Exit Routes, Fire Protection Plans & Fire Extinguishers

29 CFR 1910.33 – 38
Exit Routes and Emergency Action Plans

Triangle Shirtwaist Factory
New York City, 1911

• At 4:40pm, on March 25th, everyone was preparing to leave. Mostly women and girls ages 16-23 worked 12 hour shifts.
• Building had been declared “Fireproof”
• Blouses hung from wires stretched above, from one end to the other
• Boxes filled with cloth and lint next to sewing stations
• Work stations packed together
• Machine oil stored on the floor
Triangle Shirtwaist Factory
New York City, 1911

• The Blaze
  – Lasted only 30 minutes
  – Fire companies arrived to dropping bodies (50 had jumped 100ft)
  – Water from hoses only reached the 7th floor
  – Ladders only reached the 6th and 7th floors
  – Elevators doors opened, allowing fresh air to enter the upper floors
  – 2 fire escapes, no ladders, collapse

Triangle Shirtwaist Factory
New York City, 1911

• The Blaze (con’t)
  – Interior fire exit – locked doors
  – Other fire exits – inward opening doors
  – 150 escaped to the roof and the adjacent NY Law School
  – 8th floor human bridge

Triangle Shirtwaist Factory
New York City, 1911

• Aftermath
  – 146 workers killed (700 had been working between the 8th and 10th floors.)
  – Fireproof?
  – 36 new workplace health and safety statutes enacted
  – Beginning of of Life Safety Code
  – Unions banded together for other safety and health issues
  – More building requiring automatic sprinklers
Introduction

- Fires and explosions kill more than 200 and injure more than 5,000 workers each year
- There is a long and tragic history of workplace fires in this country caused by problems with fire exits and extinguishing systems
- OSHA requires employers to provide proper exits, fire fighting equipment, and employee training to prevent fire deaths and injuries in the workplace

Exit Route

- A continuous and unobstructed path of exit travel from any point within a workplace to a place of safety (including refuge areas)
- Consists of three parts
  - Exit access
  - Exit
  - Exit discharge
- Equivalent to the term Means of Egress in the Life Safety Code and most local building and fire codes

Exit Routes: Basic Requirements

- Exit routes must be permanent

1910.38(a)(1) Eat at Joe's Place
No ropes, or ladders
Exit Routes: Basic Requirements

- An exit must be separated by fire-resistant materials.

1910.36(a)(2)

Exit Routes: Basic Requirements

- Openings into an exit must be limited to those necessary to allow access to the exit or to the exit discharge.
- An opening into an exit must be protected by an approved self-closing fire door that remains closed or automatically closes in an emergency.

1910.36(a)(3)

The number of exit routes must be adequate

Normally 2 or more depending on
- the size of the building,
- its occupancy, or
- the arrangement of the workplace.

1910.36(b)
Exit discharge

... must lead directly outside or to a street, walkway, refuge area, public way, or open space with access to the outside... (this area) must be large enough...

Exit discharge

Exit stairs that continue beyond the level on which the exit discharge is located must be interrupted at that level by doors, partitions, or other effective means that clearly indicate the direction of travel leading to the exit discharge.

1910.36 (c)(1) and (2)

1910.36 (c)(3)
Exit Doors Must Be Unlocked

1910.36 (d)(1) and (2)

- **Must be able to open from the inside** at all times without
  - Keys,
  - Tools, or
  - Special knowledge

- **Panic bars are permitted**
  - Must be free of any device or alarm that could restrict emergency use if the device or alarm fails

Exit Doors

May be locked from the inside **only** in

- Mental,
- Penal, or
- Correctional facilities
where there is constant supervision and the employer has a plan to remove occupants from the facility during an emergency

1910.36 (d)(3)

Side-Hinged Exit Door

- Must be used to connect any room to an exit route
- A door that connects any room to an exit route **must swing out in the direction of exit travel** if
  - The room is designed to be occupied by **more than 50 people** or
  - Contains **high hazard contents**
Exit Route Capacity and Dimensions

- Must support the maximum permitted occupant load for each floor served

1910.36 (f)(1)

Exit Route Capacity and Dimensions

- Capacity must not decrease in the direction of exit route travel to the exit discharge

1910.36 (f)(2)

Typical Occupant Load Factors

<table>
<thead>
<tr>
<th>Use</th>
<th>(per person)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly Use</td>
<td></td>
</tr>
<tr>
<td>• Concentrated use</td>
<td>7 ft² net</td>
</tr>
<tr>
<td>without fixed seating</td>
<td></td>
</tr>
<tr>
<td>• Less concentrated use</td>
<td>15 ft² net</td>
</tr>
<tr>
<td>without fixed seating</td>
<td></td>
</tr>
<tr>
<td>• Bench-type seating</td>
<td>1 person/18 linear inches</td>
</tr>
<tr>
<td>• Fixed seating</td>
<td># of fixed seats</td>
</tr>
</tbody>
</table>
**Typical Occupant Load Factors (cont'd)**

