

Bangladesh Ready-Made Garment Industry High-Level Assessment Report

FINAL REPORT

PREPARED BY:
National Fire Protection Association
Quincy, Massachusetts USA

FOR:
The Alliance for Bangladesh Worker Safety
San Francisco, California USA

Note: *The findings and recommendations in this report are based on the work conducted by the project team and their visits in August 2015 to the factories identified by the Alliance in the Dhaka region of Bangladesh; they are limited to the information made available and accessible to NFPA as part of this project.*



© January 2016 National Fire Protection Association

NATIONAL FIRE PROTECTION ASSOCIATION
ONE BATTERYMARCH PARK | QUINCY, MASSACHUSETTS, USA 02169-7471
E-MAIL: GLOBAL@NFPA.ORG | WEB: WWW.NFPA.ORG

Executive Summary

The Alliance for Bangladesh Worker Safety (the Alliance) has embarked on a comprehensive program to improve worker safety in the Bangladesh Ready Made Garment (RMG) industry by upgrading factories, educating workers, and building a sustainable framework for continued improvement. This program includes key initiatives in the areas of building standards and inspections, and management and worker training.

The Alliance invited the National Fire Protection Association (NFPA), in collaboration with the University of Maryland (UMD), to provide an independent review of this program to improve worker safety. NFPA and UMD have a long history of collaboration on research and education and bring complementary strengths to this paid project.

NFPA and UMD traveled to Dhaka, Bangladesh on a fact-finding mission. This trip included visiting factories that had been identified in advance by the Alliance to see the remediation process first hand and interviewing key stakeholders. This report presents NFPA's high-level impact assessment and gap analysis of Bangladesh fire and building safety standards, protocols, inspection procedures and training programs. Section 2.0 outlines short-term recommendations that the Alliance can apply now, and Section 3.0 outlines long-term recommendations that provide a roadmap for sustainable electrical, fire and life safety in RMG manufacturing facilities.

National Fire Protection Association (NFPA) in collaboration with University of Maryland (UMD) and The Alliance for Bangladesh Worker Safety (AFBWS)



The findings and recommendations in this report are based on the work conducted by the project team and their visits in August 2015 to the factories identified by the Alliance in the Dhaka region of Bangladesh; they are limited to the information made available and accessible to NFPA as part of this project.

About the National Fire Protection Association (NFPA)

Founded in 1896, NFPA is a global, nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. The association delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy; and by partnering with others who share an interest in furthering the NFPA mission. [All NFPA codes and standards can be viewed online for free.](#) NFPA's [membership](#) totals more than 65,000 individuals around the world.



Table of Contents

Executive Summary	i
List of Tables.....	iv
1.0 Introduction	1
1.1 Background.....	1
1.2 A Partnership for Safety	2
1.3 Fact-Finding Trip to Dhaka	3
2.0 Findings and Short-Term Recommendations for the Alliance.....	6
2.1 Capacity Building.....	8
2.2 Inspection	8
2.3 Criteria for Factory Closure	9
2.4 List of Qualified Professionals.....	10
2.5 Training.....	11
2.6 Information Portal.....	12
2.7 Standards Guidance	12
2.8 Public Education	13
2.9 Extension/Transition of Alliance Activities.....	14
3.0 Findings and Long-Term Recommendations for Sustainability	15
3.1 Codes and Standards.....	16
Bangladesh National Building Code.....	16
Fire Prevention Codes.....	17
3.2 Code Regulation Practices.....	18
Construction Code Enforcement	18
Fire Prevention Code Enforcement	19
3.3 Fire Service	20
3.4 Professional Development and Certification	21
Engineering and Scientific Studies.....	21
Vocational Studies	23
Code Enforcer Studies.....	24
Professional Safety Association.....	25

3.5 Public Education	26
4.0 Conclusion.....	26
Appendix A: Short Bios of NFPA/UMD Team.....	28

List of Tables

Table 1: List of factories visited.....	4
Table 2: Organizations interviewed by NFPA in Bangladesh.....	5

1.0 Introduction

The Alliance for Bangladesh Worker Safety (the Alliance) has embarked on a comprehensive program to improve worker safety in the Bangladesh Ready Made Garment (RMG) industry by upgrading factories, educating workers, and building a sustainable framework for continued improvement. This program includes key initiatives in the areas of building standards and inspections, and management and worker training.

The Alliance invited the National Fire Protection Association (NFPA), in collaboration with the University of Maryland (UMD), to provide an independent review of this program to improve worker safety. NFPA and UMD have a long history of collaboration on research and education and bring complementary strengths to this paid project.

NFPA and UMD traveled to Dhaka, Bangladesh on a fact-finding mission. This trip included visiting factories that had been identified in advance by the Alliance to see the remediation process first hand and interviewing key stakeholders. This report presents NFPA's high-level impact assessment and gap analysis of Bangladesh fire and building safety standards, protocols, inspection procedures and training programs. Section 2.0 outlines short-term recommendations that the Alliance can apply now, and Section 3.0 outlines long-term recommendations that provide a roadmap for sustainable electrical, fire and life safety in RMG manufacturing facilities.

1.1 Background

NFPA is an international nonprofit membership organization founded in 1896, with over 65,000 members representing 100 nations supported by more than 300 employees around the world. The global mission of NFPA is to help save lives and reduce loss due to fire, electrical, and related hazards with information, knowledge and passion. That mission is accomplished through the promulgation of over 320 codes and standards for building, electrical, fire and life safety, electrical and fire data analysis and related research, professional development, public education and advocacy. Also, NFPA has an active international program focused on assisting governments and other international stakeholders to develop programs to meet their fire and life safety goals.



NFPA is the American National Standards Institute (ANSI) accredited national developer of consensus based codes and standards for the U.S. fire, building and electrical safety infrastructure. NFPA believes that the foundation for improvement in fire and building safety is the development, adoption and enforcement of effective building regulation in conjunction with public fire safety education.

