Garment and Footwear Industry

Fire and Life Safety Risk Profile

Cambodia

Funded by:

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This risk profile was commissioned in 2014 by Better Work, a joint partnership programme of the International Finance Corporation (IFC) and the International Labour Organization (ILO), with funding provided by IFC. The study examines the fire and life safety risks in garment and footwear factories participating in the ILO Better Factories Cambodia (BFC) programme, established in 2001. BFC aims to enhance competitiveness and improve compliance with labour standards in garment and footwear factories in the country.

This document provides an analysis of inherent fire and building safety risks in the Cambodian garment and footwear industry and suggests possible mitigation measures as well as recommendations to key stakeholders to reduce these industry risks. Methods of analysis include initial desk research, benchmarking, document review, stakeholder discussions, and on-site factory inspections.

The most significant fire and building safety risks identified in garment and footwear industry factories include the following:

FIRE SAFETY RISKS

- Unprotected fire hazard materials and equipment (e.g., improper segregation of fire hazard materials, partitions made of wood or fabric)
- Fire hazard activities (e.g., smoking, performing hazardous activities without standby fire extinguisher)
- Inadequate automatic fire suppression systems (e.g., absence of sprinklers, fire alarms and/or smoke detectors)
- Inappropriate means of escape (e.g., locked or obstructed emergency exit doors, lack of emergency lights and directional exit signs)
- Improperly maintained electrical installations (e.g., exposed electrical cables, poorly installed panel boards)
- Lack of emergency awareness and training (e.g., unfamiliarity with emergency evacuation procedures, lack of posted evacuation plans)
- Ineffective firefighting equipment (e.g., obstructed fire cabinets, substandard fire extinguishers)

BUILDING SAFETY RISKS

- Substandard building construction and design (e.g., poorly constructed roof structures and columns, unsafe elevated structures). Structural tests conducted show that some factories have low quality concrete, insufficiently reinforced columns, and/or no rebar in the ground slab.
- Poor building maintenance (e.g., corroded steel structures, water leaks, exposed rebar)

The absence of formal codes and regulations in Cambodia may be the primary factor contributing to factories operating below acceptable international standards in these areas. In the absence of regulatory requirements and governmental enforcement, the primary drivers currently influencing factories to implement fire and building safety measures include commercial gains from engaging satisfied buyers in business, the commitment of high-end companies/ suppliers to maintain their reputation, and voluntary compliance with third party audit requirements.

The following are therefore recommended:

Garment and Footwear Factories

Factories should tailor their actions based on their risk level, with the goal being to reach and maintain the low risk level.

High Risk Factories

- identify objectives and set targets on fire and building safety conditions
- develop policies and procedures related to fire and building safety (e.g., emergency response plan)
- focus on internal awareness and training
- establish a joint worker-management OHS committee
- send health and safety personnel to relevant trainings
- perform regular assessments to determine if targets and objectives are being met

Medium Risk Factories

- focus on evaluating weaknesses
- streamline existing risk controls
- reinforce inadequate risk mitigation measures
- adopt any missing risk mitigation measures

Low Risk Factories

- focus on maintaining performance of best practices and processes
- document and institutionalize existing fire and building safety risk mitigation measures, such as emergency procedures, regular assessments and allocation of resources/equipment
- consider OHSAS 18001 Safety Management System certification

Government

- develop and implement standards on fire and building safety
- develop a building code that is suited to Cambodia
- establish a system to ensure that all new buildings are constructed according to standards
- initiate a program in collaboration with industrial park owners to certify the soundness and safety of existing factory buildings
- strengthen existing laws on fire and building safety by issuing supporting regulations
- expand the assessment checklist used in labour inspections to comprehensively incorporate fire and building safety issues
- establish a system that would require factories to report incidents of fires and structural failure
- provide training to factory assessors to increase their capacity in performing credible and accurate inspections

Buyers

- require suppliers to perform annual basic building safety assessments and regular fire safety inspections
- provide financial assistance to factories to cover costs of safety assessments
- pressure/encourage factories to address non-compliance issues indentified in BFC assessments and other audits
- set up rewards (awards, recognitions) and penalties (reduced orders) for factories based on compliance with fire and building safety measures

GMAC

- promote awareness and information exchange by forming strategic partnerships within and outside the country
- arrange an annual industry seminar/conference on the importance of fire and building safety
- disseminate information on fire and building safety in newsletters
- conduct trainings on fire and building safety in collaboration with experts and service providers
- initiate industry-wide competitions on fire and building safety in collaboration with BFC
- organize trade fairs on fire and building safety equipment and service providers
- act as the repository for fire and building accidents

Trade Unions and Workers

- pressure other stakeholders to implement positive change
- lobby for a joint worker-management OHS committee and a fire brigade within factories
- actively participate in available trainings on fire and building safety and in emergency drills
- be aware of internal fire and building safety measures in the factory
- report dangerous conditions to supervisors/ managers and to the factory's OHS committee

PART 1

PROJECT OVERVIEW

1.1. PROJECT BACKGROUND AND OBJECTIVES

The textile, clothing and footwear (TCF) manufacturing industry remains an essential component of the global economy. It is among the most globalized sectors, employing over 60 million workers worldwide, generally women and unskilled laborers.[1] Despite the growth over the past decades, the TCF industry still faces several challenges ranging from international trade barriers to ensuring the safety and welfare of factory workers.

As a result of globalization, it is important to consider that most processes in the industry's supply chain are outsourced to developing and least developed countries, where labour is abundant and operational costs and wages are low.[2] In turn, developing countries benefit as the industry typically accounts for a large share of their total exports and is a major source of local employment.[3] The drawback is that this growth may be founded on substandard labour conditions and poor compliance with international labour standards.[4]

60 million workers worldwide

The Fire and Life Safety Risk Profiling Project aims to support the Better Work Programme in its efforts to improve working conditions in global supply chains. To ensure that Better Work is sufficiently addressing areas of greatest risk, the Profiling Project aims to assist Better Work in reviewing and refining its tools and approaches to assessing and remediating fire and building safety issues in each of the countries where it operates, including Cambodia.

This risk profiling project was initiated in the aftermath of the collapse of the Rana Plaza Building, a commercial structure housing garment factories in Bangladesh, resulting in numerous injuries and a death toll of 1,127.[5] This tragedy highlighted the real risks that factory workers in the garment and footwear industry across the world are exposed to, and led to a clamor for improved working conditions and better compliance with factory safety standards. With the help of key industry stakeholders, the Profiling Project seeks to help prevent future incidents by conducting industry level risk assessments on fire and building safety in garment and footwear factories, in order to develop a risk profile for each Better Work country programme. Having gained a better understanding of industry risks, the project recommends proactive measures that can be taken by government authorities, international buyers, industry associations, workers and trade unions, garment and footwear factories, Better Work and others to reduce those risks and enhance worker safety.

1.2. SCOPE AND LIMITATIONS

The Fire and Life Safety Risk Profile of the Cambodian garment and footwear industry is subject to the following scope and limitations:

- Risks included in this report relate only to structural integrity and fire safety in garment and footwear factories participating in the BFC Programme.
- The number of factories assessed (9) does not constitute a representative sample for statistical purposes. However, the findings from the on-site assessments in the factories visited do provide insight into the types of risks present in Cambodian garment and footwear factories, particularly when combined with the learnings from the research and desk review and the stakeholder discussions.
- The factories visited were not selected randomly; instead, a devised set of selection criteria was used to ensure that factories having a range of characteristics were included.
- Factories were assessed in accordance with the Accord on Fire and Building Safety in Bangladesh – Building Standard. A fire safety checklist and a structural safety checklist, separately developed based on the Standard, were used in the assessment. In addition, the assessment of building safety included three structural tests—Rebound Hammer Test, Ultrasonic Pulse Velocity Test, and Rebar Scanning—recommended by the said Standard under Section 8.5.6.
- The on-site inspections conducted emphasized the life safety aspects of the findings and not the protection of goods and materials in the facility.
- Life safety includes at a minimum the structural soundness of the facility and its capacity to resist fire, as well as other fire safety issues including, but not limited to, emergency exit doors, electrical wiring installations, preventive measures, and emergency preparedness.
- Risks identified during the on-site inspections were assigned risk values in order to establish their relative prioritization. The Gretener Method was the approach used for this risk quantification process. The values given for each factor in the formula (e.g., Probability, Potential impact, etc.) were not purely statistical, but were empirically derived by the experts from their own observations and evaluations.
- On-site inspections were conducted during 2014. Changes in the level of fire or building safety risks are likely to occur in subsequent years.

1.3. PROJECT APPROACH

ACE Methodology

In order to develop the Fire and Life Safety Risk Profile of the Cambodian garment and footwear industry, the Analyze-Create-Execute (ACE) Methodology, which is based on the Plan-Do-Check-Act (PDCA) cycle approach, was employed. This is a suitable methodology as it provides a systematic approach to develop an industry level risk profile that can be used as reference for several other actions.

Analyze Phase

The first phase encompasses the initial review and assessment stage which includes desk research, benchmarking, document review, site selection, stakeholder discussions and on-site factory inspections to gather necessary data.

- **Research and Desk Review**
  An initial desk research was conducted to gather existing and available secondary data relevant to the target industry in Cambodia. National data on fire and building accidents as well as the degree and extent of existing legal and regulatory schemes governing fire and building safety, when existing and accessible, were also taken into account.
- **Benchmarking**
  A set of international standards was used as the basis for analyzing existing local standards and as reference to formulate assessment checklists for the on-site factory inspections. The benchmark standard also formed the basis for suggested risk mitigation measures and recommendations for key industry stakeholders.

- ## Report Review
  A sample set of BFC factory level assessment reports was reviewed to provide information on the status of emergency preparedness in participating factories. These reports provided insights to potential concerns on fire safety where participating factories are non-compliant.

- ## Site Selection
  In preparation for the site inspection activity, a set of site selection criteria was established to identify a sample group of factories that would reflect a range of relevant characteristics of the enterprises registered with the country programme. The criteria considered for Cambodia are reflected in the table below, which also illustrates the characteristics of the factories visited during the on-site inspections.

- ## Stakeholder Discussions
  Key stakeholders in the industry and those relevant to fire and building safety in Cambodia such as government officials and representatives of local industry associations were interviewed to gather more information and better understand the current conditions of fire and building safety in the target industry.

- ## Site Inspection
  On-site factory inspections focusing on fire and building safety were conducted on the sample set of factories using exhaustive assessment checklists and procedures which include visual inspection and non-destructive structural tests, specifically:

Site Selection

	No. of Employees			Accommodation		Building Age			Location	
	Less than 500	501 to 1000	1001 or above	Existing	Not existing	Below 5 years	5 to 15 years	Above 15 years	Within Phnom Penh	Outside Phnom Penh
Factory 1		✓		✓				✓	✓	
Factory 2		✓			✓	✓				✓
Factory 3			✓	✓				✓	✓	
Factory 4		✓			✓		✓		✓	
Factory 5	✓				✓	✓			✓	
Factory 6		✓			✓	✓				✓
Factory 7			✓	✓		✓			✓	
Factory 8	✓				✓			✓	✓	
Factory 9			✓	✓		✓				✓

Rebound Hammer Test

Ultrasonic Pulse Velocity Test

Rebar Scanning

1. **Rebound Hammer Test (Schmidt Hammer):** This test is used to establish the concrete uniformity and delimit areas with low quality concrete. Also, this test is useful when detecting transitions or changes in the concrete behavior. The compression resistance of the concrete can also be established using empirical relations.

2. **Ultrasonic Pulse Velocity Test:** This test is performed by measuring the travel time of an ultrasonic pulse moving through the concrete being assessed. Higher velocity means better concrete quality.

3. **Rebar Scanning:** This test is used for locating the rebars in the concrete structure and determining the thickness of their covering. This test is also used as a complement to other non-destructive tests for the location of areas free of rebar and/or installations.

Create Phase

The second phase involves compiling all data gathered from previous activities to develop the Fire and Life Safety Risk Profile of the Cambodian garment and footwear industry.

- **Research Data Compilation**
  All data collected from the initial stages were compiled to develop the situation analysis report on fire and building safety of the target industry in Cambodia.
- **Site Inspection Report Compilation**
  Data gathered from each on-site factory inspection were compiled to form the site assessment report.
- **Industry Risk Profile Compilation**
  Using key findings and insights provided by the situation analysis report and the site assessment reports, the Fire and Life Safety Risk Profile of the Cambodian garment and footwear industry was drafted and developed.

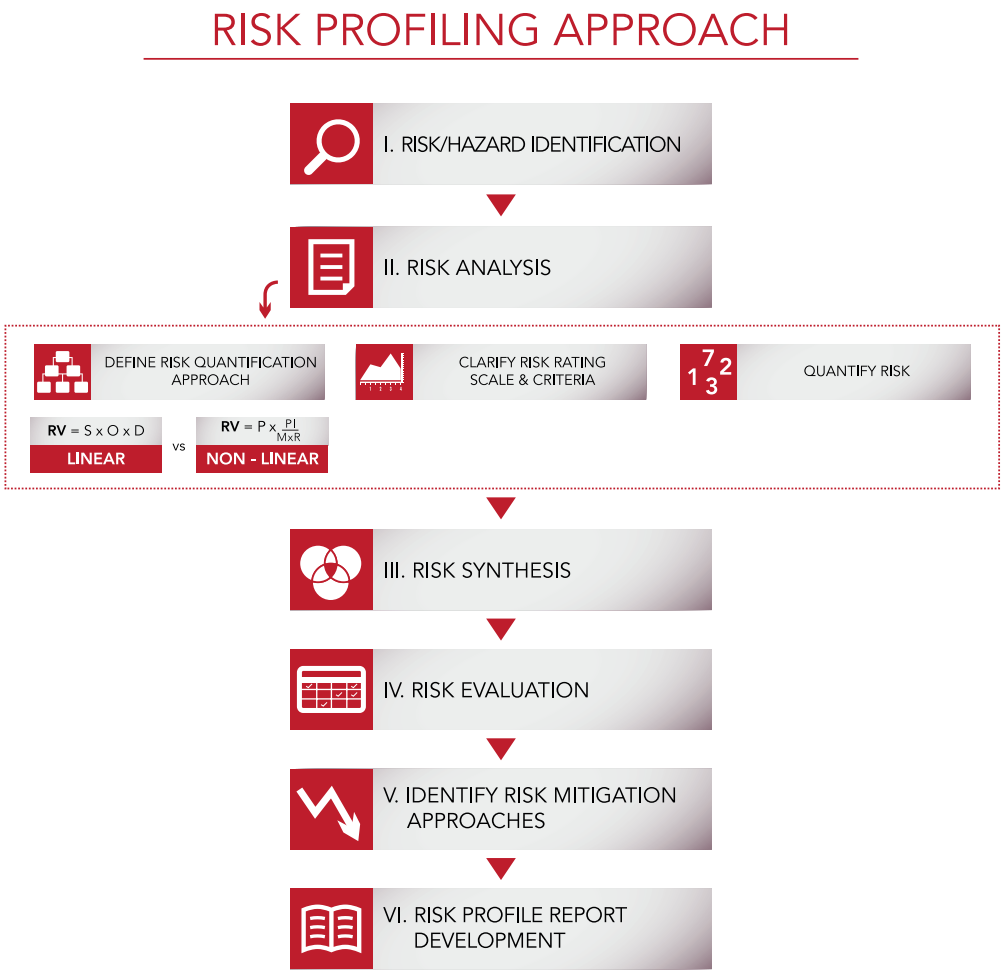
Execute Phase

The last phase includes the submission of the risk profile and conducting of a lessons-learnt discussion workshop.

- **Lessons-Learnt Discussion Workshop**
  A workshop was organized to discuss in detail the key findings and recommendations on fire and building safety put forth in this risk profile.

Risk Profile Development

The Risk Profiling Approach details the steps taken to incorporate the fire and building safety hazards identified during the on-site factory inspections into the risk profile.



Factory Level

Risk/Hazard Identification
Hazards were identified through on-site factory inspections on fire and building safety. Both the fire safety expert and the structural safety expert inspected the selected sample factories using separate checklists developed in accordance with the Accord on Fire and Building Safety in Bangladesh – Building Standard to determine the respective hazards in each factory. After all inspections were completed, an assessment report for each factory was compiled containing detailed information on hazards and other supporting documents.

Risk Analysis
This is the process of modeling and scoring causal and mitigating parameters to produce a rapid and simple estimate of relative fire and structural risks. The incentive of risk ranking techniques is to provide decision makers with a transparent and defensible way of arriving at decisions with the help of risk values. Risk Analysis comprises the process of defining the risk quantification approach, clarifying the rating scale and criteria, and quantifying each of the risks identified.

Industry Level

Risk Synthesis
There were risks identified during the on-site inspections that were found in multiple factories. These risks, though identical, may have different risk values depending on the condition of the factory where they were identified. In order to integrate these identical risks, the entry that yielded the highest risk value was retained and considered in the Risk Ranking table located in page 31.

Risk Evaluation
After coming up with the list of consolidated risks, the risks were ranked according to priority and were plotted on a heat map to provide a visual representation of the risk ranking and prioritization. The heat map can also be used to evaluate the residual risk after suggested mitigation measures are implemented. Furthermore, risks were classified under relevant categories/clusters to determine the areas of operations to which the suggested mitigation measures apply.

Identification of Risk Mitigation Approaches
Recommendations on possible risk mitigation measures and estimated costs were identified. Recommendations to prevent and protect against fire and building related hazards in the sectors were also developed for the different industry stakeholders in the country.

Risk Profile Report Development
All data obtained from the preceding steps were compiled and integrated as part of the final Risk Profile Report.

