red: Refrigerator/air-conditioner/air-cooler manufacturing

For more information on the requirements for being issued an ECC, please see Annex 8.3.1.

5.4.2.1 WASTE MANAGEMENT

E-waste, or waste of electrical and electronic equipment, contains materials and components that are often hazardous.

RECYCLING

Collection, treatment and recovery of electronic waste are essential for reducing the impact on public health and the environment. This is particularly important for end-of-life refrigerators that contain greenhouse gases in the insulation materials.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Equipment containing refrigerants such as volatile fluorocarbons (VFC) or volatile hydrocarbons (VHC) are not properly disposed of.	Remove electrical cables and loose inner parts (e.g. plastic racks, glass) of the temperature exchange equipment. Extract oil, VFC and VHC properly for further treatment. Shred the devices in an encapsulated installation into smaller components (e.g. ferrous/mixed non-ferrous scrap, foam, plastics). Apply downstream sorting process	Compliance with legislation in Bangladesh. VFC/VHC emissions are avoided.	ECA 1995 ECR 1997 ISO 14001 BAT

	to separate materials from each other.		
	Remove and capture VHC and VFC contained in the insulating foam.		
The shredding process of refrigerator components produces high amounts of dust containing pollutants, such as heavy metals (e.g. mercury from mercury switches, dioxin emissions).	Recover, store and dispose of safely the blowing agent stored in the insulating foam.	Compliance with legislation in Bangladesh.	ECR 1997
	Avoid shredding waste containing mercury.	Gases are captured and destroyed during the shredding process.	ISO 14001
	Use a dedusting filter system.		BAT
	Avoid incidents such as deflagration and fires.	Adverse impacts on health and the environment are reduced.	
	Store flammable waste apart from other waste to prevent fire spreading.		

SOLID WASTE

Sources of solid waste primarily consist of metals and plastics. Both materials can represent an opportunity for recycling and recovery.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Vacuum forming relies on extruded plastic sheet and produces a significant amount of excess material.	Control sheet quality.	Compliance with legislation in Bangladesh.	ECA 1995
	Design molds to the requirements.		ECR 1997
	Remove excess material.	The amount of waste material is minimized.	ISO 14001
	Trim the product from the sheet.		
	Regrind and recycle trimmed waste.		
Metal offcuts are discarded.	Segregate the scrap metal from other solid waste.	Compliance with legislation in Bangladesh.	ECA 1995
			ECR 1997
	Sell scrap metals to certified recycling dealers.	Waste is reduced.	ISO 14001
		Cost savings are achieved.	
		Adverse impacts on health and the environment are reduced	

LIQUID WASTE

In the manufacturing of refrigerators, the main sources of effluents result from hydrometallurgical processes, cooling, and cleaning of equipment and floors. While air cooling can help processes run more efficiently and improve worker well-being, some equipment requires cooling water to carry out specific operations.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
-----------------	---------------------------------	---------	--------------



Direct-contact cooling water contaminated with metals and suspended solids is mixed with other waste water.	Treat cooling water separately from other waste water.	Compliance with legislation in Bangladesh. Dilution effects are avoided. Assimilation into food chain is avoided.	ECR 1997 ISO 14001 BAT
---	--	---	------------------------------

5.4.2.2 AIR EMISSIONS

The main releases to air in the manufacturing of electrical and electronic goods are:

- **Solvent emissions**, used for cleaning and degreasing products and machinery, or dissolving, thinning and dispersing coatings, paintings and inks
- **Fluorinated greenhouse gases** (F-gases), used in the manufacturing of refrigeration and air-conditioning equipment, aerosols, solvents, foam blowing agents, firefighting fluids and high voltage switchgear.

Keeping air emissions to a minimum and improving processes can save money and enhance the reputation among (international) customers. The emission of greenhouse gases can be easily avoided by the use of appropriate refrigerants.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Hydrofluorocarbons (HFCs) are used as refrigerants.	Avoid the use of ozone-depleting refrigerants. Refer to more environment-friendly refrigerants, such as Cyclopentane (see 5.4.1)	Compliance with legislation in Bangladesh. Emissions of greenhouse gases (e.g. F-gases) are avoided.	ECA 1995 ECR 1997 ISO 14001
The refrigerator system is not completely sealed.	Use leak test with Nitrogen.	Compliance with legislation in Bangladesh. No leakage is detected; refrigerator system is completely sealed. Greenhouse gas emissions are avoided.	ECA 1995 ECR 1997 ISO 14001

5.4.2.3 ENERGY EFFICIENCY

Improvements in insulation, compressors, heat exchange in the evaporator and condenser, and motors can significantly increase energy efficiency.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Temperature control is not used when forming crystalline thermoplastics.	Use accurate temperature control. Make sure the operator knows about the type of thermoplastics (i.e. amorphous PS, ABS, crystalline PE, PP) and the critical forming temperature.	Compliance with legislation in Bangladesh. Energy is saved. Quality is improved.	ECA 1995 ECR 1997 ISO 14001

Compressors are not properly maintained.	Improve the control system. Drain and change the oil on a regular basis.	Compliance with legislation in Bangladesh. Energy is saved. Product quality is improved.	BLA 2006 BLR 2015 ISO 14001
Condenser heat exchange is poor.	Use evaporative condensers instead of water-cooled or air-cooled condensers. Maintain condensers on a regular basis.	Compliance with legislation in Bangladesh. Condensers are clean and free from fouling. Energy use is reduced. Product quality is improved.	ECA 1995 ECR 1997 ISO 14001

5.4.2.4 PRODUCT SAFETY

In the following, the requirements for refrigerators manufactured in Bangladesh and catered to both domestic and international markets are briefly presented.

NATIONAL REQUIREMENTS

BSTI carries out the following performance tests for refrigerators:

- Ice making test
- Pull down test
- Temperature performance test
- Water vapor condensation test
- Energy consumption test

INTERNATIONAL STANDARDS

The **international standard IEC/EN 60335-2-24** deals with the safety of household and similar electrical appliances. Part 2-24 applies to requirements for refrigerating appliances, ice-cream appliances and ice makers. **IEC/EN 60335-2-34** is relevant for motor compressors in refrigerators, air conditions and other applications. UL has adapted IEC standards to the North American market. For more information on the specific standards, please visit:

<https://webstore.iec.ch/publication/60558>

<https://webstore.iec.ch/publication/26207>

ISO 5149 was published in 2014 to promote the safe design, construction, disposal, installation and operation of refrigerating systems. It specifies the safety and environmental requirements for refrigerating systems and heat pumps. For more information on the standard, please visit:

<https://www.iso.org/standard/54979.html>

ISO 817:2014 includes designations to new refrigerants and a safety classification system based on toxicity and flammability data. For more information on the standard, please visit:

<https://www.iso.org/standard/52433.html>



All regulations aim for a **reduction of hydrofluorocarbons (HFCs)**. While climate-friendly and energy-efficient alternatives to HFCs may have their own limitations (e.g. flammability, toxicity, poor material compatibility, etc.), firms can take corrective action through adequate product design and proper maintenance of equipment to keep negative effects in check.

The Central Government of India has published a list of laws and regulations that apply to the electronics and IT industry. For more information on the content of the legal documents, please visit: <https://meity.gov.in/esdm/standards>

URS Labs India is a laboratory recognized by the Bureau of Indian Standards (BIS) and carries out tests for electronic consumer items. For more information on the testing services provided by URS, please visit: <http://www.urs-labs.com/electronic-household-products/>

In **India**, industries engaging in the recycling of electrical and electronic waste are classified as red. There is no mentioning of refrigerating appliances. The assembly of air conditioners is category white, that is not harmful to the environment. For more information on the classification of industrial sectors in India, please visit: <http://www.indiaenvironmentportal.org.in/files/file/Classification%20of%20Industries.pdf>

The **Central Power Research Institute (CPRI)** operates a testing laboratory for refrigerators. CPRI conducts tests for frost-free refrigerators and direct cool refrigerators of volumes up to 1000 liter as per the national standards IS 15750:2006 RA (2017) and IS 1476 (Part-1): 2000 RA (2016). These standards, however, are based on outdated ISO standards and fail to meet the highest safety and environmental requirements. For more updated information on the testing services, please contact CPRI or visit: <https://www.cpri.in/about-us/departmentsunits/electrical-appliances-technology-division-eatd/refrigerator-testing-laboratory.html>

Electrical and electronic equipment in South Korea are subject to safety certifications. The **Korea Certification (KC)** mark ensures that the product complies with South Korea's product safety requirements. The following product categories require a KC mark:

- Cables and cords
- Electronic and electrical appliances
- Installation accessories and connection devices
- IT and office appliances
- Lighting
- Modems
- Power supply unit capacitors or filter components
- Safety transformers
- Ship's radar equipment
- Telephones

Refrigerators fall in the category electronic and electrical appliances. Only products that have been tested by an internationally accredited testing center and certified with the KC mark can enter the Korean market. The KC mark indicates that the industrial equipment and machinery are safe; it ensures consistent quality in the manufacturing process.

For a list of certified body testing laboratories in South Korea, please visit: <https://www.iecee.org/dyn/www/f?p=106:42:0:::>

The following laws and regulations are relevant for the electronics industry in South Korea:



- Act on the resource circulation of electrical and electronic equipment:
<http://www.moleg.go.kr/english/korLawEng?pstSeq=54748>
- Act on the promotion of saving and recycling of resources:
<http://www.moleg.go.kr/english/korLawEng?pstSeq=54749&brdSeq=33>
- Act on the resource circulation of electrical and electronic equipment and vehicles:
<http://extwprlegs1.fao.org/docs/pdf/kor169190.pdf>
- Electric Appliances Safety Control Act:
<http://www.kca.go.kr/web/img/eng/4%20ELECTRIC%20APPLIANCES%20SAFETY%20CONTR OL%20ACT.doc>

For information on other South Korean laws, please visit: <http://www.moleg.go.kr/english/korLawEng>

5.5 BATTERIES AND ACCUMULATORS

Emissions to air and water and the generation of hazardous waste are key challenges of the battery manufacturing industry.

5.5.1 OCCUPATIONAL SAFETY AND HEALTH

This section highlights key processes presenting occupational hazards to workers.

Grid casting machines produce grids of lead-calcium or lead-antimony alloy.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Grid casting machine with flame shield may cause burns.	<p>Apply boundary safeguard/barrier guard to semi-automatic grid casting machines.</p> <p>Provide respiratory masks, safety boots and hand gloves to workers.</p> <p>Make sure the workers use the PPE provided.</p> <p>Replace the grid casting machine with flame shield with fully automated machine.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Fully automatic grid casting machine reduce the workers' risk of getting burn.</p> <p>The risk of legal actions and compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Workers of grid casting section are not using adequate PPE to protect against flames and fumes.	<p>Provide respiratory masks, safety boots and hand gloves to workers.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>PPE protects the workers against health and safety hazards (e.g. fumes, burns) at work.</p> <p>The risk of incidents, injuries and long-term illness are reduced.</p> <p>Absenteeism and its adverse impact on the production process is reduced.</p> <p>The risk of legal actions and compensation payments in case of injuries is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>

During **paste mixing**, lead oxide is mixed with water, acid, and other chemicals to make a thick paste.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Lead oxide escapes from paste mixing machine, dries and becomes airborne.	<p>Provide exhaust ventilation at the workstations.</p> <p>Make sure ventilation is working properly.</p> <p>Enclose mixing platform tightly and</p>	<p>The inhalation of lead dust and fumes is avoided.</p> <p>The risk of incidents and illness is reduced.</p> <p>Absenteeism and its adverse</p>	<p>ISO 14001</p> <p>BAT</p>



keep under negative pressure.	impact on the production process is reduced.
Check and maintain systems regularly to keep them leak-free.	
Keep doors and openings to mixers closed.	
Provide zones of clean air at workstation.	
Never hammer the mixers, cone feeders, hoppers, ductwork or any other paste or oxide vessel with tools to loosen oxide or paste.	
Avoid lead dust to become airborne as a result of drafts and air currents by moving equipment and motor drives.	

The **pasting machine** applies lead paste to the grid panels.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Pasting machines lack proper safety guards, which might lead to burns and direct contact with the paste.	Apply boundary safeguards/barrier guards to each grid casting and pasting machine so that workers are prevented from burns and direct contact with the paste.	Compliance with legislation in Bangladesh. Boundary safeguards/barrier guard reduce the workers' risk of getting injured such as from burn. The risk of legal actions and compensation payments is reduced.	BLA 2006 BLR 2015
The pasting machine exposes workers to lead oxide which can become airborne once it dries.	Avoid dried paste on machines and other areas to become airborne. Install exhaust ventilation around pasting machine. Enclose oven properly, and keep doors closed at all times. Maintain negative pressure in the drying oven ventilation. Clean out oven regularly. Add a light water mist on paste belts to avoid material drying and dispersion. Clean up paste spills immediately. Keep floors wet or vacuum regularly to suppress dust generation.	Exposure to lead is minimized. The risk of high blood lead level and illness is reduced. Absenteeism and its adverse impact on the production process is reduced. The risk of legal actions and compensation payments is reduced.	ECA 1995 ECR 1997
The pasting machine creates noise levels beyond the legal maximum	Control noise by - replacing pasting machines with more advanced technology	Compliance with legislation in Bangladesh.	ECR 1997 Noise Pollu-

of 75 dB(A).	gy - installing noise barriers, such as acoustic guards, to prevent the noise from affecting other sections Provide workers with ear plugs / muff. Make sure the workers use the PPE provided.	The risk of workers losing their hearing abilities in the long run is reduced. Due to noise reduction, which is a major cause of stress, the risk of accidents is reduced. Workers are better able to concentrate. Productivity and product quality are ensured.	tion Control Rules 2006 ISO 14001
--------------	---	---	--------------------------------------

In **hydrosetting**, the pasted plate racks are placed in drying chambers the temperature and humidity of which are controlled.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Dry plates are handled or moved around, increasing the risk of lead becoming airborne.	Vacuum pallets, racks, and edges of plates to prevent dust containing dried lead from being re-entrained. Provide respiratory masks and hand gloves to the workers.	Exposure to lead is reduced. The risk of high blood lead level and illness is reduced. Absenteeism and its adverse impact on the production process is reduced.	ISO 14001 BAT
Grids are covered with material that is easily contaminated with lead oxide.	Use plastic or some other material that cannot become heavily contaminated with lead.	Exposure to lead is reduced. The risk of high blood lead level and illness is reduced. Absenteeism and its adverse impact on the production process is reduced.	ISO 14001 BAT
Pasted plates are kept near drafts and thermals.	Position pasted plates away from drafts and thermals.	Exposure to lead is reduced. The risk of high blood lead level and illness is reduced. Absenteeism and its adverse impact on the production process is reduced.	ISO 14001 BAT

In **assembly**, the plates, container and other parts are compiled into a functional battery and put to charging.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
The plates are stacked manually, exposing the workers to lead dust.	Provide aprons, respiratory masks, and hand gloves to the workers. Use downdraft or slot ventilation. Use local exhaust ventilations for machines that use conveyor sys-	Exposure to lead is reduced. The risk of high blood lead level and illness is reduced. Absenteeism and its adverse impact on the production	ISO 14001 BAT

tem.	process is reduced.
Avoid leaning groups of plates against the stomach, chest, or chin. Rather handle with the hands only.	
Vacuum work station to prevent accumulation of oxide dust.	
Keep floors wet to suppress the generation of dust.	

After **stacking** the plates, they are joined with small connecting parts and burned together to form cell elements or groups. This operation can be carried out either manually at a burning station or by using an automatic cast-on-strap (COS) machine.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
The cast-on-strap (COS) machine exposes workers to lead.	Use downdraft or slot ventilation at the workstation. Provide local exhaust ventilation where necessary. Enclose machines and place in a ventilated room. Use adequate PPE (i.e. apron, respiratory mask, hand gloves) at all times. Do not lean groups against stomach, chest, or chin. Handle with hands only. Avoid setting torches at excessive temperatures. Cover drums with a plastic bag before removing. Provide rubbers or gratings for walking surfaces.	Exposure to lead dust and fumes is prevented. The risk of high blood lead level and illness is reduced. Absenteeism and its adverse impact on the production process is reduced.	ISO 14001 BAT
Workers are exposed to lead fumes when burning with torches.	Use exhaust ventilation for when cell elements or groups are dropped into container. Use downdraft or slot ventilation at workstations. Use local exhaust ventilation around torch head. Provide workers with apron, respiratory mask, and hand gloves. Make sure the workers use the PPE provided.	Exposure to lead dust and fumes is prevented. The risk of high blood lead level and illness is reduced. Absenteeism and its adverse impact on the production process is reduced.	BAT

Six cells must be connected to achieve a battery voltage of 12V. Holes punched in the partitions of the PP casing connect the cells with each other. The positive strap terminal on one side and the negative



strap terminal on the other side of the hole are pressed together and welded. This process called **inter-cell welding** is critical to lifespan and reliability of lead-acid batteries.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Lead fumes are emitted during manual welding process.	<p>Install a suitable exhaust collection system.</p> <p>Use downdraft or slot ventilation during battery assembly.</p> <p>Keep torch hose length to a minimum to prevent workers from working outside the ventilated area.</p> <p>Provide adequate PPE (gloves, hats, shoes, full-body work clothing).</p> <p>Remove protective clothing at end of shift in change rooms.</p> <p>Place contaminated clothing in labelled container in changing area for cleaning, laundering or disposal.</p> <p>Note:</p> <p>According to the United States Occupational Safety and Health Administration (OSHA), all workers must use coveralls or similar full-body work clothing if lead levels are above the Permissible Exposure Limit. Although this is not required by Bangladesh law, we strongly recommend following the OSHA requirements. The existing practice in Bangladesh is highly hazardous for human health.</p>	<p>Exposure to lead fumes is minimized.</p> <p>The risk of high blood lead level and illness is reduced.</p> <p>Absenteeism and its adverse impact on the production process is reduced.</p>	<p>ISO 14001</p> <p>BAT</p>
High pressure of the torch flame may result in lead particles to become airborne.	<p>Keep burning temperature low by substituting air-propane or air-MAP gas for oxy-acetylene flames.</p>	<p>Exposure to lead dust is minimized.</p> <p>The risk of high blood lead level and illness is reduced.</p> <p>Absenteeism and its adverse impact on the production process is reduced.</p>	<p>ECA 1995</p> <p>ECR 1997</p> <p>ISO 14001</p>

In the **formation** process, battery plates are placed in a tank and lead bars are welded (tacked) on. The positive and negative plates are then formed (i.e. charged) in the tanks. The formation process may be either dry or wet. There is no lead exposure during wet formation because batteries are assembled and filled with acid prior to charging.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
-----------------	---------------------------------	---------	--------------

Workers are exposed to lead fumes during dry charge formation.	<p>Ensure ventilation is working properly when moving plates in and out of acid tanks, drying ovens and racks.</p> <p>Use local exhaust ventilation on the torch that is required for welding lead.</p> <p>Use instruments to move plates in and out of tanks.</p> <p>Wet down plates before they are put into the tanks.</p> <p>Vacuum racks and ovens before moving plates.</p> <p>Use the “tackles” formation process.</p> <p>Provide adequate PPE (gloves, hats, shoes, full-body work clothing).</p> <p>Remove protective clothing at end of shift in change rooms.</p> <p>Place contaminated clothing in labelled container in changing area for cleaning, laundering or disposal.</p>	<p>Exposure to lead fumes is minimized.</p> <p>The risk of high blood lead level and illness is reduced.</p> <p>Absenteeism and its adverse impact on the production process is reduced.</p>	<p>ISO 14001 BAT</p>
Workers may be exposed to acid splash when placing the plates in the tanks.	Use instruments to move plates in and out of tanks.	<p>The risk of injuries and health hazards are reduced.</p> <p>Absenteeism and its adverse impact on the production process is reduced.</p>	BAT

The measures highlighted above are required to keep the lead level in the blood low. Regular blood lead level tests are required to define when to take action or suspend workers from the workplace as recommended by the UK Health and Safety Executive (see Table 7).

Table 7: Action and suspension levels

Category	Action level	Suspension level
General employees	50 µg/dl	60 µg/dl
Women of child-bearing age	25 µg/dl	30 µg/dl
Young people under 18	40 µg/dl	50 µg/dl

Source: Health and Safety Executive 2019

5.5.2 ENVIRONMENTAL CHALLENGES

Lead-acid batteries consist of lead and sulfuric acid, which are both hazardous. During the lead melting process, toxic fumes and dust require air treatment and proper PPE by the workers.

- Red: Battery
- Orange B: Assembling batteries

For more information on the requirements for an Environmental Clearance Certificate (ECC), see Annex 8.3.1.

5.5.2.1 WASTE MANAGEMENT

Good waste management practices help minimize waste that is sent for disposal or transform waste to less harmful material.

RECYCLING

The **recycling of lead-acid batteries** is one of the biggest challenges to occupational health and safety and environmental compliance.