1.2 A Partnership for Safety

The opportunity to work with the Alliance on this project supports NFPA's overall safety mission and, through the Alliance-NFPA Memorandum of Understanding signed in September of 2014, provides a vehicle for our continued collaboration toward achievement of that mission.

Through the Memorandum of Understanding, NFPA and the Alliance agreed to work together to provide information, guidance and access to resources to help protect the health and safety of workers by reducing and preventing exposure to recognized fire and electrical hazards. The agreement recognizes the Bangladeshi building and fire codes, NFPA codes and standards, the Alliance Standard on Fire and Structural Integrity and the Bangladesh Tripartite National Action Plan as integral parts of the effort to improve factory safety. NFPA and the Alliance recognize that cooperative and parallel efforts by the government and non-government organizations are important to achieving success.

The initial relationship led to an agreement in 2015 between NFPA and the Alliance, in collaboration with the UMD, for a fact-finding trip to Dhaka, Bangladesh. The trip covered four basic activities:

1. Visit a sample of factories identified by the Alliance that were targeted for remediation by the Alliance,
2. Observe building operations at such factories as well as the fire, electrical and life safety features and inspection processes,
3. Witness training sessions provided by the Alliance to in-country managers responsible for worker safety, and
4. Interview key stakeholders as identified by the Alliance and NFPA to understand both the existing capabilities to deliver worker safety and the level of engagement of these stakeholders with the concept of worker safety.



Based on these four activities, this report provides NFPA's high-level assessment with recommendations on subject areas and processes for the Alliance, government and other stakeholders to explore or undertake in order to institutionalize sustainable worker safety enforcement programs and infrastructure; factory fire, electrical and life safety best practices; and training for ongoing implementation of worker safety initiatives in Bangladesh. Note that neither the scope of the mission nor the findings in this report includes structural integrity and that the findings are based on the work conducted by the project team and their applicability is limited to the information accessible to NFPA as part of this project.

1.3 Fact-Finding Trip to Dhaka

NFPA, UMD and the Alliance participated in a fact-finding trip to Dhaka, Bangladesh August 15-25, 2015. Dhaka served as the base for the trip. As such, all of the factory visits and interviews were within the Dhaka region. The team did not visit Chittagong or other areas outside of the Dhaka region.

The team was comprised of NFPA vice president for research Kathleen Almand, PE, NFPA southwest regional director Ray Bizal, PE, NFPA southeast regional director Randy Safer and UMD adjunct professor of Fire Protection Engineering Dr. Noah Ryder, PE. All team members have backgrounds in fire protection, building safety codes and fire inspection. Short biographies of the NFPA team can be found in Appendix A. Additional technical support for this report was provided by additional staff at NFPA and UMD who did not participate in the fact-finding trip itself.

Factory visits were conducted by the NFPA/UMD team to observe their operation, witness the fire, electrical and life safety features, and understand the inspection processes used for remediation. A list of factories visited is in Table 1. Some of these factories were visited by all four team members and some were visited by a two-member team comprised of Randy Safer and Noah Ryder.

While all of the factories had undergone a complete assessment by a Qualified Assessment Firm (QAF), they were in various stages of remediation.



Factories that are sourcing products to Alliance members were the focus of the factory visits. The majority of the factories were not owned by the Alliance members. At the factories, the team held discussions with factory owners or their representatives about the assessments and remediation process. In a few cases, the factory owner was the building owner. In most cases, the factory owner was a tenant in a building. The building owner or representative was not always present in those instances when factories were building tenants.

Fourteen factory visits were completed by the NFPA/UMD team and remediation efforts identified. Most areas of factories and buildings were available for observation. Team members were able to discuss remediation issues with some factory engineers and remediation contractors on-site. Additionally, there were opportunities to approach factory workers and ask about their training and responsibilities regarding safety. At one factory, the team witnessed representatives from Fire Service and Civil Defence (FSCD) providing training to workers.

Table 1: List of factories visited

Lenny Apparels Ltd
Hopyic
FCI BD Ltd
DNV Clothings Ltd
Kwun Tong Apparels Ltd
Evince Factory
Stylecraft Ltd
Stoffatex Fashions Ltd
Cortz Apparels Ltd
AKH Shirts Ltd
Ashiana Garments Ltd



ACS Textiles
Marina Apparels Ltd
That's It Sports Wear Ltd Ha-Meem

The goals of the Alliance/NFPA relationship include promoting the institutionalization of sustainable worker safety enforcement programs and infrastructure, facilitating the adoption of best practices in the areas of fire, electrical and life safety, and encouraging the introduction of training programs in order to maintain on-going worker safety initiatives in Bangladesh. To this end, the team conducted interviews with a number of key stakeholders, including government officials and representatives from non-governmental organizations, in order to better understand local practices and capabilities. These interviews sought to collect concrete information on current worker safety efforts and also to explore the familiarity of stakeholders with core workplace safety concepts and practices. Representatives from 18 separate organizations participated in the interviews, as listed in Table 2.

Though some of the information provided in the interviews was contradictory, the team concluded that this information was representative of the varying perspectives honestly held by the interviewees.

Table 2: Organizations interviewed by NFPA in Bangladesh

Alliance for Bangladesh Worker Safety
Bangladesh University of Engineering and Technology (BUET)
Fire Service and Civil Defence (FSCD)
Bangladesh Garment Manufacturing and Export Association (BGMEA)
Bangladesh Knitwear Manufacturing and Export Association (BKMEA)
Bangladesh Ministry of Labour and Employment (MoLE)
Bangladesh Department of Inspections for Factories & Establishments (DIFE)



Group of Qualified Assessment Firms (QAFs)
Japan International Cooperation Agency (JICA)
Alliance Brands
RAJUK
Institute for Sustainable Communities (ISC)
Underwriters Laboratories – Dhaka (UL)
International Labor Organization (ILO)
Electronics Safety & Security Association of Bangladesh (ESSAB) and their member company representatives
Institution of Engineers, Bangladesh (IEB)
The Accord
U.S. Embassy Labor Attaché

The public education training programs developed by the Alliance to deliver to workers were reviewed by NFPA for general messaging issues. Although the team witnessed some training during the fact-finding trip, the assessment of training activities was not within the scope of this project.