PART 2

OVERVIEW OF THE CAMBODIAN GARMENT & FOOTWEAR INDUSTRY

2.1. INDUSTRY CONTEXT

Cambodia is located on the Indochina Peninsula, and is bordered by Thailand, Vietnam and Laos. With a population of almost 15.5 million, it is considered as the 69th most populous nation in the world.[6]

From 1998 to 2008, with a Gross Domestic Product (GDP) growth rate of close to 10% annually, the Cambodian economy was considered one of the fastest growing in Southeast Asia. Although this was interrupted from 2008 to 2010 during the global economic slowdown, strong growth resumed starting in 2011, with a steady GDP growth rate since then of almost 7% according to the World Bank.[7] Estimated Cambodian exports from January to December 2013 totaled US $6.49 billion.[8]

The garment industry has been the main driver of industrial growth since the late 1990s. In fact, its share in GDP grew from a mere 1.3% in 1995 to 15.9% in 2006.[9] The number of garment factories in the country also rose from only 20 to over 300 during the same period.[10] In 2006, the industry generated nearly US $3.3 billion in export earnings.[11] The following year, it was responsible for 90% of the country's export revenues and 27% of its industrial employment.[12]

The modern evolution of the industry can be traced to the influx of foreign investment for export-oriented garment factories from Taiwan, Malaysia, Hong Kong and Singapore starting in 1994. By 1996, foreign direct investment to the country accelerated faster due to low tariff rates as the United States and the European Union granted Cambodia "Most Favored Nation" status.[13] By the mid 1990s, the establishment of a free-market economy in Cambodia, through the passage of the 1993 Constitution, and the mechanisms instituted to incentivize foreign investments such as the 1994 Law on Investment, helped further drive the growth of the Cambodian garment and footwear industry.[14] As it stands today, the garment industry continues to dominate the Cambodian economy. It consists

of around 500 factories employing approximately 450,000 workers and is responsible for over US $4.97 billion (2013 est.) in export revenues, almost 80% of the country's total export revenues.[15] The industry remains vital to poverty reduction in the country as it provides jobs mostly to unskilled and under-educated young women from rural areas, who send remittances back to their families.[16]

The footwear sector in Cambodia is relatively young compared to the garment sector, but it has also grown considerably in the past six years,[17] with the number of factories doubling to 45 and the number of jobs generated reaching almost 62,000 in the first 6 months of 2012, according to the Ministry of Commerce.[18] Total exports from the footwear sector amounted to $353.61 million in 2013, around 5.45% of total exports.[19] The European Union serves as the primary importer of Cambodian footwear products, followed by Japan and the US.[20] A 2012 BFC report predicts further development in this sector[21] as manifested by an 8.02% growth in export figures during the first seven months of 2014 compared to the previous year.[22]

US$6.49 billion

Estimated Cambodian exports from January to December 2013

Number of factories and employment in the Cambodian garment industry, 1995-2013

	1995	1997	1999	2000	2002	2003	2004	*2005	**2006	**2007	**2008	***2013
Factories (number)	20	67	152	190	188	197	206	n/a	305	288	285	412
Employment (thousand)	18.7	51.6	96.6	122.6	210.4	234.0	245.6	270.0	317.1	347.8	327.1	400.0

*Source: USAID; *EIC; **ILO; ***BFC*

2.2. KEY STAKEHOLDERS

Engagement with industry stakeholders is important in order to acquire and understand key information regarding fire and building safety in the industry and country of interest. The stakeholders identified below have an interest in and/or influence on the development, implementation and compliance with fire and building safety standards.

The following key stakeholders were identified and engaged:

- ILO-Better Factories Cambodia – ILO-Better Factories Cambodia (BFC) is an ILO Programme that monitors labour conditions and compliance with labour standards in participating garment and footwear factories. BFC assesses the compliance of these factories with national law and international core labour standards and good practices, and conducts trainings for management and workers. It also offers tailored advisory services to participating factories to help them increase efficiency and maintain profits while respecting the rights of workers.

- Ministry of Labour and Vocational Training – The Ministry of Labour and Vocational Training is the primary agency of the Government of Cambodia responsible for the monitoring and implementation of the Labour Law and the First Occupational Safety and Health Master Plan 2009-2013. It is also the government agency responsible for the welfare of workers.

- Ministry of Interior: Department of Weapons and Explosive Management and Fire Control – The The Department is the primary authority responsible for the implementation of the Law on Fire Prevention and Firefighting. It handles all issues related to fire safety. The Department is under the Ministry of Interior.

- Ministry of Land Management, Urban Planning and Construction – The Ministry is responsible for urban planning, construction projects, resolution of land use conflicts, and the overall governance of land use in Cambodia. It is spearheading the creation of the Fire and Structural Safety inspection team tasked to monitor the condition of infrastructure in Cambodia.

- Garment Manufacturers Association in Cambodia – Garment Manufacturers Association in Cambodia (GMAC) represents all export-oriented garment and footwear factories in the country in terms of trade practices and labor disputes. The Association disseminates prompt and crucial information relevant to the garment industry

Other organizations consulted:

- Local Structural Expert (AEC) – AEC provided insights and background on local construction industry practices in Cambodia. Because of AEC's familiarity with the local building and fire safety practices, the insights of their local structural experts were therefore significant.

- Li & Fung – Li & Fung, a company specializing in supply chain management, organized a conference/meeting with several key Cambodian ministries that will lead the inter-ministerial team on safety aspects. At the time of the stakeholder discussions, Li & Fung had been conducting site visits and inspections on selected companies covering basic aspects of building safety.

The key learnings from the stakeholder discussions are the following:

1. There is an existing effort from non-government entities (e.g., BFC and Li & Fung) to improve fire safety conditions in garment and footwear factories.

2. A Law on Fire Prevention and Firefighting has been adopted by the National Assembly. However, sub-decrees detailing the implementing regulations and guidelines are still pending from the Ministry of Interior. Nothing has been implemented as of the stakeholder discussions.

3. There is an Executive Order issued in January 2014 that calls for an inter-ministerial committee to address fire and building safety. However, no clear timeline for the implementation has been concluded.

4. The current Labor Law is not sufficient to effectively ensure fire safety practices because it focuses on labour practices and working conditions. There are no adequate sub-decrees addressing fire and building safety.

5. The Ministry of Labour, Ministry of Interior, and Ministry of Land Management, Urban Planning and Construction have insufficient skills and resources to effectively implement and monitor fire and building safety practices.

6. As of 1998, building permits are required prior to construction. However, there are no procedures from government agencies to inspect whether buildings are constructed according to approved plans and designs.

7. Building contractors/designers can follow any internationally accepted standard to secure a building permit.

8. Records from the Ministry of Interior for the past three years show that no garment or footwear factory was involved in any fire accident.

9. No clear mechanism is in place to ensure that factories accurately report incidents of fire or structural failure in their facilities.

10. No official records of past incidents of building collapse were available from any agency present in the stakeholder discussions.

11. GMAC emphasized that it requires no conditions from companies with regard to fire and building safety. Basically, the challenge is that there are no clear governing guidelines, though companies are willing to comply with such requirements when made available.

PART 3

KEY FINDINGS

3.1. LEGAL AND REGULATORY REGIME

There are no comprehensive fire and building safety regulations in Cambodia. However, there are some government regulations for the garment and footwear industry that complement the requirements for Occupational Health and Safety and indirectly cover fire safety related elements. Current regulations are not sufficient to comprehensively address fire and building safety issues.

Labour Law

This legislation dated March 13, 1997 governs the relations and obligations between employers and their employees. It mainly focuses on worker welfare regarding compensation and labor practices. Only two very broad articles under Chapter 8 cover employee safety and health. Article 229 covers the creation of a Prakas that shall monitor the measures for enforcing appropriate working conditions, particularly regarding the quality of the premises, ventilation and sanitation, and individual protective instruments and work clothes, among others; Article 230 states that all enterprises must guarantee the safety of workers. It declares that the aforementioned Prakas shall also cover measures including fire prevention as well as protection from dangerous machines and apparatus. However, there is no such existing Prakas that cover fire prevention. The Labour Law also has a clause dealing with the conduct of inspections by Labour Inspectors and Labour Controllers. A notice is supposed to be served to the establishment's manager whenever infractions against the Law's provisions on health and safety are found. Work-related accidents, according to Chapter 9, are deemed the liability of business managers.

Prakas 307 "Occupational Health and Safety Conditions in Garment and Shoe Factories"

Prakas 307 is a ministerial order dated December 2007 that focuses on conditions of industrial hygiene and safety of workers in garment and shoe factories. Article 2 of the Prakas requires employers to arrange an appropriate condition for each workshop or work site that is suitable for work, including the proper arrangement of raw materials, production lines and finished products to maintain good order. Article 3 tackles warehouses. Those that contain chemicals must be isolated and equipped with proper ventilation system and other preventive systems against threats such as cracks, leakage and fire. Emergency exits must be present and simple health and safety signs and regulations must also be posted and maintained in strategic places of the warehouse. Other conditions it covers include the safe use of chemicals, mandatory trainings for workers on workplace hygiene, health and safety (Article 5), provision of appropriate working clothes (Article 6), work for women and children (Article 7), and arrangement of health services (Article 8). Prakas 307 does not contain specific provisions dealing with fire and building safety requirements.
Note: Based on unofficial ECCI translation.

Law on Fire Prevention and Firefighting

This was enacted in June 2013, to be implemented starting July 2014. Article 7 of the law authorizes the Ministry of Interior to propose and release principles, acts, trainings, and practices on fire prevention and firefighting. It also mandates the Ministry of Interior to issue various sub-decrees to enforce Article 8 (fire prevention in residential households), Article 14 (conditions on the storage, transportation, control, sale and consumption of easily flammable/explosive substances), Article 15 (provision of certificate to businesses dealing with petroleum or easily flammable/explosive substances), Article 18 (guidelines on the fire prevention and firefighting system plan required before any construction activity), and Article 19 (inspection procedures of quality and effectiveness of fire prevention and firefighting systems every two years) of the law. The one-year intermission was provided to allow relevant government agencies enough time to develop and implement the sub-decrees. However, as of the time of the site inspection activity (May 2014), no implementing rules and regulations have been developed.
Note: Based on unofficial ECCI translation.

Building Code

There is no Cambodian Building Code. Construction companies make use of foreign codes to select the standards they want to apply (e.g., UK, Hong Kong, Singapore).[23] However, efforts from the government in coordination with foreign firms have been initiated to develop national building standards. From 1998 onwards, building permits are required, but there are no allocated resources for the Ministry of Land Management to perform quality checks or verifications of the plans during construction.

Fire Prevention and Firefighting Equipment

According to the Fire Accidents Statistics Report for 2011-2013, the Ministry of Interior operates a total of 122 fire trucks and 38 fire stations; other state institutions have 24 fire trucks and 11 fire stations; and 54 fire trucks and 25 fire stations are owned by private companies. The only fire safety measures from the government adopted by the factories are the basic requirements of the Labour Law and Prakas 307. Factories registered with BFC are encouraged to adopt ILO fire safety best practices and requirements imposed by their buyers.

Factory Emergency Evacuation Drills

The 31st Compliance Synthesis Report of BFC covering May 2013 to April 2014 disclosed that 43% of the factories assessed were non-compliant with regular emergency evacuation drills. This improved to a non-compliance rate of 24% before the 3rd cycle of BFC's transparency report was released in October 2014.

Government Initiative

The government of Cambodia has recently issued a proclamation (No.002 D.N.S./P.K. dated January 2014) that calls for the establishment of an Inter-Ministerial Inspection Team on textile, garment and footwear factories through the collaboration of the following 6 government ministries:

- Ministry of Land Management, Urban Planning and Construction
- Ministry of Interior
- Ministry of Industry and Handicraft
- Ministry of Labour and Vocational Training
- Ministry of Health
- Ministry of Environment

Article 2 of the document tasks the team to compile regulations and technical affairs related to construction safety of textile, clothing and footwear factories; set conditions for evaluating textile, clothing and footwear factories in terms of building infrastructure safety, fire safety, and welfare; and inspect/evaluate safety conditions in textile, clothing and footwear factories and propose recommendations. At the time of the stakeholder discussions, the Team is still in the planning stage and no timeline regarding its further actions was presented.

The proclamation also directs provinces that have textile, clothing and footwear factories to form their respective inspection team at the provincial level that will enforce factory safety regulations.

Note: Based on unofficial ECCI translation.

Inspection by the Ministry of Labour

According to ministry officials, inspections are conducted irregularly due to lack of budget and personnel. Although the labour inspection checklist covers hygiene and working safety in Section VII, it is not sufficient and specific enough for a detailed fire and building safety assessment. Section VII includes minimal and unspecified requirements on the safety of production buildings such as appropriate temperature and the availability of air ventilation, entry/exit, emergency doors and emergency ladders; work safety such as proper lighting, noise level, smell and wetness; safety on construction sites; and hygiene such as clean toilets and sewage system. Other sections deal with basic administrative information, apprentice training, social security, labour disputes, migrant workers, and general working conditions such as compensation and working terms and conditions. There are no clear sanctions/penalties for basic fire safety violations from the checklist. Nonetheless, trainings for factory workers on firefighting and evacuation drills have been initiated in coordination with the Ministry of Interior, but no data or records regarding these trainings were provided by the officials interviewed during the stakeholder discussions.

3.2. PRIMARY DRIVERS OF FIRE AND BUILDING SAFETY PROGRESS

Based on observations and personal interviews conducted by fire and structural experts during the site inspection activity, it was noted that the primary drivers of fire and building safety in garment and footwear factories are economic/commercial gains, reputation and voluntary compliance.

Economic/Commercial Gains

During the site visits and interviews with factories, it became clear that buyers are one of the key actors influencing factories to implement fire and structural safety measures. Factories are generally willing to implement measures that will satisfy the requirements of their buyers and potentially result in additional orders. Buyers that have their own safety standards subject factories to their own fire and structural safety audits.

Reputation

Companies that have expansion factories in Cambodia tend to implement the same standards and practices as their mother company located in another country where regulations are more stringent. Expanding companies usually serve key buyers in the industry, where only reputable companies are acceptable to supply products.

BFC Assessments, Advisory Services and Training

Compliance by factories with BFC's assessment requirements also contributes to fire and building safety. All exporting garment factories in Cambodia must be registered with BFC in order to obtain an export license. [24] Factories involved in the programme undergo assessments and have access to training opportunities, advisory services and support for improvements. The return to transparent reporting in 2014 has contributed to improvements on fire safety and other issues.[25]

3.3. FACTORY FIRE AND BUILDING ACCIDENTS

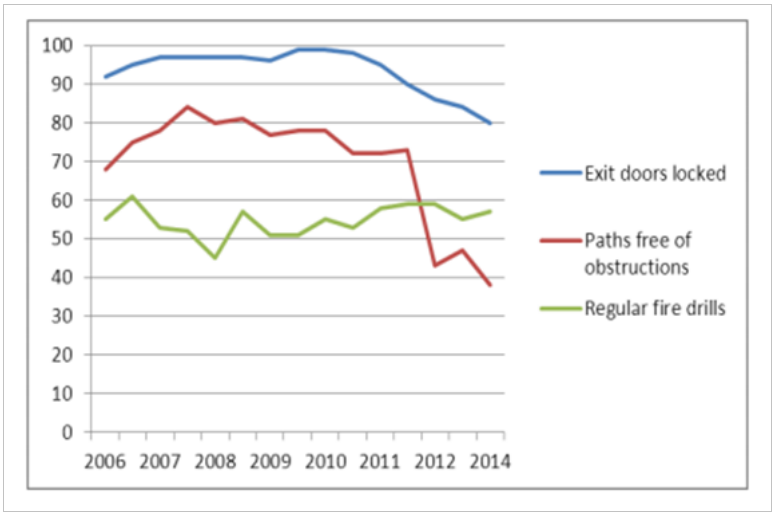
Most fire incidents in Cambodia during 2013 occurred in residential units as stated in the Fire Accidents Statistics Report for 2011-2013. Only one factory fire was recorded out of 534 incidents. The most common cause was electrical fires. The same report states that fires are usually exacerbated by carelessness, poor infrastructure development without focus on fire risks, insufficient or outdated fire trucks in provinces, shortage of expert human resources, and/or poor collaboration of public organizations and the private sector with police units. Representatives from the Fire Department of the Ministry of Interior also mentioned during the stakeholder discussions that common sources of ignition include faulty electrical installations, gas stoves, candles/incense and gasoline. Meanwhile, BFC reported that shocks, melting or flaming wires and outlets, and other minor electrical incidents are common, occurring in 10% to 20% of factories.

The number of known building safety incidents is low, though the risks are undeniably present. One recorded incident was the partial collapse of the Wing Star factory in May 2013, which killed two factory workers and injured several others.[26] The collapse was reportedly caused by additional structures constructed in the factory. The heavy load on the upper floor generated too much strain which drove the concrete ceiling to give way. This occurred just three weeks after the collapse of the Rana Plaza Building in Bangladesh. The Wing Star factory, located in Kampong Speu, was not a registered member of BFC. Another incident in October 2014 involved a garment factory in Takeo Province. Part of the floor slab of the Nikishu Enterprise factory collapsed into a basin due to its weak foundation, injuring at least eight workers.[27]

Better Factories Cambodia Assessment Reports – A Trend Analysis

One of the services provided by BFC is the assessment of participating factories on their compliance with international core labour standards and national labour laws. In assessing factory compliance, BFC uses a checklist covering basic working conditions and fundamental rights at work. The checklist includes issues regarding fire safety and emergency preparedness, but does not include the level of detail that would be required under international fire codes. Structural safety issues are not covered at all. After every factory assessment, BFC produces a report that details the factory's compliance including basic information on the factory, areas of non-compliance, good practices, and areas of potential concern. The assessment report is then released to buyers with the consent of the factory. Every year starting April 2014, results of individual factory assessments conducted within the interval period are consolidated and summarized into a Compliance Synthesis Report to provide an overview of working conditions in the Cambodian garment and footwear industry. This was a move from the former semi-annual reporting by BFC to allow the project to present a more comprehensive view of changes in working conditions.