Scrap automotive and easy-vehicle batteries are the major sources of secondary lead, which often contain impurities of plastics, bitumen and metal alloys, like silver, antimony, and tin. A typical lead-acid battery scrap consists of several components laid out in Table 8:

Table 8: Composition of lead-acid battery scrap

Component	%
Lead (alloy) components (grid, poles, etc.)	25-30
Electrode paste (fine particles of lead oxide and lead sulphate)	35-45
Diluted sulfuric acid (10-20% H ₂ SO ₄)	10-25
Polypropylene	5-8
Other plastics (PE, etc.)	2-5
Other materials (glass, etc.)	<1

Source: European Commission 2017

The highly hazardous recycling process observed in lead-acid battery manufacturing facilities needs to be addressed in various ways:

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Old lead-acid batteries are crushed manually after acid is drained, exposing workers to lead dust.	Use hammer mills to break batteries. Connect battery breaking machine to an abatement system that prevents workers from being exposed to lead dust.	Compliance with legislation in Bangladesh. Exposure to lead is reduced. The risk of high blood lead level and illness is reduced. Absenteeism and its adverse impact on the production process is reduced.	ECR 1997 ISO 14001

Lead scrap is molten in open furnaces without proper abatement system.	<p>The following furnaces can be used for smelting secondary lead:</p> <ul style="list-style-type: none"> - Blast furnaces - Rotary furnaces - Reverberatory furnaces - Electric furnaces <p>Install a suitable abatement system to minimize emissions to air.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Lead emissions to air are prevented.</p> <p>Exposure to lead fumes are reduced.</p> <p>The risk of high blood lead level and illness is reduced.</p> <p>Absenteeism and its adverse impact on the production process is reduced.</p>	<p>ECR 1997</p> <p>ISO 14001</p>
The melting of secondary lead, including other metals like cadmium, calcium, antimony or tin, exposes workers to a range of health hazards (e.g. headaches, nausea, tiredness, irritability, fever, etc.).	<p>Put fume and dust extraction systems in place (air treatment plant).</p> <p>Provide workers with adequate PPE, such as respiratory mask, heat resistant hand gloves, and boots.</p> <p>Make sure the workers use the PPE provided.</p> <p>Provide washing and changing facilities.</p> <p>Provide doctor or nurse to check blood lead level at least once in a year.</p> <p>Note:</p> <p>Given the health hazard lead poses to workers, a good practice would be to subject them to blood lead level tests once every three months.</p> <p>Inform, instruct and train all workers about exposure to health hazards and ways to protect themselves.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>Exposure to health hazards is reduced.</p> <p>The risk of high blood lead level and illness is reduced.</p> <p>Absenteeism and its adverse impact on the production process is reduced.</p>	<p>BLA 2006</p> <p>ECR 1997</p> <p>ISO 14001</p>

SOLID WASTE

The focus of every process should be laid on minimizing waste by optimizing processes and utilizing residues and waste. Particularly, metallurgical and smelting operations offer possibilities of solid waste management.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
The battery casings made of polypropylene are not separated prior to smelting.	<p>Clean polypropylene (PP) casings to remove impurities.</p> <p>Break PP casings into chips and sell for further use or process into</p>	<p>The amount of waste is reduced.</p> <p>Cost savings for raw material are achieved.</p>	<p>ECR 1997</p> <p>ISO 14001</p>



	pellets.		
Separators of old batteries are made of PE; containing impurities of lead, they are not properly disposed of.	Recover PE and reuse instead of virgin PE.	The amount of solid waste is reduced.	ECR 1997 ISO 14001
	Recover lead from separators. Use lead - as reducing agent in furnaces - for energy recovery If know-how for further use is not available, pass to ETP/ATP for treatment and disposal.	Cost savings for raw material are achieved.	
Residues in the smelting process are not properly disposed of.	Reuse the residues in the smelting process to recover lead and other metals.	The amount of solid waste is reduced.	ECR 1997 ISO 14001
	Treat the residues and the waste in dedicated plants for material recovery.	Cost savings for raw material are achieved.	
	Treat the residues and the waste, so they can be used for other applications.		
	If residues cannot be reused, pass for safe incineration as a last resort.		

LIQUID WASTE

Water is used to clean battery components, cool parts, and transport wastes. Wastewater is generated from various processes, such as battery breaking in recycling, charging electrodes, removing impurities, cooling, washing, and air pollution control (e.g. wet scrubbers). The main pollutants emitted to water are metals, metal compounds, metals in suspension and sulfates.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
The sulfuric acid (electrolyte) during battery breaking is not properly disposed of.	Remove other impurities (e.g. metals) first.	Compliance with legislation in Bangladesh.	ECR 1997 ISO 14001
	Neutralize the sulfuric acid through an ETP before disposing. Remove the lead from the sulfuric acid. Seek technical advice to select an appropriate treatment technology among the following: - electrocoagulation - ion exchange - sand filtration - chemical precipitation - ultrafiltration - reverse osmosis	The contamination of groundwater and soil with sulfuric acid is prevented.	
Batteries are crushed and stored on regular soil.	Use an acid-resistant floor surface. Have secondary containment to	Compliance with legislation in Bangladesh.	ECR 1997 ISO 14001



	avoid acids being spilled.	The contamination of groundwater and soil with sulfuric acid is prevented.	
The sulfuric acid electrolyte used in the formation bath is discharged without treatment.	Ensure treatment of sulfuric acid in ETP.	Compliance with legislation in Bangladesh.	ECR 1997 ISO 14001
		The contamination of groundwater and soil with sulfuric acid is prevented.	

Recovered sulfuric acid can be further used as laid out below:

- Reuse as pickling agent
- Reuse as raw material in the chemical industry
- Regeneration of the acid by cracking
- Production of gypsum
- Production of sodium sulfate in the desulfurization process

5.5.2.2 AIR EMISSIONS

The main releases to air in the manufacturing of batteries and accumulators are:

- Dust
- Lead and compounds
- Cadmium and compounds
- Cu, Pb, Zn, Ni and compounds
- Sb, Sn, Te and compounds
- Cd, As, Hg, Tl, Se and compounds

It is necessary to differentiate between fugitive emissions and point source emissions, the former of which are more difficult to be controlled.

Point Source Emissions:

- Exhausted into a vent or stack
- Emitted through a single point source into the atmosphere.
- The most likely listed substances to be emitted from the lead acid battery manufacturing process are particulate matter (PM10), lead, sulfuric acid and some trace metals

Fugitive Emissions:

- Not released through a vent or stack
- Examples: volatilization of acids from open vessels, particulate or lead emissions from casting or stamping processes, or spills and materials handling

The generation of dust and other releases to air puts the workers and the population that is remote from the source at risk.



Non-compliances	Corrective Actions	Benefit	Relevant for
Dry crushing of old batteries is a source of dust emissions.	Use a proper abatement system (e.g. bag filters) to minimize dust emissions.	Diffuse emissions are reduced. Workers are less exposed to health hazards. The risk of long-term illness is reduced.	ECR 1997 ISO 14001
Workers are exposed to high levels of lead dust during handling and maintaining dust collection systems.	Screw or pneumatically convey flue dust back to the process. Provide vehicles with enclosed cabs that have positive-pressure to contain the lead dust. Enclose or cover containers used to transport lead dust from dust collection systems. Restrict access to dust-collection equipment to properly trained employees. Make sure that the dust-control equipment is designed, operated and maintained properly on a scheduled basis. Provide workers with appropriate PPE (respiratory masks). Make sure the workers use the PPE provided.	Dust-control equipment is properly maintained; disruption is prevented. The release of lead to the environment is prevented. Workers are less exposed to high concentration levels of dust in the air. The risk of long-term illness is reduced. The risk of absenteeism is reduced. The risk of disrupted production and downtime is reduced.	BLA 2006 Bangladesh Labor Rules 2015
Open furnaces operate without gas extraction system.	Install a suitable furnace. Enclose the equipment and add a gas extraction system. Collect lead dust and sulfuric acid mist emissions from battery crushing, screening and wet classifying and pass them to a proper abatement system (e.g. bag filter, wet scrubber). Note: The use of bag filters and wet scrubbers may increase the energy consumption	Diffuse emissions are reduced. Workers are less exposed to health hazards. The risk of long-term illness is reduced.	ECR 1997 ISO 14001
Lead scrap is not molten at the required temperature to vaporize calcium, cadmium, tin, antimony, and other metals.	Melt the lead scrap beyond a temperature of 842°C (melting point of calcium) to make sure calcium, cadmium, tin, antimony, and other metals are vaporized.	Compliance with legislation in Bangladesh. Exposure to health hazards is reduced for workers and consumers.	ECR 1997 ISO 14001
The sulfuric acid (battery electrolyte) is not proper-	Remove other impurities (e.g. metals) first.	Compliance with legislation in Bangladesh.	ECR 1997



ly disposed of.	Neutralize the sulfuric acid through an ETP before disposing.	The risk of soil and air being contaminated by acid is reduced.	ISO 14001
Sulphate is not properly removed from lead paste before smelting.	Remove sulphate by alkaline leaching, i.e. a reaction with an alkali salt solution, prior to smelting.	Compliance with legislation in Bangladesh. Desulfurized material is fed into the furnace. SO ₂ emissions to air are reduced or prevented. Less energy is required for the smelting as less material is melted.	ECR 1997 ISO 14001

5.5.2.3 ENERGY EFFICIENCY

Automated solutions may result in energy savings and quality improvement thanks to increased precision. It is recommended for battery manufacturing firms to continuously inform about technological upgrades that also have a beneficial impact on energy consumption.

Non-compliances	Corrective Actions	Benefit	Relevant for
The grid casting machine takes a long time to reach working temperature.	Upgrade to electrically heated feeding system that reaches working temperature within short time and ensures homogeneous heating. Make sure control of temperature is possible. Keep yourself up to date about environment-friendly automated solutions.	Compliance with legislation in Bangladesh. Energy is saved. Quality is ensured.	ECR 1997 ISO 14001

5.5.2.4 PRODUCT SAFETY

In the following, the requirements for lead-acid batteries manufactured in Bangladesh and catered to both domestic and international markets are briefly presented.

NATIONAL REQUIREMENTS

BSTI provides the following tests for lead-acid starter batteries and lead-acid batteries:

- Effective capacity test
- Effective reserve capacity test
- Charge acceptance in a.m.p.s. test
- Cranking performance test
- Charge retention in volt test
- Endurance test in volt



- Electrolyte retention test

INTERNATIONAL STANDARDS

Lead-acid batteries and accumulators need to be tested and certified depending on the market they are exported to. Batteries must be free from the hazard of bursting if as a result of overcharging internal pressure needs to be released.

Manufacturers should follow international standards, such as **IEC 60896-11** including **IEC 60896-21** and **IEC 60896-22**, which regulate the requirements for **vented** and **valve-regulated (i.e. maintenance-free) battery types**. Please visit the following websites for further information on the different standards:

<https://webstore.iec.ch/publication/3849>

<https://webstore.iec.ch/publication/3850>

<https://webstore.iec.ch/publication/3851>

Furthermore, UL (UL 1989), VdS (VdS 2102en) and the Japanese Standards Association (JIS C 8702, JIS C 8707), among others, have been found to have referenced standards for maintenance-free lead-acid batteries.

In **India**, the manufacturing and recycling of lead-acid batteries are classified as red. For more information on the classification of industrial sectors in India, please visit: <http://www.indiaenvironmentportal.org.in/files/file/Classification%20of%20Industries.pdf>

The Central Government of India has published the following industry-specific rules for manufacturing batteries:

- Batteries (Management and Handling) Rules 2001:
http://www.pccdaman.info/pdf/Batteries_Rules.pdf
- Batteries (Management and Handling) Rules 2010:
[http://www.mppcb.nic.in/proc/Batteries%20\(Management%20and%20Handling\)%20Rules,%202001.pdf](http://www.mppcb.nic.in/proc/Batteries%20(Management%20and%20Handling)%20Rules,%202001.pdf)

The Bureau of Indian Standards (BIS) recognizes a number of laboratories for testing batteries. For more information, please visit: https://bis.gov.in/?page_id=1803

The **Central Power Research Institute (CPRI)** is one of the recognized laboratories by BIS and provides the following tests to the battery industry:

- Tests on automotive batteries and stationery cells as per IS 7372 -1995 (3 amnd-2007) and IS 1651 -2013.
- Secondary cells as per IEC 61427
- Tubular batteries as per IS 13369 -1992 and 2 -2003,
- Valve regulated lead-acid batteries (VRLA) as per **IS 15549 -2005** and **JIS C8702-1**.

In South Korea, **KC 62133** defines the safety requirements for portable lithium secondary cells, and for batteries made from them, for use in portable applications. It follows IEC 62133-2:2017, which specifies the requirements and tests for the safe operation of portable sealed secondary lithium cells and batteries containing non-acid electrolyte. Secondary cells and battery packs fall under KC certification and the Electrical Appliances Safety Control Act.

No standards and laws that address the requirements of lead-acid batteries have been found.



Ministry of Commerce
Government of Bangladesh



For information on South Korean laws, please visit: <http://www.moleg.go.kr/english/korLawEng>

5.6 BICYCLES

Bicycle manufacturing is a growing industry in Bangladesh. The manufacturing process is still labor-intensive and has an impact on the workers' health and the environment.

5.6.1 OCCUPATIONAL SAFETY AND HEALTH

Several processes, like the recycling of secondary steel and aluminum alloys, the tubing, painting and the tire production are hazardous for both the workforce and the environment. For more information on safety requirements of welding, which is also relevant for the manufacturing of bicycles, see Section 5.2.1.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Aluminum tubing is stamped and pressed.	Use hydroforming to mold the bicycle frame.	An evenly molded aluminum produces a sturdy frame, without weak spots. The cost for pressing and stamping equipment is saved. Energy use is reduced.	ISO 14001 BAT
Blade guards were found missing at the following machines: - Circular saw cutting - Disc cutting - Lathe cutting - Manual drilling	Provide blade guard by enclosing the upper half of the saw (from the blade down to the end of the saw arbor) with a fixed hood.	Compliance with legislation in Bangladesh. Contact with the turning blade is avoided. The risk of cuts and lacerations is banned.	BLA 2006 BLR 2015
Workers operating at the following machines are not provided with adequate PPE: - Circular saw cutting - Disc cutting - Saw sharpening - Hydraulic press - Power press - Welding	Provide ear plugs/muff, eye and face protection to the workers at the corresponding machinery. Make sure the workers use the PPE provided.	Compliance with legislation in Bangladesh. Adequate PPE protects operators against occupational health and safety hazards.	BLA 2006 BLR 2015
Electroplating prevents steel parts from rusting.	Use improved filtration on plating tanks. Place a curb around the process area to contain spills.	Frequency of purification treatment is reduced.	ISO 14001 BAT
High noise levels are generated by the following machines/operations:	Install acoustic walls or fences to separate the high-noise-level generating machinery from the rest of the floor, so that noise	Compliance with legislation in Bangladesh. The risk of workers losing	ECR 1997 Noise Pollution Control



- Circular saw cutting	spreading is avoided.	their hearing abilities is reduced.	Rules 2006
- Disc cutting machine	Provide ear plug/muff to the workers working in the affected sections.		ISO 14001
- Saw sharpening		The risk of legal actions and injury related compensation payments is reduced.	
- Hydraulic press			
- Power press			
- Welding			
Spray-painting workers are not protected against airborne pollutants in solvent-based paints.	Provide chemical resistant aprons, respiratory masks, rubber gloves, and rubber boots to spray-painting workers. Make sure the workers use the PPE provided. Use powder coating to reduce the environmental impact and health risk to workers.	Compliance with legislation in Bangladesh. Exposure to toxic chemicals is reduced. The risk of long-term illness (e.g. allergy, asthma, bronchitis) and fatal incidents is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015 ISO 14001

5.6.2 ENVIRONMENTAL CHALLENGES

The assembling of bicycles is classified as green. Only the manufacturing of rubber-based tires generates particulates and emissions to air, which are considered as highly polluting to the environment and thus requires an ETP.

- Green: Assembling of bicycles
- Orange B: Tires re-treading
- Red: Artificial rubber

For more information on the requirements for an Environmental Clearance Certificate (ECC), see Annex 8.3.1.

5.6.2.1 WASTE MANAGEMENT

Each process of bicycle manufacturing generates a specific type of waste. The focus lies on raw materials and releases to air and water.

RECYCLING

Recycling metals is an essential part of saving resources. Steel and aluminum are valuable materials that can be recycled repeatedly without diminishing their properties.



Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Poorly operating furnaces are used to smelt secondary aluminum.	Upgrade to more environment-friendly furnaces, such as: <ul style="list-style-type: none"> - Reverberatory furnaces - Rotary drum furnaces - Induction furnaces - Shaft furnaces Note: Seek technical advice from furnace supplier to select the most appropriate technology.	Emissions of dust and PCDD/F are reduced. Solid waste (salt slag, spent furnace linings, dross and filter dust) is reduced. The demand of energy for secondary aluminum is reduced.	ECR 1997 ISO 14001
Carbon used for frames is non-biodegradable and very costly to recycle.	Use aluminum as raw material. Melt aluminum for reuse, and reform.	Carbon demand is reduced. The use of hazardous chemicals is reduced. Waste is reduced.	ECR 1997 ISO 14001
Contaminants may be present in aluminum scrap.	Sort scrap into alloy types. De-coat or de-oil scrap prior to melting.	Melting efficiency is improved. The potential for emissions is reduced. Energy is saved. The production of skimmings / dross is reduced.	ECR 1997 ISO 14001
The smelting of secondary aluminum, which contains chlorine and organics, produces PCDD/F gases.	The following methods help reduce emissions of PCDD/F. <ul style="list-style-type: none"> - Active carbon technique - Improve combustion conditions to use enriched air or pure oxygen - Thermal post-combustion - Remove organic contaminants (e.g. machining oil, coatings) - Inject oxygen in upper zone of furnace - Modify furnace charging system to reduce cooling during charging - Use high-efficiency dust filtration to remove dust and PCDD/F Note: <ul style="list-style-type: none"> - Energy use increases to produce oxygen. - Collected dust may have high concentration of PCDD/F and may need to be returned to furnace for treatment. 	Emissions of PCDD/F and CO are reduced.	ISO 14001 BAT

SOLID WASTE

Most of the non-liquid discarded waste material comes from the metal-based parts production. Rubber waste will be discussed in more detail in Section 5.7.2 on automotive waste management.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
The low precision level of machines results in high amounts of off-cuts.	High level of precision and high manufacturing output can be achieved by automated solutions, such as: <ul style="list-style-type: none"> - Automated stamp presses - CNC machines - Automated heat treatment systems - Automated laser cutting systems - Automated coating systems 	Waste is reduced. Skills develop as the requirements on qualification to operate equipment increase.	ECR 1997 ISO 14001

LIQUID WASTE

Metal finishing operations are known for high consumption of water. Particularly, the painting process uses considerable volumes of water. Effluents can also result from cooling of machinery and parts.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Electroplating generates large quantities of wastewater.	Treat effluent from the electroplating bath in ETP. Use improved filtration on plating tanks.	Wastewater is reduced. The environmental impact is reduced. The frequency of purification treatment is reduced.	ECR 1997 ISO 14001
Wet spray painting generates high amounts of effluents.	Refer to improved application methods like electrostatic spray painting or powder coating. Pass wastewater to ETP for proper treatment and disposal.	Water consumption and effluents are reduced. Overspray is reduced. Large paint savings are achieved; transfer efficiency has increased.	ECR 1997 ISO 14001
During anodization, aluminum wheels are dipped in sulfuric acid to prevent corrosion.	Seek to reduce amount of wastewater and produce more aluminum hydroxide sludge by: <ul style="list-style-type: none"> - Electrodialysis - Acid sorption - Flocculating agents Aluminum hydroxide wastewater requires treatment (ETP) to reduce the aluminum concentration level upon disposal. Sulfuric acid needs to be neutralized in an ETP before disposal.	Wastewater is reduced. The environmental impact of anodization is reduced.	ECR 1997 ISO 14001

	Ensure dyes and sealants are properly disposed of.		
Metals are prepared for painting by using acid etching chemicals are used to clean metal surfaces.	<p>Use sandblasting to prepare metal surface for coating.</p> <p>Provide adequate PPE (full-body work clothing, respiratory mask, gloves) to workers.</p> <p>Make sure the workers use the PPE provided.</p>	<p>The metal surface is effectively cleaned of contaminants.</p> <p>Wastewater effluents are prevented.</p> <p>Sandblasting prevents metal from rusting.</p> <p>The use of hazardous and toxic chemicals is prevented.</p> <p>Health hazards for workers are reduced.</p>	ECR 1997 ISO 14001
The tire manufacturing process uses large quantities of water for cooling.	If the cooling water is contaminated by chemicals or metals, the wastewater must be conveyed to an ETP.	The environmental impact is reduced.	ECR 1997 ISO 14001