2.0 Findings and Short-Term Recommendations for the Alliance

The objective of the Alliance is to establish a minimum level of safety for factories, conduct safety assessments of all factories that source to their members, identify remediation necessary to meet the established minimum standard of safety, and implement the remediation. In addition, the Alliance is providing safety training to workers and management.



Based on the efforts undertaken by the Alliance, it is clear that the Alliance staff, in Bangladesh and abroad, is working hard to complete the identified tasks. This is a results-oriented operation, working to meet the goals within the predetermined five-year time limit, which ends in mid-2018.

Together with the Accord, the Alliance has developed a common standard to guide all factory inspections. This standard has been harmonized with the National Tripartite Plan of Action in order to ensure consistency with the countrywide evaluation of RMG factories. Note that this report is not an assessment of the validity of that standard.

The Alliance has also developed a document, *Assessment Protocols for Initial Fire Safety and Structural Integrity for Existing Factories*, to provide guidance on how to conduct assessments and report initial findings. At the time of the fact-finding trip, all Alliance factories had been through an initial assessment. These assessments were conducted in each of these principle areas of safety: structural integrity, electrical safety, and fire safety. Assessments were conducted by Qualified Assessment Firms with assistance from the Alliance technical staff.

The QAF engineers were required to follow the protocols outlined. After undergoing review, the reports were submitted to the factories. Findings from completed assessment were published through the Fair Factories Clearinghouse (FFC).

The Alliance is working with factories to appropriately address any safety violations. The remediation program is intended to improve structural integrity, electrical safety and fire safety by guiding factories through a Corrective Action Plan (CAP) process to ensure credible remediation and compliance with the standards. If a factory was primarily sourcing for the Accord members, the Alliance accepted and used the Accord inspection reports and CAP to track remediation progress.

In the remediation phase, remediation efforts are being prioritized and implemented. Some remediation efforts, such as fire sprinkler and fire alarm systems, take a longer period of time to complete. The remediation continues until the factory completes all the compliance issues in the CAP, at which time the factory will undergo a final inspection. Where significant design is needed for remediation, the Alliance is providing plan review services.

As indicated, all factories have been assessed, the CAPs are developed for all factories, and remediation is in varying stages for the factories. The NFPA/UMD fact-finding trip included



fourteen (14) factory visits, where some factories visited had completed remediation, some were in the process of remediation, and some had not begun remediation.

The Alliance program has clearly raised the level of awareness of electrical, fire and life safety, and care is being taken by the Alliance to ensure that the remediation work is completed correctly. But there is a lot of work still to be done.

2.1 Capacity Building

Safety engineering capacity is one obstacle the Alliance must overcome in order to meet the demand within the five-year self-imposed timeframe.

In August of 2015, all factories sourcing for the Alliance had undergone their initial inspections and remediation plans were under development and review prior to construction. These remediation plans are being returned by the Alliance plan reviewers to the designers multiple times for noncompliance. As a result, the Alliance plan review process has slowed, which in turn has slowed down the implementation of remediation. This could be improved by hiring professional assistance from trained and qualified consultants to complete the plan review backlog, or increase the number of trained and qualified Alliance personnel conducting plan review services. It is important that quality plan review be conducted to help ensure that remediation is ultimately effective.

Recommendation 2.1:

It is recommended that the Alliance increase its capacity to reduce the backlog of plan review, either by hiring more people to conduct plan review or by contracting to qualified agencies for conducting plan review services.

2.2 Inspection

Although the Alliance is making great efforts to review plans for remediation, it is equally important to provide construction inspections early during the installation process to help



mitigate poor compliance with the reviewed plans. This quality control will improve effectiveness of design measures and allow corrections to be made before the entire system is installed.

This is particularly important for high-value systems, such as fire sprinkler systems, building compartmentation (fire doors), and fire alarm systems, where catching a repetitive error early could save money and effort. This quality control effort would also allow drawings to be corrected to show as-built conditions.

Early intervention could be accomplished by utilizing trained and qualified consultants to completely inspect the construction and installation of systems, or increase the number of trained and qualified Alliance personnel to fulfill inspection needs.

Recommendation 2.2:

It is recommended that the Alliance provide early and ongoing inspections during remediation construction to ensure adherence to approved plans so as to achieve proper and effective remediation.

Recommendation 2.3:

It is recommended that design drawings be amended to show as-built conditions after inspections of remediation construction.

2.3 Criteria for Factory Closure

The Alliance has established criteria for structural integrity assessments which determine critical issues that escalate remediation and may lead to suspension of operations. They have worked with the government so that they may determine imminent closure. However, no such criteria have been established for the electrical, fire and life safety assessments of factories. In some cases, factories may be imminently dangerous without effective recourse, and money spent towards remediation may be better spent on factory relocation.

The most important aspect of the criteria is whether it is reasonable to expect occupants to successfully egress from a building that is undergoing a life-threatening event. This includes consideration of the exit capacity and ability to retrofit the exits. If there is no possibility for



reasonable egress or for remediating the issue, then the Alliance should consider suspending operations within the factory or be responsible for providing an equivalent measure of protection that would be demonstrated through a risk matrix/assessment.

Such criteria could be established for electrical and fire safety integrity assessments of factories that determine critical issues that escalate remediation and even determine suspension of operations. The criteria could be established by the use of a qualitative risk analysis. Immediate actions for escalation may include establishment of a fire watch program at the factory during the escalation process and prior to factory closure. Such a program would establish a person in charge (with no other duties) of the fire and life safety of the factory at all times. This fire watch should include crowd management, implementation of fire safety measures to reduce risks, frequent fire drills, and a schedule of appropriate interim fire watch inspections.

Recommendation 2.4:

It is recommended that the Alliance develop criteria for electrical, fire and life safety assessment deficiencies posing an imminent threat to life safety, as are done for structural safety. These criteria could be used to determine critical issues that require interim fire safety measures and escalate remediation. These criteria should be used in the escalation/suspension process, with notification to the government throughout so they can take steps with the factory if/when the Alliance decides to suspend operations at that factory. The government response should even consider imminent closure.