The most recent Compliance Synthesis Report, dated 30 April 2014, covers 362 garment and 9 footwear factories. The report shows both advances and declines in compliance of factories with different categories of legal requirements. In particular, declines in compliance were noticed in the worker health and safety category. Fire safety and emergency preparedness remain key issues in the garment industry where compliance has improved slowly or decreased in the factories covered. One of the top 10 non-compliance issues is obstructed access paths with a non-compliance rate of 62%, the lowest since 2006. Moreover, as illustrated in the following graph, more than 20% of factories still have locked emergency exits during working hours and although compliance with the conduct of regular fire drills improved, the increase was minimal. Eight of the nine footwear factories included in this report complied with requirements for clearly marked emergency exits and escape routes, but only 56% of footwear factories conducted emergency drills every six months, and only 44% kept emergency exits unlocked during working hours.[28]



Key Fire Safety Compliance Measures, 2006-2014 (Garment industry-wide)

BFC's return to transparency reporting in 2014 where it publicly discloses factory-specific compliance information for factories with low compliance or non-compliance on critical issues has also led to improvements in different areas including fire safety. As factories are assessed, they receive BFC Critical Issues and Low Compliance reports that detail the compliance information that will be disclosed publicly. Factories are then given at least 60 days between issuance of the reports and public disclosure to make necessary improvements.[29] To illustrate the impact of transparent reporting, the compliance rate of factories on regular emergency evacuation drills rose from 57% pre-transparency to 76% post-transparency according to the 3rd cycle of the BFC Transparency Database report released on 20 October 2014.[30]

As part of the research activity for the development of the Fire and Life Safety Risk Profile, assessment reports of 30 garment factories and 10 footwear factories, provided by BFC, were randomly sampled to understand the following:

- The assessment method currently being implemented by BFC
- The types of items the assessment checklist covers and whether fire and building safety are being addressed
- The compliance level of factories related to fire safety and emergency preparedness

This review exclusively focused on findings relating to fire safety and emergency preparedness. The set of factories involved in this review did not in any way affect the selection of factories for the site inspection activity.

Garment Sector

After totaling the number of findings on emergency preparedness of each garment factory, the result shows that there are 19 top compliant factories, 9 middle compliant factories, and 2 bottom compliant factories.

Compliance Ranking	Number of Findings on Emergency Preparedness	Number of Sample Factories
Top	0 – 1	19
Middle	2 – 4	9
Bottom	5 or more	2

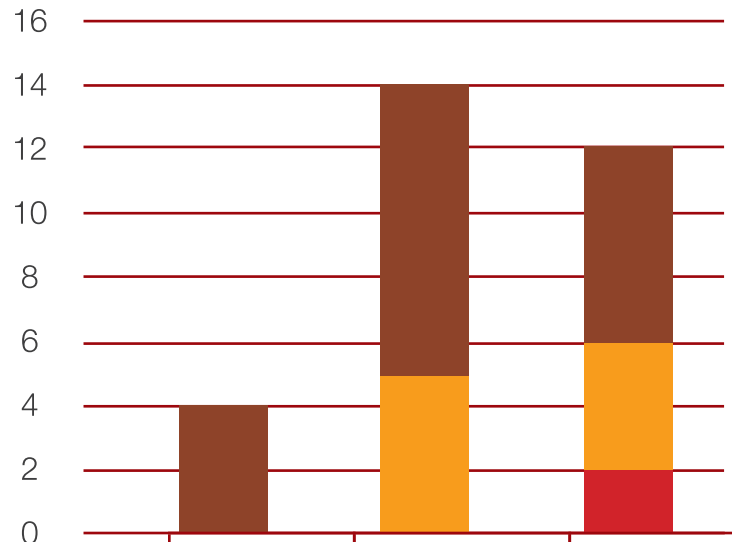
Note: based on 30 sample assessment reports

Based on data in their respective assessment reports, 4 factories are large-scale; 14 factories are medium-scale; and 12 factories are small-scale enterprises.

Category	Number of Workers	Number of Sample Factories
Large-scale	1001 or above	4
Medium-scale	501 - 1000	14
Small-scale	1 - 500	12

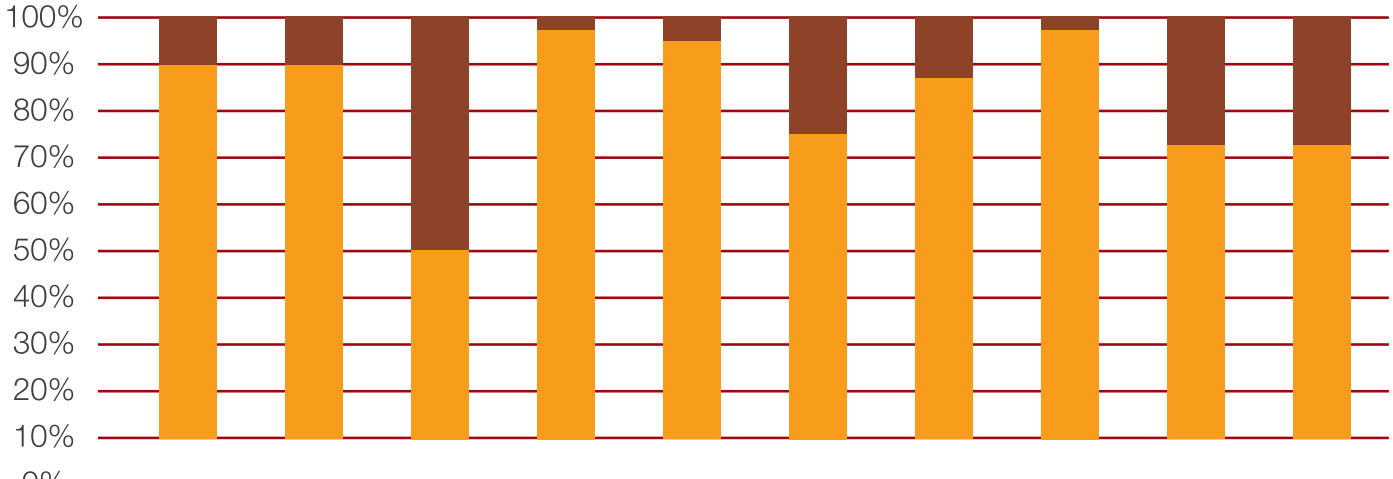
Note: based on 30 sample assessment reports

The review shows that all large-scale, 9 medium-scale and 6 small-scale factories are top compliant; 5 medium-scale and 4 small-scale factories are middle compliant; and 2 small-scale factories fall under the bottom compliance ranking.



	Large-scale	Medium-scale	Small-scale
Top Compliant	4	9	6
Mid Compliant	0	5	4
Bottom Compliant	0	0	2

Overall Compliance of Garment Factories on Emergency Preparedness



	Are procedures in place to handle emergencies? (fire, explosion, natural disaster)	Are managers, supervisors, and workers aware of these procedures?	Does the factory hold regular emergency drills?	Does the factory have enough emergency exits?	Are all emergency exits clearly marked?	Are all emergency exits unlocked during working hours, including overtime?	Are all emergency exits accessible?	Does factory have any fire extinguishers?	Are there enough regularly serviced fire extinguishers withi easy reach of workers?	Has management trained enough workers to use the fire extinguishers?
Non-Compliant	3	3	15	1	2	7	4	1	8	8
Compliant	27	27	15	29	28	23	26	29	22	22

Based on the 30 sample assessment reports, half of garment factories looked at did not comply with the required regular conduct of emergency drills. This was the requirement with the most non-compliance. Factories also have to improve on providing workers training on how to properly use fire extinguishers and on having enough regularly serviced fire extinguishers that are within easy reach of workers.

The sample factories showed good compliance with other BFC requirements. The requirements that factories complied with the most were the need for sufficient emergency exits and adequate fire extinguishers, with only 1 non-compliant factory each. At least 75% of factories were compliant with 7 out of 10 requirements.

According to the statistics, large-scale and medium-scale garment factories in Cambodia tend to be more compliant with requirements on emergency preparedness than small-scale factories. For 8 of the 10 requirements, all large-scale factories were compliant. In addition, all 4 large-scale factories belong to the top compliance ranking. For medium-scale factories, more than 60% belong to the top compliance ranking and all factories were compliant with 5 out of 10 requirements. On the other hand, the 2 bottom compliant factories are both small-scale enterprises. However, before making any broad conclusions, one must take into account the large disparity/unequal representation of the number of factories under the three categories (4 representing large-scale factories; 14 representing medium-scale factories; and 12 representing small-scale factories), and the fact that these 30 factories only constitute 7% of all active garment factories that have been registered with and been monitored by BFC as of April 2014.

Footwear Sector

After totaling the number of findings on emergency preparedness of each footwear factory, the result shows that there are 2 top compliant factories and 8 middle compliant factories. No factory fall under the bottom compliance ranking.

Compliance Ranking	Number of Findings on Emergency Preparedness	Number of Sample Factories
Top	0 - 1	2
Middle	2 - 4	8
Bottom	5 or more	0

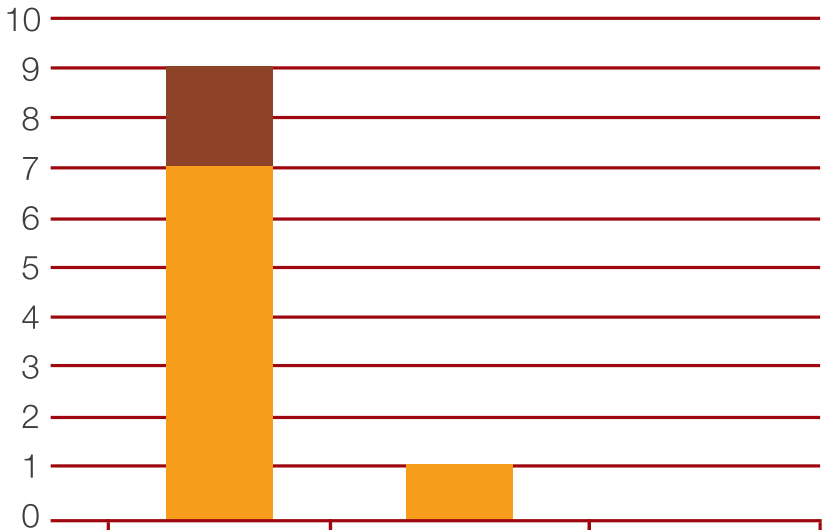
Note: based on 10 sample assessment reports

Based on data in their respective assessment reports, 9 factories are large-scale and 1 factory is medium-scale. There are no small-scale sample factories.

Category	Number of Workers	Number of Sample Factories
Large-scale	1001 or above	9
Medium-scale	501 - 1000	1
Small-scale	1 - 500	0

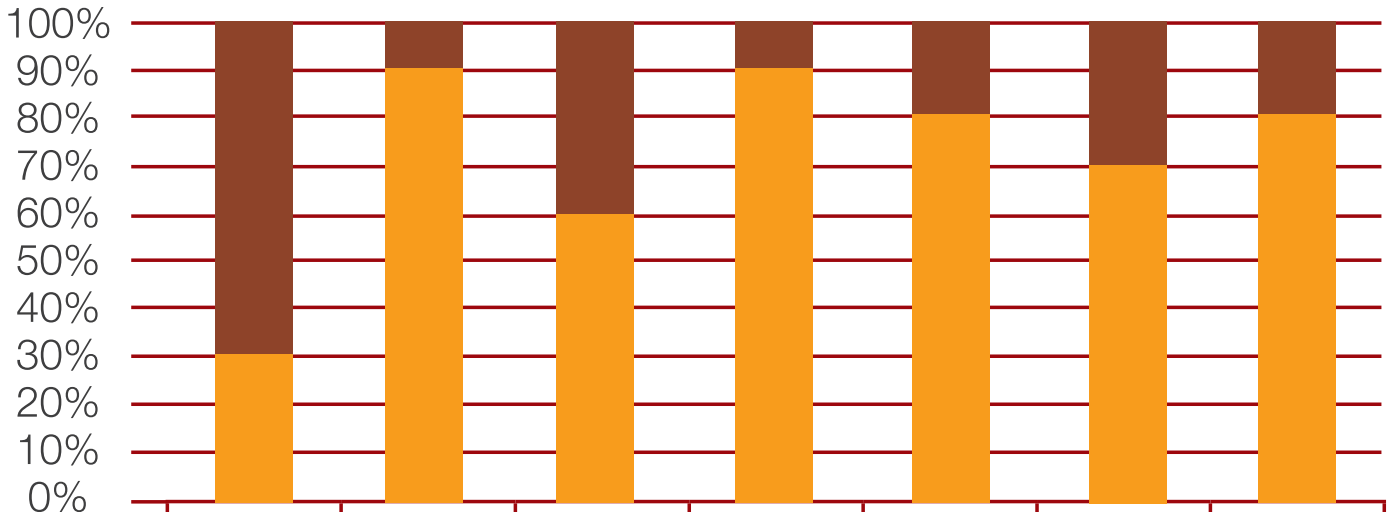
Note: based on 10 sample assessment reports

2 large-scale footwear factories are top compliant; the rest of large-scale factories and the only medium-scale factory are all under the middle compliance ranking.



	Large-scale	Medium-scale	Small-scale
Top Compliant	2	0	0
Mid Compliant	7	1	0
Bottom Compliant	0	0	0

Overall Compliance of Footwear Factories on Emergency Preparedness



	Does the factory hold regular emergency drills?	Does the factory have enough emergency exits?	Are the emergency exits unlocked, unobstructed & accessible during working hours, including overtime?	Are emergency exits and escape routes clearly marked and posted in the workplace?	Does the factory have adequate fire-fighting equipment?	Has the employer trained an appropriate number of workers to use the fire-fighting equipment?	Does the factory have a fire alarm & detection system?
Non-Compliant	7	1	4	1	2	3	2
Compliant	3	9	6	9	0	7	8

Based on the assessment reports of the 10 sample factories, the highest area of non-compliance relates to the failure to conduct regular emergency drills (70%). Aside from this, emergency exits were inaccessible, obstructed or locked during working hours in 4 factories.

The highest areas of compliance relate to having enough emergency exits, and clearly marking exits and escape routes, with only 1 non-compliant factory each. Factories also showed good compliance with having adequate firefighting equipment as well as detection and alarm systems.

Footwear factories in Cambodia tend to have a large workforce and generally show good compliance with BFC requirements. None among the sample factories fell under the bottom compliance ranking and 2 top compliant factories that are large-scale had no findings on any requirement. However, the large disparity/ unequal representation of the number of factories under the three categories (9 representing large-scale factories; 1 representing medium-scale factories; and no representation for small-scale factories), and the fact that these 10 factories only represent around 22% of the footwear factories in the country, should also be taken into account before making any broad conclusions.

PART 4

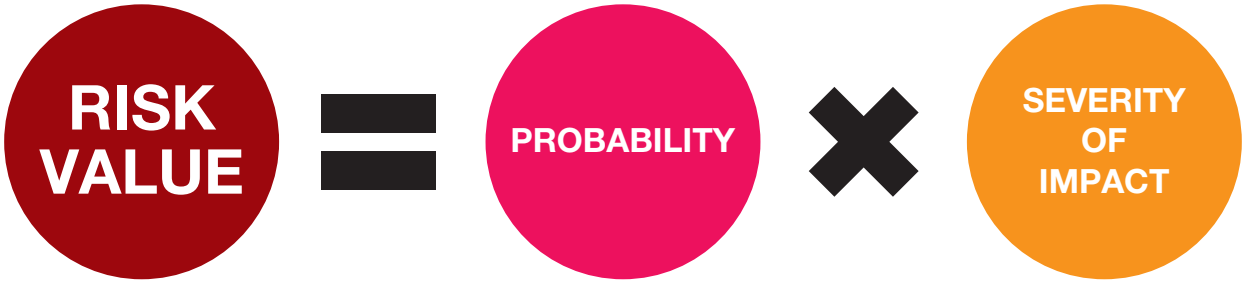
INDUSTRY RISK PROFILE

Risk Quantification Approach

The Gretener Method for Risk Assessment is one of the widely used and most well-documented fire risk ranking methods available. This method is suitable to quantify the risks identified because of its simple mathematical formulation as well as its consideration for the facility's insurance rating and code enforcement.

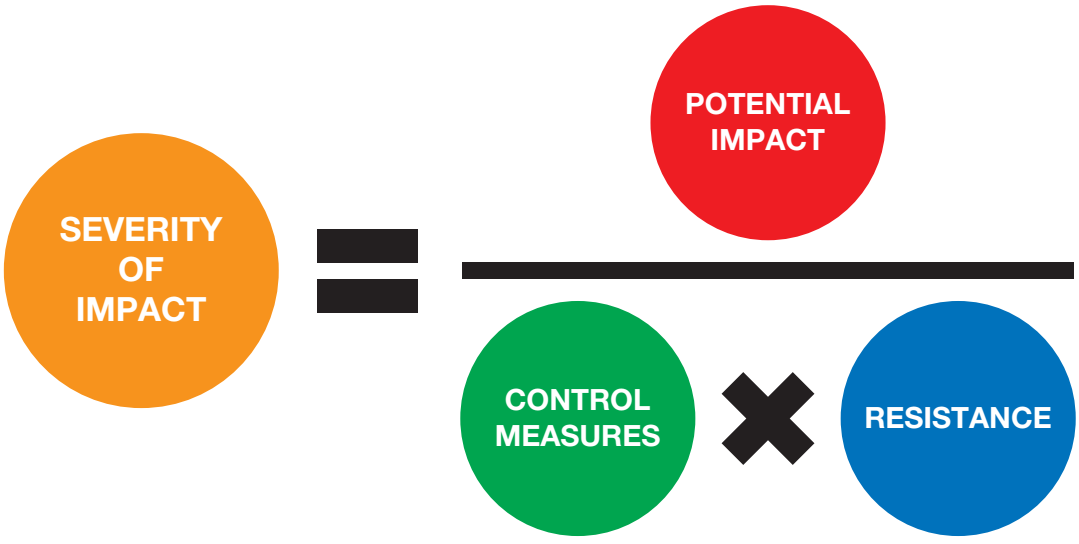
The Gretener Method is derived from the universal risk assessment formula: Risk = (Severity) x (Probability of Occurrence) x (Detection or Control). However, the Severity parameter takes into consideration compliance with standards and the factory's capacity to resist fire, which are both empirically derived from the on-site factory inspections.

The product of the fire/structural incident probability due to the risk and the risk's severity of impact yields the Risk Value.



DEFINITIONS
Risk Value - The assigned prioritization value for each fire or structural risk finding, derived from the probability and severity of impact.
Probability - Probability that a fire or structural incident will occur due to the risk.
Severity of Impact - Degree of danger caused by the risk.