5.6.2.2 AIR EMISSIONS

Finishing processes, like solvent-based spray painting or electroplating, bear a significant health risk and are harmful to the environment.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
During the electroplating process, operators are exposed to hazardous fumes, mist, and gases.	<p>Preclean the object before it gets plated.</p> <p>Install an exhaust hood at the electrolyte containing plating bath to vent away vapor, fumes and mist.</p> <p>Provide respiratory mask, eye protection, gloves, face splash protection, waterproof apron, and waterproof footwear to the workers.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Workers are protected from fumes, mist, gases, and dust.</p> <p>Negative health effects are prevented.</p> <p>The risk of long-term illness is reduced.</p>	ECR 1997 ISO 14001
Wet spray painting is favored as a labor-intensive low-cost application method.	<p>Use electrostatic painting for the application of paint.</p> <p>Use powder coating to apply electrically charged powder paint pigments to metals and aluminum.</p> <p>Refer to newer (wet) paint technology to lower VOC emissions.</p>	<p>The emission of volatile organic compounds (VOC) is minimized.</p> <p>Overspray is avoided.</p> <p>Powder coated waste is inert and thus suitable for land-filling.</p> <p>Disposal of powder-coated parts is hazardous-free.</p>	ECR 1997 ISO 14001

	<p>Note:</p> <p>Powder coated metal objects require oven curing, increasing the energy use.</p>	<p>The use of chemicals for rework of inadequately powdered parts is prevented.</p> <p>The risk of health hazards is reduced.</p> <p>Powder coating ensures high quality finishing.</p>	
Workers are exposed to fine particulates and fumes from powder coating.	<p>Only apply powder paint in rooms designed to contain the contaminants locally.</p> <p>Install a dust collection system that captures the contaminants or any powder that does not adhere to the target.</p> <p>Provide the workers with appropriate PPE (respiratory masks).</p> <p>Make sure the workers make use of the PPE.</p>	<p>The risk of inhaling fine particulates and fumes is reduced.</p> <p>The risk of illness (e.g. respiratory diseases) is reduced.</p> <p>The risk of downtime and lost production is reduced.</p>	<p>BLA 2006 Bangladesh Labor Rules 2015</p>
Solvent-based cleaners are used to remove the metal surface from contaminants.	<p>Use phosphate-free pretreatment technology to clean and prepare metal parts prior to painting/coating.</p> <p>Use alkaline cleaners to remove organic soils.</p>	<p>The use of solvents is prevented.</p> <p>The use of materials is reduced.</p> <p>Waste is reduced.</p> <p>Consistent adhesion of the paint is achieved.</p>	<p>ECR 1997 ISO 14001</p>
Sulfuric acid fumes are released to air during the anodization process.	<p>Install local exhaust ventilation to remove fumes at the source.</p> <p>Use a scrubber for additional cleaning before releasing into the air.</p>	<p>The risk of health hazards is reduced.</p> <p>Workers are protected from fumes, mist and gases.</p> <p>The risk of possible irritant is reduced.</p>	<p>ECR 1997 ISO 14001</p>
During the mixing of rubber and chemicals, particles are emitted to air.	<p>Install effective ventilation and dust abatement equipment.</p> <p>Provide respiratory masks, gloves, apron, and safety goggles to the workers.</p> <p>Make sure the workers use the PPE provided.</p>	<p>The generation of dust is reduced.</p> <p>The risk of health hazards is reduced.</p> <p>Workers are protected from fumes, mist and gases.</p>	<p>ECR 1997 ISO 14001</p>
Workers are exposed to fumes from mixing natural or synthetic rubber with other chemicals.	<p>Provide respiratory masks, gloves, aprons, and safety goggles to the workers.</p> <p>Make sure the workers use the PPE provided.</p>	<p>The exposure to fumes is reduced.</p> <p>The risk of health hazards is reduced.</p> <p>Workers are protected from fumes, mist and gases.</p>	<p>ECR 1997 ISO 14001</p>

5.6.2.3 ENERGY EFFICIENCY

Energy efficiency can be increased either by reutilizing the waste heat (→reuse) or by improving the efficiency level of the manufacturing process (→reduce). In bicycle manufacturing, steel, aluminum and rubber require heat treatment to deliver the desired properties (e.g. hardness, tolerances).

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Waste heat of heat treatment ovens is not recovered.	Install vestibules and air curtains to retain heat.	Waste heat is recovered.	ECR 1997
	Use heat exchanger to make use of waste heat and generate electricity.	Energy use is reduced.	ISO 14001

5.6.2.4 PRODUCT SAFETY

In the following, the requirements for bicycles manufactured in Bangladesh and catered to both domestic and international markets are briefly laid out.

NATIONAL REQUIREMENTS

There are no mandatory tests for bicycles. The only test provided by BSTI is the bicycle rim test.

INTERNATIONAL STANDARDS

For the international market the main standard applicable is **ISO 4210**.

ISO 4210-1:2014 specifies the terms and definitions related to safety and performance requirements for the design, assembly, and testing of bicycles and sub-assemblies. For more information on this standard, please visit: <https://www.iso.org/standard/59908.html>

ISO 4210-2:2015 sets out the safety requirements for city and trekking, young adult, mountain and racing bicycles with a saddle height between 635 mm and 750 mm. The national standards organizations of European countries are bound to implement this European Standard. For more information, please visit: <https://www.iso.org/standard/68260.html>

The US **Consumer Product Safety Commission (CPSC)** regulates the requirements for bicycles pursuant to the Federal Hazardous Substances Act (FHSA). The latest amendments made in 2011 include changes in bicycle technology, material and design, as well as new testing requirements and certification requirements for children's products. For more information on CPSC requirements for bicycles and chemical use, please visit: <https://www.cpsc.gov/Business--Manufacturing/Business-Education/Business-Guidance/Bicycle-Requirements>

ASTM developed a series of standards for the manufacture and performance of bicycles and components. For more information on ASTM standards, please visit: <https://www.astm.org/Standard/standards-and-publications.html>

The paints used in electrostatic spray painting and powder coating require compliance with the highest international standards. **REACH** applies to all chemical substances of one ton or more per year that are manufactured or imported in the European Economic Area (EEA). For more information on the chemicals to be used for the European market, please visit the European Chemicals Agency: <https://echa.europa.eu/en/information-on-chemicals/registered-substances>



Ministry of Commerce
Government of Bangladesh





5.7 MOTORCYCLES AND AUTOMOBILES

Manufacturers of motor vehicles and parts face a variety of challenges to comply with regulations and requirements in local and international markets.

5.7.1 OCCUPATIONAL SAFETY AND HEALTH

The automotive industry uses a wide range of raw materials, such as sheet metal, steel components, ABS components, aluminum components, steel tubes, and rubber in the manufacturing process. Rubber processing, the manufacture of tires and spray painting are among the most hazardous processes. Motorcycle and automobile manufacturing are still at an infant stage, which is why a variety of components, such as electrical (e.g. lighting, blinkers) and electronical parts (e.g. CDI, flasher, rectifiers), are usually imported in SKD form.

Non-compliances	Corrective Actions	Benefit	Relevant for
The tire-buffing machine may get the operator's clothing entangled on the rasp.	Provide a barrier guard. Apply a safety interlock switch. Make regular checks to ensure the interlock is kept in position and is working effectively.	Compliance with legislation in Bangladesh. The risk of accidents and serious injuries is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Traps and nips and pulley drive of the rasp motor of the buffing machine are occupational hazards.	Provide a fixed guard to fully enclose the drive. Apply safety interlock with the motor.	The risk of accidents and injuries is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Peeling blade of peeling machine is not properly secured.	Position the controls at a safe distance from the peeling zone. Make sure the tire is not revolving when the operator removes strips or chunks of tread. Make sure the operator can only remove strips or chunks of tread when the tire is not rotating.	The risk of accidents and injuries is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Gravity closure of the tire press causes trapping risk.	Press should be designed to prevent the risk of closure under gravity.	The risk of accidents and injuries is reduced. Down time caused by safety issues and injury related	BLA 2006 BLR 2015



		absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	
Powered closure of the tire press causes trapping risk.	Provide a tripping device to arrest and reverse the closing movement when the device is operated. Provide a safety device to arrest and reverse the closing movement if any part of the operator's body approaches the trapping zone during the closing cycle.	The risk of accidents and injuries is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Hot parts of the tire press may cause burns.	Prevent access to hot parts by providing suitable insulation. Provide fire resistant PPE (e.g. fire-resistant gloves, fire-resistant apron, goggles, and safety shoes). Make sure the workers use the PPE provided.	The risk of health hazards (e.g. burns) is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Inflated tires suddenly burst or release pressure.	Limit the maximum air pressure available at the machine to the minimum necessary for the tests carried out. Ensure the machine is designed to apply the inflation pressure in sequential steps. Limit the maximum inflation pressure on a car tire inflation-testing machine to 4 bar (59 psi). Limit the maximum inflation pressure on a truck tire inflation-testing machine to 10 bar (147 psi). If higher pressure is necessary, enclose the machine in a blast protection enclosure. Provide strong, rigid guards to protect the operator from injuries if a tire bursts. Interlock to ensure the air pressure cannot exceed the permitted maximum. Ensure operators never touch the tire when it is inflated to above 5 bar. Any inspection should be entirely visual when this pressure is exceeded. Provide workers with suitable eye	The risk of accidents and serious injuries is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015



	protection. Make sure the workers use the PPE provided.		
Workers are exposed to high levels of vibration from skiving operation.	<p>Select low-vibration tools.</p> <p>Ask equipment supplier for information about vibration emission levels.</p> <p>Avoid tools with vibration emission significantly above the average vibration levels.</p> <p>Check the measures introduced are effective.</p> <p>Limit the length of time each day that the operator is allowed to carry out skiving. Rotate workers.</p>	<p>The risk of health hazards (e.g. vibration syndromes) is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>
Workers are exposed to high noise levels during buffing, skiving, inflation testing and tire bursting.	<p>Reduce the noise at source by fitting silencing equipment to noisy air exhaust and extraction systems.</p> <p>Provide acoustic enclosures.</p> <p>Segregate noisy machines from other relatively quiet processes.</p> <p>Mark affected areas with noise warning signs.</p> <p>Provide all people entering the area with hearing protectors.</p>	<p>Compliance with legislation in Bangladesh.</p> <p>The risk of workers losing their hearing abilities is reduced.</p> <p>Due to the reduction of noise, which is a major cause of stress, the risk of accidents is reduced.</p> <p>Workers can concentrate better. Absenteeism is reduced; productivity and product quality are ensured.</p>	<p>ECR 1997</p> <p>ISO 14001</p>
Manual handling of heavy or awkwardly shaped objects causes injuries.	<p>Avoid the need for hazardous manual handling, so far as is reasonably practicable.</p> <p>Assess the risk of injury from any hazardous manual handling that cannot be avoided.</p> <p>Reduce the risk of injury from hazardous manual handling, so far as is reasonably practicable by using mechanical aids and equipment (e.g. engine hoist, powered conveyor, roll cages, trolleys).</p> <p>Keep heavier items at ground level when storing in racking. Only store lighter items (under 10 kg) above shoulder level.</p>	<p>The risk of accidents and injuries is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p> <p>The risk of legal actions and injury related compensation payments is reduced.</p>	<p>BLA 2006</p> <p>BLR 2015</p>



Motorcycle seats in Bangladesh are mostly handmade, with few semi-automatic processes involved. The materials used are leather, foam, and metal and plastics for the baseplate. The foam used in motorcycle seat construction is made from polyurethane.

Non-compliances	Corrective Actions	Benefit	Relevant for
Leather sewing machine lack upper and lower pulley guards.	Fit leather sewing machine with upper and lower pulley guards to protect workers from rotating parts.	Compliance with legislation in Bangladesh. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Leather cutting operators do not wear suitable PPE.	Provide metal hand gloves and respiratory masks to the workers. Make sure the workers use the PPE provided.	Compliance with legislation in Bangladesh. The risk of health hazards (e.g. cuts) is reduced. The risk of accidents and long-term illness (e.g. asthma, bronchitis) are reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Operators pour the liquid foam solution into the mold without using appropriate PPE.	Provide respiratory masks, eye protection and gloves to the workers. Make sure the workers use the PPE provided.	Compliance with legislation in Bangladesh. The risk of inhaling toxic substances is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 BLR 2015
Flammable blowing agents are used for the PU foam production.	Use water as foaming agent. Provide eye protection, chemical resistant gloves, respiratory masks, and aprons to the workers. Make sure the workers use the PPE provided.	The risk of fire hazards is prevented. The risk of inhaling toxic substances is reduced. Down time caused by safety issues and injury related absenteeism is reduced. The risk of legal actions and injury related compensation payments is reduced.	BLA 2006 ECR 1997

Both foaming and compressed staple machine cause high noise adjacent to each other.	Separate the foam from the compressed staple machine. Provide ear plugs/muff to the workers of that section.	Compliance with legislation in Bangladesh. The risk of workers losing their hearing abilities in the long term is reduced.	ECR 1997 Noise Pollution Control Rules 2006 ISO 14001
---	---	---	---

5.7.2 ENVIRONMENTAL CHALLENGES

The assembling of motorcycles does not involve any harmful processes to the environment, whereas the domestic processing of natural and synthetic rubber is harmful to health and the environment and requires treatment.

- Green: Assembling of motorcycles
- Orange B: Tires re-treading
- Red: Artificial rubber

Automotive vehicles and motors are assembled in SKD form in Bangladesh. As carbon monoxide and hydrocarbons are emitted to air, this industry is considered as hazardous. The larger the factory, the greater is classified its impact on the environment:

- Orange B: Assembling of motor vehicles
- Orange B: Motor vehicles repairing work up to 10 hundred thousand taka capital
- Red: Motor vehicles repairing work above 10 hundred thousand taka capital

For more information on the requirements for an Environmental Clearance Certificate (ECC), see Annex 8.3.1.

5.7.2.1 WASTE MANAGEMENT

The production and assembly of motorcycles, three-wheelers, and buses generates a variety of waste materials, such as metals, solvents, batteries, or plastics, which require adequate management (e.g. reuse, recycling, treatment).

RECYCLING

Automotive waste is highly recyclable. However, few recycling activities were observed in Bangladesh where the use of primary materials is the safest method to ensure quality. In addition to the recycling of steel, metals (see 5.2.2.1), and plastics (see 5.1.2), there are opportunities for reducing the environmental impact and saving costs if quality can be maintained.

PU waste from motorcycle seat production can be recycled based on the following methods:

- **Mechanical** (physical) recycling: includes grinding of PU waste into powder, compression molding, adhesive pressing and bonding of PU waste
- **Chemical** recycling: valuable materials are recovered by converting the waste into its original raw materials, i.e. recovery of monomers
- **Thermochemical** recycling: waste stream is used as a source of energy or fuel by pyrolysis, gasification or hydrogenation



- **Energy** recovery: through incineration, decomposition and combustion of PU waste

Recycling is the most valuable solution if recovery options do not provide environmental benefits. Incineration with energy recovery is an important method to recycle and reuse waste. Technology can ensure that emissions from waste combustion plants are managed safely.

SOLID WASTE

Steel, aluminum, plastic and rubber are the main materials used in the motorcycle and automobile industry. Most of the waste is generated during stamping, welding, painting and assembly, which have been partly described elsewhere (see 5.2.2.1, 5.6.2).

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
PU foam waste is discarded.	Sell on to companies certified in polyurethane recycling processes.	Waste is reused or recovered. Cost benefits are achieved. Landfilling or incineration without energy recovery by City Corporation is avoided.	ISO 14001

LIQUID WASTE

The automotive industry is a major consumer of water for various production processes.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Wet spray painting generates high amounts of effluents.	Refer to improved application methods like electrostatic spray painting or powder coating. Pass wastewater to ETP for proper treatment and disposal.	Water consumption and effluents are reduced; adverse environmental effects are prevented. Overspray is reduced. Large paint savings are achieved; transfer efficiency has increased.	ECR 1997 ISO 14001
During anodization, aluminum (or other metallic surface) wheels are dipped in sulfuric acid to prevent corrosion.	Reduce the amount of wastewater and produce more aluminum hydroxide sludge through <ul style="list-style-type: none"> - Electrodialysis - Acid sorption - Flocculating agents Aluminum hydroxide wastewater requires treatment (ETP) to reduce the aluminum concentration level upon disposal. Neutralize sulfuric acid in an ETP before disposal. Ensure dyes and sealants are properly disposed of.	Wastewater is reduced. The adverse environmental effects of anodizing are reduced. Hardness, corrosion resistance and other properties are ensured.	ECR 1997 ISO 14001



5.7.2.2 AIR EMISSIONS

Airborne emissions from specific automotive operations are particularly harmful to the workers' health and the environment and require effective remediation.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
PU foam is made from isocyanate and polyol.	<p>Avoid direct skin contact with isocyanates during handling, weighing and mixing of raw materials.</p> <p>Provide the workers with eye protection, chemical resistant gloves, respiratory masks, and aprons.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh</p> <p>Exposure to hazardous air pollutants is reduced.</p> <p>The risk of respiratory and dermal diseases is reduced.</p>	<p>BLA 2006</p> <p>ECR 1997</p> <p>ISO 14001</p>
Spray painting and powder coating expose workers to hazardous substances (e.g. isocyanate).	<p>Use properly designed spray-painting booths that are enclosed or partially enclosed.</p> <p>Inspect and maintain spray booths regularly.</p> <p>Provide breathing air, if required.</p> <p>Keep spray booths clear of residues and overspray.</p> <p>Control spray drift in walkways, public areas and air conditioning intake vents.</p> <p>Provide gloves, respiratory masks, goggles, face shields, and respirators to the workers.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh</p> <p>Exposure to hazardous air pollutants is reduced.</p> <p>The risk of health hazards and serious illness (e.g. asthma, cancer) is reduced.</p> <p>Negative environmental effects are minimized.</p> <p>The frequency of purification treatment is reduced.</p>	<p>ECR 1997</p> <p>ISO 14001</p>
Workers of welding, painting, assembly and testing sections are exposed to airborne substances such as dust, fumes, gases, vapor, mists and smoke.	<p>Install local exhaust ventilation to capture dust, fumes and gases at the source (e.g. use on-tool extraction when cutting or sanding).</p> <p>Regularly inspect and clean ventilation and dust collection systems to remove dust build-up.</p> <p>Provide gloves, respiratory masks, safety goggles, face shields, and respirators to the workers.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Compliance with legislation in Bangladesh</p> <p>Waste is reduced.</p> <p>The risk of inhaling toxic substances is reduced.</p> <p>Down time caused by safety issues and injury related absenteeism is reduced.</p>	<p>ECR 1997</p> <p>ISO 14001</p>
Workers are not protected against dust from tire	Provide effective local exhaust ventilation systems to capture the	Compliance with legislation in Bangladesh	ECR 1997 ISO 14001



buffing and skiving operations.	<p>dust at the source.</p> <p>Keep the area clean using a dust-less method.</p> <p>Provide workers with respiratory masks, eye protection and apron.</p> <p>Make sure the workers use the PPE provided.</p>	<p>Exposure to airborne dust is reduced.</p> <p>The risk of health hazards and serious illness (e.g. asthma, cancer) is reduced.</p>	
Workers are exposed to fine particulates and fumes from powder coating.	<p>Only apply powder paint in rooms designed to contain the contaminants locally.</p> <p>Install a dust collection system that captures the contaminants or any powder that does not adhere to the target.</p> <p>Provide the workers with appropriate PPE (respiratory masks).</p> <p>Make sure the workers make use of the PPE.</p>	<p>The risk of inhaling fine particulates and fumes is reduced.</p> <p>The risk of illness (e.g. respiratory diseases) is reduced.</p> <p>The risk of downtime and lost production is reduced.</p>	<p>BLA 2006 Bangladesh Labor Rules 2015</p>
Workers are exposed to rubber fume during vulcanizing.	<p>Install effective local exhaust ventilation systems to capture the dust at the source.</p> <p>Segregate tire-curing press from the rest of the factory.</p>	<p>Compliance with legislation in Bangladesh</p> <p>Exposure to airborne dust is reduced.</p> <p>The risk of health hazards and serious illness (e.g. cancer) is reduced.</p>	<p>ECR 1997 ISO 14001</p>
Rubber compounds are heated during rubber milling, exposing workers to rubber fumes.	<p>Install effective local exhaust ventilation systems to capture dust and fumes at the source.</p> <p>Always use gloves to handle cured and uncured rubber.</p> <p>Provide workers with respiratory masks, eye protection and apron.</p>	<p>Dermal exposure risks are adequately controlled.</p> <p>The risk of health hazards and serious illness (e.g. asthma, cancer) is reduced.</p> <p>Negative environmental effects are minimized.</p>	<p>ECR 1997 ISO 14001</p>
Tire grinding processes expose workers to rubber dust and particles and may generate hazardous air pollutants (HAP).	<p>Install local exhaust ventilation to control dust, mist and fumes in rubber (compound preparation and mixing and) finishing processes.</p> <p>Maintain filters, hoods and mechanical equipment regularly.</p> <p>Provide workers with appropriate PPE (respiratory masks).</p> <p>Make sure the workers use the PPE provided.</p>	<p>The workers' exposure is reduced.</p> <p>The risk of respiratory illness is reduced.</p> <p>The risk of absenteeism and downtime is reduced.</p>	<p>BLA 2006 Bangladesh Labor Rules 2015 ECR 1997</p>
The fuel used in motor vehicles is of low quality	<p>Use clean fuels that have been tested by an accredited laboratory.</p>	<p>Harmful emissions are reduced.</p>	<p>ECR 1997 ISO 14001</p>

and increases harmful emissions.	Make sure all fuel and fuel additives meet national environmental standards.	The population's exposure to harmful emissions is reduced.
----------------------------------	--	--

5.7.2.3 ENERGY EFFICIENCY

Energy consumption in heating, cooling, and the production of raw materials, such as steel, aluminum, and rubber, is high.