2.4 List of Qualified Professionals

The Alliance is working with a number of different designers and contractors and the results vary based on the experience and qualifications of these professionals. Qualifications can be measured through national or internationally established professional organizations providing training and certification. Examples of analogous U.S. based qualifications include such credentials as Certified Fire Protection Specialist (CFPS), National Institute for Certification in Engineering Technologies (NICET), licensing as a Professional Engineer (PE), or extensive experience under the supervision of a qualified engineering professional. Bangladesh equivalents may or may not exist; other qualifications may be reasonable to consider.



As remediation work progresses, the Alliance becomes more familiar with the capabilities of the designers and contractors through their work experience and performance, or by training and certifications. Maintaining a list of approved designers and contractors could assist the Alliance hire more effective and efficient professionals. Conversely, designers and contractors whose performance did not meet expectations could be removed from the list.

Recommendation 2.5:

It is recommended that the Alliance establish and maintain a list of designers and contractors that are known to be qualified through experience, or are deemed to be qualified by training and certifications in specific areas of expertise.

2.5 Training

Across the board, those involved in the Alliance remediation efforts indicated a need for a better understanding of the requirements of the NFPA codes and standards referenced in section 1.6.5 of the *Alliance Fire Safety and Structural Integrity Standard*. Training would benefit design engineers, factory personnel, plan reviewers, installers, construction inspectors, and system maintenance personnel. Consideration should be given to including the Accord, ILO and Institute for Sustainable Communities (ISC) since they mirror the Alliance efforts, and in some cases overlap.

Implementation of training will increase the efficiency of the design/installation process and ensure a higher degree of effective remediation. This will help ensure that designs are prepared with a higher degree of compliance, thereby increasing the efficiency of the plan review process and reducing turn-around time. It would also promote a higher degree of compliance in system installations, ensuring system effectiveness, reliability and proper maintenance.

Training can be accomplished by hiring any number of consultants or organizations to provide in-house training, followed up by web-based refresher training.

Recommendation 2.6:

It is recommended that training be provided in the near future for those involved in the design and installation of factory remediation, and to those involved in the inspection, testing and maintenance of the remediation work.



Training should be provided on the following NFPA Standards:

NFPA 13, *Standard for the Installation of Sprinkler Systems*

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*

NFPA 22, *Standard for Water Tanks for Private Fire Protection*

NFPA 25, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*

NFPA 70, *National Electrical Code* ®

NFPA 72, *National Fire Alarm and Signaling Code*

NFPA 101, *Life Safety Code* ®

2.6 Information Portal

Similar to the common desire for training on the NFPA codes and standards, many suggested the need for an information platform for the electrical, fire and life safety community in Bangladesh. The Alliance would be able to provide timely information to those involved with remediation, and others would be able to discuss issues related to remediation and compliance. This could be accomplished by developing an on-line community with discussion capabilities and resources.

Recommendation 2.7:

It is recommended that, in the near future, an on-line information platform be established for those involved in the remediation to discuss issues, share ideas, and access information.

2.7 Standards Guidance

Some involved in the remediation efforts were unfamiliar with the proper application and use of the *Alliance Fire Safety and Structural Integrity Standard*. A commentary to the standard, if developed, could also include a mapping of the codes and standards to be utilized and indicate how they interact with each other. This information should be provided on-line, and consideration should be made to providing this to the Bangladesh government agencies involved in codes and standards development and enforcement.



Recommendation 2.8:

It is recommended that the Alliance develop a commentary on how to effectively and efficiently utilize the *Alliance Fire Safety and Structural Integrity Standard* during the remediation effort.

2.8 Public Education

The Alliance has developed public education programs for managers and workers to educate them on a variety of safety issues.

There are a number of stakeholders, such as factory owners, compliance auditors and midlevel managers, whose oversight responsibilities could position them as “first interveners” for electrical, fire and life safety. Training on the fundamentals of electrical, fire and life safety (housekeeping, exit pathways, equipment labeling, etc.) could be developed and offered at no charge to these stakeholders.

In some factories, factory workers have been trained to take on responsibilities for safety. These workers were easily identified as having been trained in first aid or initial firefighting. Some were also trained to take on responsibilities as floor fire warden.

The fact-finding team learned from several factory owners that productivity had increased when they provided this type of training and upgraded their electrical and fire safety systems. They identified the business benefits for providing safer factories indicating there was better attendance, better employee retention, and less production down time when these safety measures were in place.

A significant benefit of this type of stakeholder training is encouraging safety awareness among employees to maintain a minimum level of safety.

Recommendation 2.9:

It is recommended that training be provided for factory owners, compliance auditors and mid-level managers. This could be provided by distance learning or a one to two day course offered in conjunction with compliance audit training or management training. Curriculum exists internationally and should be modified for local conditions and local languages. Support for this learning should come from a consortium of brands/manufacturers who are the end users.



Recommendation 2.10

It is recommended that basic public fire safety messaging components be developed to improve the knowledge of workers in fire, electrical and general building safety hazards. These components (in a format appropriate to the application) should be based on the general public safety principles embedded in NFPA's public education programs, but adapted for the Bangladesh workplace. These products could form the basis for dialogue between employers, families, workers as well as contract factories and the brands as identified in the AFBWS guidelines.

Recommendation 2.11:

It is recommended that the Alliance develop a "Fundamentals of Building, Fire and Life Safety" text consisting of basic building and fire protection safety practices for commercial facilities, and this program should be developed in the form of information modules.

Recommendation 2.12:

It is recommended that the Alliance develop training programs for the standards development, adoption, plan review, inspection and enforcement communities based on these information modules (in web based or other forms as appropriate).

2.9 Extension/Transition of Alliance Activities

An extraordinary amount of effort has been dedicated to assessing and remediating all of the Alliance factories, but the pressure to have all the factories remediated by the impending end of the Alliance should be balanced with completing all the remediation properly. In order to have the biggest impact on sustainable safety in the industry, the Alliance should remain until all the factory remediation has been completed and the factory personnel are familiarized with necessary inspection, testing and maintenance. If the Alliance is not extended, the Alliance should transition their efforts to the government, individual brands, or to NGOs.

