BUILDING SAFETY ASSESSMENT FOR RMG SECTOR
(FIRE AND ELECTRICAL SAFETY)

Bureau of Research, Testing and Consultation
Bangladesh University of Engineering & Technology
(BUET)
How fire is generated?

Heat fluxes in the vicinity of ignition sources (Fuel)

Igniting objects e.g. matches, burning paper & cigarettes, gas burners, etc.

Or

electric spark, electric short circuit, heating element of machines or mechanical friction
Fires in buildings behave differently from outdoor fires. Heat and toxic smoke rise to the ceiling and spread outwards and downwards.

Smoke passes through any space or opening.
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR (FIRE AND ELECTRICAL SAFETY)

Consequence of Fire

CONFLAGRATION
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR (FIRE AND ELECTRICAL SAFETY)

Fire Hazard (Smoke)
Heat release rate (rise of temperature) and generation rates of products of fire (hazardous smoke) are governed by:

- fire initiation within the ignition zone
- fire propagation rate beyond the ignition zone
- fire ventilation
- external heat sources
- presence or absence of the fire suppression agents
- Materials:
  - shapes, sizes, and arrangements fire propagation rate beyond the ignition zone
  - chemical natures
  - types of additives mixed in presence of other materials
During burning heat released is transferred as conductive, convective and radiative heat fluxes from the flame causing rise in temperature.

Incomplete combustion generates smoke, CO, hydrocarbons, and other intermediate products, resulting in an increase in non-thermal hazard (i.e. smoke)
Prevention of Fire
To save life and property

Control fire:
• Heat source
• Source interaction and ignition

Manage fire:
• Fire movement through vent, by confinement
• Structural stability

Manage fire exposure:
• Limit exposed
• Defend exposed
• Provide safe destination

Suppress fire:
• Detect, communicate, respond
• Apply suppressant (automatically or manually)
Fire safety objective must be to:

- Save life
- Reduce property damage

May be achieved by:

- Control of initiation of fire
- Control of propagation of fire and smoke
- Provide and control proper circulation and safe exit of occupants
- Fire extinguishment
Control of Initiation of Fire

Controlling:
- Heat source
- Source interaction and ignition

Checking all electrical wirings and connections as per standards

Checking whether all electro-mechanical systems are installed and maintained according to the standards and as per manufacturers specification
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR
(FIRE AND ELECTRICAL SAFETY)
REMEMBER

As garments factories use combustible material which ignite easily and these factories use heat as a part of their production process, so fire initiation can not be stopped.
MANAGE FIRE

Through control of propagation of fire and smoke

Control by construction:
• Venting and confinement
• Structural stability

The main objectives of venting and confinement by design are:

- to facilitate escape of people from fire by restricting spreading of smoke and hot gases into escape routes;
- to facilitate fire fighting by providing easy access to fire fighters in the building;
- to reduce property damage from fires
Design the Factory Building to Achieve:

- Occupant circulation during panic situation due to fire
- Appropriate relocation of the occupant to the safe areas
- Control fire and smoke propagation
- Proper house keeping provisions
What is the REAL SITUATION ???
Floor Plan

3 ENCLOSED STAIRS
3 STAIRS
3 TOILET BLOCKS
PRODUCTION FLOOR WITH PACKING
4 ELEVATORS
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR (FIRE AND ELECTRICAL SAFETY)
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR
(FIRE AND ELECTRICAL SAFETY)
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR (FIRE AND ELECTRICAL SAFETY)
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR
(FIRE AND ELECTRICAL SAFETY)
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR (FIRE AND ELECTRICAL SAFETY)
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR (FIRE AND ELECTRICAL SAFETY)
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR
(FIRE AND ELECTRICAL SAFETY)
Fire & Electrical Safety Assessment Methodology

- Analysis of approved building floor plans
- Raw data collection: measurements, sketches, photographs, checking as built conditions
- Analysis
- Report
<table>
<thead>
<tr>
<th>Building Safety Assessment for RMG Sector (Fire and Electrical Safety)</th>
</tr>
</thead>
</table>

### Guideline for Fire and Electrical Safety Visual Inspection

- Factory Identification, Classification for Occupancy, Construction type, Hazard type, Horizontal Exits, Refuge Areas, Atrium, Vertical Openings, Barrier Wall, Ventilation system, Basement
- Fire Separation, Building Height, Structural Elements, Enclosure Walls, Floor Division, Interior Finish, Entry, Stair Case, Exit Signage, Lift, Fire Lift, Lift lobby
GUIDELINE FOR FIRE AND ELECTRICAL SAFETY VISUAL INSPECTION (Contd.)