Non-compliances	Preventive / Corrective Actions	Benefit	Relevant for
Electricity is required to cool rubber compound mixing, milling, and extruding machines.	Use wet cooling tower systems to cool the warmwater returning from the process by direct contact with the air.	Energy is saved. Cost savings are achieved.	ISO 14001 BAT
Cooling tower is not properly maintained.	Keep air inlet louvres free of obstruction, so air can pass through the packing. Clean the tower-fill regularly to ensure proper air and water distribution. Avoid short cycling of the circulation fan and long off periods to cool the water temperature. Short cycling causes excessive wear and tear. Solids deposited on heated surfaces reduce effectiveness of heat transfer, resulting in increased energy consumption. Constantly control the correct temperature for the process. Avoid unnecessary operations.	Energy is saved. Cost savings are achieved.	ISO 14001 BAT
Compressed air systems used by rubber processing machines are not properly maintained.	Use a ring main to supply compressed air to the point of use. Generate air at the lowest possible pressure. Use a pressure regulator. Avoid no-load operation. Make sure automatic stop/start control stops the compressor after a period of no-load running. Use variable speed drives on piston and screw compressors. Refer to computer-based controls for multiple compressor plant. Use recovered heat to pre-heat domestic water and air heat for	Energy is saved. Cost savings are achieved. Product quality is improved.	ECR 1997 ISO 14001

space heating.

5.7.2.4 PRODUCT SAFETY

In the following, the requirements for motor vehicles manufactured in Bangladesh and catered to both domestic and international markets are briefly laid out.

NATIONAL REQUIREMENTS

The Environment Conservation Rules 1997 set emission standards for motor vehicles, which were amended in 2005 (see Table 9, Table 10, Table 11, and Table 12). Values for petrol-run two- and three-wheelers are just above the Euro 2 emission standard of the European Union, which already phased out in 2015 and has been replaced by more stringent standards (see below). The following tables are amendments for diesel (see Table 9 and Table 10) as well as petrol and CNG driven vehicles (see Table 11 and Table 12).

Table 9: Emission standards for diesel driven vehicles during registration – light and medium duty

Vehicle type	Emission Standards (gm/km)			Test Procedure
	CO	HC + NO _x	PM	
Light duty (not more than 8 seats in addition to driver & max. weight up to 2.5 tons)				
New type approval	2.72	0.97	0.14	91/441/EEC
Conformity of production	3.16	1.13	0.18	
Imported used	3.16	1.13	0.18	
Medium duty (more than 8 seats in addition to driver but less than 15 seats & weight more than 2.5 tons but up to 3.5 tons)				
New Type Approval	6.9	1.7	0.25	93/59/EC
Conformity of production	8.0	2.0	0.29	
Imported used	8.0	2.0	0.29	

*For the diesel engines with 85kW or less power the limit is to be multiplied by a factor of to 1.7.

Abbreviations:

EC: European Council

EEC: European Economic Community

ECE: Economic Commission for Europe

Table 10: Emission standards for diesel driven vehicles during registration – heavy duty

Vehicle type	Emission Standards (gm/kWh)				Test Procedure
	CO	HC	NO _x	PM*	
Heavy duty (more than 15 seats in addition to driver & weight more than 3.5 ton)					
New type approval	4.5	1.1	8.0	0.36	91/542/EEC and ECE R 49.02
New conformity of production	4.9	1.23	9.0	0.4	
Imported used	4.9	1.23	9.0	0.4	

*For the diesel engines with 85kW or less power the limit is to be multiplied by a factor of to 1.7.

Abbreviations:



EC: European Council
EEC: European Economic Community
ECE: Economic Commission for Europe

Table 11: Emission standards for petrol and CNG driven vehicles during registration – light and medium duty

Vehicle type	Emission Standards (gm/km)		Emissions due to Evaporation (g/test)	Test Procedure
	CO	HC + NO _x		
(2 and 3 wheeled) 4-stroke	4.5	3.0	-	ECE-40
Light duty (not more than 8 seats in addition to driver & max. GVW. 2.5 tons)	2.2	0.5	2.0	94/12/EC
Medium duty (more than 8 seats in addition to driver but less than 15 seats & GVW more than 2.5 tons but max. 3.5 tons)	5.0	0.7	2.0	96/69/EC

* Applicable for CNG driven vehicles

Abbreviations:

CNG: Compressed Natural Gas

EC: European Council

EEC: European Economic Community

ECE: Economic Commission for Europe

Source: S.R.O. No: 220-Law/2005: In exercise of the powers conferred by section 20 of the Bangladesh Environment Conservation Act, 1995 (Act 1 of 1995), the Government hereby amended the Environment Conservation Rules, 1997

Table 12: Emission standards for petrol and CNG driven vehicles during registration – heavy duty

Vehicle type	Emission Standards (gm/kW-hr)			Evaporation emissions (g/test)	Test Procedure
	CO	HC/NMHC*	NO _x		
Heavy duty (More than 15 seats in addition to driver & GVW. more than 3.5 ton)					91/542/EEC
New type approval (Petrol / CNG)	4.5	1.1	8.0	2.0	and ECE R 49.02 and *13- mode test cycle
New conformity of production (Petrol / CNG)	4.9	1.23	9.0	2.0	
Imported used (Petrol / CNG)	4.9	1.23	9.0	2.0	

* Applicable for CNG driven vehicles

Abbreviations:

CNG: Compressed Natural Gas

EC: European Council

EEC: European Economic Community

ECE: Economic Commission for Europe

Source: S.R.O. No: 220-Law/2005: In exercise of the powers conferred by section 20 of the Bangladesh Environment Conservation Act, 1995 (Act 1 of 1995), the Government hereby amended the Environment Conservation Rules, 1997

The following tests are required by BRTA. It is noteworthy that the only emission testing facility is in Dhaka:

- Engine power and torque
- Measurement of dimensions
- Weight and center of gravity

- Turning circle radius
- Speed
- Brake performance test
- Critical speed for stability
- Fuel consumption
- Ramp test
- Exhaust gas emission
- Noise level
- NDT facilities
- Different environmental tests (e.g. air pollution, air composition, noise level, industrial light intensity, Environmental Impact Assessment)

5.7.2.5 INTERNATIONAL STANDARDS

The European emission standards range from Euro 1 to Euro 6 and aim to reduce air pollution from two- and three-wheelers. Over the years, emissions of hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NO_x) were gradually lowered. Euro 4, which is currently the minimum standard for two- and three-wheeled vehicles, and Euro 5, which will be mandatory from January 2020, further reduced absolute limits for CO, HC, and NO_x emissions and particulate matter (PM). Evaporative emission tests and on-board diagnostic systems have been added to ensure compliance with emission standards over a lifetime. Table 13 presents the requirements for motorcycle exports to the European Union.

Table 13: Euro emission standards applicable to motorcycles (≥ 150 cc)

	EURO 1	EURO 2	EURO 3	EURO 4	EURO 5
CO (g/km)	13.0	5.5	2.0	1.14	1.00
HC (g/km)	3.0	1.0	0.3	0.17	0.10
NO _x (g/km)	0.3	0.3	0.15	0.09	0.06
PM (g/km)	-	-	-	-	0.045
SHED* test	-	-	-	Yes	Yes
On-board diagnostics	-	-	-	Yes (OBD1)	Yes (OBD2)
Durability	-	-	-	20,000 km	lifetime

*Evaporative emissions

Source: www.motorcyclenews.com

The US emission standards provided by the **Environmental Protection Agency (EPA)** are less strict with hydrocarbons, carbon monoxide and nitrogen oxide emissions than the European emission standards, although testing procedures are different. For more information, please visit: <https://www.epa.gov/emission-standards-reference-guide/epa-emission-standards-light-duty-vehicles-and-trucks>

IATF 16949:2016 is an internationally recognized automotive quality management system standard that builds on ISO 9001 and migrated from ISO to the International Automotive Task Force (IATF) in 2016. For

more information and customer specific requirements, please visit:
<https://www.iatfglobaloversight.org/>

In **India**, motorcycles and motorized vehicles are left out of the industrial classification. Only synthetic rubber is classified as orange. For more information on the classification of industrial sectors in India, please visit: <http://www.indiaenvironmentportal.org.in/files/file/Classification%20of%20Industries.pdf>

The **Bharat Stage IV** emission standards are in effect for two- and three-wheeler models in India (see Table 14):

Table 14: Emission standards for two-wheelers in India

Emission Standard for 2-W	Motorcycle Class	Emission Limits (g/km) ^[1]			
		CO	NO _x	HC+NO _x	
				If Evap. Test ≤ 2.0 g/test	If Evap. Test ≤ 6.0 g/test
Bharat III (2010) IDC	All 2-W	1.0	-	1.0	1.0
	Class 1 and Sub-class 2-1	1.403	0.39	0.79	0.59
	Subclass 2-2	1.970	0.34	0.67	0.47
Bharat IV (2016 TA; 2017 AV)	Subclass 3-1 and 3-2	1.970	0.20	0.40	0.20
European Standards – WMTC testing					
Euro 3 (2006)	V _{max} <130km/h	2.62	0.17	0.92	0.92
	V _{max} ≥130km/h	2.62	0.22	0.55	0.55
Euro 4 (2016 TA; 2017 AV)	V _{max} <130km/h	1.14	0.07	0.45	0.45
	V _{max} ≥130km/h	1.14	0.09	0.26	0.26

[1] Test procedure and driving cycles according to WMTC GTR-2 regulations, incorporating amendment

Source: International Council on Clean Transportation 2014

South Korea has harmonized its emission standards with the Euro standards of the European Union. Two-wheeled motorcycles are subject to Euro 3 emissions standards, while three-wheeled vehicles have to comply with Euro 2 standards (see Table 15):

Table 15: Korea motorcycle emission standards

Emission Standards for Two and Three-Wheelers					
Two-Wheelers		CO (g/km)	HC (g/km)	NO _x (g/km)	HC+NO _x (g/km)
Euro 3 Since 2008.1.1	Less than 45km/hr	1.0	—	—	1.2
	< 150 cc	2.00	0.80	0.15	—
	≥ 150 cc	2.00	0.30	0.15	—
Three-Wheelers		CO (g/km)	HC (g/km)	NO _x (g/km)	HC+NO _x (g/km)
Euro 2 Since 2008.1.1	All	7.0	1.5	0.4	—

Source: Transport Policy 2018



Ministry of Commerce
Government of Bangladesh





6 CONCLUDING REMARKS

The provisions of this handbook constitute minimum social and labor standards and good environmental practices drawing on best available techniques (BAT). Companies are recommended to aim for solutions exceeding these minimum standards as BAT change and improve over time.

However, the Bangladeshi context and the lack of available funds for adopting clean technologies may set limits to improving the environmental performance levels. Hence, local and small-scale solutions, such as abatement techniques or guarding solutions, are often required to protect human health and reduce the impact on the environment.

It is mandatory for manufacturing firms of the plastics industry and sub-sectors of the light engineering industry to comply with national laws and regulations. Wherever legislation falls below international standards, export-oriented firms are expected to apply that provision which provides highest protection. Effective regulatory measures, including enforcement, are indispensable for ensuring social and environmental responsibility. Likewise, buyers and suppliers have the responsibility to continuously update and communicate their requirements when it comes to potential conflicts with national legislation.

While global market integration requires consensus on compliant practices, the greatest impact of these measures will be felt by local communities whose health and environmental conditions would significantly improve.



7 REFERENCES

American Chemistry Council 2019: Polyurethanes. Sustainability: Polyurethane Recycling. Retrieved from: <https://polyurethane.americanchemistry.com/Polyurethane-Recycling/> (25 February 2019)

Batterieforum Deutschland 2019: Blei-Säure Batterien. Retrieved from: <https://www.batterieforum-deutschland.de/infoportal/batterie-kompodium/sekundaere-batterie/blei-saeure-batterien/> (31 January 2019)

Bike Europe 2015: New ISO Standard for Bicycles Implemented. Retrieved from: <https://www.bike-eu.com/laws-regulations/nieuws/2015/01/new-iso-standard-for-bicycles-implemented-1018946> (30 January 2019)

Carel 2018: Which refrigerants are allowed worldwide on stand-alone units? Retrieved from: <https://www.carel.com/blog/-/blogs/which-refrigerants-are-allowed-worldwide-on-stand-alone-units-> (13 February 2019)

CustomPartNet 2019: Blow Molding. Retrieved from: <http://www.custompartnet.com/wu/blow-molding> (31 January 2019)

Department of Environment - Government of Bangladesh 2012: Revisions of Vehicular Emission Standards for Bangladesh. Draft Final Report - Part 1. Retrieved from: http://case.doe.gov.bd/file_zone/feedback/Revisions%20of%20Vehicular%20Emission%20Standards%20for%20Bangladesh.pdf (30 January 2019)

Electrical Installation 2019: How an electrical cable is made. Retrieved from: http://www.electrical-installation.org/enwiki/How_an_electrical_cable_is_made (31 January 2019)

European Commission 2001: Reference Document on Best Available Techniques in the Ferrous Metals Processing Industry. Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/BREF/fmp_bref_1201.pdf (30 January 2019)

European Commission 2005: Reference Document on Best Available Techniques in the Smitheries and Foundries Industry. Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/BREF/sf_bref_0505.pdf (30 January 2019)

European Commission 2006: Reference Document on Best Available Techniques for the Surface Treatment of Metals and Plastics. Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/BREF/stm_bref_0806.pdf (30 January 2019)

European Commission 2007: Reference Document on Best Available Techniques in the Production of Polymers. Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/BREF/pol_bref_0807.pdf (30 January 2019)

European Commission 2009: Reference Document on Best Available Techniques for Energy Efficiency. Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/BREF/ENE_Adopted_02-2009.pdf (30 January 2019)

European Commission 2013: Best Available Techniques (BAT) Reference Document for Iron and Steel Production. Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/BREF/I&S/IS_Published_0312.pdf (30 January 2019)

European Commission 2016: Best Available Techniques (BAT) Reference Document for Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector. Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/BREF/CWW_Bref_2016_published.pdf (30 January 2019)



European Commission 2017: Best Available Techniques (BAT) Reference Document for the Non-Ferrous Metals Industries. Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/BREF/NFM/JRC107041_NFM_bref2017.pdf (30 January 2019)

European Commission 2018: Best Available Techniques (BAT) Reference Document for Waste Treatment. Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/BREF/WT/JRC113018_WT_Bref.pdf (30 January 2019)

European Commission 2018: Waste Electrical and Electronic Equipment (WEEE). Retrieved from: http://ec.europa.eu/environment/waste/weee/index_en.htm (31 January 2019)

European Commission 2019: Traffic rules and regulations for cyclists and their vehicles. Retrieved from: https://ec.europa.eu/transport/road_safety/specialist/knowledge/pedestrians/special_regulations_for_pedestrians_and_cyclists/traffic_rules_and_regulations_for_cyclists_and_their_vehicles_en (31 January 2019)

European Parliament 2006: Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC. Retrieved from: <https://eur-lex.europa.eu/eli/dir/2006/66/oj> (30 January 2019)

European Parliament 2011: Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Retrieved from: <https://eur-lex.europa.eu/eli/dir/2011/65/oj> (30 January 2019)

European Parliament 2012: Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE). Retrieved from: <https://eur-lex.europa.eu/eli/dir/2012/19/oj> (30 January 2019)

FSSC 22000 2019: Ensuring consumer trust in the supply of safe food & drinks. Retrieved from: <http://www.fssc22000.com/documents/home.xml?lang=en> (31 January 2019)

Gesamtverband der Deutschen Versicherungswirtschaft e. V. (GDV) 2001: Maintenance-free Lead Acid Batteries: Requirements and test methods. In: VdS Guidelines for Alarm Systems. Retrieved from: http://vds-global.com/fileadmin/vds_publicationen/vds_2102en_web.pdf (30 January 2019)

Government of South Australia 2017: Automotive workshops. Work health and safety guidelines. Retrieved from: <https://www.safework.sa.gov.au/sites/default/files/automotiveworkshopsafetyguidebook.pdf?v=1529036644> (19 February 2019)

Green Club 2019: Comparison of Oxo-Biodegradable and Hydro-Biodegradable Plastics. Retrieved from: <http://www.greenclubinc.com/powerpoint/Green%20Club%20-%20Oxo%20vs%20Hydro%20comparison.pdf> (28 February 2019)

Health and Safety Executive 2019: Cable joints and repairs. Retrieved from: <http://www.hse.gov.uk/lau/lacs/18-1.htm> (6 February 2019)

ILO Encyclopedia of Occupational Health and Safety 2011: Engineering Controls. Retrieved from: <http://www.iloencyclopaedia.org/part-xii/rubber-industry/item/393-engineering-controls> (7 April 2019)

Infineum International Ltd 2018: Euro 5 motorcycles. Retrieved from: <https://www.infineuminsight.com/insight/aug-2018/euro-5-motorcycles> (30 January 2019)

International Council on Clean Transportation 2014: Bharat Stage IV Emission Standards for Two-Wheelers in India. Retrieved from:



https://www.theicct.org/sites/default/files/publications/ICCTupdate_BSIV-motorcycles_aug2014.pdf
(30 April 2019)

International Finance Corporation 2007: Environmental, Health, and Safety. General Guidelines. Retrieved from: <https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES> (28 February 2019)

International Labor Office 2003: Safety and health in the non-ferrous metals industries. Geneva. Retrieved from: https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/normativeinstrument/wcms_107713.pdf (30 January 2019)

International Labour Organization (no year): Hazardous Child Labor. Retrieved from: https://www.ilo.org/asia/WCMS_224118/lang--en/index.htm (4 February 2019)

International Labour Organization 2001: Substantive provisions of labour legislation: The Elimination of Discrimination in Respect of Employment and Occupation. Retrieved from: <https://www.ilo.org/legacy/english/dialogue/ifpdial/llg/noframes/ch7.htm#5> (28 February 2019)

International Labour Organization 2014: The meanings of Forced Labour. Retrieved from: https://www.ilo.org/global/topics/forced-labour/news/WCMS_237569/lang--en/index.htm (28 February 2019)

MET Laboratories (2019): MET's Battery Testing Capabilities. End-to-end testing & certification solutions helping you verify the integrity, reliability, performance, and safety of your battery products. Retrieved from: <https://www.metlabs.com/industries/battery/battery-testing-capabilities/> (17 Jan 2019)

Nikje, M. M. A. 2016: Recycling of Polyurethane Wastes. Smithers Rapra Technology Ltd. Shawbury / United Kingdom. Retrieved from: https://books.google.de/books?hl=de&lr=&id=KwBNDwAAQBAJ&oi=fnd&pg=PR1&dq=%22Recycling+of+Polyurethane+Wastes%22&ots=z_Oz4g068d&sig=G44DaSaoAKHvaHj-YwavPuGY5jE#v=onepage&q=%22Recycling%20of%20Polyurethane%20Wastes%22&f=false (20 February 2019)

Organisation for Economic Co-Operation and Development 2008: OECD Guidelines for Multinational Enterprises. Retrieved from: <http://www.oecd.org/investment/mne/1922428.pdf> (7 April 2019)

Organization for Economic Co-operation and Development 1995: Recycling of copper, lead and zinc bearing wastes. Retrieved from: [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=OCDE/GD\(95\)78&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=OCDE/GD(95)78&docLanguage=En) (30 January 2019)

Organization for Economic Co-operation and Development 1998: Small Businesses, Job Creation and Growth: Facts, Obstacles and Best Practices. Retrieved from: <https://www.oecd.org/cfe/smes/2090740.pdf> (28 January 2019)

Plastic Waste Management Institute 2016: An Introduction to Plastic Recycling. Retrieved from: https://www.pwmi.or.jp/ei/plastic_recycling_2016.pdf (30 January 2019)

Schwalbe 2019: Reifenbau. Retrieved from: <https://www.schwalbe.com/en/reifenaufbau.html> (31 January 2019)

Shield Batteries 2019: About Batteries. Batteries and technical terms. Retrieved from: <https://www.shieldbatteries.co.uk/technical/about-batteries.html> (31 January 2019)

Sit, D. 2016: Chapter 12: Manufacturing of Refrigerators. In: Services in Global Value Chains. pp. 377-399 (2016)



Smiths Metals 2019: Materials. Retrieved from: <https://www.smithmetal.com/metal-stockholders.htm> (31 January 2019)

Step Initiative 2014: Solving the E-Waste Problem (Step) White Paper: One Global Definition of E-waste. Retrieved from: http://www.step-initiative.org/files/documents/whitepapers/StEP_WP_One%20Global%20Definition%20of%20E-waste_20140603_amended.pdf (30 January 2019)

The Financial Express 2018: Exports of plastic bottle waste crash-land after China ban. Entrepreneurs looking at India as alternative destination. 28 January 2018. Retrieved from: www.today.thefinancialexpress.com.bd/trade-market/exports-of-plastic-bottle-waste-crash-land-after-china-ban-1517068986 (31 January 2019)

Thomas 2019: The Environmental Impact of Anodizing. Retrieved from: <https://www.thomasnet.com/articles/custom-manufacturing-fabricating/anodizing-environmental> (15 February 2019)

TransportPolicy.net 2018: EU. Motorcycles. Emissions. Retrieved from: <https://www.transportpolicy.net/standard/eu-motorcycles-emissions/> (30 January 2019)

TransportPolicy.net 2018: South Korea. Motorcycles. Emissions. Retrieved from: <https://www.transportpolicy.net/standard/south-korea-motorcycles-emissions/> (30 April 2019)

United Nations Human Rights Office of the High Commissioner 2011: Guiding Principles on Business and Human Rights. Implementing the United Nations “Protect, Respect and Remedy” Framework. Retrieved from: https://www.ohchr.org/documents/publications/GuidingprinciplesBusinesshr_eN.pdf (7 April 2019)

United States Department of Labor 1999: Metalworking Fluids: Safety and Health Best Practices Manual. Retrieved from: https://www.osha.gov/SLTC/metalworkingfluids/metalworkingfluids_manual.html#e (7 April 2019)



8 ANNEX

8.1 LABOR STANDARDS

8.1.1 GUIDELINES FOR CORPORATE BUSINESSES ON HUMAN RIGHTS

A. Foundational principles

Business enterprises should respect human rights. This means that they should avoid infringing on the human rights of others and should address adverse human rights impacts with which they are involved.