The Severity of Impact is calculated as the ratio between the risk's potential impact and the existing protective measures in place. Therefore:



DEFINITIONS
Potential Impact – Probable degree of severity or danger to life.
Control Measures – Existing fire safety measures (e.g., alarm, sprinklers, fire extinguishers) or structural safety measures (e.g., compliance to plans/design, building permits).
Resistance – Building ability to resist/minimize passage of flame in general.

The values for these individual factors are not based solely on statistics, but are also based on learnings from the on-site factory inspections and experts' own observations.

Rating Scale and Criteria

PROBABILITY RATING	
Probability of Fire/Structural Failure	Rating
High: • Imminent danger/incident will happen at any time. • Factory activity/practice may imminently result to fire. • Factory condition has a high potential to cause fire or immediate spread of fire. • Structural or building condition may cause imminent threat/failure at any time.	4
Moderate: • Factory condition may result to building collapse or fire in the near future. • Factory condition will not directly cause fire or building collapse but may cause fatalities. *(Note: may be rated as High if there are occurrences in multiple sample factories or based on the assessor's judgment.)*	3
Low: Relatively low chance that incident/failure will happen.	2
Remote: Incident/failure is unlikely.	1

Note:
1. Risks that will not directly cause/trigger fire or structural incidents (e.g., no available fire alarm system, inadequate emergency plans, substandard fire extinguishers) are rated as Moderate but may be influenced by the frequency of occurrence.
2. Findings that may cause fire or building safety risks (e.g., open electrical wires, weak structures) are rated according to the Probability Table.

POTENTIAL IMPACT RATING	
Potential Impact	Rating
High: May cause death or severe injury to multiple employees.	4
Moderate: May cause injury to some employees that requires hospitalization.	3
Low: May cause minor injury to few employees that will not disrupt operations. Basic first aid required.	2
None: No impact.	1

CONTROL MEASURES RATING	
Preventive and Control Measures	Rating
High: Full compliance to fire and structural requirements, with evidence of complete safety management documentation and best practices.	4
Moderate: Generally acceptable. Compliant with the requirements in key areas but needs to improve some areas.	3
Low: Partial compliance to requirements/standards. Needs improvement in key areas.	2
Poor: Non-implementation of building and fire safety measures.	1

Note: Minimum requirements are based on the Bangladesh Accord or applicable country regulations.

RESISTANCE RATING	
Facility Fire Resistance	Rating
High: Critical areas are properly protected with partitions using fire resistive materials. (e.g., gypsum board, concrete, brick).	4
Moderate: Critical areas are enclosed using non-fire resistive materials (e.g. wood, metal sheet, screen).	3
Low: Critical areas are not enclosed (e.g. boiler, electrical panels, generators, workshops, flammable material storage). There are flammable items in some areas.	2
Poor: Generally flammable environment. No partitions/enclosures in any areas with flammable items. Fire can easily spread across areas in the factory.	1

Note:

1. Though footwear and garment factories fall under G2 category (Moderate Hazard Industrial Occupancy) and H2 (Moderate Risk Storage), the overall resistance rating of the factory may vary due to age, type, and management of materials and facility.

2. Since this factor is not applicable for building safety risks, the same rating provided for the "Control Measures" factor will also be applied to this factor in order to compute the Risk Value using the aforementioned formula.

Risk Ranking

The tabulated data presented below illustrates the consolidated risks ranked from highest to lowest based on their corresponding Risk Value. The frequency of occurrence of each hazard among the sites assessed is identified in the table to support and justify the probability of certain risks that do not directly cause fire or structural accidents. This section reflects the process of risk synthesis and does not include suggested risk mitigation measures.

For risks that were found in multiple factories, the entry that yielded the highest risk value was retained and considered in the Risk Ranking.

Example:
The fire safety hazard/risk *"Workers randomly interviewed are not fully aware of firefighting and proper evacuation procedures"* appeared in 7 out of 9 factories. Using the formula and the rating scale and criteria in Section 4 above, each entry of the risk was assigned its own risk value depending on the condition of the factory where it was identified as illustrated in the following table:

Risk: Workers randomly interviewed are not fully aware of firefighting and proper evacuation procedures.						
Factory	Potential Impact	Control Measures	Resistance	Severity of Impact	Probability	Risk Value
1	4	1	1	4	4	16
2	4	1	3	1.33	4	5.33
3	4	1	3	1.33	4	5.33
4	4	1	2	2	4	8
5	4	1	3	1.33	4	5.33
6	4	1	1	4	4	16
7	4	1	2	2	4	8

Given that fire and building safety risks are threats to life, the highest Risk Value derived for this particular risk, which is 16 (factories 1 & 6), was the one used in the Risk Ranking table below.

	FIRE SAFETY HAZARDS / RISKS (Observed in the factories)	Frequency	Potential Impact	Control Measures	Resistance	Severity of Impact	Probability	RISK VALUE
1	Automatic sprinkler system is not available in key areas of the facility.	8	4	1	1	4	4	16
2	An open-type chemical storage area is located within the production area.	1	4	1	1	4	4	16
3	*Cloth is used as drop ceiling in the production area.	1	4	1	1	4	4	16
4	*The maintenance/repair area (with grinding machine) is not properly segregated from the production process area.	1	4	1	1	4	4	16
5	*Smoking is permitted in a hazardous area.	1	4	1	1	4	4	16
6	Fire hazard activities are being performed at the same time without standby fire protection equipment.	1	4	1	1	4	4	16
7	Workers randomly interviewed are not fully aware of firefighting and proper evacuation procedures.	7	4	1	1	4	4	16
8	Standpipe / hose reel / hydrant system is not available in the facility.	4	4	1	1	4	3	12
9	*Emergency exits are locked and inaccessible during working hours.	4	4	1	1	4	3	12
10	*A fire hose cabinet is obstructed.	1	4	1	1	3	4	12
11	*Flammable waste materials are present at the blower and compressor equipment area.	1	3	1	1	3	4	12
12	Wood is used as the material for the flooring/ceiling in the working area. (Fire hazard material)	1	4	1	1	4	3	12
13	The shop maintenance area is situated beside the pigment (paint) area without a sufficient wall.	1	4	1	1	4	3	12
14	There is no emergency exit at the dormitory.	1	4	1	1	4	2	8
15	*Flammable waste materials in the disposal area are not properly segregated.	1	2	1	1	2	4	8
16	Electrical cables are exposed.	5	4	1	2	2	4	8
17	*Hazardous installation of LPG tank.	1	4	1	1	4	2	8
18	The oven exhaust is not properly installed.	1	4	1	2	2	4	8
19	*A portable ceiling type extinguisher is not appropriately installed.	1	4	1	1	4	2	8
20	*Emergency lights and directional exit signs are insufficient.	8	4	2	1	2	4	8
21	The LPG tank in the kitchen area has no installed anti-leak or automatic shut-off device.	1	4	2	1	2	4	8
22	There are no evacuation plans posted at strategic places in the facility.	1	4	1	2	2	4	8
23	*Emergency exit pathways are obstructed.	4	4	1	2	2	4	8

	FIRE SAFETY HAZARDS / RISKS (Observed in the factories)	Frequency	Potential Impact	Control Measures	Resistance	Severity of Impact	Probability	RISK VALUE
24	*The hose used for a fire extinguisher is substandard.	1	4	1	1	4	2	8
25	*The waste fabric area is unsecured and is made of light materials.	1	2	1	1	2	4	8
26	An emergency exit pathway is passing through a hazard area.	1	4	1	2	2	3	6
27	*The boiler room is made of light materials such as plywood. (i.e., easily combustible)	1	4	2	1	2	3	6
28	*Cables are improperly installed.	2	3	1	2	2	3	6
29	*The boiler room is not properly enclosed.	2	4	2	1	2	3	6
30	*Evacuation plans posted at strategic places in the facility are insufficient.	5	4	2	1	2	3	6
31	*Fire alarms and smoke detectors are lacking in the entire facility.	6	4	2	1	2	3	6
32	*Panel boards and electrical cables are poorly installed.	4	3	1	2	2	3	6
33	*The main distribution panel has no proper grounding system.	1	3	1	2	2	3	6
34	The exit door opens inward.	2	4	1	2	2	3	6
35	The electrical room has no automatic fire protection system.	1	3	1	1	3	2	6
36	The kitchen hood has no automatic fire suppression system.	1	3	1	1	3	2	6
37	Workers and factory personnel are not familiar with fire emergency contact numbers.	1	4	1	2	2	3	6
38	Fire alarms and smoke detectors are not available in the dormitory building.	1	4	1	2	2	2	4
39	*The electrical conductor used for the ironing machine is substandard.	1	3	1	3	1	4	4
40	*Housekeeping and maintenance of the standby power generator is poor.	1	3	2	2	1	4	4
41	*The hose of a fire extinguisher is not properly installed.	1	4	1	2	2	2	4
42	*The raceway/conduit used is substandard.	1	2	1	3	1	4	4
43	*The compressor equipment is not properly installed.	1	2	2	1	1	3	3
44	*Switchboard of the machine at the sole production area is not properly mounted.	1	3	2	2	1	3	3
45	*The main distribution panel is not properly labeled.	1	3	2	2	1	2	2

**Photos of some fire safety risks can be found in Appendix F.*

	STRUCTURAL SAFETY HAZARDS / RISKS (Observed in the factories)	Frequency	Potential Impact	Control Measures	Resistance	Severity of Impact	Probability	RISK VALUE
1	*The structure of the main warehouse is not well-constructed. (e.g., poor welding, no system to resist lateral load)	2	4	1	1	4	4	16
2	*The steel roof structure is made of built-up steel trusses and does not appear to be designed by an engineer.	2	4	1	1	4	4	16
3	*Elevated storage structure/mezzanine is not well-constructed or insufficiently supported.	3	4	1	1	4	4	16
4	The anchorage of the external roofing is detached.	1	4	1	1	4	4	16
5	*The emergency staircase at the office/dormitory building does not appear to be strong enough for emergency use.	1	4	1	1	4	3	12
6	*The load bearing structure of the balcony and steel bridge is not clear.	1	3	1	1	3	4	12
7	*Concrete strength and quality is low. (NDT: Rebound Hammer; Ultrasonic Pulse Velocity Test)	3	4	1	1	4	3	12
8	*Columns have low reinforcement ratio. (NDT: Rebar Scanning)	2	3	1	1	3	3	9
9	*Steel structures are corroded.	1	3	1	1	3	3	9
10	*Ancillary steel structures are not well-constructed.	2	2	1	1	2	4	8
11	*Lean-to structures are not well-constructed or insufficiently supported.	2	2	1	1	2	3	6
12	*A steel stairway is severely corroded.	1	2	1	1	2	3	6
13	*Slab scanning showed that no rebars exist in the ground slab. (NDT: Rebar Scanning)	2	2	1	1	2	2	4
14	*The overhead truss holding pipelines/cables does not appear to be properly fixed at the supports.	1	2	2	2	1	3	3
15	*Newly added pipelines on the overhead truss are insufficiently supported.	1	2	2	2	1	3	3
16	*There is a leak in the water storage tank area.	1	3	2	2	1	2	3
17	*A column is out of position.	1	3	2	2	1	2	2
18	*A reinforcement bar is exposed.	1	2	2	2	1	2	2
19	*Ceiling panels are deformed and about to fall.	1	2	2	2	1	2	2

**Photos of building safety risks can be found in Appendix F.*

4.2. THE RISK PROFILE MODEL

All hazards identified on the factory-level were classified under nine clusters that constitute the industry risks on fire and building safety. The hazards identified are listed in the table that follows the graphic.

Risk Classification / Industry Risk Clusters

A. Fire Hazard Materials and Equipment

Flammable / fire hazard materials are not properly protected or segregated.
Unprotected fire hazard materials present possible sources of ignition. Combustible materials in the factory must be controlled and properly managed.

Hazards:	Risk Value:
A1 An open-type chemical storage area is located within the production area.	16
A2 Cloth is used as drop ceiling in the production area.	16
A3 Flammable waste materials are present at the blower and compressor equipment area.	16
A4 Wood is used as the material for the flooring/ceiling in the working area.	12
A5 Flammable waste materials in the disposal area are not properly segregated.	12
A6 The oven exhaust is not properly installed.	8
A7 The installation of LPG tank is hazardous.	8
A8 The LPG tank in the kitchen area has no anti-leak or automatic shut-off device.	8
A9 The waste fabric area is unsecured and is made of light materials.	8
A10 The boiler room is not properly enclosed.	6
A11 The boiler room is made of light materials such as plywood. (i.e., easily com bustible)	6

B. Fire Hazard Activities

Hazardous activities or practices are carried out in the presence of hazardous materials or equipment.
Performing a hazardous activity in combination with another hazardous activity or in the presence of combustible materials increases the chance of a fire incident.

Hazards:	Risk Value:
B1 Smoking is permitted in a hazardous area.	16
B2 The maintenance/repair area (with grinding machine) is not properly segregated from other working areas.	16
B3 Two hazardous activities are being performed at the same time without standby fire protection equipment.	16
B4 The shop maintenance area is situated beside the pigment area without a suffi-cient wall.	12

C. Automatic Fire Suppression Systems

Automatic fire suppression systems in the facility are absent or inadequate.
Inadequate or absent automatic fire suppression systems may result in the immediate spread and non-containment of fire. Automatic suppression systems help delay and control the fire while waiting for the firefighting team.

Hazards:	Risk Value:
C1 Automatic sprinkler system is not available in key areas of the facility.	16
C2 Standpipe / hose reel / hydrant system is not available in the facility.	12
C3 Fire alarms and smoke detectors are lacking in the entire facility.	6
C4 The kitchen hood has no automatic fire suppression system.	6
C5 The electrical room has no automatic fire protection system.	6
C6 Fire alarms and smoke detectors are not available in the dormitory building.	4

D. Means of Escape

Means of egress in the event of an emergency are inconspicuous, obstructed or inaccessible.
All workplaces must have clearly identified and accessible means of escape at all times to ensure that everyone can evacuate in the event of fire or other emergency.

Hazards:	Risk Value:
D1 Emergency exits are locked and inaccessible during working hours.	12
D2 Emergency lights and directional exit signs are insufficient.	8
D3 Emergency exit pathways are obstructed.	8
D4 There is no emergency exit at the dormitory.	8
D5 The door opens inward.	6
D6 An emergency exit pathway is passing through a hazard area.	6

E. Electrical Installations

Electrical equipment is improperly maintained or incorrectly installed.
Ignition sources such as electrical installations and equipment must be properly installed and maintained.

Hazards:	Risk Value:
E1 Electrical cables are exposed.	8
E2 Panel boards and electrical cables are poorly installed.	6
E3 The main distribution panel has no proper grounding system.	6
E4 Cables are improperly installed.	6
E5 The electrical conductor used for the ironing machine is substandard.	4
E6 Housekeeping and maintenance of the standby power generator is poor.	4
E7 The raceway/conduit used is substandard.	4
E8 The compressor equipment is not properly installed.	3
E9 Switchboard of the machine at the sole production area is not properly mounted.	3
E10 The main distribution panel is not properly labeled.	2

F. Emergency Awareness and Training

Workers and factory personnel lack awareness and training regarding emergency procedures.
Sufficient information, awareness, training and supervision should be provided to employees to ensure their safety in the event of danger.

Hazards:	Risk Value:
F1 Workers are not fully aware of firefighting and proper evacuation procedures.	16
F2 There are no evacuation plans posted at strategic places in the facility.	8
F3 Evacuation plans posted at strategic places in the facility are insufficient.	6
F4 Workers and factory personnel are not familiar with fire emergency contact numbers.	6

G. Firefighting Equipment

Firefighting equipment is deemed ineffective because of obstruction or improper installation.
Basic firefighting equipment such as fire extinguishers and fire hoses are the first line of defense against fire accidents. Therefore, this equipment must always be in good working condition and easily accessible.

Hazards:	Risk Value:
G1 A fire hose cabinet is obstructed.	12
G2 A portable ceiling type extinguisher is not appropriately installed	8
G3 The hose used for a fire extinguisher is substandard.	8
G4 The hose of a fire extinguisher is not properly installed.	4

H. Building Construction and Design

Building construction and design are substandard.
Building structural design plays a big role in safety. Proper design ensures that all materials used and structures built are according to standards.