**Use**  
**Assembly Use**
- Waiting spaces 3 ft² net –  
  (Restricted - See NFPA 101 Ch. 13)
- Kitchens 100 ft²
- Library stack areas 100 ft²
- Library reading rooms 50 ft² net

Adapted from table 7.3.1.2 Life Safety Code 101 - 2000

**Typical Occupant Load Factors (cont'd)**

**Use**  
**Industrial Use**
- General and high hazard 100 ft²
- Special purpose industrial See NFPA 101 Ch. 13
  - Low population density
  - Most areas occupied by automated machinery or equipment
  - Low or ordinary hazard

**Business Use**  
100 ft²

**Storage Use**  
See NFPA 101 Ch. 13  
(not mercantile storerooms)

**Exit Route Capacity and Dimensions**

- Ceiling must be at least 7½ ft high with no projection reaching a point less than 6 ft 8 in from floor
- An exit access must be at least 28 in wide at all points

1910.36 (g)(1) and (2)
## Capacity Factors

<table>
<thead>
<tr>
<th>Stairways (width per person)</th>
<th>Level Components and Ramps (width per person)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board and care</td>
<td>0.4 in</td>
</tr>
<tr>
<td>Health care</td>
<td>0.3 in</td>
</tr>
<tr>
<td>• sprinklered</td>
<td>0.6 in</td>
</tr>
<tr>
<td>• non-sprinklered</td>
<td>0.5 in</td>
</tr>
<tr>
<td>High hazard contents</td>
<td>0.7 in</td>
</tr>
<tr>
<td>All others</td>
<td>0.3 in</td>
</tr>
</tbody>
</table>

## Exit Route Capacity and Dimensions

- **Objects that project**
  
  into the exit route must not reduce the width of the exit route to less than the minimum width requirements for exit routes

  **1910.36 (g)(4)**

## Minimize Danger to Employees

- **Exit routes must be kept free of explosive or highly flammable furnishings or other decorations**

  **1910.37 (a)(1)**
Minimize Danger to Employees

• Exit routes must be free and unobstructed

1910.37 (a)(3)

Minimize Danger to Employees

1910.37 (a)(2) and (4)
• Arrange exit routes so that employees will not have to travel toward a high hazard area, unless it is effectively shielded

• Emergency safeguards (e.g., sprinkler systems, alarm systems, fire doors, exit lighting) must be in proper working order at all times

Lighting and Marking Must be Adequate and Appropriate

• Each exit must be clearly visible and marked with an “Exit” sign

1910.37 (b)(1) to (3)
Lighting and Marking Must be Adequate and Appropriate

• Each exit route door must be free of decorations or signs that obscure the visibility of the door.

Lighting and Marking Must be Adequate and Appropriate

• If the direction of travel to the exit or exit discharge is not immediately apparent, signs must be posted along the exit access indicating direction to the nearest exit.
• The line-of-sight to an exit sign must clearly be visible at all times.

1910.37 (b)(4)

Lighting and Marking Must be Adequate and Appropriate

• Each doorway or passage along an exit access that could be mistaken for an exit must be marked “Not an Exit” or similar designation, or be identified by a sign indicating its actual use (e.g., closet).

1910.37 (b)(5)
Lighting and Marking Must be Adequate and Appropriate

Exit Routes Must be Maintained During Construction, Repairs, or Alterations

- Employees must not occupy a workplace until the exit routes...are completed and ready for employee use...

1910.37 (d)(1)
Exit Routes Must be Maintained During Construction, Repairs, or Alterations

- Employees must not be exposed to hazards of flammable or explosive substances or equipment used during construction, repairs, or alterations, that are beyond the normal permissible conditions in the workplace, or that would impede exiting the workplace.

1910.39(b) Written and Oral Fire Prevention Plans

- Must be in writing
- Be kept in the workplace
- Be made available to employees for review
- Employer with 10 or fewer employees may communicate the plan orally to employees.