The responsibility of business enterprises to respect human rights refers to internationally recognized human rights – understood as those expressed in the international bill of human rights and the principles concerning fundamental rights set out in the international labor organization’s declaration on fundamental principles and rights at work.

The responsibility to respect human rights requires that business enterprises:

- avoid causing or contributing to adverse human rights impacts through their own activities, and address such impacts when they occur;
- seek to prevent or mitigate adverse human rights impacts that are directly linked to their operations, products or services by their business relationships, even if they have not contributed to those impacts.

The responsibility of business enterprises to respect human rights applies to all enterprises regardless of their size, sector, operational context, ownership and structure. Nevertheless, the scale and complexity of the means through which enterprises meet that responsibility may vary according to these factors and with the severity of the enterprise’s adverse human rights impacts.

In order to meet their responsibility to respect human rights, business enterprises should have in place policies and processes appropriate to their size and circumstances, including:

- a policy commitment to meet their responsibility to respect human rights;
- a human rights due diligence process to identify, prevent, mitigate and account for how they address their impacts on human rights;
- processes to enable the remediation of any adverse human rights impacts they cause or to which they contribute.



B. Operational principles

Policy commitment

As the basis for embedding their responsibility to respect human rights, business enterprises should express their commitment to meet this responsibility through a statement of policy that:

- is approved at the most senior level of the business enterprise;
- is informed by relevant internal and/or external expertise;
- stipulates the enterprise's human rights expectations of personnel, business partners and other parties directly linked to its operations, products or services;
- is publicly available and communicated internally and externally to all personnel, business partners and other relevant parties;
- is reflected in operational policies and procedures necessary to embed it throughout the business enterprise.

For more information on the UN Guiding Principles on Businesses and Human Rights, see the full document: https://www.ohchr.org/documents/publications/GuidingprinciplesBusinesshr_eN.pdf

8.1.2 GUIDELINES ON LICENSES

8.1.2.1 PROCEDURE FOR GETTING FIRE LICENSE

The following steps provide guidance on how to apply for a fire license:

- Collect application form from Dhaka head office of Fire Service and Civil Defense.
- Fill up the form
- Add supporting documents to application
 - o Attached copy of certificate of incorporation with memorandum and articles of association.
 - o Layout/plan of building
 - o Valuation Certificate from Municipality/City Corporation/Union Porishad
 - o Deed of agreement if the property is rented
- Submit application with supporting documents
- Inspection by the Fire Service and Civil Defense Inspector
- After the inspection, a demand note is issued that states that fees need to be paid. Points of violation are flagged, and time is given to the applicant to address these issues.
- Sites will be revisited to check whether the flagged violations have been addressed and fire-fighting equipment has been put in place.
- Fire license is issued

8.1.2.2 PROCEDURE FOR GETTING TRADE LICENSE

The process is managed by the local government authority, i.e. either City Corporation or the Union Parishad of the business. The license is issued in the name of the license holder and such license is not



transferable. A fee for the trade license has to be deposited at any bank as indicated on the Trade License form.

Required documents for trade license:

- Attested copy of rental agreement
- Copy of the holding tax payment receipt
- Copy of fire license
- Declaration on non-judicial stamp of Tk. 150/- to abide by the rules and regulations of the authority
- One copy of passport size photograph
- Memorandum of Article and Certificate of In-Corporation (in case of a limited company)

8.1.2.3 PROCEDURE FOR APPROVAL OF FACTORY LAYOUT PLAN AND EXTENSION LAYOUT PLAN

- Before use, change or expansion of any houses, building or premises as factory, approval in writing of the inspector general or any officer empowered by him shall be taken. Provided, however, that the inspector general or any officer empowered by him shall not sanction any approval without any inspection on the spot.
- For taking approval under the by-law (1), all applications have to be submitted as per Form-76 which shall be accompanied by the following documents, namely:
 - o A list of brief statement along with different production flow chart.
 - o Two sets of layout plan in ammonia or blue print which shall include the followings, namely:
 - Factory's location and the site plan along with entry and drains;
 - Elevation and necessary sectional elevation of different buildings, provision of normal lighting, ventilation, placement of machinery, location of dining room, toilet etc. and exit and entrance plan during fire incident;
 - o Layout plan of the factory building as approved by the local or due authority; and
 - o Relevant other information as per requisition of the inspector general.
- If the Inspector General is satisfied, then he will send back a copy of the submitted layout plan to the applicant as per sub-rule (2) and if he imposes any other conditions, then subject to said condition(s), he will approve the factory's layout plan in cases or will expand, change or amend the layout plan or will seek other details for approval of the lay-out plan.
- Without written permission of the inspector general, no change in any approved layout plan may be brought.
- In case the factory building being brick-built or being a building with more than one storey, then the application shall be accompanied by structural design of the building as certified by a government specified authority, soil test and certificate for construction of building by any recognized engineering establishment.

8.1.3 GUIDELINES ON PREVENTING FORCED LABOR



The following steps provide practical guidance on how to prevent forced labor:

- The company needs to define a policy and procedures prohibiting forced labor and prison labor (see sample policy below).
- The company needs to define a recruitment policy and establish strong recruitment procedures (see sample policy below).
- The company needs to assign responsible personnel to monitor, document, update, and control that policies and procedures are properly implemented.
- The company needs to ensure the policy is effectively communicated in trainings and internal meetings and published in local language.

A sample policy and procedures on the prohibition of forced labor can look like as follows:

Policy

- The company does not use involuntary or forced labor indentured, bonded or otherwise nor does it support the use of forced or compulsory labor in any form including bonded, forced, and/or compulsory prison labor.
- The company prohibits all relevant individuals from coercing employees in any way or unnecessarily limiting employees' freedom of movement.
- The company does not require employees to submit original of documents at the time of employment or during the period of his employment with the company.

Procedure

General

- Maintains employment application and service contract, to include statement applicants are seeking employment voluntarily and are not under threat or any penalty and to be signed by each applicant.
- Provides compensation directly to worker as mentioned in their contract, company makes sure that the correct payment is paid to the workers as agreed.
- Job description of Security staff has been defined, limiting security tasks to normal security matters such as the protection of property or personnel.
- If necessary, original documents are only taken from the employees for the verification and after verification the original documents are returned to the employees.
- During the time of employee's interview, the potential candidate is briefed about the fact that he/she is under no compulsion to join the company and similarly he/she is free to dis-associate with company as per his/her own free will at any given time but under compliance with the rules as agreed in the appointment letter.
- Manager, Administration and Compliance, ensure that workers who are doing overtimes are under no pressure or threat from their Departmental Head for compulsory OT.
- In case where any company's employee decides to leave the company, Compliance and Personnel ask about the reason(s) of leaving in order to make sure that he/she is not leaving under unlawful compulsion or threat.
- Manager, Administration and Compliance trains all departmental heads on the company's policies and procedures prohibiting involuntary or forced labor.



- A suggestion box is placed in the facility; if any employee wants to report any incident, he/she can use the suggestion box without mentioning his/her identity, the matter will be investigated and resolved by the Company.
- Manager, Administration and Compliance ensure continuous communication between workers and management through designated members of different committees. Compliance and Personnel directly monitor regarding the issues related to the workers are communicated to the management for effective corrective and preventive measures.

Responsibility and authority

- Manager, Administration and Compliance is responsible for implementation of the policy.

Responsibilities

- Proper communication of company's prohibition of forced labor policy to the respective supervisors and workers.
- Organizing meetings and training programs to ensure that the policy is properly communicated and understood by the employees.

Communication & Training

- Where required, Managing Director will notify that to the top management and will take required step about that and Manager, Administration and Compliance is responsible to train the designated persons to ensure the compliance of updated laws.
- Training records are maintained according to training document.

The following guidelines serve for defining policy and procedures on recruitment:

Objective

- The factory's Recruitment Policy aims to enriching its talent pool by acquiring skills and functional expertise that strengthen its goal to become a Leader in the sector.

Scope

- The objective of the Recruitment Policy is to source the best talent from Internal and External resources to achieve the Business Objectives and Goals of the Company.

Internal recruitments

Scope

New vacancy

Replacement

Responsibility

- Requirement requisition: HR head/Departmental Head
- New vacancy approval: Executive Director/HR head



Key policy

- Internal vacancies shall be posted on the Notice Board.
- Eligible employees may apply for any vacancy.
- All applications shall be sent through e-mail or by hand to HR department
- Databank of potential candidate profiles shall be hand over to the concerned HR/HODs
- In case of non-availability of suitable internal candidate(s), external sources shall be approached.
- The process of selection shall include (i) Panel interview (ii) competency matching and (iii) a skill test shall be administered.
- The decision of the panel shall be binding and final.

External recruitments

Responsibility

- Requirement requisition: HR head/Departmental Head
- New vacancy approval: Executive Director/HR head

Key policy

- In case of non-availability of suitable internal candidate(s) with requisite talent /expertise for the vacant post(s), external sources shall be approached.
- Referred candidates through existing Employees may be considered

Hiring for employment

- The factory AAA will comply with the Bangladesh Labor Law / relevant national laws applicable in case of employment and other related activities. The factory implements the following policies while hiring or recruiting employees. The Company shall employ adult workers only, 18 Years old & above as defined by the law of the land. The Company shall not use forced labor and shall not extract work from any person under any intimidation or for which the worker has not offered voluntarily.

Responsibility

- We are an equal opportunity employee and shall follow a non-discriminatory behavior for employing and related activities.
- We hire employees through an employment committee headed by a representative from the HR/HODs as management representative. The committee is neither influenced nor biased by any influence from inside or outside.
- Employment will be provided based on education, experience, demonstrated skills and abilities (mandatory testing during hiring), supported proof of age certification, sound physical and mental health.



- The Company shall actively pursue to hire the best human resources available in the country for employment.

Documentation

- The advertisement for the employment will be placed in a populous area or newspaper or in front of the factory as deemed proper by the management. The advertisement will specify the position and required experience and qualification of job.
- General employees and Supervisors are encouraged to bring reference for prospective employees.
- For highly skilled and senior management level staffs the management puts advertisement in the newspapers and internet as well.
- Appropriate verbal or written or practical tests will be taken to select the eligibility of the candidate.
- The following document must be provided by the candidate at the time of employment:
 - o Bio Data with 3 copies of passport size photographs.
 - o Nationality Certificate from City Corporation/ municipality or Union Parishad Chairman as applicable.
 - o Age verification certificate indicating 18 or above on the date of application. Persons below the age of 18 will be automatically disqualified. Though Bangladesh Labor Law allows employment below 18 years with working hours and types restrictions, but here at the factory management strictly maintains the age requirement to be above 18 years that is good for employment without any restriction. The prospective candidate will undergo a physical and mental health check by a qualified practitioner and job assurance will be subjected to positive results from the tests. (An age estimation form must be completed)
 - o Certificates of education and experience where relevant.
- Upon satisfying the criteria for the job, a prospective employee will be given an appointment letter.

8.1.4 GUIDELINES ON ENSURING FREEDOM OF ASSOCIATION

- The company needs to define and have a policy of freedom of association in place (see example below).
- The company needs to assign responsible personnel to monitor, document, update, and control that the policy is properly implemented.
- The company needs to conduct an education program for management and workers on workers' rights.
- The company needs to make sure that the employees' representatives are elected by the employees.
- Union representatives should work unbiased and effectively represent the interests of their members and non-unionized workers. A union allows employees to join for bargain collectively.



- The company needs to display grievance handling minutes of the meeting (employee list with affiliations and representatives).

The following sample policy and procedures provide guidance on ensuring freedom of association and collective bargaining:

Policy

- The company recognizes and respects the rights of employees to exercise their lawful rights of freedom of association and collective bargaining.
- The company does not discriminate against employees who form or participate in lawful associations and/or collective bargaining. Forms of discrimination include, but are not limited to:
 - o Wage penalties
 - o Suspension
 - o Termination
- The company does not discriminate against applicants who have previously exercised their lawful rights of freedom of association and/or collective bargaining.

Procedures

General

- The company allows freedom of movement during employee breaks unless such movement interferes with the work of other employees.
- The company allows the employees to leave the company ground for reasons other than normal security reasons.
- The company acknowledges the right of every employee to form free association or not to do so for collective bargaining.
- The company has a Worker Participation Committee (WPC) with the participation of both management and workers.
- The management selects the management representatives; the workers elect their representatives.
- Pictures of members of the WPC are posted at strategic locations in the factory.
- WPC meetings will be held on once in every two month-basis.
- Minutes of WPC meetings are maintained and displayed at a Notice Board.
- In addition, suggestion boxes are placed in the facility; if any employee wants to make complaints any incident, he/she can use the suggestion boxes without mentioning his/her identity.

Responsibility and authority

- The Manager Compliance is responsible for Implementation & Communication of the abovementioned policy and procedures.

Responsibilities

- The policy is properly communicated to and understood by the employees.



Communication and training

- Compliance and Personnel will train the designated persons to ensure the compliance of updated laws.
- Training records are maintained according to training document.

8.1.5 GUIDELINES ON INITIATING A COLLECTIVE BARGAINING PROCESS

- **Preparation:** Choose a negotiation team and representatives of both union and employer. Both parties should be skilled in negotiation and labor laws.
- **Discussion:** Both parties meet to set ground rules for the collective bargaining negotiation process.
- **Proposal:** Both representatives make opening statements, outlining options and possible solutions to the issue at hand.
- **Bargaining:** Following proposals, the parties discuss potential compromises, bargaining to create an agreement that is acceptable to both parties. This becomes a “draft” agreement, which is not legally binding, but a stepping stone to coming to a final collective bargaining agreement.
- **Final Agreement:** Once an agreement is made between the parties, it must be put in writing, signed by the parties, and put into effect.

Further steps to improve the process of collective bargaining:

- Begin the process of negotiations with proposals, not demands.
- Avoid taking public positions for or against certain proposals in advance of negotiations.
- Give negotiators proper authority to bargain.
- Avoid unnecessary delays in beginning negotiations and in conducting them.
- Insist on offering facts and arguments.
- Make plenty of proposals to enhance the opportunities to find compromises.
- Be prepared to compromise.
- Be prepared to get results gradually.
- Preserve good manners and keep discussions focus on relevant issues.

8.1.6 GUIDELINES ON EQUAL REMUNERATION

Train supervisors and managers to avoid wage discrimination

- Employers need to make sure that all supervisors and managers receive proper training on how to avoid wage discrimination and make employment decisions based on legitimate and nondiscriminatory reasons.

Make decisions based on skill and performance

- Employers, supervisors and human resource managers need to make sure that all employment decisions regarding promotions, raises, bonuses, etc., are based on legitimate and nondiscriminatory factors such as skill, merit and performance, rather than an employee's

membership in a protected class. Employers should avoid wage differentials based on sex, race, national origin or any other protected class unless they can be justified by legitimate and nondiscriminatory reasons.

Provide timely and effective performance evaluations

- Employers should aim to provide employees with yearly or biannual performance evaluations. In doing so, employers should clearly set out the employer's expectations and show the employees how they are meeting them or not meeting them.

8.1.7 GUIDELINES ON DISCRIMINATION

8.1.7.1 GUIDELINES ON DISCRIMINATION AT THE WORKPLACE

- Develop a set of qualifications and prerequisites before you start hiring for a job. Judge the candidates based on these professional parameters. If you fear a colleague is discriminating in their choices, ask for a third party to assess the candidates based on merits alone.
- Make sure no job candidate or employee is discriminated because of their names, gender, the color of their skin, ethnicity or origin, religion and beliefs, maternal status, political affiliation, national origin or sexual orientation.
- Set non-negotiable equal pay for new hires (based on their degrees). This stops discrimination regarding salary offers and accounts for the fact that women are on average more hesitant to negotiate their salaries.
- Develop a clear harassment and discrimination policy at work. Post it in a common location and add it to your employee handbook. Place a human resource manager in charge of complaints.
- Take complaints very seriously. No one should be told to "stop being so sensitive" if they are being mistreated at the office.
- Provide staff training on discrimination or harassment. Make it clear that there is a zero-tolerance policy when it comes to discrimination. Announce how complaints and disciplinary action will be handled.
- Trainings should include topics of gender, race, disability, religion, ethnicity or origin, and age.

Other steps to be considered:

- The labor inspectorate has proved largely ineffective. Pressure the Government to improve the monitoring of factory working conditions. Third-party monitoring by programs such as 'Better Work'/'Better Factories' can establish useful mechanisms for establishing non-discriminatory working conditions.
- Be more receptive to learning and request more knowledge transfer from audits.
 - o Audits should combine finding violations with informally counseling the factory on how to improve conditions based on their own experience in the audit field.
 - o Do not coach or threaten your own workers ahead of factory visits by auditors. Effective refusal to allow entry will be reported to the corresponding authority.
 - o Accept unannounced inspections and be willing to learn.



- Liaise with a local civil society organization (CSO) to create a direct mechanism to report labor rights violations to the third-party organization.
 - Make factory reports available to individual workers and unions, so they can verify whether the reports accurately portray the working conditions in the given factory.
 - Create a database for brands that periodically updates information on the improvement process in factories.

8.1.7.2 GUIDELINES FOR ESTABLISHING A GRIEVANCE COMMITTEE

Grievance can be defined as a “cause of distress (such as an unsatisfactory working condition) felt to afford reason for complaint or resistance”.

A Grievance Committee is a committee formed by representatives of the management and employees.

The Grievance Committee may consist of maximum six persons, with three representatives of workers/employees and management each. One of them is elected to act as head of the committee. Members from the Participation Committee (PC) may be preferably included in the Grievance Committee.

To file a complaint with the Grievance Committee, it is recommended to follow the procedure as described below:

Procedure

- Prepare and set a procedure for filing the grievance, and hearing and enquiring it.
- Set up a grievance box in a private location so that, if necessary, grievances can be filed anonymously
- The Grievance Committee should deal with individual complaints only. For collective complaints, seek council from the Participation Committee (PC) or the trade union.
- Any grievance is expected to be raised in written form. A Welfare Officer who may or may not be part of the Grievance Committee may assist in filing the written complaint. Once a complaint is made, the Grievance Committee should meet and discuss the merits of the complaint and, if not accepted, shall dismiss it and communicate the same to the complainant.
- If there is enough evidence to substantiate the complaint, the Grievance Committee proceeds with conducting an inquiry.

Conducting Inquiry

The Grievance Committee takes statements from both the aggrieved and the accused as well as the witnesses.

If required, the Grievance Committee holds the meetings/enquiries in a private place.

The Grievance Committee records the statements and takes signatures from the persons whose depositions have been taken. The Grievance Committee concludes and sends the report to the management or the disciplinary authority (e.g. Participation Committee).

During the enquiry, if technical assistance is required, the Grievance Committee may consult with in-house technicians to determine the action to be taken. Work-related complaints shall be addressed by hearing the head of the concerned department.



An enquiry is expected to be completed within a specified time period, that is not later than 45-60 days of filing the complaint. The Grievance Committee shall communicate the decision to the aggrieved person and take remedial action within this period.