The system of assessing (inspecting) factories, developing a remediation plan, enforcing the codes and standards from design through occupancy established and used by the Alliance is effective. Currently, the infrastructure established by the Alliance for factory remediation is not being used to train those from the government or NGOs that will continue the work after the Alliance is gone. This could be accomplished by working with the government or NGOs to shadow



the Alliance during plan review, construction inspections, occupancy, and on-going inspection, testing and maintenance programs.

The work that the Alliance has done and is doing of inspecting factories for compliance with minimum standards, reviewing designs of upgrades and inspecting construction, inspecting the maintenance of the safety features and existing facilities and training management and workers should ultimately transition to the government. A succession plan would benefit in this transition.

Since the Accord will be ending their commitment too, the Alliance should collaborate with the Accord on transitioning their work to the national government. Assistance from non-government organizations, like the ILO and industry trade groups, will be necessary to transition this work of the Alliance. Safety associations, universities, and national and international organizations should be able to monitor the progress of the government as they manage the safety of their citizens.

Recommendation 2.13:

It is recommended that the Alliance reach out to vested and non-vested organizations such as the ILO, the Institute for Sustainable Communities, BGMEA and BKMEA, and the government to develop a succession plan to assist the national government to transition the work of the Alliance to the appropriate government agencies. This should be done collaboratively with other efforts such as the Accord and the ILO.

Recommendation 2.14:

It is recommended that consideration be given to extend the Alliance or develop plans to transition the Alliance effort after the Alliance is gone in order to oversee completion of factory remediation, system inspection, testing and maintenance programs, and new factory construction. The Alliance brands should be encouraged to incorporate this work into their social compliance auditing if the Alliance is not extended.

3.0 Findings and Long-Term Recommendations for Sustainability

As indicated above, it is vital that the work of the Alliance be sustained. This means that factories need to be maintained at the high level of safety to which they have been remediated.



Inspection, testing and maintenance of those remediated factories will be important into the foreseeable future.

It also means that other factories, which may source to Alliance brands in the future, including those not yet built or occupied, should also be scrutinized to the same level. This broad responsibility must be shared by the various fire and electrical safety stakeholders in Bangladesh.

3.1 Codes and Standards

Bangladesh National Building Code

The 2006 edition of the Bangladesh National Building Code (BNBC) is currently being used in Bangladesh. This code, which was and continues to be developed by the Bangladesh University of Engineering and Technology (BUET), is comprehensive for new construction; however, its development does not appear to be conducted in an open, consensus process with equal opportunity for all stakeholders to participate. Further, the BNBC is not developed on a scheduled frequency for responding to technological or societal updates.

The Alliance developed and is using the *Alliance Fire Safety and Structural Integrity Standard* as the minimum standard for Alliance factories. The basis for the Alliance standard is the 2006 BNBC, but the Alliance standard has additional requirements above and beyond the BNBC.

Recommendation 3.1.1:

It is recommended that the Bangladesh National Building Code, and other relevant construction, electrical, fire and life safety codes be developed in an open, consensus process that allows all stakeholders to participate equally. It is also recommended that this development process ensure fairness, due process, and a means of appeal. It should be reoccurring on a reasonable frequency.

Recommendation 3.1.2:

It is recommended that the Alliance participate in the BNBC change process recommended above and suggest revisions to mirror the provisions found in the *Alliance Fire Safety and Structural Integrity Standard*.



Fire Prevention Codes

Currently there are few requirements in the BNBC that regulate the use and occupancy of existing buildings for fire and life safety. There does not appear to be a comprehensive fire prevention code established to regulate the use and occupancy of existing buildings for safe operations. The provisions in such a code should address a minimum level of safety features for buildings based on occupancy. These provisions would help sustain a safer environment for the future use of these buildings.

Providing a comprehensive fire prevention code for existing buildings and occupancies is imperative to the sustainability of the Alliance remediation efforts, as well as the RMG sector altogether. The Alliance has already established minimum requirements for its existing factories. Remediation work is being conducted based on this standard. Consideration should be given to utilizing this as a basis for the government fire prevention code. This would be a long-term effort for Bangladesh, but it needs to begin.

Recommendation 3.1.3:

It is recommended that provisions of a fire prevention code for maintaining existing occupancies be developed and published in a separate code from the building code. This code should establish minimum requirements for building features in existing buildings, fire safety and housekeeping requirements for occupancies, fire prevention requirements, and inspection, testing and maintenance requirements for fire and life safety systems. This fire code should be maintained in an open, consensus process that allows all stakeholders to participate equally. It is also recommended that this development process ensure fairness, due process, and a means of appeal. It should be reoccurring on a reasonable frequency. This effort could be considered by BUET or collaboratively with another agency, such as Fire Service and Civil Defence.

Recommendation 3.1.4:

It is recommended that minimum standards established by the Alliance for existing buildings and occupancies be recommended for consideration by the Bangladesh government for inclusion in the fire prevention code.



3.2 Code Regulation Practices

Construction Code Enforcement

Currently, remediation construction efforts are being conducted and reviewed by the Alliance. However, once the Alliance term expires, it is not clear that complete plan review and related services will be conducted by the national or regional government. It is imperative that complete plan review – for structural, electrical, fire and life safety regulations – be conducted to ensure that buildings and systems are designed and constructed in accordance with national codes and standards.

Depending upon where a building is constructed, there may be different organizations taking an active role in regulating the construction. In Dhaka, RAJUK is given the authority to regulate construction. In Chittagong, the Chittagong Development Agency (CDA) is overseeing construction, and in the Export Zones it may be the Bangladesh Export Processing Zone Authority (BEPZA). In other areas of the country, there may not be any agency regulating construction. Consequently, there may be considerable gaps in the regulation of construction in Bangladesh.