1910.39(c)(1) Minimum Elements of a Fire Prevention Plan

- A Fire Prevention Plan must include
  - A list of all major fire hazards
  - Proper handling and storage procedures for hazardous materials
  - Potential ignition sources and their control
  - The type of fire protection equipment necessary to control each major hazard
1910.39(c)(2) Minimum Elements of a Fire Prevention Plan

• Procedures to control accumulations of flammable and combustible waste materials

Cans of paint left open, not stored or disposed of upon completion of work

1910.39(c)(3) Minimum Elements of a Fire Prevention Plan

• Procedures for regular maintenance of safeguards installed on heat-producing equipment to prevent the accidental ignition of combustible materials

1910.39(c)(4)-(5) Minimum Elements of a Fire Prevention Plan

• The name or job title of employees responsible for maintaining equipment to prevent or control sources of ignition or fires
• The name or job title of employees responsible for the control of fuel source hazards
1910.39(d) Employee Information

- An employer must inform employees upon initial assignment to a job of the fire hazards to which they are exposed.
- An employer must also review with each employee those parts of the fire prevention plan necessary for self-protection.

Portable Fire Extinguishers (PFE’s)

29 CFR 1910.157

- Provide PFE’s
- Mount, locate & identify so that they are readily accessible
- Maintain operability & keep in designated places

General Requirements

- The employer shall
  - Provide PFE’s
  - Mount, locate & identify so that they are readily accessible
  - Maintain operability & keep in designated places
Selection and Distribution

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
<th>Distance (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ordinary Combustibles</td>
<td>75</td>
</tr>
<tr>
<td>B</td>
<td>Flammable Liquids</td>
<td>50</td>
</tr>
<tr>
<td>C</td>
<td>Energized Electrical Equip.</td>
<td>50-75</td>
</tr>
<tr>
<td>D</td>
<td>Flammable Metals</td>
<td>75</td>
</tr>
<tr>
<td>K</td>
<td>Combustible Cooking Media</td>
<td>-</td>
</tr>
</tbody>
</table>

Inspection, Maintenance and Testing

- Visually inspected
  - Monthly
- Maintenance check
  - Annually
- Hydrostatic testing
  - Based upon Table L-1
- Alternate equivalent protection must be provided during maintenance and recharging

Hydrostatic Testing

<table>
<thead>
<tr>
<th>Type of extinguishers</th>
<th>Test interval (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soda acid (stainless steel shell)</td>
<td>5</td>
</tr>
<tr>
<td>Cartridge operated water and/or antifreeze</td>
<td>5</td>
</tr>
<tr>
<td>Stored pressure water and/or antifreeze</td>
<td>5</td>
</tr>
<tr>
<td>Wetting agent</td>
<td>5</td>
</tr>
<tr>
<td>Foam (stainless steel shell)</td>
<td>5</td>
</tr>
<tr>
<td>Aqueous Film Forming Foam (AFFF)</td>
<td>5</td>
</tr>
<tr>
<td>Loaded stream</td>
<td>5</td>
</tr>
<tr>
<td>Dry chemical with stainless steel</td>
<td>5</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>5</td>
</tr>
<tr>
<td>Dry chemical, stored pressure, with mild steel, brazed brass or aluminum shells</td>
<td>12</td>
</tr>
<tr>
<td>Dry chemical, cartridge or cylinder operated, with mild steel shells</td>
<td>12</td>
</tr>
<tr>
<td>Halon 1211</td>
<td>12</td>
</tr>
<tr>
<td>Halon 1301</td>
<td>12</td>
</tr>
<tr>
<td>Dry powder, cartridge or cylinder operated with mild steel shells</td>
<td>12</td>
</tr>
</tbody>
</table>
Training and Education

• What
  – Fire extinguisher use
  – Hazards involved with incipient stage fire fighting

• When
  – Upon initial employment
  – At least annually thereafter

Fight or Flee?

• Make sure everyone has left or is leaving the building
• Make sure the fire department has been called
• Make sure the fire is confined to a small area and is not spreading
• Be sure you have an unobstructed escape route to which the fire will not spread
• Be sure you have read the instructions and that you know how to use the extinguisher

Remember The "PASS"-word

<table>
<thead>
<tr>
<th>Pull the pin: This unlocks the operating lever</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aim low: Point the extinguisher nozzle (or hose) at the base of the fire</td>
</tr>
<tr>
<td>Squeeze the lever about the handle: This discharges the extinguishing agent</td>
</tr>
<tr>
<td>Sweep from side to side: With the extinguisher aimed at the base of the fire, sweep back and forth until the flames appear to be out</td>
</tr>
</tbody>
</table>
www.osha.gov eTools
Means of Egress

- Floorplan Demo
  www.osha.gov/SLTC/etools/evacuation/floorplan_demo.html

- Means of Egress Example 1
  www.osha.gov/SLTC/etools/evacuation/egress_demo.html

- Means of Egress Example 2
  www.osha.gov/SLTC/etools/evacuation/egress_demo2.html