Appeal

If the aggrieved is not satisfied with the decision of the Grievance Committee, s/he can file an appeal against the decision before the top management, the Managing Director (MD) or the Chief Executive Officer (CEO). The top management can form an appellate committee.

The appellate authority is expected to give a reply within 30 days. The Grievance Committee can review the procedures carried out by the inquiry committee and, if necessary, again go for further inquiry. The decision of the appellate committee is the final decision from the management side.

Labor court

If the aggrieved is still not satisfied with the decision of the appellate committee, she/he can go to the labor court that will handle the grievance in accordance with legal provisions.

Confidentiality of complaints

Complaints of harassment and violence are sensitive issues and thus should be treated confidentially by the Grievance Committee. The Grievance Committee should only release as much information as is necessary to investigate and respond to the complaint or if required to do so by law. Out of respect for the individuals concerned, it is essential that the complainant, accused, witnesses and anyone else involved in the formal investigation of a complaint maintain confidentiality throughout the investigation and afterwards.

8.1.7.3 NATIONAL GUIDELINES FOR DEALING WITH SEXUAL HARASSMENT

The following guidelines are quoted from the Supreme Court verdict on sexual harassment:

“In view of the inadequacy of safeguards against sexual abuse and harassment of women at work places and educational institutions whereby noble pledges of country Constitution made in so many articles to build up a society free from gender discrimination and characterized by gender equality are being undermined everyday in every sphere of life, supreme court are inclined to issue certain directives in the form of guidelines as detailed below to be followed and observed at all work places and educational institutions till adequate and effective legislation is made in this field.

These guidelines shall apply to all work places and educational institutions in both public and private sectors within the territory of Bangladesh.

Aims and objectives.

The aims and objectives of these guidelines include-

- (a) to create awareness about sexual harassments;
- (b) to create awareness about the consequences of sexual offences;
- (c) to create awareness that sexual harassment is punishable offence.

Duties of employers and authorities.

It shall be the duty of the employers and other responsible persons in work places, and the authorities of all educational institutions to maintain an effective mechanism to prevent or deter the commission of



offences of sexual abuse and harassment, and to provide effective measures for prosecution of the offences of sexual harassment resorting to all available legal and possible institutional steps.

Definition of Sexual Harassment includes-

- a. Unwelcome sexually determined behaviour (whether directly or by implication) as physical contact and advances;
- b. Attempts or efforts to establish physical relation having sexual implication by abuse of administrative, authoritative or professional powers;
- c. Sexually coloured verbal representation;
- d. Demand or request for sexual favours;
- e. Showing pornography;
- f. Sexually coloured remark or gesture;
- g. Indecent gesture, teasing through abusive language, stalking, joking having sexual implication.
- h. Insult through letters, telephone calls, cell phone calls, SMS, pottering, notice, cartoon, writing on bench, chair, table, notice boards, walls of office, factory, classroom, washroom having sexual implication.
- i. Taking still or video photographs for the purpose of blackmailing and character assassination;
- j. Preventing participation in sports, cultural, organizational and academic activities on the ground of sex and/or for the purpose of sexual harassment;
- k. Making love proposal and exerting pressure or posing threats in case of refusal to love proposal;
- l. Attempt to establish sexual relation by intimidation, deception or false assurance.

Such conduct mentioned in clauses (a) to (l) can be humiliating and may constitute a health and safety problem at workplaces or educational institutions; it is discriminatory when the woman has reasonable grounds to believe that her objection would disadvantage her in connection with her education or employment in various ways or when it creates a hostile environment at workplaces or educational institutions.

ii) Concerned Authority means an authority of any educational institution or work place in both public and private sectors, which is authorised under the relevant disciplinary rules to take action in case of misconduct.

iii) Disciplinary Rules mean rules prescribed by any Act or Ordinance or any other sub-ordinate legislations and include any rules framed for maintenance of discipline in any public or private institutions, organisations and work places.

Creating awareness and public opinion.

- a. In order to deter and eliminate sexual harassment and torture, and to create a safe environment for work and education, the employers/ management of all workplaces and authorities of all educational institutions will attach prime importance to the publicity and publication against sexual harassment and gender discrimination. There must be sufficient orientation before the formal classes start for a new session in educational institutions, and monthly, half yearly orientation in all workplaces and institutions;
- b. There must be arrangement for proper counselling for the concerned persons, if necessary;



- c. Awareness of the rights of female students and employees guaranteed and conferred by the Constitution and the statutes should be created by notifying in simple words the relevant provisions of the Constitution and the statutes;
- d. The educational institutions and the employers will maintain regular communication and effective consultation with the administrative authorities to create awareness among the personnel in law enforcing agencies in this regard;
- e. To prepare and publish booklets containing these guidelines and provisions of the Constitution and statutes regarding gender equality and sexual offences;
- f. To create awareness regarding fundamental rights guaranteed in the Constitution;

Preventive steps.

All employers and persons in charge of work places and authorities of all educational institutions shall take effective measures for prevention of sexual harassment. To discharge these obligations, they shall take, amongst others, the following steps:

- a. Prohibition of sexual harassment and sexual torture as defined in clause 4 above should be notified, published and circulated widely and in an effective manner;
- b. Constitutional and statutory provisions against gender discriminations and sexual harassment and punishment for the offences of sexual harassment and torture should be widely circulated;
- c. To ensure that there is no hostile environment towards women at workplaces and educational institutions, and to engender confidence and trust in women workers and students that they are not placed in a disadvantaged position in comparison to their male colleagues and fellow students.

Disciplinary Action:

Appropriate disciplinary action must be initiated in case of any falling within the definition of sexual harassment and torture in clause 4 of these guidelines.

Complaints:

Where such acts do not constitute misconduct under the disciplinary rules, an appropriate and effective mechanism must be evolved at the workplaces, and educational institutions, in both public and private sectors for record and redress of the complaint made by the victim. The following measures must be included in the complaint mechanism.

- (a) It must be ensured that the identity of the complainant and also that of the accused will not be disclosed until the allegation is proved;
- (b) Security of complainant will be ensured by the Concerned Authority;
- (c) Complaint can be lodged by the victim or through her relatives, friends or lawyers, and it can be sent by mail also;
- (d) A complainant can file the complaint with a female member of the Complaint Committee separately;
- (e) The complaint will be lodged with the Complaint Committee to be constituted as provided in clause 9 below.

Complaint Committee.

- (a) In all work places and educational institutions in both public and private sectors, the Concerned Authority will constitute a Complaint Committee in order to receive complaints, and to conduct investigation and make recommendations.



(b) The Complaint Committee will have minimum five members and majority of the members will be women. The head of the Complaint Committee should be a woman, if available.

(c) The Complaint Committee should have at least two members from outside the organization concerned, preferably from organizations working on gender issues and sexual abuse.

(d) The Complaint Committees will submit annual reports to the Government on the compliance of these guidelines.

10. Procedure of the Complaint Committee. Normally the complaint has to be lodged with the Complaint Committee within 30 working days of the occurrence. To verify the complaint the Complaint Committee will:

i). In case of minor harassment, if it is possible, the Complaint Committee shall dispose of the complaint with the consent of the parties involved and shall report to the Concerned Authority of the educational institution or work place in public or private sector, as the case may be.

ii) In all other cases the Complaint Committee shall investigate the matter.

iii) The Complaint Committee will have the power to send registered notice by mail to the parties and the witnesses, conduct hearing, gather evidence, and examine all relevant papers. In this type of complaint, apart from oral evidence emphasis should be placed on circumstantial evidence. To conduct the work of the Complaint Committee effectively the related office of the educational institutions and workplaces in both public and private sectors will be bound to extend any cooperation which is requested from them. The Complaint Committee will keep the identities of the complainant/s confidential. While recording the testimony of the complainant/s any question or behaviour which is intentionally base, insulting or harassing should be avoided. The testimony must be recorded in camera. If the complainant wants to withdraw the complaint or stop the investigation then the reason behind this has to be investigated and mentioned in the report.

The Complaint Committee shall submit the investigation report with recommendation within 30 working days to the Concerned Authority of the educational institution or work place, as the case may be. The period of 30 days may be extended up to 60 days where it is found necessary.

If it is proved that a false complaint has been filed intentionally then a report will be submitted to the Concerned Authority recommending appropriate action for the complainant/s. The Complaint Committee will take decisions on the basis of the view expressed by the majority of its members.

Punishment:

The Concerned Authority may suspend temporarily the accused person (other than students) and in case of students, may prevent them from attending their classes on the receipt of the recommendation of the Complaint Committee. If the accused is found guilty of sexual harassment, the Concerned Authority shall treat it as misconduct and take proper action according to the disciplinary rules of all work places and the educational institutions in both public and private sectors within 30 (thirty) days and/or shall refer the matter to the appropriate Court or tribunal if the act complained of constitutes an offence under any penal law.

The above guidelines will be strictly followed and observed in all educational institutions and work places in both public and private sectors until adequate and appropriate legislation is made in this field.

In this judgment the expression, “woman” has been used to include a female of any age as defined in the Nari-O-Shisu Nirjaton Daman Ain, 2000.”



8.1.7.4 GOOD PRACTICE FOR DEALING WITH SEXUAL HARASSMENT

It is illegal for an employer to discriminate on the basis of race, religion, sex, marital status, political affiliation, national origin or sexual orientation. Managers and supervisors have an obligation not to engage in any form of discrimination, harassment or sexual misconduct.

The following guidelines can be understood as a **good practice** for helping workers to react on a situation of sexual harassment.

If you are sexually harassed:

Say no:

- Do not ignore the behavior.
- Directly communicate, either verbally or in writing, that the conduct is unwelcome.
- Refuse all invitations for further personal interaction.

Report harassment to the Management or/and the Sexual Harassment Committee:

- Inform the Top Management or the Sexual Harassment Committee about the harassment, so the company is aware of the harassment and legally responsible to act.
- Describe the problem and how you want it fixed.
- Follow the non-discrimination policy, if there is one.

Write it down

- Write down exactly how you experienced the harassment, including dates, places, times, and possible witnesses.
- Keep the record at some safe place, preferably not at work.

Talk to others

- Tell other people at work about the harassment to find support and see if other people have been harassed by the offender, too.

The complaint is not being investigated or the company pretends there is not enough evidence of harassment

- Return to the Top Management or Sexual Harassment Committee you have filed the complaint with and find out why it was not investigated.
- If the complaint was investigated, but the harasser remained unsanctioned, find out why.
- If disciplinary matters are confidential, the company may refrain from telling what happened.
- If the harassment has not stopped, let the Top Management or Sexual Harassment Committee know that the action taken was not effective.
- If the company's investigation was inadequate and the harassment continues, you may be able to file a legal claim.



- You may want to consult with an attorney to ask for legal advice.

The company disclosed the complaint despite your request for keeping it confidential

- Your employer should have made clear to you that the harassment allegations are kept confidential to the extent possible. However, the employer cannot be expected to guarantee complete confidentiality as the employer has the duty to prevent and correct harassment.
- The employer may set up an informational phone line for employees to discuss issues of harassment anonymously, which may help prevent harassment in the future.
- Retaliation of co-workers, supervisors or managers in the form of unfair treatment (= discrimination) is illegal. You may want to consult with an attorney to ask for legal advice.

You complained to the Top Management or Sexual Harassment Committee; the person harassing you stopped, but it makes you uncomfortable working with him/her. The company refused to transfer one of you to another section/department.

- The disciplinary measure should be proportional to the gravity of the offence. That means:
 - o If the harassment was minor, like some inappropriate remarks by a person with no history of similar misconduct, counseling and an oral warning may suffice.
 - o If the harassment was severe or persistent, like repeated lewd remarks, unwanted attention, up to groping and rape, suspension or discharge may be appropriate.
- Remedial actions should not negatively affect the complainant. Unlawful retaliation is not helpful in correcting the harassment and must be avoided.

Punitive actions

Every employee, supervisor or manager will be subject to disciplinary action up to and including termination of employment, depending on the circumstances and the severity of the conduct. The company may refer to a range of potential **actions to prevent further harassment by the offender**:

- oral or written warning or reprimand;
- transfer or reassignment;
- demotion;
- reduction of wages;
- suspension;
- discharge;
- training or counseling of harasser to ensure that s/he understands why his/her conduct violated the employer's anti-harassment policy; and
- monitoring of harasser to ensure that harassment stops.

The company may refer to the following **actions to correct the effects of the harassment**:

- restoration of leave taken because of the harassment;

- expungement of negative evaluation(s) in employee's personnel file that arose from the harassment;
- reinstatement;
- apology by the harasser;
- monitoring treatment of employee to ensure that s/he is not subjected to retaliation by the harasser or others in the work place because of the complaint; and
- correction of any other harm caused by the harassment (e.g., compensation for losses).

8.1.8 GUIDELINES ON MINIMUM AGE

Review national laws regarding child labor

- Obtain information from the website of the Ministry of Labor on the national law regulating employment of children, regarding the minimum age for employment and a hazardous child labor list.
- Obtain information on national policies and programs about child labor from the Ministry of Labor and from local government authorities.
- Consult your national employers' organization or your trade association for information about specific buyers' requirements regarding child labor.
- Obtain information from ILO experts on child labor at your country's ILO office or on the ILO's website.

Meet your buyers' requirements

- Comply with industry codes, local law or international standards – whichever provides the higher protection for children.
- Ensure adolescents are employed in decent conditions (e.g. decent pay, job contract, working hours, etc.).

Check the age of your employees by applying the following methods:

- Medical examination prior to employment;
- Multiple written documents and affidavits;
- Culturally sensitive interviews with employees and applicants who appear to be too young;
- End of compulsory schooling certificate for those above minimum age;
- School enrolment certificate for those in light work.

Identify hazardous work

- Obtain the list of hazardous work. If you are unclear how the law applies to your company, you can consult national employers' organizations and labor inspectors.
- If a list of hazardous activities is not available, you can consult the ILO website, medical personnel or safety and health experts. Guidance can be found in ILO's Recommendation 190 supplementing the Worst Forms of Child Labor Convention, 1999 (No. 182).
- Consult with your workforce to understand what hazardous work is in your workplace.



- Consider pursuing a workplace safety and health risk assessment to determine hazards at the workplace.

Carry out workplace risk assessment

- Identify the hazards by walking around the workplace, asking workers for their opinion.
- Identify who might be harmed and how (e.g. all workers in the factory risk lung diseases with machine operators at higher risk of exposure, and dust can cause cancer).
- Evaluate risks by identifying them and deciding on safety and health risk control measures. List what is already in place and focus on practical, achievable measures (e.g. sweep up dust regularly; install washing and shower facilities; provide disposable dust masks; organize training).
- Record the name of the person responsible for putting each control measure into action and the date when it should be completed. Prioritize actions.
- Record findings, monitor and review the risk assessment. Update it when necessary.

Remove children from hazardous work.

Reduce the hours for children under the minimum age.

8.1.9 GUIDELINES ON COMPLIANCE WITH REGULAR EMPLOYMENT

To comply with industry codes, local law or international standards, make sure the following documents are available:

- Provide original copy of working contract to the employee and keep the photo copy in the personal file.
- Provide Photo ID card to all workers.
- Maintain personal file for all workers.
- Maintain service book for all workers.
- Update employment history i.e. promotion record, wage increment, leave status, disciplinary action (if any) to the service book on a regular basis.

8.1.10 GUIDELINES ON WORKING HOURS

The basic documents to comply with the regulations on working hours are as follows:

- Policy and procedures on working hours and overtime (a sample policy is outlined below)
- In and out-time record/time card
- Piece rate record
- Wage record
- Pay slip
- Production record

Below is a sample policy and procedures on working hours:



Policy

- The company informs all prospective employees, at the time of hiring, the policies and procedures and legal limitations on the maximum number of hours of work per day, week, and months, both regular and overtime, and the maximum number of consecutive days they can legally be required to work.
- The company ensures the hours worked each day and the days worked each week; do not exceed the legal maximum.
- The company provides one day off after every six consecutive days
- The company implements a regular workday of 08 hours.
- The company has an organized (punch) system of record keeping.
- The company defines the regular overtime requirements, as maximum-2 hours/day.
- Under no circumstances the company allows work over 6 days in a week and 2 (two) hours of overtime.
- The company allows employees legally required or contractually agreed rest breaks and identifies whether they are compensated.
- The company defines the normal workweek as 06 days from Saturday to Thursday and designates days off for rest as Friday.
- The company designates days off for legal holidays as per Bangladesh Labor Law and government gazette notification.

Procedures

- Normal Working Hours
 - o The company maintains the following working hours:
 - o Saturday to Thursday: 08:00 am - 07:00 pm. (including 2 hours overtime)
 - o One-hour break for lunch and prayers. (1.00 pm to 2.00 pm)
 - o The Manager Compliance and Personnel is responsible for ensuring all prospective employees are made aware at the time of hiring of legal limitations and the company expectations pertaining to hours of work and days of rest.
 - o Compliance and Personnel / Departmental Heads ensure that under normal circumstances, no worker spends more than 8 hours at work per day or 48 hours per week.
 - o Every employee, when enters into factory premises, he/she use time card is maintained by timekeeper, which signed by each worker.
- Overtime Hours
 - o Saturday - Thursday: 5 pm - 7pm (2 hours maximum)
- Overtime working:
 - o Whenever a Department Head feels the need to go for overtime production in order to meet the production/shipment targets, he/she fills the overtime sheet by identifying the persons for overtime, duration of overtime and activity to be done during overtime and send to Managing Director for approval.
 - o Manager, Administration and Compliance verify the time of each worker identified on the time cards.



- Compensation of overtime working:
 - o Compliance and Personnel make sure that overtime payments are made at double rate with the monthly basic salary of the employee.
- Willful Overtime by workers.
 - o The Compliance and the Personnel strictly monitor the willingness of all those employees who usually do the overtime activity.

Responsibility and authority

- The Managing Director, Manager, Administration, Compliance and HR are responsible for implementation of this policy.

Responsibilities

- The Personnel and the Compliance along with all relevant individuals, including all individual responsible for the hiring process, on the company's requirement to ensure all prospective employees are made aware at the time of hiring of legal limitations and the company's expectations pertaining to the maximum number of hours of work per day, week and month, and the maximum number of consecutive days the employees will be expected to work.
- The Compliance and the Personnel are responsible for posting the legal maximum regular and overtime hours and days of rest information in the native language (s) of the company's workers and management personnel.
- The Compliance and the Personnel are responsible for communicating, deploying and monitoring the Practice of ensuring all work is performed in the factory and employees do not work more than regular or overtime hours per day, week or month.

Communication and training

- The Compliance and the Personnel will train the designated persons to ensure the compliance of updated laws.
- Training records are maintained according to training document.

8.1.11 GUIDELINES ON WAGES AND BENEFITS

The following steps are to be taken to meet legal regulations on wages and benefits:

- Develop a policy on wages and benefits (see sample policy below).
- Minimum wage, overtime premiums and social benefits must be displayed and understood.
- Determine a responsible person to monitor this system.
- Prepare and keep payroll records for at least 1 year.
- Issue wage slips including all calculations in the local language.
- Identify the kinds of wage payments (cash or cheque) and the basis (monthly, hourly, piece rate).



Make sure the following documents are available:

- Policy and procedures on wages and benefits
- Payroll record
- Pay slip in local language
- Piece rate wage records
- Other benefit records (group insurance, provident fund) if any
- Leave records

A sample policy on wages and benefits can be found below:

Policy

- The company pays at least the total minimum compensation required by local laws, including all mandated wages, allowances and benefits to its workers and staff.
- The company does not pay less than the minimum wage prescribed by the local law to unskilled workers. To other category of workers, wages paid will be in line with those prevailing in the industry.
- The company publishes legal minimum wage rates, overtime rates, benefit policies, and additional payment information in the native language.

Procedures

General

- Under supervision of Personnel, Compliance and Accounts section ensure the compliance against this policy.
- The company makes sure that salaries of employees are not deducted as a matter of punishment imposed from any superior to subordinate.

Salary

- Company makes sure that all the salaries of permanent employees are in accordance with the labor law and disbursed through an adequate procedure on given schedule.

Paydays

- Salary will be paid within the 7th working day of the month. Each salary will include earnings for all work performed through the end of the previous payroll period.
- Overtime will be paid on the same day when salary is paid.
- In the event that a regularly scheduled payday falls on a day off such as a holiday, employees will be paid on the first day of work following the regularly scheduled payday in working time.
- Salary of the workers includes all allowances as admissible under the law.

Overtime

- OT work will be ensured and payment calculation for OT work will be double the rate of the wage.

**Responsibility and authority**

- Manager, Admin & Compliance, Accounts Manager, are responsible for implementation of this policy.

Responsibilities

- Communicate policy on minimum wages, overtime compensation rates, legally mandated benefits and additional payments to all employees.
- Organize meetings and training programs to ensure that the policy is properly communicated and understood.

Communication & Training

- Manager Compliance and Personnel will train the designated persons to ensure the compliance of updated laws wherever required.
- Training records are maintained according to training document.