It is our understanding that RAJUK conducts plan review only of the structural loading. It is important that a complete plan review be conducted on structural, electrical, fire and life safety designs of buildings. It is also important that inspections confirm whether buildings are being constructed in accordance with approved plans for all aspects of design. The building should also be recognized as fit for occupancy when construction is completed and a certificate of occupancy is issued, which defines the occupancies allowed based on the construction. Doing so would help sustain the level of safety embarked upon by the Alliance into the future.

Recommendation 3.2.1:

It is recommended that authority be provided for regulation of construction throughout the entire country of Bangladesh.

Recommendation 3.2.2:

It is recommended that a full plan review be conducted to the BNBC and other related construction codes and standards by those agencies, such as RAJUK, CDA, and BEZPA, which have the authority to regulate construction. This should apply to new construction, retrofitting construction on existing buildings, and a change of occupancy for buildings. The plan review



should include structural, electrical, fire and life safety provisions of the code and extend into related construction inspections to confirm compliance with the codes.

Recommendation 3.2.3:

It is recommended that each building under construction, undergoing remediation, or that is changing occupancy be issued a certificate of occupancy prior to building occupancy. This certificate by the governing authority affirms that the building has been designed, constructed and occupied in accordance with the regulations set forth in the BNBC (and other national codes and standards) and that the building is fit for occupancy as described by the regulations.

Recommendation 3.2.4:

It is recommended that government agencies with the authority to regulate construction shadow the work by the Alliance (and Accord) to learn from their work and become familiar with the system that has been implemented for the remediation.

Fire Prevention Code Enforcement

Fire Service and Civil Defence appears to unsystematically visit buildings and provide fire safety training to factory workers, but it does not appear that any national agency is conducting regular fire inspections of existing occupancies. It is important to ensure existing buildings are being utilized for the purpose for which they were designed and constructed. Regular fire inspections also serve to monitor for changes being made to building features and for changes to the use or occupancy, both of which could jeopardize the safety of the occupants.

Fire and life safety inspections would greatly reduce the risk of fire and other hazards, and sustain the work completed by the Alliance into the future.

Recommendation 3.2.5:

It is recommended that fire prevention inspections of existing occupancies be conducted by FSCD on a systematic basis to ensure that a minimum level of safety is maintained during on-going occupancy of existing buildings based on the codes adopted. These inspections should also ensure that electrical, fire and life safety systems are inspected, tested and maintained in accordance with the codes and standards adopted. In the interim, in accordance with the short-term recommendations, the Alliance brands should be encouraged to continue to follow up with fire prevention inspections through their social compliance audits.



Recommendation 3.2.6:

It is recommended that government agencies with the authority to regulate fire prevention codes of existing buildings shadow the work by the Alliance (and Accord) to learn from their work and familiarize them with the system that has been implemented for the remediation.

3.3 Fire Service

Fire services are provided by the Bangladesh government organization *Fire Service and Civil Defence* (FSCD). This is a more centralized way of providing firefighting services to the public utilizing larger strategic fire stations throughout the country, rather than a number of tactically placed fire stations.

Firefighters appear to be trained and equipped for fire and emergency response. The largest obstacle to fire operations is population density. Due to the sheer number of people in the population centers, response is hindered by traffic. As a result, fire department response is likely not to occur prior to flashover. For this reason, fire prevention measures are considered to be most important and should be emphasized.

Due to the traffic congestion and centralized form of firefighting operations, current fire station locations may not provide the best response. An evaluation of potential station locations to provide for a quicker response would benefit the factories served by FSCD. This evaluation could be based on the type and frequency of fires experienced in different locations within Bangladesh.

It was noted that in the Export Zones, fire stations were placed to serve these areas. This appears to provide a more positive tactical response to a controlled area.

In some cases, factories have established fire brigades that are trained and equipped for firefighting purposes. This includes capabilities to address fire operations in the entire building with trained personnel and modern firefighting equipment. The expanded use of private fire brigades could be an alternative to reducing public fire department response times by decentralizing fire department locations.



Recommendation 3.3.1:

It is recommended that consideration be given to establishing fire stations that are more tactically positioned in clusters of buildings for faster response. An alternative would be training factory owners to operate fire brigades for firefighting operations within their buildings. This could be done in accordance with standards for fire brigades, such as NFPA 600, *Standard for Industrial Fire Brigades*.

3.4 Professional Development and Certification

In order to develop and sustain electrical, fire and life safety in Bangladesh, awareness and knowledge of the principles and practice of these safety topics are required. It is apparent that there are gaps in knowledge related to electrical, fire and life safety in various key stakeholder groups and at various levels. These gaps must be filled in order to develop and sustain electrical, fire and life safety in Bangladesh. Some of this has been addressed in the short-term recommendations, but it has a far reach for future Alliance factories.

Currently, there are international training, certificate and certification programs available that focus on different aspects of electrical, fire and life safety. Encouraging stakeholders in building design, construction and code enforcement to participate in training and achieving certification in electrical, fire and life safety will help fill the knowledge gaps.

Engineering and Scientific Studies

Engineering and sciences are taught at the major universities, but there are insufficient engineering and science courses in the areas of basic fire science and building, fire and electrical safety. The need for education and training in these areas extends from design and plan review to inspection, testing and maintenance. Providing such courses will help in the sustainability of the safety climate in Bangladesh as this knowledge spreads into the existing codes and standards and manifests into safer buildings.

Courses could be implemented at the universities that extend from the general engineering disciplines into related electrical, fire and life safety. For example, electrical engineering principles could extend to electrical safety design and fire alarm design. Architectural engineering principles could extend into fire science, fire behavior, and human behavior in fire



scenarios. Civil or mechanical engineering principles could be applied to fire suppression systems and hydraulics. At some point elective courses could be combined into an undergraduate or graduate program.

While fire protection engineering education does not exist in Bangladesh at the university level, there also do not appear to be any certificate programs for graduate or senior level undergraduate engineers. Such curriculum, covering the essentials in fire and life safety design for the engineering professional, would aid in sustaining a safety culture in the engineering community, which would ultimately manifest as safer buildings. The curriculum should include courses that cover basic fire science and principles of electrical and fire safety design, and should focus on the practice of design, inspection and maintenance of systems. In addition to the training provided by these certificate programs, certification would demonstrate competence in the subject areas of expertise.