Hazards:	Risk Value:
H1 The structure of the main facility is not well-constructed. (e.g., poor welding, no system to resist lateral load)	16
H2 The steel roof structure is made of built-up steel trusses and does not appear to be designed by an engineer.	16
H3 Elevated storage structure/mezzanine is not well-constructed or insufficiently supported.	16
H4 The emergency staircase at the office/dormitory building does not appear to be strong enough for emergency use.	12
H5 The load bearing structure of the balcony and steel bridge is not clear.	12
H6Concrete strength and quality is low. (NDT: Rebound Hammer; Ultrasonic Pulse Velocity Test)	12
H7 Columns have low reinforcement ratio. (NDT: Rebar Scanning)	9
H8 Ancillary steel structures are not well-constructed.	8
H9 Lean-to structures are not well-constructed or insufficiently supported.	6
H10 Slab scanning showed that no rebars exist in the ground slab. (NDT: Rebar Scanning)	4
H11 The overhead truss holding pipelines/cables does not appear to be properly fixed at the supports.	3
H12 Newly added pipelines on the overhead truss are insufficiently supported.	3
H13 A column is out of position.	2

I. Building Maintenance

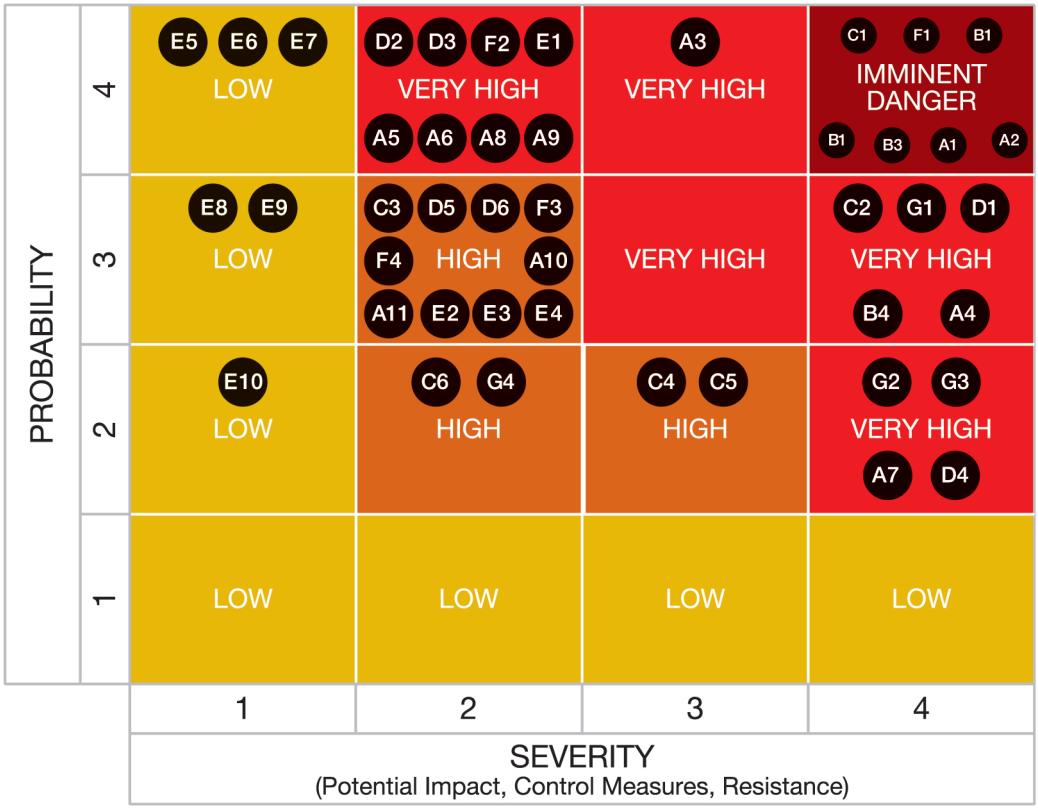
Building maintenance is poor.
Overlooked dilapidation and inadequate maintenance of the building may lead to loose mosaic tiles and plasters of external walls, spalling concrete (breaking into fragments), and rusty steel trusses which may put the safety of workers at risk.

Hazards:	Risk Value:
I1 The anchorage of the external roofing is detached.	16
I2 Some steel structures are corroded.	9
I3 A steel stairway is severely corroded.	6
I4 There is a leak in the water storage tank area.	3
I5 A reinforcement bar is exposed.	2
I6 Ceiling panels are deformed and about to fall.	2

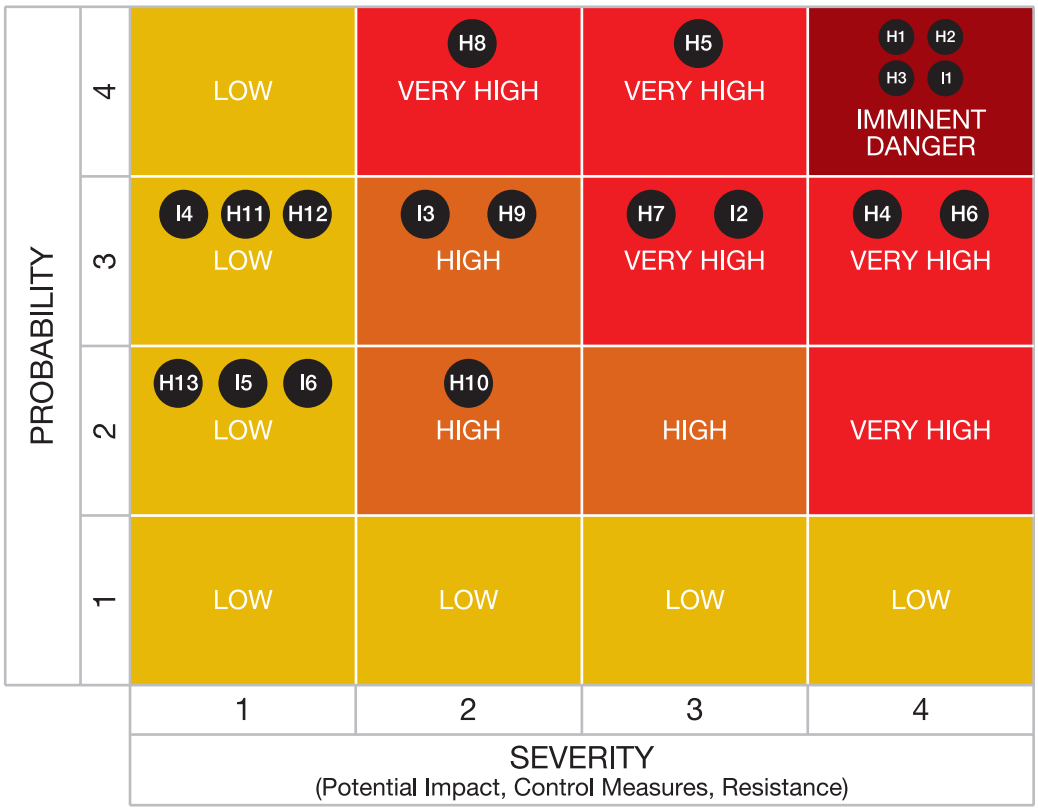
4.3. RISK HEAT MAP

The Risk Heat Map provides a visual representation of the likelihood and severity of the hazards listed above. Each circle relates back to a hazard identified during the on-site factory inspections (using the same coding system used in the preceding tables).

Fire Safety



Building Safety



4.4. RISK PROFILE MATRIX

The Risk Profile Matrix details the nine industry risk clusters in order of priority together with their corresponding impact on life safety and proposed mitigation approach. Recommended document templates that factories or assessors may use are included as Appendices to the risk profile.

Definition of terms:
Industry Risk Description – general industry risk derived from categories of observed factory risks/hazards.
Risk Impact on Life Safety – The potential impact on life safety of the defined industry risk cluster.
Score – A summary of all risk values falling under the risk cluster from the factory-level risks. Risk scores are presented for comparison against other industry risk clusters to facilitate prioritization.
Proposed Mitigation Approach - Recommended actions to mitigate and manage the industry risk.

Industry Risk Description	Risk Impact on Life Safety	Score	Proposed Mitigation Approach
FIRE HAZARD MATERIALS AND EQUIPMENT **Flammable/fire hazard materials and equipment are not properly protected or segregated.** This includes improper segregation of materials and equipment, poor housekeeping, presence of combustible materials within the factory (e.g., cardboard, wood, cloth) as partitions, and the improper installation or enclosure of fire hazard equipment such as the boiler, LPG tank, oven or chemicals.	Fire hazard materials and equipment that are not properly protected, stored or disposed of may become possible sources of ignition or explosion.	108	Hazardous equipment and materials should be compartmentalized, isolated, protected and labeled accordingly. Automatic suppression systems and shut-off devices should also be provided. Good housekeeping practices should be implemented and factory personnel should be trained to identify potential fire hazards. Recommended Document: Appendix A – Fire Safety Inspection Checklist *Note:* *1. Factory management may utilize this checklist to perform regular fire safety inspection internally.* *2. Values specified in the checklist were derived from the Bangladesh Accord on Fire and Building Safety Standard. When there is applicable local laws, requirements of the local laws shall supersede the said Standard.*
FIRE HAZARD ACTIVITIES **Hazardous activities or practices are being done in the presence of hazardous materials or equipment.** This includes smoking in areas with flammable materials and performing two or more activities that may start fire in the same area without a sufficient wall or standby firefighting equipment.	Performing a hazardous activity in combination with another hazardous activity or in the presence of combustible materials increases the chance of a fire incident.	60	Implement a company-wide policy that cigarette smoking is not allowed within the company premises. Adopt a policy for hot works. For any activity that presents a possible source of ignition such as welding, acetylene works, grinding, or other similar maintenance work, always require a standby fire extinguisher. Recommended Document: Appendix D – Guidelines for Maintenance Activities Inside the Factory

Industry Risk Description	Risk Impact on Life Safety	Score	Proposed Mitigation Approach
AUTOMATIC FIRE SUPPRESSION SYSTEMS **Automatic fire suppression systems in the facility are absent or inadequate.** This includes the absence or lack of automatic sprinkler systems, standpipe systems, fire alarms, or smoke detectors in areas of the facility where people are usually present.	Absent or inadequate automatic fire suppression systems may cause high casualties due to spreading fire and the non-containment and inability to suppress the fire source. Automatic fire suppression systems also serve as an advanced signal in case of fire.	50	The complementary approach to controlling the burning rate is the use of a fire suppression system. Factories should install automatic fire suppression systems or improve them if inadequate. A variety of suppression technologies currently exist, including wet- and dry-pipe sprinklers (residential and commercial), water mist systems, carbon dioxide and other gaseous suppression systems, and foam systems (including AFFF). Estimated Cost: The cost for installing automatic fire sprinkler systems in buildings ranges from under a dollar to about $2.00 per square foot. For a dry-pipe system, the average cost is $3.00 to $5.00 per square foot depending on the sprinkler type and factory location.
MEANS OF ESCAPE **Means of egress in the event of an emergency are inconspicuous, obstructed or inaccessible.** This includes locked emergency exit doors, blocked or hazardous emergency exit pathways, doors opening inwards, and the lack of emergency lights and directional exit signs.	Inconspicuous, obstructed or inaccessible means of escape will impede people from quickly evacuating the factory and proceeding to a safe area. There is also the likelihood of people getting trapped inside the factory if means of escape are locked during working hours.	48	Factory management should assign responsibility to a Safety Officer (or equivalent) who will ensure that all exits are always unlocked, accessible and unobstructed during working hours. Directional exit signs should always be visible and emergency lights must be sufficient and in good working condition. Recommended Document: Appendix A – Fire Safety Inspection Checklist
ELECTRICAL INSTALLATIONS **Electrical equipment is improperly maintained or incorrectly installed.** This includes exposed electrical cables, poorly installed panel boards, substandard electrical components, and poor housekeeping for machines such as the standby power generator, compressor and switchboard.	Substandard installation or poor maintenance of electrical cables and equipment are possible sources of ignition, short circuit or electrocution. Electrical fires (Class C) are harder to put out.	46	Inspection of electrical installations should be regularly conducted by a competent electrician to ensure that cables/connections and panel boards are properly installed and that electrical equipment/machines are properly maintained. Recommended Document: Appendix A – Fire Safety Inspection Checklist
EMERGENCY AWARENESS AND TRAINING **Workers and factory personnel lack awareness and training regarding emergency procedures.** This includes lack of awareness on the part of workers on the factory's emergency evacuation procedures, lack of	Lack of awareness of factory personnel and workers on factory emergency procedures and important emergency numbers will result to chaos and slow evacuation during fire incidents. Failure to notify the fire department	36	Conduct regular internal awareness training on the proper use of firefighting equipment, the different types of fire and how to correctly extinguish each one, as well as fire drills (evacuation procedures) consistently at least twice a year. Employees should also be oriented on emergency hotline numbers and protocols in case of fire.

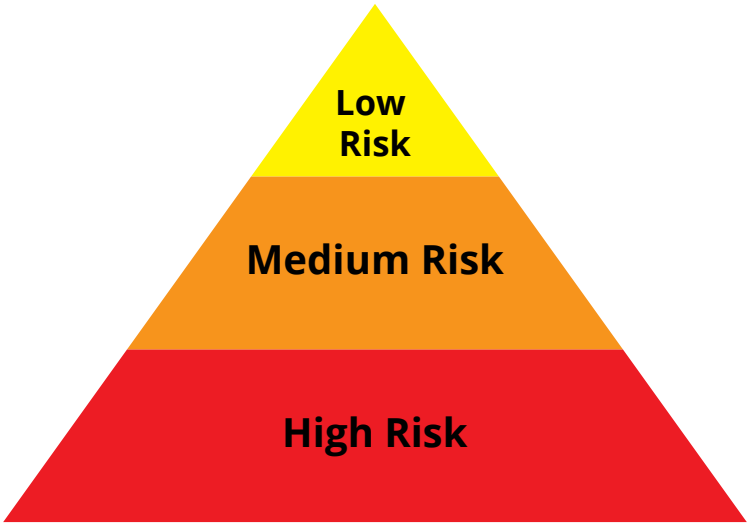
Industry Risk Description	Risk Impact on Life Safety	Score	Proposed Mitigation Approach
knowledge of factory management and workers on important emergency hotline numbers, and the absence or lack of adequate evacuation plans posted in strategic places within the factory premises.	in a timely manner will delay the response resulting to more damage and casualties. For people inside the factory, not knowing where to proceed in the event of an emergency will also prevent rapid evacuation.		The number of emergency evacuation plans posted within the factory premises should be increased. An adequate firefighting team should be designated with clearly established responsibilities. The number of members required in a firefighting team should be determined based on the following factors: 1. Size of the factory 2. Number of buildings and floors 3. Distribution of team members across the factory Recommended Document: Appendix B – Fire Safety Awareness Guide
FIREFIGHTING EQUIPMENT **Firefighting equipment is deemed ineffective because it is obstructed or improperly installed.** This includes the obstruction of fire cabinets containing the fire hose or extinguisher, the use of substandard firefighting equipment, and the improper positioning of automatic ceiling-type fire extinguishers.	Firefighting equipment is useless if it is obstructed or improperly installed. The failure to function or the inaccessibility of firefighting equipment will result in non-containment of the fire source.	32	Implement periodic maintenance and inspect firefighting equipment including its condition and accessibility on a quarterly basis. Recommended Document: Appendix A – Fire Safety Inspection Checklist
BUILDING CONSTRUCTION AND DESIGN **Building construction and design are substandard.** This generally includes the poor construction of parts of the main facility, such as the roof structure, lean-to structures, staircases, columns, and overhead trusses. Subsequent additions to the building such as elevated mezzanines were also deemed unsafe. Structural tests conducted found that some factories have low concrete strength and quality, insufficiently reinforced columns, and no rebar in the ground slab.	Weak or overloaded building structures, especially those frequented by people may collapse and cause casualties when put under too much strain or in the event of natural calamities.	119	Prohibit any installation of additional structures within the factory premises unless designed by a competent engineer. Conduct preliminary assessment on the factories, especially those that do not have a structural plan or as-built drawings. Estimated Cost of Structural Assessment & Non-Destructive Tests: $1,500-$3,000 per day depending on the location and size of the building. Non-destructive tests include Rebar Hammer Test, Ultrasonic Pulse Velocity Test, and Rebar Scanning Test.
BUILDING MAINTENANCE **Building maintenance is poor.** This includes corroded steel structures, water leaks, deformed ceiling panels, detached anchorages, and exposed rebar.	Dilapidated parts of the factory due to neglect or improper maintenance may collapse and cause injuries or casualties.	38	Conduct a thorough periodic building maintenance activity to check and repair deteriorated structures, steel trusses, and concrete damage. Recommended Document: Appendix C – Building Maintenance Checklist

PART 5

RECOMMENDATIONS

This Risk Profile establishes that while the Cambodian garment and footwear industry plays one of the leading roles in the country's economy, improvements are needed to ensure fire and building safety within factories.

One key learning from this study is that factories in the industry exhibit different levels of fire and building safety depending on a multitude of both internal and external factors. Consequently, factories can be categorized as low risk, medium risk, or high risk. Those that have high compliance with requirements and take proactive measures to ensure fire and building safety are likely to have low risks, while factories that do otherwise may have higher risks. Depending on the level of risk, factories require different levels of effort in order to establish or maintain fire and building safety as a norm.



For the industry to maintain growth while ensuring decent working conditions, risks including fire and building safety risks to life or property must be controlled. Factories and all other industry stakeholders must act both individually and collectively to reduce risks, risk profile presents recommendations in two layers, at the factory and the industry level, to guide all industry stakeholders in commencing or augmenting fire and building safety initiatives. Factory level recommendations can be taken by enterprises internally, while industry level recommendations require proactive involvement of a range of stakeholders.

5.1. FACTORY LEVEL

Factories have a fundamental role to play in addressing fire and building safety issues since they directly control conditions on their premises. Changes may entail additional expenses and movement of resources. However, factories that are willing to initiate positive changes and that understand the costs and benefits of such improvements will gain advantage in the long run compared to those that do not. Factories also should collaborate with other industry stakeholders to produce the most positive outcome for the industry as a whole.

High risk, medium risk and low risk factories should tailor their actions based on their risk level by utilizing or implementing OHSAS 18001:2007 and using the Plan-Do-Check-Act (PDCA) cycle approach. The recommended measures are cumulative, such that medium risk factories must have undertaken the PDCA measures recommended for high risk factories, and low risk factories must have completed and sustained the recommendations for both high and medium risk factories. The goal is to reach and maintain the low risk level.

OHSAS 18001:2007 is an internationally recognized standard developed to guide all kinds of organizations establish reliable occupational health and safety management systems.