8.2 OCCUPATIONAL SAFETY AND HEALTH (OSH)

8.2.1 GUIDELINES ON HEALTH AND SAFETY COMMITTEES

Steps to be taken to form a safety committee:

- The representatives of the safety committee should have equal representation from the owner/management and from the workers.
- The safety committee is comprised by:
 - o One President
 - o One Vice President
 - o One Member Secretary and
 - o Other members of the committee.
- All members unanimously select a Member Secretary in the first meeting of the committee.
- The committee will distribute the responsibility of different departments/sections related to occupational health and safety upon its members.
- The committee shall nominate its President. The owner or Managing Director of the industry shall nominate their representative(s) for the committee. The Vice President and the representative(s) on behalf of the workers shall be nominated through joint bargaining of Collective Bargaining Agent (CBA) or by the workers' representatives of the "Participation Committee".
- The Representative for joint bargaining shall nominate a Workers' Representative from the workers working in each section, department, floor, storehouse and unit separately. Then, the nominated/elected Representative shall be included in the Safety Committee.
- If there is no Representative for joint bargaining in any institute/factory, the Representatives included in the committee on behalf of the workers shall nominate the Workers' Representative(s) of the "Participation Committee" for the Safety Committee, from the workers who are employed in various sections, departments, floor, storehouse and units.
- Within 7 days of the nomination of Workers' Representative, the Owner shall nominate his/her representative. Within 15 days of this type of nomination, the President shall call the first meeting of the Safety Committee, having discussion with the Vice-President and other members.
- The President shall inform the Inspector General about the formation of the Safety Committee through written form within 10 days of holding the first meeting.
- If there are at least one-third of female workers in any institute, at least one third of the Workers' Representative must be nominated from female.

Vacancy of the posts in Safety Committee and filling up the vacancy:

- After the formation of the committee, if there is an announcement of vacancy in the Member posts due to resignation, retirement, termination of jobs, death of a Member, the vacancies can be filled up, having support from minimum two-thirds of the Members of the Safety Committee; provided that the Workers' Representative shall be nominated from the workers and the Owner's Representative shall be nominated by the Owner.



- The Inspector General or the Inspector authorized by him/her must be informed if any change occurs in the posts of Safety Committee.

Term of Safety Committee

The term of the Safety Committee shall last for 2 years after holding the first meeting.

Special rule

Factories, industry units or group of institutes with less than 50 employees work, can follow this code in order to ensure occupational safety and health.

8.2.2 GUIDELINES ON EMERGENCY AND EVACUATION PLANS

The following steps are to be taken to implement emergency and evacuation plans:

Prepare policies and procedures

1. Objectives and goals of the emergency response plan
 - Objectives
 - Minimize incidents through preventive measures.
 - Provide effective means to limiting the size and consequences incidents through effective emergency equipment and procedures
 - Utilize insurance to safeguard against large, unforeseen incidents/accidents
 - Goals
 - Primary goal – people: Protection from fatal injuries and prevention of loss of lives
 - Secondary goal – property: Prevention of property damage
 - Tertiary goal – operations: Protection of business operations
2. Comply with statutory legal fire safety requirements.
3. Continuous monitoring and reviewing the emergency response system to ensure effectiveness.
4. Setting targets for continuous and continual improvements.
5. Periodical review of the policy and procedures.

Carry out risk assessments

Risk assessments are one of most important aspect to develop an effective emergency response plan. There are certain steps to be followed to conduct the risk assessments.

- Types of potential emergency situations that could occur in the factory, for example
 - Fire
 - Flood or water logging



- Earthquake
 - Large chemical spillage
 - Explosion in boiler
 - Leakage in gas pipe lines, etc.
- Identify the hazards that could cause the emergency
 - Potential sources of hazards (except for earthquake and flood)
 - Identify the potential risks to the people.
 - Special consideration must be given to people with physical disability, young workers, pregnant women, children (in the crèche)
- Evaluate, remove and mitigation measures of the potential hazards:
 - Evaluate the potential hazards and chances of occurring any emergency.
 - Based on the evaluation analyze the potential severity of the incidents.
 - Based on severity prioritize the preventive measures to reduce the hazards.
 - Provide warning systems to reduce the casualties.

Prepare an emergency response plan

The objective of an emergency response plan is to deal with any emergency situation and to ensure the employees know how to act and they are evacuated safely. Emergency plans should be developed based on the outcome of risk assessments.

An effective emergency response plan should include the following:

- Assign specific duties and responsibilities to be performed in case of an emergency situation.
- How to warn people if there is an emergency situation.
- What the production management/staff (i.e. supervisors, line chiefs) should do in case of an emergency situation
- How the evacuation process is to be carried out.
- Where people should assemble after the evacuation process is complete and procedures for checking whether the premises have been fully evacuated or not.
- Identification of key escape routes and how people can gain easy access to the escape routes and evacuate safely.
- Contingency plan for evacuation in case one or more escape route cannot be used.
- Phased evacuation plans (where some areas are needed to be evacuated while other areas are alerted but not required to evacuate until later.
- Plans to deal with people once they evacuated the premises.

Carry out well-planned drills

A well planned and executed drill will help:

- Identify and recognize the weaknesses and gaps in evacuation strategies.
- Review and adapt the evacuation procedure.
- Assign responsible persons to act during an emergency.



- Identify the types of training required for both the workers and the emergency response team
- Familiarize new employees with the evacuation procedures.

Evacuation drills should not be focused on fire only, but address other emergency situations, too.

Communication and training

To implement an effective emergency response plan, workers and staff must be aware of the emergency response procedure of the organization. The emergency response procedure should be communicated through posting the important subpart of procedures and also through regular and periodical trainings. Trainings can be conducted section wise; training contents should cover at least the following:

- What is an emergency?
- What types of emergencies are we dealing with?
- How do we act in case of an emergency?
- What are the potential sources of an emergency?
- Who to report to in case an unexpected situation is observed?
- What are the objectives and purpose of the evacuation plans?

8.2.3 GUIDELINES ON LIGHTING

Table 16: Monthly maintenance checklist

Checking parameters	Date	Departments/sections									
										Signature of responsible person	Verified by responsible person (maintenance department)
Dust & dirt											
Working conditions											
Lumen											
Wiring											
Loose connection											

Table 17: Corrective actions and follow-up on lighting maintenance

Section								
Date								
Checking parameters	Yes	No	N/A	Corrective Action	Timeframe for completion	Responsible	Status	Special notes (if required)
Dust & dirt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Working conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Lumen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Wiring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Loose connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Signature of responsible person				Approved by		Verified by		

8.2.4 GUIDELINES ON GOOD HOUSEKEEPING

A workplace is safer when it is clean and sanitary. Housekeeping can eliminate workplace hazards.

Poor housekeeping can be a cause of accidents because of:

- Loose objects on floors, stairs and platforms
- Being hit by falling objects
- Slipping on greasy, wet or dirty surfaces
- Cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping

Good housekeeping is important in order to:

- Allow for a quick emergency response
- Reduce ignition hazards
- Ensure safe and rapid emergency evacuation
- Reduce the amount of flammable and combustible materials

Effective housekeeping is an ongoing daily operation; occasional clean-ups are insufficient in preventing accidents.

5S is a method to organize the workplace according to the 5 phases which are named after Japanese terms (Seiri, Seiton, Seiso, Seiketsu, Shitsuke) and can be translated into English as follows: sort, set in

order, shine, standardize, and sustain. 5S introduces standard operating procedures that ensure efficient, clean and safe working.

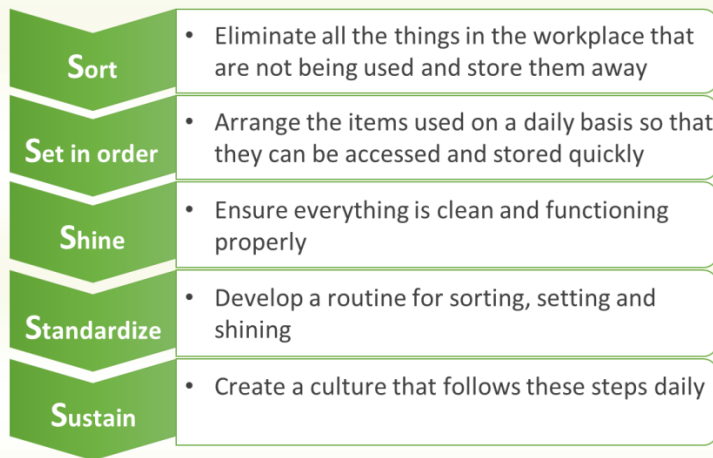


Figure 4: 5S and housekeeping

8.2.5 GUIDELINES ON ELECTRICAL SAFETY

Electrical short circuits are one of the main reasons for fire incidents in factories. To reduce the hazards of fire incidents, periodical checking of electrical wirings and installations is very important. For an effective and systematic monitoring of electrical safety, the following steps should be followed:

- Assign duties and responsibilities to the maintenance department or certified electrician(s).
- Develop and implement section wise checklists for checking the electrical wiring and installation.
- Checking could be done weekly or biweekly, depending upon the operational activities and size of factories.
- Develop and implement corrective action procedures to ensure immediate action can be taken to resolve any hazard observed related to electrical installations.

An example of the parameters to be checked is given below.

Table 18: Electrical maintenance checklist

Section								
Date								
Checking parameters	Y e s	No	N/A	Corrective Action	Timeframe for completion	Responsible	Status	Notes
Electrical contacts are not freely accessible or bare?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Electrical installations are not mounted close to open blades or lie loosely on tables.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					



Electrical installations cannot make their surrounding electrical-ly live?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
High voltage/danger signs displayed wherever relevant, e.g. to the main power connection, or to the main fuse box.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Housings of electrical junction boxes, electric switch-gear/electrical control rooms and fuse boxes made of flameproof material, lockable and available only for authorized personnel.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Electrical installations installed in a fixed and secured manner, so that they cannot fall down or that people's bodies or limbs can be caught in them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Power sockets, switches, lamp mounts etc. function properly and are they in good condition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Signature of responsible person	Approved by				Verified by			

8.2.6 GUIDELINES ON FIRE SAFETY

The following guidelines are conducive to improving the fire safety management:

- Define specific roles and responsibilities for all levels across the organization.
- Develop upstream measures.
- Implement a process that holds management and supervisors accountable for being actively involved in ensuring fire safety.
- Implement incentives for safety performance and apply disciplinary measures (in line with the law) for poor safety performance.
- Ensure that all the members of the safety committee understand their assigned roles and responsibilities, have a defined charter, and function properly.
- Provide multiple paths for employees to make suggestions, concerns and problems regarding fire safety.
- Implement an investigation system to ensure that investigations are conducted on a timely basis, neutral, complete and effective.

The following checklist serves as an example to ensure fire safety:



Table 19: General fire safety checklist

Section								
Date								
Checking parameters	Yes	No	N/A	Corrective Action	Timeframe for completion	Responsible	Status	Notes
All escape routes are free from any obstruction.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
All escape routes are clearly marked with signs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
All emergency exits open outwards.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Emergency staircases & exits are in good conditions & free from obstruction.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Functioning fire alarm system installed, which includes smoke sensors and alarm devices.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Visible flashing-light alarm in noisy areas where employees wear ear protection.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Evacuation plot plan is available at the production floor in eye sight.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
All personnel in the work place familiar with emergency evacuation procedures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Emergency exits are not locked or blocked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Emergency lights are in working conditions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Signature of responsible person	Approved by				Verified by			

8.2.7 GUIDELINES ON MACHINE SAFETY

An effective machine safety management requires a continuous monitoring system that ensures all machines are guarded with appropriate safety guards and are periodically preventively maintained.

The following steps are conducive to developing and implementing a continuous monitoring system:

- Develop and implement a machine safety checklist and a periodical machine maintenance schedule (see Table 20 and Table 21).



Table 20: General machine safety checklist

Checking parameters	Y e s	No	N/A	Corrective Action	Timeframe for comple- tion	Responsible	Status	Notes
Machine safety ensured (elec- tricity connections, machine guards, needles, belts, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Emergency switch off devices installed and functional which prevent hazard in case of equipment failure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Visibly signs at hazardous ma- chinery instructing personnel to wear protective clothing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Operating instructions provided with relevant machines.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Fitted with protective devices to avoid injuries (e.g. eye guards/finger guards/needle guards/drive belt safety cov- er/ventilator guards/hand guards) are in good conditions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Generator & boiler are protect- ed and not in the production area/production floor (separate room).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Visible safety rules and operat- ing instructions for the steam boilers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
High-pressure safety relief valves installed in every steam boiler and tested for proper functioning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
High-pressure steam distribu- tion network in good condition (leakage).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Is it ensured that employees do not work close to high-pressure safety valves, leaks or pipes, which have been insulated on a makeshift basis, or other possi- ble sources of danger?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Signature of responsible person				Approved by		Verified by		

Table 21: Machine maintenance schedule (annual planning)

Machines	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Signature of responsible person								Approved by				

- Assign duties and responsibilities to the responsible persons of the relevant department, i.e. maintenance department.

8.2.8 GUIDELINES ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

The following rules provide guidance for the use of PPE at the workplace:

- PPE should be used as a last resort, whenever risks to health and safety cannot be adequately controlled in other ways.
- PPE must be properly assessed before use and must be fit for purpose.
- Maintenance and proper storage of PPE is important.
- PPE should be provided with instructions and trainings on how to use it safely.
- The best possible way to assess the required PPEs is to follow the instruction given in Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS) of the chemical substances.
- The section 8 of MSDS/SDS provides information on the required PPE for that specific chemical substance.
- Chemical manufacturers, suppliers or local agent can provide the information where the required PPE can be available.
- An initial assessment of the numbers of chemicals is required to understand the requirements of PPE.
- The initial assessment should be conducted as per the following:
 - o Check and update the chemical inventory.
 - o List out the numbers of chemicals used in productions.
 - o Check the required PPEs specifications in the MSDS/SDS.
 - o List out the numbers of employees working with chemical substances.
 - o Calculate the types and quality of PPE required.



The following checklist helps you assess the need for Personal Protective Equipment (PPE):

Table 22: PPE assessment checklist

Section									
Date									
Name of chemicals used	Requirement of PPE			Types of PPEs and specification	Name of employees	Quantity required	Suppliers details	Status	Notes
	Yes	No	N/A						
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
Signature of responsible person				Approved by		Verified by			

8.2.9 GUIDELINES ON VENTILATION

Inadequate ventilation has an adverse impact on the employees' health and directly affects their productivity. In the plastic and light engineering industry, insufficient ventilation causes long-term exposure to chemical substances.

To properly assess the ventilation, it is advisable to test the indoor air quality standards. Testing can be done from any Government recognized institutions such as Bangladesh University of Engineering & Technology (BUET), Department of Environment (DOE) or any other third-party testing institute (i.e. TÜV, UL, SGS, ITS, etc.).

Testing should be done at least once a year and should cover all the sections of the factory. Ambient air quality testing parameters are prescribed in The Environment Conservation Rules 1997 – amended in 2005, schedule 2 (see Table 23).



Table 23: Air quality standards

Air pollutant	Standards	Average time
Carbon Monoxide (CO)	10 mg/m ³ (9 ppm) ^(Ka)	8-hour
	40 mg/m ³ (35 ppm) ^(Ka)	1-hour
Lead (Pb)	0.5 µg/m ³	Annual
Oxides of Nitrogen (NO _x)	100 µg/m ³ (0.053 ppm)	Annual
Suspended Particulate Matter (SPM)	200 µg/m ³	8-hour
PM ₁₀	50 µg/m ³ ^(Kha)	Annual
	150 µg/m ³ ^(Ga)	24-hour
PM _{2.5}	15 µg/m ³	Annual
	65 µg/m ³	24-hour
Ozone (O ₃)	235 µg/m ³ (0.12 ppm) ^(Gha)	1-hour
	157 µg/m ³ (0.08 ppm)	8-hour
	80 µg/m ³ (0.03 ppm)	Annual
Sulfur di Oxide (SO ₂)	365 µg/m ³ (0.14 ppm) ^(Ka)	24-hour

ppm: Parts Per Million

Source: S.R.O. No: 220-Law/2005: In exercise of the powers conferred by section 20 of the Bangladesh Environment Conservation Act, 1995 (Act 1 of 1995), the Government hereby amended the Environment Conservation Rules, 1997

Based on the outcome of the test result, the management can take appropriate and practical measures how to improve the air quality level and the ventilation system, such as:

- Eliminate the source of air pollutants: isolate the area.
- Provide additional exhaust fans to blow out the fumes and odor.
- Take administrative measures, such as opening more windows during working hours for better air flow.
- Provide adequate and appropriate personal protective equipment.

8.2.10 GUIDELINES ON CHEMICAL MANAGEMENT

Consider the following areas for implementing an effective chemical management:

Up-to-date chemical inventory list

- Inventory must include all dyes and chemicals. For example: samples, cleaning chemicals, chemicals used in laboratory, etc.
- A comprehensive chemical inventory list should include the following information:



- | | |
|--|---|
| 1. Product name. | 10. Function (what is function of the substance) |
| 2. Product number. | 11. Confirmation of RSL/MRSL/REACH etc. |
| 3. Manufacturer. | 13. Confirmation reference (manufacture self-declaration letters, positive list, chemical test reports, etc.) |
| 4. Manufacturer's origin. | 14. Availability of MSDS/SDS |
| 5. Manufacturer's contact details. | 15. Date of MSDS. |
| 6. Local agent/supplier name. | 16. Comments |
| 7. Local agent/supplier origin. | |
| 8. Local agent/supplier contact details. | |
| 9. Area of usage. | |

- In order to prepare a comprehensive chemical inventory, list the representatives from the following departments should be involved:
 - Top management
 - Procurement
 - Production
 - Chemical warehouse
 - Maintenance department
 - Laboratory

Procurement of chemicals and dyes

It is always advisable to procure dyes and chemicals from trusted and reputed suppliers. Before procurement of any dyes and chemicals, the following questions must be considered:

- What are the least hazardous chemicals available on the market that can be used?
- What is the minimum quantity required?
- How should the chemicals be stored?
- Is the chemical previously used already available in the inventory?
- Is the chemical storage equipped to store the chemical?
- Is the personnel trained on handling the chemicals safely?

When procuring any dyes and chemicals, the following documents should be requested or checked:

- Suppliers' self-declaration regarding conformance to standards (e.g. RoHS, REACH, corporate RSL/MRSL)
 - Restricted Substances Lists usually refer to substances that may not be legislated but have been identified as hazardous to the worker, consumer or the environment.



- The **Manufacturing Restricted Substance List (MRSL)** defines chemicals which must not be present deliberately in formulations used in the production of goods.
 - The **Restricted Substance List (RSL)** gives the maximum limits allowed for each chemical as residue on the final product. The primary supplier must have a Due Diligence Procedure in place to ensure compliance with these limits.
 - Non-compliance with the requirements of the RSL may lead to actions, such as a fine or a return of the product to the manufacturer on the basis of a breach of contract.
- Positive lists of the manufacturers (if available)
 - Certificate from a recognized certification body
 - Third-party testing report (from recognized laboratory)
 - Safety Data Sheet (SDS)
 - Technical Data Sheet (TDS)

Storage, handling and disposal of chemicals

Basic storage guidelines:

- Storing should be done as per the guidelines provided in the SDS
- Maintain storage temperature as per SDS
- Store the chemicals away from direct sunlight and do not keep them in open space
- Segregate chemicals by incompatibility
- Store flammable chemicals and toxic chemicals separately
- Segregate dry from wet chemicals
- Check for special storage conditions (i.e. temperature, relative humidity, limited shelf life)

Basic handling guidelines:

- Identify the chemicals before using
- Review and understand the hazards before using chemicals (MSDS/label)
- Chemical substances should be dispensed to the employees by an authorized person
- Dispense of small units only
- All dispensing of chemicals should be recorded
- Chemicals at the workplace should be stored in small tanks which are visibly marked and cannot be damaged
- Only create what is needed to minimize disposal

Basic disposal guidelines:

- Chemicals should be disposed in a way so that disposed chemicals cannot contaminate the environment (e.g. soil, water etc.).

The following list (Table 24) developed by the Zero Discharge of Hazardous Chemicals (ZDHC) initiative shows which chemicals are incompatible with each other and thus should not be stored together. These recommendations are applicable to any manufacturing industry using chemicals. Similar chemicals should be stored together and must be placed away from other groups of chemicals that might cause reactions if mixed.