The Bangladesh Professional Engineers Registration Board is maintained through the Institution of Engineers, Bangladesh. Requirements for registration include a recognized engineering degree, membership in the Institution, work experience, and achievement in the Core Training Objectives noted in several reports.

While registration is not specific to a practice, membership in the Institution is described by engineering divisions: Civil, Mechanical, Electrical, Chemical, Agricultural, Computer and Textile. There is no division identified for Fire Protection. While the Institution of Engineers, Bangladesh maintains a combined membership of over 40,000, there are considerably fewer registered Professional Engineers and no requirements for licensure to practice.

Recommendation 3.4.1:

It is recommended that BUET, and other educational organizations, establish a resource or knowledge platform for courses related to fire protection engineering. This resource should be scoped and developed based on an assessment of the needs of the community; global resources should be adapted to meet the country needs. This will provide capacity in the long term for fire and life safety engineers. These courses could eventually be considered for an undergraduate or graduate degree program in fire protection engineering.

Recommendation 3.4.2:

It is recommended that a certificate program for graduate or senior level undergraduate engineers be developed in the near term because the development of a full undergraduate



education program in fire protection engineering is only achievable in the relative long term. This certificate program curriculum should cover the essentials in fire and life safety design for the engineering professional, and a certificate of completion of the curriculum would serve as a credentialing mechanism. This will provide more near term capacity for fire and life safety design professionals.

Recommendation 3.4.3:

It is recommended that engineers be trained on the codes and standards regulating the types of electrical, fire and life safety systems they are designing.

Recommendation 3.4.4:

It is recommended that the Institution of Engineers, Bangladesh be encouraged to establish a division of engineering for Fire Protection.

Vocational Studies

A wide range of capabilities exists in the fire and electrical contracting communities, but it is nevertheless apparent that comprehensive training is needed for both electrical and fire safety contractors. Training needs include fire protection fundamentals, codes and standards training, and vocational training.

There does not appear to be specific training or licensure requirements for those installing fire alarm systems or water-based fire suppression systems. Very different skills and knowledge are needed to install these two types of systems. Different skills and knowledge are also needed to properly install fire alarm systems from general electrical systems or to properly install an automatic fire sprinkler system versus a potable water system.

No vocational schools were identified in Bangladesh that focus on fire safety systems, and there do not appear to be any agencies licensing contractors to perform installations. Vocational and standards training could be filled by a fire protection association, or an industry association. Completion of a subject program could be the basis for a licensure program.

Most important is to provide training to those installing electrical and fire protection systems. This will increase the knowledge base of the installers, and ultimately increase the capacity of



those installers. It will also increase the sustainability of electrical and fire and life safety, as systems are installed to a higher degree of reliability and competency.

Recommendation 3.4.5:

It is recommended that vocational training be established for contractors that are installing electrical and fire protection systems. This could be accomplished through a formal educational institution, a trade association, or a fire protection association. Completion of a particular program could be the basis for licensing in a particular field; continuing education should also be considered as a requirement for continued licensure.

Recommendation 3.4.6:

It is recommended that contractors performing installations of fire alarms and fixed suppression systems be certified by a credible international organization in the short term, since establishing a formal vocational training system is a long-term goal.

Recommendation 3.4.7:

It is recommended that contractors be trained on the codes and standards regulating the types of electrical, fire and life safety systems they are installing.

Code Enforcer Studies

There is a gap in the level of knowledge of codes and standards with private and public sector enforcement personnel. A minimum level of training should be provided to those involved in building and fire code enforcement.

Those involved in code enforcement should also consider achieving certifications in electrical, fire and life safety. Several international associations already offer these types of certification programs. An example is NFPA certifications for Fire Inspector I, Fire Inspector II and Fire Plans Examiner. For those involved in the construction of electrical systems, NFPA maintains a program for Certified Electrical Safety Worker. For those involved with code enforcement, design and construction, NFPA maintains a program for Certified Fire Protection Specialist.



Recommendation 3.4.8:

It is recommended that a training academy for building and fire code officials be established. Graduation from this academy would require completion of a curriculum of training courses and practicum, which can be modeled after international examples. Graduation would be the basic credential for fire or building inspectors. Public sector organizations such as FSCD and RAJUK should be primary stakeholders. Curriculum guidance can come from the international community and be adapted for local use and language.

Recommendation 3.4.9:

It is recommended that those involved in enforcement of codes and standards achieve certification in international fire and building code enforcement programs.

Recommendation 3.4.10:

It is recommended that those enforcing codes and standards be trained on the codes and standards regulating the types of electrical, fire and life safety systems they are reviewing and inspecting.

Professional Safety Association

There is a need for ongoing information and training resources, and networking platforms for the electrical, fire and life safety community. An electrical, fire and life safety institute or association would provide a resource and knowledge platform to both the public and private sector. Regular meetings would provide a point for networking and allow those interested in safety to focus attention on established goals in the community regarding safety. This would also allow the opportunity for professionals to share their expertise and formalize training programs.

Currently, the Electronics Safety and Security Association of Bangladesh (ESSAB) is a focal point for many involved in the installation of fire protection systems. Established in 2013, this non-profit association has taken an interest in increasing the professionalism of the fire protection industry. It is identified as a trade association, which might not encompass all stakeholders involved in fire protection or electrical safety, including the fire service, government safety representatives.



Recommendation 3.4.11:

It is recommended that a fire and electrical safety institute or association be available to serve as a resource and knowledge platform for electrical, fire and life safety, which is available to the public and private stakeholders. The optimum model for this is a public/private sector collaboration which would include guidance and funding from all stakeholders. This should be a NGO, with a focus on the subject of safety, rather than a particular stakeholder.