PDCA is described in the OHSAS 18001 standard as follows:

- Plan: establish the objectives and processes necessary to deliver results in accordance with the organization's OHS policy
- Do: implement the processes
- Check: monitor and measure processes against OHS policy, objectives, legal and other requirements, and report the results
- Act: take actions to continually improve OHS performance

	Plan	Do	Check	Act
High Risk	*Identify objectives and set targets on fire and building safety conditions *Assess risks and define corresponding mitigation measures to be implemented as well as the required resources *Plan resources such as people, equipment, budget, and timeline *Establish a joint worker-management OHS committee and clearly define roles and responsibilities *Develop an Emergency Response Plan and an OHS policy (see appended reference guideline for the development of an ERP)	*Implement defined risk mitigation measures *Implement the Emergency Response Plan/ Procedures (awareness training to all employees) *Begin regular fire safety inspections *Start performing preliminary building structural assessments *Send health and safety personnel to relevant trainings	*Monitor and investigate near-misses, incidents, and non-conformities *Conduct internal audits of the OHS management system *Management reporting and performance review (Review the performance of the OHS system to check the effectiveness, suitability and opportunities for improvement)	*Implement corrective actions (to prevent recurrence of hazardous events) and preventive actions (to prevent occurrence of hazardous events) *Implement changes and opportunities for improvement on the OHS system

Medium Risk	*Identify and evaluate weaknesses (Based on the result of this activity, the organization shall plan and document accordingly the prioritization of actions and controls to be performed.)	*Streamline existing risk mitigation measures *Reinforce or adopt inadequate risk mitigation measures *Implement planned mitigation and controls for identified weaknesses such as building preventive maintenance activities	*Monitor and investigate near-misses, incidents, and non-conformities *Conduct regular fire safety inspections *Perform periodic building structural assessments *Conduct internal audits of the OHS management system *Management reporting and performance review (Review the performance of the OHS system to check the effectiveness, suitability and opportunities for improvement)	*Implement corrective actions (to prevent recurrence of hazardous events) and preventive actions (to prevent occurrence of hazardous events) *Implement changes and opportunities for improvement on the OHS system
Low Risk	*Consider OHSAS 18001 Safety Management System certification *Establish, implement and maintain procedures for identifying and accessing other legal and buyer OHS requirements applicable (The organization shall then determine the resources required to comply including the timeline of activities.)	*Document and institutionalize existing fire and building safety risk mitigation measures, such as emergency procedures, regular assessments and allocation of resources/ equipment *Maintain performance of good practices and processes	*Sustain regular fire and building safety assessments *Evaluate compliance with other legal and buyer requirements *Management reporting and performance review (Review the performance of the OHS system to check the effectiveness, suitability and opportunities for improvement)	*Implement corrective actions when target objectives are not met or when near-misses, incidents, and nonconformities occur. (Corrective action may include change in policies, additional controls, resource or any activity that will mitigate the issues.)

High risk factories have the most improvement measures to implement. Planning in high risk factories includes identifying objectives and setting targets, as well as developing policies and procedures related to fire and building safety. For imminent risks, immediate mitigating actions have to be enforced as soon as possible. High risk factories also have to develop an emergency response plan and focus on providing internal awareness and training to their workers. Factory management must take time to increase their awareness as well. In addition to conducting regular training and emergency evacuation drills, factory management should ensure that workers are not merely attending but are actually learning from the activities. A joint worker-management OHS committee should be established to deal with fire and building safety as well as other OHS issues, and personnel be sent to relevant trainings.

Factories are considered medium risk when existing risk mitigating measures are unable to guarantee good outcomes. Despite being present, these measures are deemed not to be effective. As a whole, factories in this level are not consistent in maintaining good practices on fire and building safety. They should focus on evaluating their weaknesses, streamlining existing risk controls, reinforcing inadequate risk mitigation measures and putting missing ones in place.

Low risk factories are to focus on maintaining the processes and policies in place that contribute to the low risk level. To ensure sustainability, factories can document and institutionalize their existing fire and building safety risk mitigation measures, such as emergency procedures, regular assessments and allocation of resources/equipment. These factories can also consider certification on OHSAS 18001 Safety Management System.

Regardless of their risk level, all factories should conduct periodic fire safety inspections (e.g., evaluation of the adequacy of fire safety processes, capability of firefighting equipment/systems, and controls on fire hazard activities and materials) internally every quarter to minimize the risk of fire. In addition, factories should perform regular preliminary building structural assessments (e.g., evaluation of the adequacy of building safety processes and quality of building structural components) by contracting civil engineers in order to identify potential hazards and minimize the risk of partial structure collapse. These assessments also help in determining if the set targets and objectives are being met. For countries like Cambodia that do not have comprehensive standards and codes, factories may use other international standards such as the Bangladesh Accord as an assessment benchmark while national standards are absent. Existing standards or buyer requirements, if deemed better, can also be used in performing these assessments.

While factories can implement changes internally, consistent reinforcement from key industry stakeholders is essential for improvements to become sustainable. In the end, all these activities and collaborations will ensure that fire and building safety is made a priority and eventually a norm in the industry.

Government

The absence of formal codes and regulations on fire and building safety may be the primary factor contributing to factories operating below acceptable international standards in these areas. Putting in place a legal and regulatory framework is critical to sustainable progress on these issues.

The national government, as an enforcing body, should develop and implement standards on fire and building safety that can be adopted by all factories in every industry. Relevant government agencies should develop a building code that is suited to Cambodia. In the interim, the government can officially endorse internationally recognized standards or codes that must be followed. In addition, a system to ensure that all buildings proposed to be constructed are built according to standards should be put in place. To ensure safety in existing buildings, a program to certify their soundness can be initiated in collaboration with industrial park owners.

Several existing laws can also be strengthened through the issuance of supporting regulations. The Law on Fire Prevention and Firefighting, adopted in 2013, can be reinforced by expediting the law's implementing guidelines. The Ministry of Interior, together with other relevant ministries and advisory bodies, should commence drafting Prakas on Article 8 (fire prevention in residential households), Article 14 (conditions on the storage, transportation, control, sale and consumption of easily flammable/explosive substances), Article 15 (provision of certificate to businesses dealing with petroleum or easily flammable/explosive substances), Article 18 (guidelines on the fire prevention and firefighting system plan required before any construction activity), and Article 19 (inspection procedures on quality and effectiveness of fire prevention and firefighting systems every two years). Providing guidance, trainings, and good practices on fire prevention and firefighting that conform to the law will also further strengthen it.

Aside from existing laws, the government, on the provincial level, should establish a system that would require factories to report incidents of fires and structural failure. The national government can consolidate these statistics for record-keeping purposes and make them available to other stakeholders for transparency. This information is significant in measuring the improvement of the industry on fire and building safety.

Furthermore, the six ministries involved in Proclamation No.002 D.N.S./P.K. dated January 2014 must immediately implement the order which calls for an Inter-Ministerial Inspection Team on textile, garment and footwear factories. Inspection activities to be done by the team should include comprehensive fire and building safety assessments. While under development, the current labour inspections conducted by the Ministry of Labour and Vocational Training should incorporate fire and building safety issues. To successfully conduct factory inspections, the government should have staff competent to recognize fire and building safety risks. Providing training opportunities to factory inspectors would increase their capacity in performing credible and accurate inspections.

Buyers

Labour-intensive industries such as the garment and footwear industry are considered buyer-driven value chains where influence resides with retailers. Considering this fact and Cambodia's current regulatory regime, international buyers in the Cambodian garment and footwear industry have the leverage to push for fire and building safety improvements. They should require suppliers to perform annual basic building safety assessments and conduct regular fire safety inspections. In addition, buyers can pressure/encourage factories to address non-compliance issues indentified in BFC assessments and other audits. Since this entails additional costs for factories, buyers can provide financial assistance to cover costs of safety assessments. Some international buyers already assess the factories they source from using their own assessment tools, which should be reviewed periodically to ensure that building and fire safety issues are adequately addressed.

Using the "carrot and stick approach", international buyers can also set up rewards and penalties for factories based on compliance with fire and building safety measures. For instance, buyers may confer awards on factories that have consistently exhibited good practices on fire and building safety based on buyers' own factory assessment or in coordination with BFC. This can encourage factories that do not prioritize such initiatives to consider making improvements. The award can serve as a marketing tool for factories, which would encourage factories to compete for the distinction. Factories that receive such awards benefit from exposure and an increased reputation. On the other hand, factories that consistently exhibit very poor performance on fire and building safety may face sanctions such as reduced orders.

GMAC

GMAC has an essential role to play in driving improvements on fire and building safety in garment and footwear factories. One factor that can hinder a factory's initiative to improve fire and building safety conditions is lack of awareness. GMAC's role could be focused on addressing this issue, including gathering and disseminating information on fire and building safety good practices that have proved valuable to the industry in other countries. The organization, as an employer association, can act as a liaison for all other stakeholders and is therefore on a good position to promote awareness and information exchange.

Given GMAC's network of over 600 members, it already has the infrastructure to serve as an information center and as such, GMAC can play a leading role in promoting awareness and advocacy through an annual industry seminar/conference on the importance of fire and building safety. This can be coupled with regular information dissemination on fire and building safety guidelines in its newsletters. A good example is the inclusion of contact details for service providers conducting structural assessments in its August 2013 newsletter. GMAC should strive to publish useful information on a regular basis to keep factories up to date.

GMAC, acting as a liaison, can partner with other stakeholders and institutions to create a culture where fire and building safety is a norm in the industry. Besides seminars, GMAC can also conduct hands-on trainings focused on fire and building safety in collaboration with experts and service providers. With BFC, GMAC can initiate industry-wide competitions similar to BFC's competition for garment workers on the country's Labour Law. GMAC can also partner with BFC in organizing trade fairs where factories can gather information on equipment and systems available for purchase that will improve fire and building safety. GMAC also can assist the government in developing and maintaining a repository for fire and building accidents. Lastly, GMAC has the capacity to reach out to garment associations in other countries to form strategic partnerships and exchange knowledge and information.

Workers and Trade Unions

Workers and trade unions can pressure other stakeholders to implement positive change. They can lobby for the creation of a joint worker-management OHS committee and a fire brigade within factories. Individually, workers should actively participate in available trainings on fire and building safety and in emergency drills. They can make themselves proactively aware of internal fire and building safety measures in the factory such as the emergency evacuation plan and the location of emergency exits and fire extinguishers. Lastly, workers who come across fire and building safety risks should report dangerous conditions to supervisors/managers and to the factory's OHS committee. Dangerous conditions may include unsafe acts of other workers, potential sources of fire such as substandard electrical wirings and unprotected flammable materials, and noticeable building damage like cracks and bending of steel structures.

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International Finance Corporation (IFC)

IFC is a member of the World Bank Group. It finances and provides advice for private sector ventures and projects in developing countries in partnership with private investors and, through its advisory work, helps governments create conditions that stimulate the flow of both domestic and foreign private savings and investment.

International Labour Organization (ILO)

The International Labour Organization (ILO) is the tripartite UN agency that brings together governments, employers and workers of its 183 member states in common action to promote decent work throughout the world. The main aims of the ILO are to promote rights at work, encourage decent employment opportunities, enhance social protection and strengthen dialogue on work-related issues.

Better Work

Better Work is an innovative partnership programme between the ILO and the IFC. Operational since 2009, the programme aims to improve both compliance with labour standards and competitiveness in global supply chains. Better Work aims to have a significant and direct impact through its own country-based programmes in the garment sector, as well as indirect impact through its influence, knowledge sharing and partnerships.

ECC International

ECC International is a leading people and process improvement solutions provider in Southeast Asia, focused on process improvement, process automation solutions and learning solutions. With HQ in the Philippines, ECCI operates in 5 countries across South and Southeast Asia including Vietnam, Malaysia, Indonesia and India.

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APPENDIX A

FIRE SAFETY INSPECTION CHECKLIST

FIRE SAFETY INSPECTION CHECKLIST

Factory Name:
Factory Address:
Date of Inspection:
Name of Inspector:

☐ Can the fire department easily access the factory?

Fire Protection Systems

☐ Is there an available automatic sprinkler system?
- ☐ Is the automatic sprinkler system tested monthly? (check previous test records)
- ☐ Does the automatic sprinkler system have a working water/air pressure?
- ☐ Are there available records of recent sprinkler system testing?

☐ Is there a direct connection to a water source?

☐ Is there a standpipe system? (water piping built into buildings to which fire hoses can be attached by firefighters, allowing manual application of water to the fire)

Emergency Lights

☐ Are emergency lights present?
- ☐ Is the number of emergency lights adequate? (for all corridors, aisles, exit doors, and stairways)
- ☐ Are all emergency lights operable? (30 sec. test)
- ☐ Are all emergency lights tested monthly?
- ☐ Do all emergency lights properly illuminate egress paths?
- ☐ Are there available records of recent lighting system tests?

Fire Alarm and Detectors

☐ Are fire alarms present?
- ☐ Is the number of fire alarms adequate? (the notification signal is adequate to accommodate all people present in the factory, including people with sight or hearing related disabilities)
- ☐ Are all fire alarms functional?
- ☐ Is there a fire alarm pull station (to activate the alarms) near each exit?
- ☐ Are fire alarm pull stations visible and accessible?

☐ Are there heat/smoke detectors on the ceiling?
- ☐ Is the number of heat/smoke detectors adequate? (Max radius for smoke detector is 7.5m; max radius for heat detector is 5.3m. Detector radius should reach every part of the room.)
- ☐ Are all heat/smoke detectors functional? (check previous test records)

☐ Is the fire department automatically notified?

☐ Are there available records of recent fire alarm system maintenance?

Fire Extinguishers

- ☐ Are fire extinguishers present?
  - ☐ Is the number of fire extinguishers adequate? (Extinguishers shall be placed so that maximum travel distance to the nearest unit shall not exceed 30m/100ft.)
  - ☐ Are all fire extinguishers serviceable?
  - ☐ Are all fire extinguishers easily accessible and unobstructed?
  - ☐ Are all fire extinguishers mounted properly near each exit door? (If gross weight is less than 40lb.: top of the fire extinguisher should be not more than 1.53m/5ft. above the floor. If gross weight is more than 40lb.: top of the fire extinguisher should not be more than 1.07m/3.5ft. above the floor.)
  - ☐ Are all fire extinguishers the proper type? (suitable for the flammable materials that are nearby)
  - ☐ Are there available records of recent fire extinguisher maintenance?
- ☐ Is there an available documented inventory of all firefighting equipment?

Escape Routes

- ☐ Are emergency exits present?
  - ☐ Are emergency exits adequate?
  - ☐ Are emergency exits readily visible?
  - ☐ Are emergency exits clear and unobstructed?
  - ☐ Are there two remote exits available?
  - ☐ Do emergency exits have sufficient width for the occupancy load? (Doors – minimum of 0.8m/32in.)
  - ☐ Is the travel distance within the limit of 30 meters?
  - ☐ Are emergency exits adequately illuminated?
  - ☐ Are all exit enclosures free of storage?
- ☐ Do doors swing in the direction of egress travel?
- ☐ Do doors open easily?
- ☐ Are doors unlocked during working hours?
- ☐ Are corridors and aisles of sufficient size? (Minimum of 0.9m/36in.)
- ☐ Is there a designated evacuation area?

Exit Signs

- ☐ Are exit signs present?
  - ☐ Are exit signs adequate? (Lighted exit signs shall be placed at entrance to an exit. Additional exit signs shall be placed throughout the facility anywhere the continuation of the egress is not obvious.)
  - ☐ Are exit signs readily visible?
  - ☐ Are exit signs illuminated?
  - ☐ Is there an emergency power for exit signs?
  - ☐ Do the exit signs lead to an evacuation area?

Electrical Wiring and Cabling

- ☐ Is there an electrical plan?
- ☐ Are there exposed electrical wiring installations?
- ☐ Are all electrical circuits properly grounded?

☐ Do all electrical installations have proper enclosures?
☐ Are all switches in good condition?
☐ Is there an over-current protection?

Main Switch and Switchboard
☐ Is the main switch properly enclosed?
☐ Is the main switch easily accessible to responding firemen?
☐ Is the main switch easily accessible for maintenance?
☐ Is the switchboard properly enclosed?

Housekeeping
☐ Are all areas free of clutter and excessive combustible materials?
☐ Is smoking regulated?
  ☐ Is smoking totally prohibited in the facilities?
  ☐ Are there "No Smoking" signs posted conspicuously?
  ☐ Is a specific area designated for smoking?
☐ Are stocks stored properly?
☐ Are incompatible materials separated?
☐ Is trash removed on a regular basis?

Operating Features
☐ Is there a fire safety director/officer?
□ Are fire/emergency drills conducted regularly? *(at least 2 per year)*
☐ Is there a firefighting team available?
  ☐ Is the firefighting team trained?
  ☐ Is the firefighting team familiar with the fire safety plan?
  ☐ Is the firefighting team familiar with emergency contact numbers?
  ☐ Does the firefighting team have an organizational chart?
  ☐ Does the firefighting team have clearly identified responsibilities?
☐ Is there an emergency evacuation plan in case of fire?
  ☐ Are evacuation plans posted at strategic places in the factory?
  ☐ Is the firefighting team familiar with the evacuation plan?
  ☐ Are all managers, supervisors and workers familiar with the evacuation plan?
  ☐ Are managers and supervisors trained on how to lead an evacuation?
  ☐ Does the factory issue fire instruction cards?
☐ Is there a sufficient number of factory workers trained to use firefighting equipment? (The number of members required in a firefighting team should be determined based on the following factors: size of the factory, number of buildings and floors, and distribution of team members across the factory.)
☐ Are hot work permits being issued and implemented?
☐ Are commodities properly organized? (good housekeeping is being observed)
☐ Are storage areas made of fire resistive materials?
□ Are emergency exits properly maintained without obstruction or padlocking?

APPENDIX B

FIRE SAFETY AWARENESS GUIDE

FIRE SAFETY AWARENESS GUIDE

This Fire Safety Awareness Guide was developed for participating factories registered with Better Work/Better Factories Cambodia in order to impart basic information and increase the knowledge of workers on fire safety procedures and practices.

HOW DOES FIRE DEVELOP?

Fire develops when three elements, usually called the Fire Triangle, are present: **Oxygen**, **Heat** and **Fuel**. To create a chemical reaction, there has to be enough oxygen in the atmosphere and some sort of fuel such as wood, fabric or gasoline. Combustion happens when the fuel is heated to its ignition temperature and fire dies whenever one of the three elements is eliminated.

WHAT ARE THE CLASSES OF FIRE?

Class A – Fire involving ordinary solid combustibles such as wood, paper, fabric or any fuel source that leaves ashes. Water is the best extinguisher for Class A fires.

Class B – Fire involving flammable or combustible liquids or gases such as paint, gasoline or petrol, but not cooking oil and fats. Water is ineffective in extinguishing Class B fires because it may spread the burning liquid.

Class C – Fire that is electrically energized and involves short-circuiting electrical equipment or overloaded electrical wiring. Class C fire has a risk of causing electrocution when the fire comes in contact with a conductor, so do not attempt to use water to douse an electrical fire. Water can be used only when the electrical equipment or wiring is already unplugged or de-energized.

Class D – Fire involving combustible metals such as Magnesium and Potassium. This usually occurs in laboratories.

