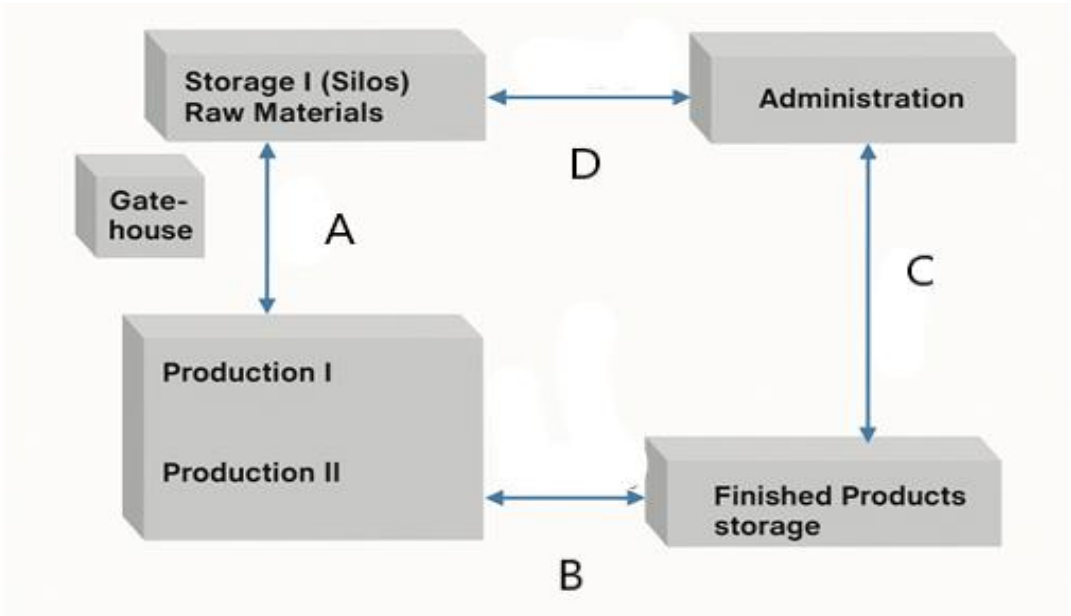
Calculation methodology for EML and PML

The steps to estimate PML/EML from fire or explosion are the following:

Step 1 - Create a layout plan (site map) showing:

- Building separations
- Construction details (roofs, walls, materials)
- Firewalls and separation walls
- Percentage (%) of open areas in walls.
- Building height, floors
- Occupancy type and severity
- TIV (Total Insurance Value) per building

For example:



Distance A (feet)	70
Distance B (feet	80
Distance C (feet.)	100
Distance D (feet)	80

	Sum Insured (USD)	**Severity exposure**
Production I - Production II	12,000,000	moderate
Storage I (silos)	3,000,000	moderate
Storage Finished Products	4,000,000	severe

Other (Administration)	1,000,000	light
TOTAL	20,000,000	

	Width North face	Width East fase	Width South face	Width west face
Production I - Production II	20%	20%	20%	20%
Storage I (silos)	10%	10%	10%	10%
Storage Finished Products	10%	10%	10%	10%
Other (Administration)	10%	50%	50%	50%
TOTAL	40	10	40	10

Dimension of Buildings (feet)	Height	Width North face	Width East fase	Width South face	Width west face
Production I - Production II	20	240	150	240	150
Storage I (silos)	50	150	30	150	30
Storage Finished Products	15	150	75	150	75
Other (Administration)	15	50	50	50	50

Step 2 - Subdivision of risks into Fire Areas, We have to study which sectors can be considered "fire areas"

- A group of buildings separated from other buildings by certain distances.
- Installations in the open (e.g. stocks stored in open)
- Inside buildings fire walls or Spatial or Constructional Fire Area separation