3.5 Public Education

In addition to the public education efforts of the Alliance to managers and workers, Fire Service and Civil Defence and the Department of Inspection for Factories and Establishments (DIFE) are both providing public education to factory workers and managers. This messaging should be coordinated and based on the programs developed by the Alliance to ensure that it is reinforced and not conflicting. To sustain this program, the national government should establish a schedule for outreach for safety education.

Recommendation 3.5.1:

It is recommended that the national government, either through FSCD or DIFE, be encouraged to take the fire safety messaging developed by the Alliance and continue to provide this as public education to workers and managers on a regular schedule.

4.0 Conclusion

The tragedy of Rana Plaza and numerous fatal fires in the RMG industry spurred a movement to improve factory safety in Bangladesh. The Alliance is carrying out a significant amount of work to increase the level of safety in their sourcing factories.

This increase in safety by the Alliance is also being felt beyond the Alliance factories simply by affecting the buildings that house those factories. Momentum is carrying this issue of safety in the RMG industry, and it is being taken seriously by non-government organizations and the Bangladesh national government alike.



Many of the observations in this report address the issue of sustaining the tremendous work of the Alliance. Clearly, the national government has a key responsibility for sustaining the level of safety into the future. The Tripartite Plan of Action indicates that the national government understands this responsibility.

Stakeholders have also invested a great deal of effort and financial resources to accomplish the goal of increased safety in the RMG industry. But the end of the five-year commitment is just the beginning of movement for the safety revolution in Bangladesh.

This commitment to safety is an important part of the investment in the RMG industry and will help to achieve future export goals. The investment is not just from the brands and retailers receiving the products; it is an investment by the factory owners, building owners and the national government. This concerted effort has helped the Alliance to achieve these safety goals. It must continue and grow.

It is incumbent on non-government organizations to take a portion of the responsibility for the safety of the industry. Future incidents will affect all stakeholders. Garment industry trade associations vested in the industry, such as the Bangladesh Garment Manufacturers and Export Association and the Bangladesh Knitwear Manufacturers and Export Association, should play a vital role in maintaining the level of safety being established through the Alliance work and securing safe factories in the future.

The Bangladesh national government must continue to grow into their responsibility. Meeting this responsibility could be achieved at the national or the regional level, as long as consistent levels of safety are provided throughout the country.

Overall, the Alliance has taken on a huge responsibility to increase the level of safety to workers in factories sourcing to the Alliance brands. A tremendous amount of effort has already occurred and a considerable amount of work is yet to be done. All of this is scheduled within a five-year timeframe. For the short-term, the work is progressing well and the Alliance is doing a good job to achieve the goal of an increased level of safety. The sustainability of these efforts after the five-year timeframe depends on how well these efforts are transferred to other stakeholders.



Appendix A: Short Bios of NFPA/UMD Team

Raymond B. Bizal, P.E.

Mr. Bizal is the Southwest Regional Director for the National Fire Protection Association (NFPA). In this capacity, he provides outreach to NFPA stakeholders regarding the many activities undertaken by the association. He also supports the adoption and enforcement of NFPA codes and standards, and advocates for fire safety at the local and state legislative levels.

Prior to joining NFPA in 2000, Ray spent 12 years with the International Conference of Building Officials (ICBO) and International Fire Code Institute (IFCI), where he served in several positions, including Uniform Fire Code Coordinator and Manager of Code Development. As manager of code development, he was responsible for the development of the Uniform Codes and related documents, as well as ICBO's participation in the technical development of the ICC's International Codes and related documents. He also served as staff liaison for the drafting and development of the Wildland Urban Interface Code in the late 1990's, which was produced through the California State Fire Marshal's office from a FEMA grant.

With nearly 30 years in the fire protection profession, Ray also worked at the Lockheed Missiles and Space Company Fire Department as a fire protection specialist, and Factory Mutual Engineering Association as a loss prevention consultant. Holding a Bachelor's degree in Mechanical Engineering from the University of Colorado at Boulder, he is a registered Fire Protection Engineer in California.

Kathleen H. Almand, P.E., FSFPE

Kathleen Almand is Vice President, Research, National Fire Protection Association responsible for its affiliated Research Foundation, and its Fire Analysis, Research, Data Analytics, and Library Functions. She has a MSc. civil engineering from the University of Ottawa, Canada and is a registered professional engineer in the State of Maryland and a Fellow of the Society of Fire Protection Engineers. Prior to joining NFPA in 2004, Kathleen was the Executive Director of the Society of Fire Protection Engineers and held research and management positions with the Civil Engineering Research Foundation, the American Iron and Steel Institute, and the National Academy of Sciences.



Randy Safer

Randy Safer is the NFPA Southern Regional Director and is responsible for the activities in the 11 states in his region. He promotes and assists in the adoption of NFPA codes and standards by state and local authorities, assures appropriate representation at code hearings and legislative sessions, coordinates activities with NFPA staff and key constituencies, and identifies ways NFPA services can improve fire, building, and life safety in his region. He also supports research, educational, membership, and other NFPA activities.

Prior to joining NFPA in 2008, Randy was the Director of Code Enforcement with the Tennessee State Fire Marshal's Office where he was responsible for three field offices across the state handling functions of fire and building code enforcement and plan review. Prior to this position, Randy was the fire chief in Hendersonville, Tennessee and he started his fire service career in 1977 with the Beaumont, Texas Fire Department.

Noah L. Ryder, PE, MBA

For 15 years Noah Ryder has focused on understanding fire and explosion phenomena and their interaction with both the built and natural environment. He concentrates on how safety can be improved at a facility through the use of computational fluid dynamics modeling, quantitative risk assessments, hazard evaluations, and performance-based design. Ryder's knowledge and experience has been used globally within the process industries, oil and gas industry (on and off-shore), mining operations, manufacturing facilities, as well as large commercial, residential, and assisted-care facilities. He is a Licensed Fire Protection Engineer and has a BS and MS degrees from the University of Maryland's Department of Fire Protection Engineering, and an MBA from the R.H. Smith Business School. He is currently enrolled in a Ph.D. program in Mechanical and Mechatronics Engineering at the University of Waterloo, Ontario, Canada that focuses on combustion phenomena.