Class K – Fire involving cooking oil, animal and vegetable fats, or grease. Class K is different from Class B fires because the fuel source can far exceed in temperature compared to other combustible liquids.

You can easily remember the classes of fire by keeping in mind that Class A fire leaves ASHES; fuel of a Class B fire BOILS; Class C fire involves electric CURRENT; Class D fire is caused by a DENSE material/metal; and Class K fire usually happens in the KITCHEN.

WHAT ARE THE COMMON TYPES OF FIRE EXTINGUISHER?

In order to effectively extinguish fire, you must be aware what class of fire you are attempting to control. Depending on the class of fire, a certain extinguishing agent can be more effective than others. That is why there are different types of fire extinguishers designed to fight different classes of fire.

Air-Pressurized Water (APW) Extinguishers – APW extinguishers are filled two-thirds with regular water and pressurized with air. Dousing fire with water is the best way to remove heat, but this is not effective against some classes of fire. This type of extinguisher is only best used on Class A fires. Using this on Class B fires will only spread the flames while using this on Class C fires may result to electrocution.

Foam Extinguishers – This type of extinguisher discharges foam that has a blanketing effect that prevents the re-ignition of the fuel by separating oxygen from the other elements. This can be used for Class A and B fires.

Carbon Dioxide (CO_2) Extinguishers – This type of extinguishers is filled with pressurized CO_2, a cold non-flammable gas that is heavier than oxygen. It works by displacing oxygen in the atmosphere and cooling the fuel source. This type of extinguishers is effective against Class B and C fires only. CO_2 extinguishers are characterized by a hard horn and the absence of a pressure gauge.

Dry Chemical Extinguisher – This type of extinguisher makes use of fine yellow powder to coat the fuel and separate it from oxygen. The powder also disrupts the fire's chemical reaction. Dry Chemical Extinguishers may either be labeled "BC" or "ABC", indicating which classes of fire the extinguisher is effective against. This is the most common type of extinguisher used due to its wide coverage.

Always remember to use the appropriate type of fire extinguisher. Fire extinguishers are normally designed with pictographs to easily identify what classes of fire they are designed to fight.

HOW TO USE A FIRE EXTINGUISHER

Since a combination of heat, oxygen and fuel has to be present in order for fire to develop, fire extinguishers work because they are designed to eliminate one of the elements of the fire triangle. Once you have the appropriate type of fire extinguisher to fight the fire, it can effectively be operated using the **PASS method**.

Pull the safety pin. – The safety pin of the handle at the top of the extinguisher serves as a locking mechanism. Releasing it will allow the discharge of the fire extinguisher.
Aim at the base. – To effectively put out fire, it is important to extinguish the fuel source. Always aim the nozzle or hose at the base of the fire and not at the flames.
Squeeze the lever slowly. – As long as the lever is squeezed, the extinguisher will discharge the extinguishing agent.
Sweep from side to side. – Move the fire extinguisher hose from side to side until the fire is put out.

Always operate a fire extinguisher from a safe distance, moving forward as the fire starts to diminish. A regular extinguisher can normally be used for around ~10 seconds.

WHEN FIGHTING A FIRE WITH A FIRE EXTINGUISHER..

- Before attempting to use a fire extinguisher to fight a fire, make sure that you (or someone else) alert the fire department first and activate the fire alarm systems.
- If there are people who are in imminent danger, assist them first if you can without risking your own life.
- Face the fire in the direction of the wind to prevent inhaling toxic smoke. Stay low and keep your back to the exit so that you don't get trapped if the fire becomes uncontrollable.
- Always aim at the base of the fire. If the source is a flowing flammable liquid, aim at the point of leakage.
- It is better to have more people with extinguishers aiming at the fire simultaneously than to use several fire extinguishers one by one.
- If the fire becomes uncontrollable and you cannot extinguish it, leave immediately and close the door behind you to help delay the spread of fire.
- Once the fire is put out, do not leave the area immediately. Monitor the area just in case the fuel source reignites.
- Make sure to recharge the discharged fire extinguisher immediately.
- Do not attempt to fight a fire if it makes you nervous or uncomfortable. Evacuate immediately and inform other occupants by activating the alarm system. Alert proper authorities and let them handle the fire.

NEVER FIGHT A FIRE IF..

- The fire is rapidly spreading. Only use an extinguisher in the early stages of the fire to control it. Otherwise, evacuate the facility immediately and alert other occupants and the fire department.
- You do not know what the source of fire is. Knowing what is burning will give you an idea what type of fire extinguisher to use.

- The appropriate fire extinguisher is not available. Using the inappropriate extinguisher may just escalate the situation.
- You do not have a means of escape. Always ensure that your back is facing an exit so you can evacuate immediately if the situation gets out of control.
- You are at risk of inhaling toxic smoke and other poisonous gases. Smoke inhalation is one of the main causes of fire-related deaths.
- The fire is larger than a desk in size or if the flames are reaching the ceiling.

FIRE SAFETY PRECAUTIONS & PRACTICES

Prevention is always better than cure. The best way to minimize loss brought about by fire is to prevent the fire from breaking out in the first place.

- Always separate or compartmentalize combustible materials such as fabric or paper from ignition sources.
- Do not leave open flames like candles unattended and keep them away from flammable surfaces.
- Dispose of waste, especially flammable waste, properly.
- Where smoking is permitted, dispose of cigarette butts in a designated container and make sure that smoking materials are completely out. Only smoke within designated areas.
- Always be aware of potential fire hazards in and near your working area. Report observed hazards so that management can take action.
- Perform fire hazard activities only when standby fire extinguishers are available. Hot work operations must be performed in accordance with the hot work policy.
- Make sure all electrical appliances are in good condition. Unplug them when not in use.
- Do not overload outlets and extension cords.
- Make sure all electrical installations are properly installed.
- Do not leave cooking unattended.

Being knowledgeable on what to do before and during the event of fire can save lives.

- Be familiar with your building's fire and life safety systems. Know what and where they are, how to raise the alarms, and how they work.
  - ✓ Smoke Detectors
  - ✓ Manual Pull Alarms
  - ✓ Stairwells
  - ✓ Fire Doors
  - ✓ Fire Alarm System
  - ✓ Water Sprinkler System
- Be familiar with the location of fire extinguishers in your building.
- In case of fire, alert others in the building by activating the alarm systems to begin evacuation and call the fire department as soon as possible. Do not silence the alarms without permission from the fire department.
- Be aware of the facility's emergency evacuation plan. Know where the emergency exits (at least 2) are from your working area and be familiar with the evacuation assembly point.
- Keep corridors, hallways, staircases and pathways free from obstruction. Do not pile or stock things that will hamper means of egress.

- Join trainings on the proper use of fire extinguishers. Fire extinguishers should only be operated by people who are knowledgeable on their use. Never attempt to extinguish a fire if your own safety is at risk.
- Participate and pay attention in company-wide fire drills.
- Keep calm during emergencies.
- Remember or take note of emergency numbers (e.g., fire department, police) that you can contact in case of emergencies.
- Never use elevators during a fire emergency.
- If you cannot leave the building, create a safe area by sealing the room. Put wet cloth on small openings to prevent the passage of smoke. Stay low, put a wet cloth on your nose and mouth, and call for help.
- If your clothes catch fire, always remember to Stop, Drop and Roll until the flames die. Do this while covering your face.

APPENDIX C

BUILDING MAINTENANCE CHECKLIST

BUILDING MAINTENANCE CHECKLIST

Factory Name:	
Factory Address:	
Date of Inspection:	**Building Inspected:**
Name of Structural Engineer:	

- ☐ Does the building have available structural layout plans?
- ☐ Are there no signs of overloading?
- ☐ Is the usage of the facility compatible with the designed loading?
- ☐ Are there no signs of building tilt/settlement?
- ☐ Are there no signs of building deformation?
- ☐ Are there no visible structural cracks?

Exterior Walls

- ☐ Clean?
- ☐ In good condition?
- ☐ Without cracks or damage (e.g., holes, water stains)?

Interior Walls

- ☐ Clean?
- ☐ In good condition?
- ☐ Without cracks or damage (e.g., holes, water stains)?

Doors & Door Frames

- ☐ In good condition?
- ☐ Latches in place and lubricated?
- ☐ With secure handles?
- ☐ Has working locks?

Windows & Window Frames

- ☐ In good condition?
- ☐ Latches in place and lubricated?
- ☐ Has secure hinges?
- ☐ Without cracks or breakage?

Roof/Ceiling

- ☐ Clean?
- ☐ In good condition?
- ☐ Are panel boards / ceiling tiles in place?
- ☐ Without leaks?
- ☐ Without cracks or damage (e.g., holes, water stains)?

Floors

- ☐ In good condition?
- ☐ Without cracks?
- ☐ No loose/cracked/missing tiles?
- ☐ Clean and free from litter?

Stairs

- ☐ In good condition?
- ☐ No loose stair treads?
- ☐ No loose handrails?
- ☐ Without cracks?

Seats & Tables

- ☐ Clean?
- ☐ In good condition?

Steel Structures

- ☐ Are columns free from rust/corrosion?
- ☐ Are columns free from exposure to damaging environment (e.g., water, chemicals)?
- ☐ Are bolts and trusses free from rust/corrosion?
- ☐ Are bolts and trusses installed firmly?
- ☐ Are other steel structures free from rust/corrosion?

Electrical Installations and Wirings

- ☐ Are electrical panels properly covered?
- ☐ Are electrical equipment unplugged when not in use?
- ☐ Are cords of electrical equipment in good condition?
- ☐ Are breaker boxes properly covered / enclosed?
- ☐ Are breakers properly labeled?
- ☐ Are ceiling lights working?
- ☐ Are light switches working?
- ☐ Are elevators functioning properly?

Housekeeping

- ☐ Are work areas clean and orderly?
- ☐ Is trash disposed of properly?
- ☐ Are waste cans emptied regularly?
- ☐ Are water fountains clean and operating?
- ☐ Are sprinkler heads clean?
- ☐ Are sprinkler heads in good condition?
- ☐ Are sprinklers not leaking?
- ☐ Are water faucets not leaking?
- ☐ Are storage areas clean and free of clutter?
- ☐ Are aisles and other pathways unobstructed?
- ☐ Are exit signs and other signage legible?

APPENDIX D

GUIDELINES FOR MAINTENANCE ACTIVITIES INSIDE THE FACTORY

GUIDELINES FOR MAINTENANCE ACTIVITIES INSIDE THE FACTORY

Hot Work such as welding, flame cutting, brazing, grinding, and soldering are temporary industrial processes that can cause unwanted explosion or fire accidents when heat or hot debris from the operation comes in contact with combustible materials. When performed or managed improperly, hot work can result to loss of life and/or property.

This policy aims to minimize the risks and prevent such incidents by presenting safety guidelines that must be observed by factories when performing hot work.

BEFORE

- Prior to commencing, hot work operations such as welding, flame cutting, brazing, grinding, soldering and other similar activities that involve flames or produce heat and/or sparks must be approved by top management or if available, the designated Safety Supervisor.
- When hiring contractors, the management must discuss with them the project completely including the type and scope of hot work to be conducted and the hazards in the area.
- An **approval** shall be expressed by the Safety Supervisor or his equivalent before initiating any hot work operation.
- The Safety Supervisor is responsible for ensuring that all combustible materials identified in the assessment are properly moved, protected or shielded from ignition.
- Combustible materials shall be relocated at least 35 feet away from the hot work activity. If impractical, combustible materials shall be properly protected using fire resistant materials (e.g., welding blanket, welding curtain).
- Openings in cracks, walls or ducts within 35 feet shall be covered to prevent passage of sparks to adjacent areas.
- The Safety Supervisor shall ensure that fire suppression systems are available and operable and that fully-charged, appropriate and operable fire extinguishers are available and easily accessible in the hot work area.
- Special precautions must be taken to avoid accidental triggering of fire detection or suppression systems. A wet rag may be laid over a nearby sprinkler head, but must be removed immediately after completion of the hot work operation.
- The Safety Supervisor shall make sure that firefighting equipment is available in the working area.

DURING

- Nearby workers shall be relocated or protected from heat, sparks, slag, or arc flashing.
- When unsafe conditions develop during the performance of the hot work, the hot work operator must inform the management and/or the Safety Supervisor immediately. The Safety Supervisor must reassess the area.
- The maintenance personnel working shall ensure that a portable fire extinguisher of appropriate size and type and a pail of water are readily available. The personnel must be trained in the use of the fire extinguisher.
- When a fire develops, the maintenance personnel working shall try to extinguish the fire only if the equipment is capable. If not, the personnel must sound the alarm immediately.

AFTER

- The maintenance worker must remain at least 30 minutes after the completion to monitor and control potential fire hazards.

APPENDIX E

GUIDELINES FOR THE DEVELOPMENT OF AN EMERGENCY RESPONSE PLAN

Contents **Page**

Table of Records of Emergency Plan Revision

S/N	Plan Version	Date of Exercise*	Date of Approval	Name and Appointment of Approving Officer	Signature of Approving Officer	Remarks

Note:

Date of Exercise – Date when the newly drafted/revised emergency plan has been validated. Emergency Plan should only be endorsed and approved after it has been validated by the relevant government authority.

Table of Records of Emergency Exercise Conducted

S/N	Date of Exercise	Comments	Appointment of Conducting Officer	Signature of Conducting Officer

Note:

Emergency Exercise shall be conducted at least once a year.

EMERGENCY RESPONSE PLAN

1 SITUATION

1.1 Introduction

State the ownership and management of the installation. Write up of the **nature of business, products and method** of the installation's activities and the various agencies involved in the operation such as suppliers of raw materials, etc. (If any other companies are used in the process, state down the company)

1.2 Area of Operations

1.2.1 Location of Installation and its main access road

State the address of the installation. State all the possible entrances to the installation from the main access roads (Indicate the entrances on the site plan, surrounding lands should be included in the site plan.)

1.2.2 General description of the surroundings and neighboring premises of the Installation

Identify and describe the neighboring occupancies such as highly populated residential or environmentally sensitive areas surrounding the installation.

1.2.3 Layout of Installation

Provide a brief description of the layout of the site such as the location of the admin block, process plants, tank farm, storage warehouse, etc. with the aid of a schematic site map.

1.2.4 Location, storage and quantities of hazardous products, chemicals and gases (See Annex 1)

Detailed description of the location, quantity stored and the storage conditions of hazmats such as storage temperature, pressure, etc. at site. Location of the hazmat must be indicated on the site plan(s) clearly.

1.2.5 Description of process areas (including summary of the processes and operations carried out)

A brief summary of the processes, operations and other activities such as hot work carried out within the process areas. State the duration of the each processes and operations (24 hours daily, only normal office hours)

Provide a summary table of all process at various locations of the installation.

1.3 Hazard and Risk Assessment

1.3.1 Main areas where hazards are present on site

State the main areas of hazards (flammable, toxic, etc.) and the safety/emergency control measures that are in place to handle the hazards. The Material Safety Data Sheets (MSDS) of each hazmat that could be found at site must be included in the ERP.

E.g.: Releases from XXXX Handling

(1) Hazards

The two principal potential hazards following a release of XXXXX are evaporation of the volatile liquid leading to the formation of a flammable vapor cloud in the atmosphere, and radiation from an ignited pool fire. Ignition of the cloud might also lead to a vapor cloud explosion.

If XXXXX were spilled onto open, flat ground, it would spread out to form a shallow pool. If the releases were not stopped, the pool would continue to spread until it reach an equilibrium size where the spill rate is equal to the evaporation rate (for unignited releases) or burning rate (for ignited releases)

(2) Emergency Control Measures

XXXXX vapor is normally 1.5 times heavier than air and the vapor produced as XXXXX vaporizes from the liquid at its normal boiling point is even heavier. Therefore, it will tend to spread along the ground assisted by the visible fog of condensed water vapor created. Ignitable mixtures extend beyond the visible area. Such escape can be controlled by water spray. Water should be applied to fire-exposed tanks and cool surrounding risks. Eliminate all sources of ignition and the flow of gas should be stopped, if possible.

(3) Safety Control Measures

a. XXXXX gas leak detectors are installed to detect gas leaks.
b. Automatic water spray system with heat detectors is installed to activate and drench the tanks when the temperature is high.
c. Daily monitoring by shift personnel for leakage.

1.3.2 Descriptions of ALL possible scenarios

Identify and describe all the possible scenarios, including the worst case scenarios that could happen. State briefly all the assumptions, risk study methodology adopted and mitigation measures identified in these scenarios. Tabulate and draw all the possible hazard zones, consequence distances and safety distances necessary for each scenario involved on the site plan. See **Annex 2** for the criteria for determining hazard distances.

2 AIM

The aim of this emergency response plan is to prevent and reduce injury to personnel and minimize property damage and loss. This ERP details the various preventive measures and operational actions that need to be undertaken by the company to contain any hazmat leaks/spills and to control or extinguish any fire in the event of emergency situations occurring within the installation.

3 EXECUTION

3.1 Concept of Operations

The emergency operation to be conducted in phases is as follows:

Phase	Action
I	Company personnel to carry out initial response and alert relevant government authority
II	Relevant government authority predetermined turnout response to the scene for mitigation, containment, security cordoning, evacuation, and rescue activities
III	To conduct major operations for containment and minimize risks with other related agencies
IV	To clean up / decontaminate and resume normal operations

3.2 Emergency Actions by Installation

Detailed description of emergency actions to be carried out by the Company Emergency Response Team (CERT) **See Annex 3**

3.2.1 Procedure to notify relevant government authority

3.2.1.1 Notification procedure during office hours and after office hours

Standard Operating Procedures (SOP) to be adopted to notify relevant government authority in the event of an emergency discovered during and after office hours.

E.g.: During office hours, any occurrence of incident resulting in an emergency alarm, the shift supervisor on duty shall activate in-house emergency response procedure. The site incident commander (SIC) shall be notified and he will inform relevant government authorities by telephone after initial assessment of the situation. The SIC shall be the liaison officer. He shall provide information and necessary assistance to the responding government authority.

3.2.1.2 Details of worker population during day and night

State the working population of the company during the day and the night including Sundays and public holidays.