Table 24: Incompatible chemicals

Chemical group	Incompatible chemicals
Acetic acid	Aldehyde, bases, carbonates, hydroxides, metals, oxidizers, peroxides, phosphates, xylene
Ammonia	Acids, aldehydes, amides, halogens, heavy metals, oxidizers, plastics, sulfur
Calcium oxide	Acids, ethanol, fluorine, organic materials
Carbon tetrachloride	Benzoyl peroxide, ethylene, fluorine, metals, oxygen, plastics, silanes
Chromic acid	Acetone, alcohols, alkalis, ammonia, bases
Chlorine	Alcohols, ammonia, benzene, combustible materials, flammable compounds (hydrazine), hydrocarbons (acetylene, ethylene, etc.), hydrogen peroxide, iodine, metals, nitrogen, oxygen, sodium hydroxide
Chlorine dioxide	Hydrogen, mercury, organic materials, phosphorus, potassium hydroxide, sulfur
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Formaldehyde	Strong oxidizing agents, caustics, strong alkalis, isocyanates, anhydrides, oxides, and inorganic acids. Formaldehyde reacts with hydrochloric acid to form the potent carcinogen, bis-chloromethyl ether. Formaldehyde reacts with nitrogen dioxide, nitromethane, perchloric acid and aniline, or peroxyformic acid to yield explosive compounds. A violent reaction occurs when formaldehyde is mixed with strong oxidizers.
Hydrogenperoxide	Acetaldehyde, acetic acid, acetone, alcohols, carboxylic acid, combustible materials, metals, nitric acid, organic compounds, phosphorus, sulfuric acid, sodium, aniline
Hydrogensulphide	Acetaldehyde, metals, oxidizers, sodium
Hypochlorites	Acids, activated carbon
Oxalic acid	Oxidizers, silver, sodium chlorite
Potassium permanganate	Benzaldehyde, ethylene glycol, glycerol, sulfuric acid
Sulfuric acid	Potassium chlorates, potassium perchlorate, potassium permanganate

Source: <http://www.roadmaptozero.com>

8.2.11 GUIDELINES ON NOISE MANAGEMENT

In order to manage the noise level, it is advisable to conduct a noise assessment test at least once a year. Depending on the test result, the factory can take proper action to control and manage the noise level. Possible ways of controlling the noise level are:

- Isolate the noise prone areas or machines (generators, boilers, etc.).
- Engineering/technical controls reduce, at source, the noise produced by a machine or a process.
- Use screens, barriers, enclosures and absorbent materials to reduce the noise.

- Re-design and lay out the workplace to create quiet workstations.
- Limit the time people spend in noisy areas.
- Providing personal protective equipment (ear plugs, ear drums etc.)

For noise level standards and permissible noise exposure levels, see Table 25 for Bangladesh and Table 26 for the United States.

Table 25: Noise level standards (ECR 1997)

Category of Areas	Standards determined at (dBA) unit	
	Day (6 am – 9 pm)	Night (9 pm – 6 am)
Silent zone	45	35
Residential area	50	40
Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purposes)	60	50
Commercial area	70	60
Industrial area	75	70
Notes: <i>Areas up to a radius of 100 meters around hospitals or educational institutions or special institutions/ establishments identified/to be identified by the Government are designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.</i>		

Source: Noise Pollution Control Rules 2006

Table 26: Permissible noise exposure levels in the United States

Duration per day in hours	Maximum sound level (dBA)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25	115

Source: Occupational Safety and Health Administration 2019

8.2.12 GUIDELINES ON FIRST AID

Observe the following guidelines for an effective first aid management:

- Define clear procedures for first aid management and how to handle major illness and trauma.
- Assign duties and responsibilities to certified first aiders who maintain the first aid kits.
- Develop and implement a monitoring system to ensure that sufficient and non-expired first aid contents are always available in the first aid kits.
- In addition to the certified first aiders, train more employees from each section on basic first aid management to ensure that in case one certified first aider is absent, another can im-

mediately take over the responsibilities. First aid training must be conducted by a certified doctor or a medical practitioner.

- Special training should be provided to workers working at dangerous workplaces, such as handling with chemicals. Training content should be prepared by a certified doctor and while preparing the content, first aid measures mentioned in MSDS must be taken into consideration. MSDS section 4 describes the first aid measures.
- Even though it is not necessary for every factory to have an ambulance room or health care center, it is always better to have a MoU with a nearby hospital to ensure, in case of major accidents, the injured person(s) can be taken to the hospital without delay.
- Always post emergency contact details at prominent locations, such as entry and exit gates, notice boards, security sections, so they are easily visible.

Table 27 shows the first aid content which is required by law:

Table 27: First aid content

SL No.	Contents	10 – 50 employees	More than 50 employees
		Quantity	Quantity
1	Small sterile bandages	12	24
2	Packets of disinfected cotton, weighing 0.5 ounce each	6	12
3	Medium sized disinfected bandages	6	12
4	Large sized sterile bandages	6	12
5	Large sized sterile bandages that are used in case of burns	6	12
6	Bottle of Hibisol or Hexasol	1 (2 ounces)	N/A
7	Bottle of rectified Spirit	1 (2 ounces)	1 (4 ounces)
8	Instruments of clogging/stopping bleeding such as Turniccate		
9	Roll of adhesive plaster	1	N/A
10	Pair of scissors	1	1
11	Analgesic and antacid type of tablets, ointments used for burnt parts, ointments for eyes and antiseptic solution appropriate for surgery		
12	Packs of edible saline	6	12
13	Copy of leaflet regarding primary aid	1	1
14	Roller bandages, having breadth of 4 inches	N/A	12
15	Roller bandages, having breadth of 2 inches	N/A	12
16	Triangular bandages	N/A	6
17	Bottle of alcoholic solution, bearing 2% of iodine	N/A	1 (4 ounces)
18	Packs of safety pin	N/A	2
19	Slices of bamboo or wood, which is used in case of bone fracture	N/A	12

Source: http://www.mole.gov.bd/site/view/legislative_information/Acts-%E2%80%8D&-Rules



Table 28: First aid box checklist

Section				
First Aid Box No.				
Checked By				
Date				
SL No.	Required material available	Yes	No	If no, what action is needed?
1	Small sterile bandages	<input type="checkbox"/>	<input type="checkbox"/>	
2	Packets of disinfected cotton, weighing 0.5 ounce each	<input type="checkbox"/>	<input type="checkbox"/>	
3	Medium sized disinfected bandages	<input type="checkbox"/>	<input type="checkbox"/>	
4	Large sized sterile bandages	<input type="checkbox"/>	<input type="checkbox"/>	
5	Large sized sterile bandages that are used in case of burns	<input type="checkbox"/>	<input type="checkbox"/>	
6	Bottle of Hibisol or Hexasol	<input type="checkbox"/>	<input type="checkbox"/>	
7	Bottle of rectified spirit	<input type="checkbox"/>	<input type="checkbox"/>	
8	Instruments of clogging/stopping bleeding such as tourniquet	<input type="checkbox"/>	<input type="checkbox"/>	
9	Roll of adhesive plaster	<input type="checkbox"/>	<input type="checkbox"/>	
10	Pair of scissors	<input type="checkbox"/>	<input type="checkbox"/>	
11	Analgesic and antacid type of tablets, ointments used for burnt parts, ointments for eyes and antiseptic solution appropriate for surgery.	<input type="checkbox"/>	<input type="checkbox"/>	
12	Packs of edible saline	<input type="checkbox"/>	<input type="checkbox"/>	
13	Copy of leaflet regarding primary aid	<input type="checkbox"/>	<input type="checkbox"/>	
14	Roller bandages, having breadth of 4 inches	<input type="checkbox"/>	<input type="checkbox"/>	
15	Roller bandages, having breadth of 2 inches	<input type="checkbox"/>	<input type="checkbox"/>	
16	Triangular bandages	<input type="checkbox"/>	<input type="checkbox"/>	
17	Bottle of alcoholic solution, bearing 2% of iodine	<input type="checkbox"/>	<input type="checkbox"/>	
18	Packs of safety pin	<input type="checkbox"/>	<input type="checkbox"/>	
19	Slices of bamboo or wood, which is used in case of bone fracture	<input type="checkbox"/>	<input type="checkbox"/>	
Additional Questions		Yes	No	If no, what action is needed?
Are the first aid contents in good condition?		<input type="checkbox"/>	<input type="checkbox"/>	
Is the expiry date still valid?		<input type="checkbox"/>	<input type="checkbox"/>	
Signature of responsible person		Approved by		Verified by

8.2.13 GUIDELINES ON TRAININGS

Trainings are critical to corporate success. Meaningful training positively impacts on areas such as product quality, employee motivations and performance, efficiency and profitability, among others. To design and develop effective trainings the factory should start with conducting a Training Needs Assessment (TNA) to:

- Identify the gap between current and required levels of knowledge, skill and attitude
- Identify what the general content of the training should be
- Prepare proper training plan
- Ensure appropriate and effective training is delivered
- Achieve organization's training goals and objectives

Training Need Assessment (TNA)

Follow the steps outlined below to conduct a training need assessment (TNA):

- Prepare a draft outline of the training needs
- Conduct a survey
- Prepare a questionnaire for your target group
- Interview the target group
- Carry out the data analysis
- Prepare training contents
- Select competent trainers

Conduct **internal trainings** based on the TNA to meet the objectives and targets of the organization. Provide a variety of training modules to improve effectiveness, such as:

- Induction training for newly joined employees
- On-the-job practical training
- Training on general social compliance issues
- Specific training on Occupational Safety and Health (OSH)
- Training on the rights and responsibilities of employees
- Training on general environmental compliance issues
- Training on product-specific waste management guidelines (including e-waste)
- Training on segregation process for recycling

The modules and topics can be adjusted depending on the requirements and necessities. New training modules shall be introduced depending on relevant requirements.

Refer to **external trainings** if internal resource persons are not capable of providing such trainings. There are several external training institutions in Dhaka, which provide different types of training according to customer requirements, such as: BD Jobs, UL, Intertek, SGS, Bureau Veritas, TÜV SÜD, among others.



8.3 GUIDELINES FOR ENVIRONMENTAL COMPLIANCE

8.3.1 ENVIRONMENTAL CLEARANCE CERTIFICATE

The procedure for applying for the Environmental Clearance Certificate is defined by The Environment Conservation Rules 1997, Section 7, pp. 4-8 (Bangla version):

7. Procedure for issuing Environmental Clearance Certificate. – (1) For the purpose of issuance of Environmental Clearance Certificate, the industrial units and projects shall, in consideration of their site and impact on the environment, be classified into the following four categories:

- (a) Green;
- (b) Orange – A;
- (c) Orange – B; and
- (d) Red.

(2) Industries and projects included in the various categories as specified in sub-rule (1) have been described in Schedule – 1.

(3) Environmental Clearance Certificate shall be issued to all existing industrial units and projects and to all proposed industrial units and projects falling in the Green Category.

(4) For industrial units and projects falling in the Orange – A, Orange – B and Red categories, firstly a Location Clearance Certificate and thereafter an Environmental Clearance Certificate shall be issued:

Provided that the Director General may, without issuing a Location Clearance Certificate at the first instance, directly issue Environmental Clearance Certificate if he, on the application of an industrial unit or project, considers it appropriate to issue such certificate to the industrial unit or project.

(5) The entrepreneur of the concerned industrial unit or project shall apply to the concerned Divisional Officer of the Department in Form-3 along with appropriate fees as specified in Schedule – 13.

(6) The following documents shall be attached with an application made under sub-rule (5):-

(a) For Green Category:

- (i) general information about the industrial unit or project;
- (ii) exact description of the raw materials and the manufactured product; and
- (iii) no objection certificate from the local authority;

(b) For Orange – A Category:

- (i) general information about the industrial unit or project;
- (ii) exact description of the raw materials and the manufactured product;
- (iii) no objection certificate from the local authority;
- (iv) process flow diagram;



- (v) Layout Plan (showing location of Effluent Treatment Plant);
- (vi) effluent discharge arrangement;
- (vii) outlines of the plan for relocation, rehabilitation (if applicable);
- (viii) other necessary information (if applicable);

(c) For Orange – B Category:

- (i) report on the feasibility of the industrial unit or project (applicable only for proposed industrial unit or project);
- (ii) report on the Initial Environmental Examination of the industrial unit or project, and also the process flow diagram, Layout Plan (showing location of Effluent Treatment Plant), design of the Effluent Treatment Plant (ETP) of the unit or project (these are applicable only for a proposed industrial unit or project);
- (iii) report on the Environmental Management Plan (EMP) for the industrial unit or project, and also the Process Flow Diagram, Layout Plan (showing location of Effluent Treatment Plant), design of the Effluent Treatment Plant and information about the effectiveness of the ETP of the unit or project, (these are applicable only for an existing industrial unit or project);
- (iv) no objection certificate from the local authority;
- (v) emergency plan relating adverse environmental impact and plan for mitigation of the effect of pollution;
- (vi) outline of the relocation, rehabilitation plan (where applicable);
- (vii) other necessary information (where applicable).

(d) For Red Category:

- (i) report on the feasibility of the industrial unit or project (applicable only for proposed industrial unit or project);
- (ii) report on the Initial Environmental Examination (IEE) relating to the industrial unit or project, and also the terms of reference for the Environmental E.C.R. '97 Impact Assessment of the unit or the project and its Process Flow Diagram; or Environmental Impact Assessment report prepared on the basis of terms of reference previously approved by the Department of Environment, along with the Layout Plan (showing location of Effluent Treatment Plant), Process Flow Diagram, design and time schedule of the Effluent Treatment Plant of the unit or project, (these are applicable only for a proposed industrial unit or project);
- (iii) report on the Environmental Management Plan (EMP) for the industrial unit or project, and also the Process Flow Diagram, Layout Plan (showing location of Effluent Treatment Plant), design and information about the effectiveness of the Effluent Treatment Plan of the unit or project (these are applicable only for an existing industrial unit or project);
- (iv) no objection certificate of the local authority;
- (v) emergency plan relating adverse environmental impact and plan for mitigation of the effect of pollution;



- (vi) outline of relocation, rehabilitation plan (where applicable);
- (vii) other necessary information (where applicable);

(7) If an application for an Environmental Clearance Certificate for an industrial unit or project of Green Category is made under sub-rule (5) along with the relevant documents specified in sub-rule (6), then, within 15 days of the receipt of the application, the certificate shall be issued, or the application shall be rejected mentioning appropriate reason for such rejection.

(8) If an application is made under sub-rule (5) along with the relevant documents specified in sub-rule (6), then in the case of an Orange- A Category industrial unit or project, within thirty days of the receipt of the application, and in the case of an Orange-B or Red Category industrial unit or project, within sixty days of the receipt of the application, a Location Clearance Certificate shall be issued or the application shall be rejected mentioning appropriate reasons for such rejection.

(9) Upon receiving Location Clearance Certificate under Sub-rule (8), the entrepreneur–

- (a) may undertake activities for land development and infrastructure development;
- (b) may install machinery including ETP (applicable for industrial units or projects of Orange-A and Orange-B Category only);
- (c) shall apply for Environmental Clearance Certificate upon completion of the activities specified in clauses (a) and (b), and, without the Environmental Clearance Certificate, shall not have gas line connection, and shall not start trial production in the industrial unit, and in other cases shall not operate the project (applicable for Orange-A and Orange-B Category industrial units or projects only);
- (d) shall submit for approval of the Department the EIA report prepared on the basis of program outlined in IEE Report along with time schedule and ETP design (applicable only for Red Category industrial units or projects);

(10) Where an application is received under clause (c) of sub-rule (9), Environmental Clearance Certificate shall, within fifteen working days in case of industrial unit or project of Orange-A Category and within 30 working days in case of industrial unit or project of Orange-B Category, be issued to the entrepreneur or the application shall be rejected mentioning appropriate reasons.

(11) Where an application is received under clause (d) of sub-rule (9) in relation to an industrial unit or project of Red Category, the EIA report along with the time schedule and ETP design shall, within sixty working days, be approved or the application shall be rejected mentioning appropriate reasons;

(12) After EIA is approved under sub-rule (11), the entrepreneur –

- (a) may open L/C for importing machineries which shall include machineries relating to ETP; and
- (b) shall, after installation of ETP, apply for Environmental Clearance Certificate without which he shall not have gas line connection and shall not start trial production in case of an industrial unit, and in other cases shall not start operation of the project.

(13) Where an application under clause (a) of sub-rule (12) is received in relation to an industrial unit or project of Red Category, Environmental Clearance Certificate shall be granted to the concerned entrepreneur within thirty working days, or the application shall be rejected mentioning appropriate reasons.

(14) Where an application is received under sub-rule (5) along with the documents specified in sub-rule (6), Environmental Clearance Certificate shall, within thirty working days in case of an industrial unit or project of Orange-A Category and within sixty working days in case of Orange-B and Red Category, be



issued to the concerned entrepreneur or the application will be rejected mentioning appropriate reasons.

Environmental Management Plan

The Environmental Management Plan (EMP) is a supporting document for getting the Environmental Clearance Certificate (ECC) from the Department of Environment (DoE). Any company under category Orange B and Red that applies for an ECC has to submit the Environmental Management Plan along with other supporting documents. Download the Environmental Management Plan document from:

http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/71a829c3_6b74_4ee9_90a6_158e2898b228/emp_format_industries%20%281%29.pdf

8.3.2 WASTE MANAGEMENT

The following guidelines serve as an example for a waste management policy and are expected to lead to both environmental and economic benefits:

Waste management planning

Characterize waste according to composition, source, types of waste produced, generation rates, or according to local regulatory requirements. Effective planning and implementation of waste management strategies should include:

- Review of new waste sources during planning, siting, and design activities, including during equipment modifications and process alterations, to identify expected waste generation, pollution prevention opportunities, and necessary treatment, storage, and disposal infrastructure.
- Collection of data and information about the process and waste streams in existing facilities, including characterization of waste streams by type, quantities, and potential use/disposition.
- Establishment of priorities based on a risk analysis that takes into account the potential EHS risks during the waste cycle and the availability of infrastructure to manage the waste in an environmentally sound manner.
- Definition of opportunities for source reduction, as well as reuse and recycling.

Waste prevention

Processes should be designed and operated to prevent, or minimize, the quantities of wastes generated and hazards associated with the wastes generated in accordance with the following strategy:

- Substitute raw materials or inputs with less hazardous or toxic materials, or with those where processing generates lower waste volume.
- Apply manufacturing process that convert materials efficiently, provide higher product output yields, including modification of design of the production process, operating conditions, and process controls.
- Introduce good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, off specification, contaminated, damaged, or excess to plant needs.



- Institute procurement measures that recognize opportunities to return usable materials such as containers and which prevents the over ordering of materials.
- Minimize hazardous waste generation by implementing stringent waste segregation to prevent the commingling of non-hazardous and hazardous waste to be managed.

Recycling and reuse

The total amount of waste may be significantly reduced through the implementation of recycling plans, which should consider to:

- Evaluate waste production processes and identify potentially recyclable materials.
- Identify and recycle products that can be reintroduced into the manufacturing process or industry activity at the site.
- Investigate external markets for recycling by other industrial processing operations located in the neighborhood or region of the facility (e.g., waste exchange).
- Establish recycling objectives and track waste generation and recycling rates.
- Provide training and incentives to employees in order to meet objectives.

Treatment and disposal

If waste materials are still generated after the implementation of feasible waste prevention (reduction, reuse, recovery and recycling measures), waste materials should be treated and disposed of, avoiding potential impacts to human health and the environment. Selected management approaches should be consistent with the characteristics of the waste and local regulations, and may include one or more of the following:

- On-site or off-site biological, chemical, or physical treatment of the waste material to render it non-hazardous prior to final disposal (i.e. urban/common effluent treatment plant).
- Treatment or disposal at permitted facilities specially designed to receive the waste. Examples include:
 - o composting operations for organic non-hazardous waste;
 - o properly designed, permitted and operated landfills or incinerators designed for the respective type of waste; or
 - o other methods known to be effective in the safe, final disposal of waste materials such as bioremediation.

Hazardous waste management

Hazardous waste should always be segregated from non-hazardous waste. If generation of hazardous waste cannot be prevented through the implementation of the above general waste management practices, its management should focus on the prevention of harm to health, safety, and the environment, according to the following additional principles:

- Understanding potential impacts and risks associated with the management of any generated hazardous waste during its complete life cycle.
- Ensuring that contractors handling, treating, and disposing of hazardous waste are reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled.



- Ensuring compliance with applicable local and international regulations.

In addition to the recommendations for treatment and disposal applicable to general waste, the following issues specific to hazardous waste should be considered:

- In the absence of qualified commercial or government-owned waste disposal operators, facilities generating waste require to:
- Install on-site waste treatment or recycle processes.
- Construct facilities that will provide for the environmental sound long-term storage of waste on-site or at an alternative appropriate location up until external commercial options become available.

Waste storage

Waste is stored in a manner that prevents the mixing or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatibles or physical separation such as walls or containment curbs:

- Store in closed containers away from direct sunlight, wind and rain.
- Secondary containment systems should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment.
- Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters.
- The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location.
- Provide adequate ventilation where volatile wastes are stored.

Employees require specific training in handling and storage of hazardous waste:

- Provide information on chemical compatibility to employees, including labelling each container to identify its contents.
- Limit access to hazardous waste storage areas to employees who have received proper training.
- Clearly identify (label) and demarcate the area, including documentation of its location on a facility map or site plan.
- Conduct periodic inspections of waste storage areas and document the findings.
- Prepare and implement spill response and emergency plans to address their accidental release.
- Avoid underground storage tanks and underground piping of hazardous waste.