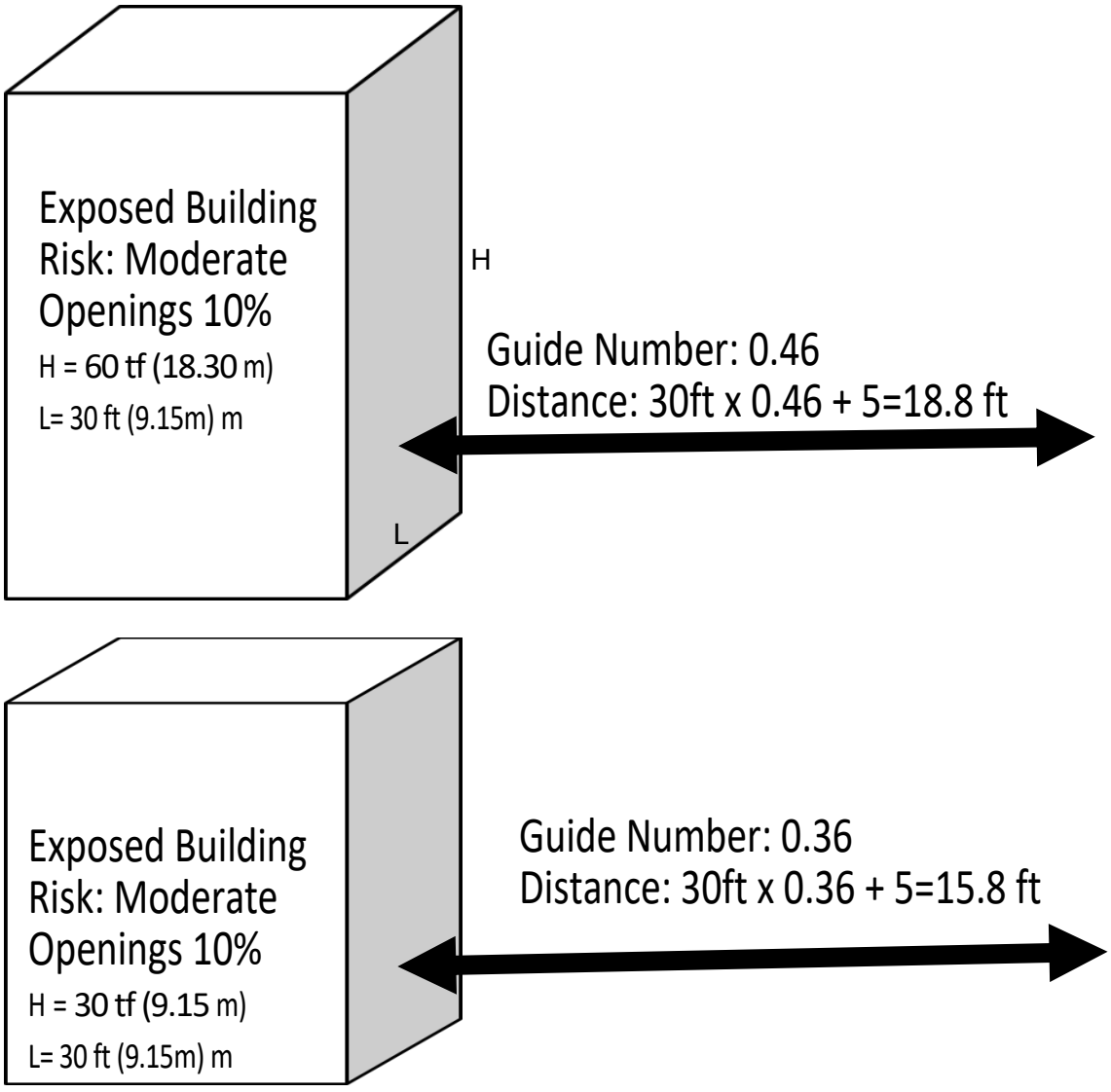
In most cases, fire is the risk that determines the PML/EML. And when it comes to evaluating the spread of a fire from one building to another, the distance between buildings and also the height of the buildings becomes important.

To assess the fire spread from a burning building to another structure, we use the methodology indicated in NFPA 80A.

This standard provides us with an “index number” based on the height-to-width or width-to-height ratio of the building from which the fire originates (the exposed building), depending on the type of fire load (light, moderate, severe) and the percentage of openings.

This index number is then multiplied by the height or width of the building (whichever is smaller). That means the height influences both the determination of the index number and the formula for the required distance.

The following example shows the difference in the required separation distance to prevent fire spread for buildings of different heights:



The burning building is called the exposing building, while the other which is threatened is called the exposed building.

