Cause Mapping is a Root Cause Analysis method that captures basic cause-and-effect relationships supported with evidence.

**Step 1. Problem**

### What
- Problem(s)
  - 16 employees injured, vapor cloud explosion, 5 month downtime

### When
- Date
  - October 6, 2005
- Time
  - 15:05
- Different, unusual, unique
  - NA

### Where
- Facility, site
  - Point Comfort, TX Formosa Facility
- Unit, area, equipment
  - Olefins II Unit
- Task being performed
  - Moving compressed gas bottles

### Impact to the Goals
- Safety
  - 16 employees injured (2 serious burns)
- Environmental
  - 7 million gallons water used to cool vessels and contain fire
- Community Impact
  - Community shelter in place, shutdown I-35
- Production-Schedule
  - 2 month outage of Olefins II Unit
- Property, Equip, Mtls
  - Extensive damage to Olefins II Unit
- Labor, Time
  - Extensive labor (repair, investigation, clean-up)

**Step 2. Analysis**

**Basic Level Cause Map** - Start with simple Why questions.

1. Why?
   - Safety Goal Impact: 16 employees injured, 2 serious burns
   - Explosion and initial fire
   - Large propylene vapor cloud

2. Why?
   - Safety Goal Impact: 16 employees injured, 2 serious burns

3. Why?
   - Property Goal Impact: Ineffective personal protective equipment
   - Large propylene vapor cloud
   - Explosion and initial fire

**More Detailed Cause Map**

### FORMOSA POINT COMFORT EXPLOSION CAUSE MAP

16 employees were injured, a local elementary school was evacuated and significant damage occurred when a propylene vapor cloud ignited at the Formosa Point Comfort plant.

The propylene leak started when a fork truck, moving compressed gas cylinders struck a live bleed valve and nipple containing liquified propylene. The unit was down for 5 months for repair.

**Step 3. Solutions**

<table>
<thead>
<tr>
<th>No.</th>
<th>Action Item</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Review plant locations of hazards and require fire retardant clothing where there is potential for flash fires</td>
<td>Ineffective personal protective equipment</td>
</tr>
<tr>
<td>2</td>
<td>Emergency isolation valves on large vessels containing hazardous materials</td>
<td>No remote isolation valves</td>
</tr>
<tr>
<td>3</td>
<td>Review potential for vehicular impact during process hazard reviews</td>
<td>No barrier around nipple</td>
</tr>
<tr>
<td>4</td>
<td>Review current design/safety standards for updating earlier plant and unit designs</td>
<td>Design was not updated to include new fireproofing standard</td>
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