3.2.2 Procedure of implemented In-Place Protection

3.3 Grouping and Tasks **(See Annex 4)**

State the role and responsibilities of various groups (site main controller, site incident controller, emergency response team, security personnel, key personnel) using the Annex.

3.4 Coordinating Instructions

3.4.1 Key personnel emergency contact numbers

The key personnel to be notified must be contactable during office hours and after office hours (Contact no. must include both the contact numbers during office hours and after office hours. e.g., individual mobile phone / pager or home contact no.)

3.4.2 Contacts of neighboring companies

Provide the contact number of the neighboring companies within 500m radius, whereby in the event of the incident escalating beyond the boundaries of the installation, the company shall have to inform its neighbors.

3.4.3 Sector boundaries

Identify the various sectors of operations so as to determine the potential hazard zones and evacuation zones.

Note:
The incident site shall be sectorized into HOT, WARM and COLD zones during emergency. The definitions of the various zones are as follows:

Hot Zone – This is the area around the incident that requires all personnel entering to be fully protected by means of breathing apparatus sets and proper protective clothing and to be decontaminated upon leaving the zone.

Warm Zone – This is the area directly outside the Hot Zone. All personnel in this zone should be equipped with breathing apparatus and if the situation requires, done the mask for full protection against toxic hazard gas.

Cold Zone – This is the non-hazard zone outside the Warm Zone.

3.4.4 Alerting and reporting to relevant government authority

Detail the procedures/method of alerting the relevant government authority and reporting upon its arrival.

3.4.5 Control points

Explain the purpose of each control point (Reporting Point, Evacuation Assembly Area, First Aid Point, etc). Indicate the location of all control points on the layout map.

3.4.6 Safety and others

Details of other safety measures adopted by the company to minimize the risks involved during an emergency.

3.4.6.1 Emergency procedures

3.4.6.1.1 Emergency shutdown procedures

Describe briefly the emergency shutdown procedures for various processes and equipment during an emergency such as gas leakage, loss of containment storage tank, etc. Attach details of shutdown procedure of various processes and equipment as Annexes.

3.4.6.1.2 Emergency evacuation procedures

General description of how evacuation will be conducted. Attach the company's emergency evacuation plan as an Annex.

3.4.6.2 Containment of hazardous substances (Spill, Leak and Vapor Release)

3.4.6.2.1 Containment procedures

Describe briefly the containment procedures in place for hazmat spill, leak and vapor release. Attach full plans as an Annex.

3.4.6.2.2 List of containment equipment

Tabulate the information (type, quantity and function) of containment equipment or facilities that are available in the company.

3.4.6.3 Monitoring of released hazardous substances (Spill, Leak and Vapor Release)

3.4.6.3.1 Monitoring procedures

Describe how monitoring activities will be carried out by the company. Attach monitoring plan as an Annex.

3.4.6.3.2 List of monitoring equipment

Tabulate the information (type, quantity, general functions/capabilities and location) of monitoring equipment (portable gas detectors, pH meters, organic vapor monitor, etc.) that are available in the company.

3.4.6.4 Firefighting and rescue

3.4.6.4.1 Firefighting and rescue procedures

Description of the firefighting and rescue procedures that shall be carried out to mitigate the incident. Attach full details of the firefighting and rescue procedures/plans as an Annex.

3.4.6.4.2 List of firefighting and rescue equipment

Tabulate the information (type, quantity, general functions/capabilities and location) of firefighting and rescue equipment that are available in the company.

3.4.6.5 Clean-up operations

3.4.6.5.1 Clean-up procedures

Description of the clean-up procedures that shall be carried out by the company at the recovery stage. Attach full details of containment procedures/plans as an Annex.

3.4.6.5.2 List of clean-up equipment

Tabulate the information (type, quantity, general functions/capabilities and location) of clean-up equipment that are available in the company.

3.4.6.5.3 List of clean up contractors

Tabulate the information (name, address, contact person and contact number, type of clean-up actions that will be done) of clean-up contractors used by the installation.

4 SERVICE SUPPORT

4.1 Equipment

4.1.1 Fire protection facilities

4.1.1.1 Detection systems

Description of detection systems such as smoke, firefighting monitoring and gas detection, leakage detection system, wind vane/wind sock, etc. available in the installation. Indicate the location detection systems on the site installation map.

4.1.1.2 Suppression systems

Description of extinguishing systems such as sprinkler system, drencher system for fuel oil tanks, hydrants, fire extinguishers available in the installation. Indicate the location and quantity (if any) of the various suppression systems on the site map.

4.1.2 Other extinguishing agents

Tabulate the information of the extinguishing agents (type, brand name, package, location and quantities) available.

4.1.3 Containment equipment (leak control, spill control, absorbents, etc.)

Tabulate the information (name, quantity and location) of containment equipment available.

4.1.4 Other protection and general equipment

Tabulate the information (name, quantity and location) of other protection and general equipment used in the installation.

4.1.5 Safety and first aid equipment

Tabulate the information (type, capacity, quantity and location) of safety and first aid equipment such as breathing apparatus, resuscitators, stretchers, blankets, first aid boxes, etc.

4.2 Manpower

4.2.1 In-house Emergency Response Team

Show the organization structure of the in-house emergency response team. Describe the roles, responsibilities and functions of the in-house company emergency response team (CERT). **See Annex 3**

5 COMMAND AND SIGNAL

5.1 Command

5.1.1 Incident Organization Chart

Show the incident organization chart. Describe the roles and responsibilities of the key personnel in the incident organization chart.

5.1.2 Location and component of Command Center

Indicate the location of the command center on the installation map.

Indicate the location of site incident controller, site main controller, etc.

5.2 Signal

5.2.1 Communication Flowchart

Communication flowchart showing details on the linkage between the site main controller, site incident controller, in-house emergency response team commander and responding government authority. State also the means of communication (walkie-talkie, etc.) between each party.

Annex 1

INVENTORY LIST OF HAZARDOUS SUBSTANCES

Table 1: Summary

UN Class	Maximum Quantity Stored On-Site (MT/Kg)
Class 2 Flammable Gas, Non-flammable Compressed Gas, Poison Gas	
Class 3 & 4 Flammable Liquid, Flammable Solid, Spontaneously Combustible, Dangerous When Wet	
Class 5 Oxidizing Agent, Organic Peroxide	
Class 6 Poison, Harmful, Infectious Substances	
Class 8 Corrosive	

Annex 1

Table 2: Details

Chemical	UN Class	PSA DG Grouping	FPA H/F/R*	Physical Form	Type of Packaging / Container	Unit Capacity of Packaging / Container (Metric Tonnes/Kg)	Total No. of Packaging / Container	Maximum Qty. Stored On-site (Metric Tonnes/Kg)

*** State the Health / Flammability / Reactivity value of the chemical**

Annex 2

CRITERIA FOR CALCULATING CONSEQUENCE DISTANCES

Hazard Model	Results
Thermal Radiation	**Distances to:**
	(1) 4.0 kW/m2
	(2) 12.5 kW/m2
	(3) 37.5 kW/m2
	(4) Maximum fireball radius
	(5) Duration of fireball
Blast Overpressure	**Distances to**
	(1) 5.0 psi
	(2) 2.0 psi
	(3) 1.0 psi
	(4) 0.5 psi
Exposure to Toxic Release / Gases	**Maximum Downwind distance to:**
Fatality Zone: 3% fatality	**Fatality Zone**
Injury Zone: IDLH (< 1% fatality for 30 mins. exposure)	**Injury Zone**
Hot Zone: IDLH	**Hot Zone**
Warm Zone: TLV	**Warm Zone**
	Using meteorological input: **• Wind speed = 1 m/s, Stability F** **• Wind speed = 2 m/s, Stability B** **• Wind speed = 3 m/s, Stability C** **• Wind speed = 1 m/s, Stability D**

Annex 3

ROLES AND RESPONSBILITIES OF COMPANY EMERGENCY RESPONSE TEAM (CERT)

Site Main Controller (SMC)

SMC shall be a senior member of the installation management. He shall be in charge of the overall emergency response operations in the company and the one to liaise with senior officials of relevant government agencies.

Key Responsibilities of the SMC include:

(a) Coordinate the activities of external emergency organizations and work closely with relevant government authorities.

(b) Provide relevant government authorities with the following:
   i) Site Layout Map
   ii) Building plan
   iii) Company emergency response plan
   iv) Company's hazmat inventory and location of hazmat inventory
   v) Overall worker population
   vi) Incident resources available at site

(c) Provide the Incident Manager with the necessary information and decisions to any action that concerns the company SOPs and policies

(d) Authorize the shutdown of operations in the company

(e) Authorize the release of information to media and government agencies

(f) Assist the Incident Manager in determining the termination of the emergency and authorizing re-entry upon complete recovery

Annex 3

Site Incident Controller (SIC)

He shall be a senior member of the installation supervisory staff. He is responsible of the overall actual ground response operations. He is to provide assistance and information to responding government authority during emergency operations.

Key Responsibilities of the SIC include:

(a) Establishing the on-site emergency response team

(b) Sizing up incident situations and recommending response strategy and tactical plan

(c) Determining incident control zones

(d) Setting up field incident command post

(e) Commanding and directing emergency response team

(f) Ensuring emergency responders' safety and monitoring personnel fatigue and stress

(g) Deploying emergency equipment and appliances

(h) Directing rescue operations if necessary

(i) Maintaining constant communication with the SMC and emergency responders

(j) Ensuring proper decontamination of equipment and responders

(k) Coordinating recovery activities

Annex 4

Detail Grouping and Tasks

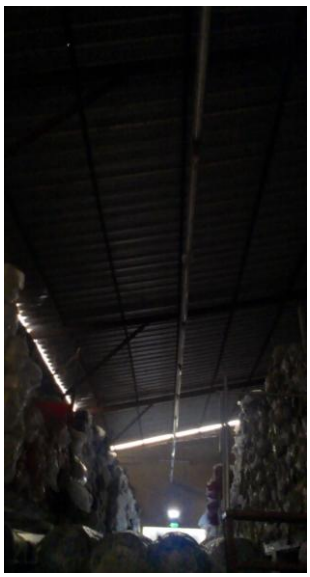
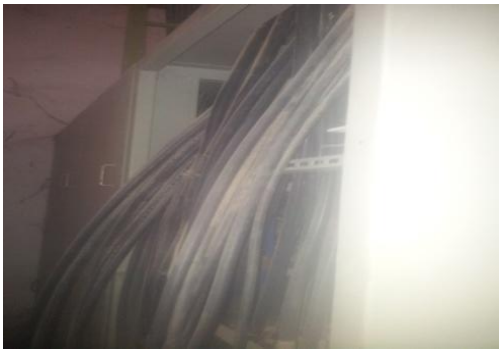
S/NO	GROUPING	GENERAL TASKS	PHASE	DETAILED TASKS	REMARKS
1	Site Main Controller		I		
			II		
			III		
			IV		
2	Site Incident Controller		I		
			II		
			III		
			IV		
3	Emergency Response Team		I		
			II		
			III		
			IV		

APPENDIX F

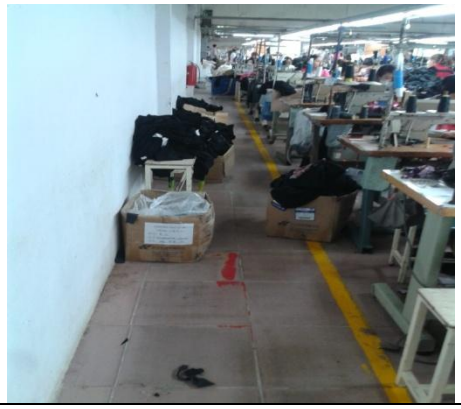
PHOTOS OF RISKS FROM THE SITE ASSESSMENT ACTIVITY

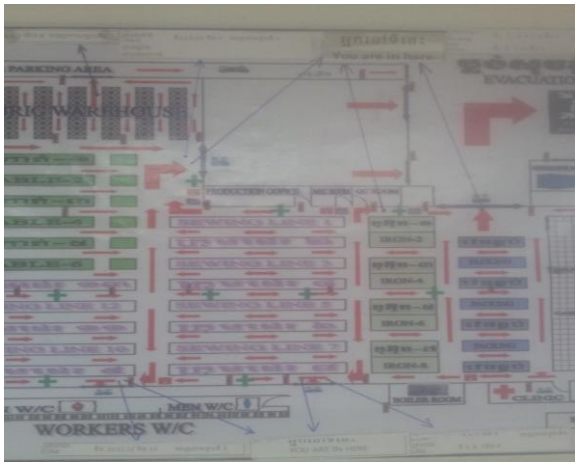
FIRE SAFETY RISKS/HAZARDS

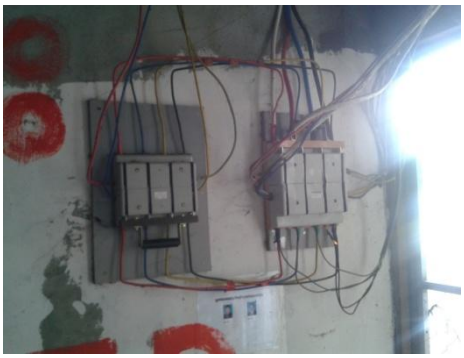
Cloth is used as drop ceiling in the production area.	
The maintenance/repair area (with grinding machine) is not properly segregated from other working areas.	
Smoking is permitted in a hazardous area.	
Emergency exits are locked and inaccessible during working hours.	 

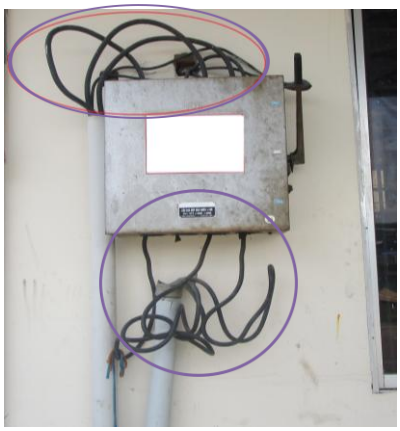
A fire hose cabinet is obstructed.	
Flammable waste materials are present at the blower and compressor equipment area.	
Flammable waste materials in the disposal area are not properly segregated.	
Electrical cables are exposed.	 

The installation of LPG tank is hazardous.	
The oven exhaust is not properly installed. The exhaust of the oven is within the room and is directed toward the PVC ceiling.	
A portable ceiling type extinguisher is not appropriately installed.	
Emergency lights and directional exit signs are insufficient.	 

Emergency exit pathways are obstructed.	  
The hose used for a fire extinguisher is substandard. An ordinary household hose was used instead of a correct fire extinguisher hose. In case of fire, this fire extinguisher may not function properly.	
The waste fabric area is unsecured and is made of light materials. Waste materials are also not compartmented or segregated properly.	
The boiler room is made of light materials such as plywood (i.e., easily combustible).	

Cables are improperly installed.	
The boiler is not properly enclosed.	
Evacuation plans posted at strategic places in the facility are insufficient.	
Fire alarms and smoke detectors are lacking in the entire facility.	

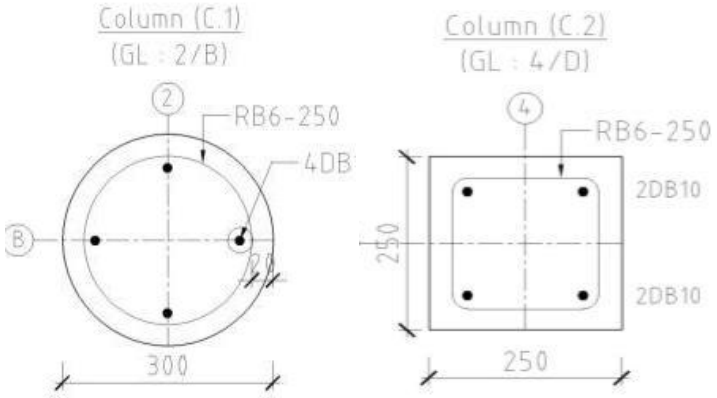
Panel boards and electrical cables are poorly installed.	 
The main distribution panel has no proper grounding system.	
The electrical conductor used for the ironing machine is substandard.	
Housekeeping and maintenance of standby power generator is poor.	
The hose of a fire extinguisher is not properly installed.	

The raceway/conduit used is substandard.	
The compressor equipment is not properly installed. The foundation is made of wood.	
Switchboard of the machine at the sole production area is not properly mounted.	
The main distribution panel is not properly labeled.	

BUILDING SAFETY RISKS/HAZARDS

The structure of the main facility is not well-constructed. (e.g., poor welding, no system to resist lateral load)	Small roof joists; slender and improperly braced steel columns; poor welding connections between steel members:  Disconnected steel members:  The connections between steel lattice columns and concrete columns are poorly constructed: 
The steel roof structure is made of built-up steel trusses and does not appear to be designed by an engineer.	

Elevated storage structure/mezzanine is not well-constructed or insufficiently supported. Since the structure is used as storage, overloading can eventually occur and cause structural failure. Welding connections are mostly spot welded and are unlikely to resist significant storage load.	 
The anchorage of the external roofing is detached.	
The emergency staircase at the office/dormitory building does not appear to be strong enough for emergency use.	
The load bearing structure of the balcony and steel bridge is not clear.	 There does not appear to be any beams supporting the cantilever balcony.  Sagging was noticed on the steel bridge.

Concrete strength and quality is low. (NDT: Rebound Hammer; Ultrasonic Pulse Velocity Test)	
Columns have low reinforcement ratio. (NDT: Rebar Scanning)	
Steel structures are corroded.	
Ancillary steel structures are not well-constructed.	

Lean-to structures are not well-constructed or insufficiently supported.	
A steel stairway is severely corroded.	
Slab scanning showed that no rebars exist in the ground slab. (NDT: Rebar Scanning)	
The overhead truss holding pipelines/cables does not appear to be properly fixed at the supports.	

Newly added pipelines on the overhead truss are insufficiently supported. Small pieces of steel were welded to the overhead truss to support newly added pipelines, which cannot fit inside the truss. Welding connections of these steel pieces do not appear to be sufficient.	
There is a leak in the water storage tank area.	
A column is out of position.	
A reinforcement bar is exposed.	
Ceiling panels are deformed and about to fall.