If a building is connected to another through a conveyor, it should be considered part of the same fire area. Conveyors can transmit fire from one site to another unless they are equipped with a locking system—such as dampers that automatically close upon fire detection.

The photograph shows how a fire can easily spread through a conveyor helped by the wind, the slope and the material of the belt.	

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Electrical wires also spread fire unless they have a properly sealed passage through a fire wall.

Step 3 - Establish damage hypotheses for different scenarios

For Property Damage: The fire scenario is the most commonly analyzed. We must evaluate the severity of the hazard (light, moderate, or severe), the combustibility of materials, the presence and effectiveness of firewalls, and especially the expected performance of fire protection systems.

For example:

- If a building with a severe hazard and no fire protection systems is affected, the fire can potentially consume the entire fire area.
- If fire protection systems exist and are expected to function properly, the damage might be contained to a portion of the fire area.

We must also consider:

- Response time of internal or external firefighting teams.
- Availability and functionality of fire water systems, sprinklers, hydrants, etc.
- Existence of automatic detection and alarm systems.

In some cases, it may be necessary to consider Explosion Scenarios (e.g., VCE – Vapor Cloud Explosion) or Natural Phenomena (earthquakes, floods, windstorms), depending on the location and exposure of the site.

Step 4: Estimate the "Probable Maximum Loss (PML)" and the "Estimated Maximum Loss (EML)"

The damage estimate is based on:

- The value distribution (machinery, stock, buildings) in each fire area.
- The percentage of damage expected based on the severity of the scenario and the assumed effectiveness of protection systems.

It is important to differentiate:

- PML: Assuming protection systems work with average efficiency and firefighting response is appropriate.
- EML: Assuming protection systems fail or are overwhelmed, and response is delayed or ineffective.

When estimating the Business Interruption Loss (BI):

- Evaluate the dependence of the production process on the affected fire area.
- Estimate the time required to repair or replace the damaged equipment or infrastructure.
- Determine if there are alternatives available (manual work, backup machines, alternate suppliers, etc.)
- Consider the production capacity loss, impact on sales, gross margin, and potential penalties for delivery failures.

Our recommendations are to take the largest of the following situations:

- The hypothesis with the highest PD or MBD and add its corresponding BI loss, or Largest BI Loss + its initiating PD / MBD Loss

	EML	PML	Comment
Property Damage	15,000,000	5,000,000	Base on fire at Paint storage (storage I building)
Debris Removal	600,000	200,000	
Inflation (3%)	450,000	150,000	
Total	16,050,000	5,350,000	
Business Interruption	15,000,000	8,000,000	EML A 12 month rebuild of Production Building. PML: 6 month reparation. leasing of a replacement warehouse
Inflation	750,000	400,000	
Total	15,750,000	8,400,000	
Combined PD+BI ($)	30,750,000	13,400,000	

Combined PD+BI (%)	68%	30%	As % of TIV PD=$ 20,000,000 BI=$ 15,000,000

Summary

- Provide a definition of EML/PML, not just 3 letters …
- Provide a scenario, stating where the fire starts, how it propagates and why it stops. Include assumptions …
- Provide information regarding business interruption, contingency business interruption and dependencies …
- Provide split of values insured per area and per class … Provide loss estimate both in monetary terms and % of TSI

How is EML/PML calculated in high-rise buildings?

When high-rise buildings have " Combustible curtain wall system" there is no doubt that the EML (in even the PML) is 100%, as the Grenfeld and other cases have shown us.

The Grenfell Tower fire in London (UK) on June 14, 2017, which caused dozens of deaths, was surprising for the speed of its vertical spread.

Firefighters usually estimate that the fire generated in residential occupations takes a minimum of 30 minutes to go from one level to another, but in this case the fire spread to several upper floors in the same period of time.

The start of the fire was reported at 1:00 am on the 4th floor and by 3:45 the flames had reached the 23rd floor.

Even when the buildings do not have combustible coatings, it has happened that some fires in the lower part have affected the entire structure of the building and it has been necessary to demolish them completely. It should not be forgotten that fighting fires from 20 meters high is very difficult, because

firefighters do not have ladders or equipment to work at that height. An example has been the Windsor building in Madrid downtown in 2005.

Our recommendation for buildings over 15 stories tall is to consider 100% EML.