Detection System
Alarm System
Fire Suppression System

Electro-Mechanical system:
Electrical Substation
Power Generator
Natural Gas/LNG/CNG/LPG
Cooking Facilities

Detail Electrical wiring
Fire Commend Station
Fire Drill
ASSESSMENT STANDARDS FOR FIRE AND ELECTRICAL SAFETY

Assessing parameters related to building design, electrical and electro-mechanical systems, fire detection and alarm systems, active fire fighting system are to be decided based on Laws of the land:

- Fire law
- Labour and Industrial law
- Bangladesh National Building Code (BNBC)
- Any other laws applicable for occupancy G2 (moderate hazard industries)
“Notice and disclaimer of liability concerning the use of NFPA documents”

“The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein”.

“Law and Regulations

Users of these documents should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so”.

WHAT NFPA CLAIMS?
2.12 REQUIREMENTS FOR OCCUPANCY
H - STORAGE BUILDINGS (as per BNBC)

2.12.7 Special Hazards
“The storage of hazardous materials shall not exceed the exempt amount as specified in Table 3.2.7. The storage of moderate and low hazardous materials shall be separated at least by a two hour fire resistive construction”.

2.1.8 Occupancy H: Storage Buildings
“H2 MODERATE FIRE RISK STORAGE : These shall include any building or portion thereof which is used for storage of materials which do not constitute the danger of self-ignition but which in the event of fire will burn with moderate rapidity, for example, warehouses, godowns or depots containing high fire risk materials, such as paper, textiles, cotton, jute etc., library stack rooms. Items which shall be deemed to render a building hazardous are specified in Sec 2.13.13 part 3 of BNBC along with the exempted amount for each item…..”
Table 3.2.7
Exempt Amounts of Hazardous Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Class/State</th>
<th>Maximum Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Liquefied flammable</td>
<td></td>
<td>230 litres</td>
</tr>
<tr>
<td>6. Combustible fibres</td>
<td>Loose</td>
<td>2800 litres (2.8m³)</td>
</tr>
<tr>
<td>7. Combustible fibres</td>
<td>Baled</td>
<td>28,000 litres (28m³)</td>
</tr>
<tr>
<td>8. Flammable solids</td>
<td></td>
<td>230 kg.</td>
</tr>
</tbody>
</table>
NFPA 13
“Chapter 12 Storage

12.2.2.2.2.1 The minimum number of design sprinklers for ordinary hazard and miscellaneous storage in accordance with this standard.

12.1.2.3 Large drop, control mode specific application and ESFR sprinklers shall be permitted to protect ordinary hazard, storage of Class I through Class IV commodities”.
“Section 2902
Definitions
Combustible fibers. Readily ignitable and free-burning fibers, such as coca fiber, cotton, hemp, jute, kapok, oakum, sisal, Spanish moss, straw, tow, wastepaper, or other natural or synthetic fibers that possess similar qualities.

Section 2904 (Loose fiber storage)
2904.4 Storage of more than 500 cubic feet to 1000 cubic feet.
Loose combustible fibers in quantities exceeding 500 cubic feet (14 m³) but not exceeding 1,000 cubic feet (28 m³) shall be stored in rooms enclosed with 2-hour fire-resistance-rated fire barriers, with openings protected by an approved opening protected assembly having a fire protection rating of 1½–hours, and constructed in accordance with the construction codes, including the building code.”
New York City Fire Code: Chapter 29
Combustible fibers (Contd.)

“2904.5 Storage of more than 1,000 cubic feet to 2,500 cubic feet. Loose combustible fibers in quantities exceeding 1,000 cubic feet (28 m³) but not exceeding 2,500 cubic feet (70 m³) shall be stored in rooms enclosed with 2-hour fire-resistance-rated fire barriers, with openings protected by an approved opening protected assembly having a fire protection rating of 1½–hours, and constructed in accordance with the construction codes, including the building code. The storage room shall be protected throughout by a sprinkler system”. 
New York City Fire Code: Chapter 29
Combustible fibers (Contd.)

“Section 2905
Baled storage
2905.1 Bale size and separation. Baled combustible fibers shall be limited to single blocks or piles not more than 25,000 cubic feet (700 m³) in volume, not including aisles or clearances. Blocks or piles of baled fiber shall be separated from adjacent storage by aisles not less than 5 feet (1524 mm) wide, or by flash-fire barriers constructed of continuous sheets of noncombustible material extending from the floor to a minimum height of 1 foot (305 mm) above the highest point of the piles and projecting not less than 1 foot (305 mm) beyond the sides of the piles”.

New York City Code requires **NO SPRINKLER** for up to 700m³ for Baled storage even though NFPA suggested otherwise. **BNBC requirement is only 28m³.**
(Loose fiber storage) (for combustible fibers)

• New York City Code requirement
  NO SPRINKLER for up to 28m³
• BNBC requirement
  NO SPRINKLER for up to 2.8m³
• NFPA suggested SPRINKLER
Baled storage (for combustible fibres)

- New York City Code requires **NO SPRINKLER** for up to 700m$^3$
- BNBC requirement **NO SPRINKLER** for up to 28m$^3$
- NFPA suggested **SPRINKLER**
BUILDING SAFETY ASSESSMENT FOR RMG SECTOR (FIRE AND ELECTRICAL SAFETY)

THANK YOU