Capacity Planning for Emergency Response in Process Disasters

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Key issues

- Accountability and sense of trust
- Mobilization of resources
- Panic control
- Correct information
- Correct interpretation capacity
- Fear Vs. facts
CHEMICAL ACCIDENT TRIGGERS

Few examples

- Process or storage system failures
- Instantaneous bulk release of pollutants/contaminant
- Mass release from natural source
- Spillage from hazardous waste
- Spillage / release during transport or shipping
- Natural calamities, e.g. earthquake, flooding, landslide, etc.
- Terrorist attacks/Sabotage
- Mass poisoning (intentional or unintentional)
CHEMICAL DISASTER: IMPACTS

- Living Organisms
  - Humans
  - Livestock
  - Plants
  - Immediate Short-term & Long-term Effects
  - Death, Injury, Disease & Disability

- Abiotic Environment
  - Soil & Water Bodies
  - Atmosphere
  - Pollution
  - Property
Emergency Preparedness for Process Safety

• .. is a critical component of Process Safety Management.

• Employer must address what actions employees are to take when there is an unwanted release of highly hazardous chemicals.
3 layers of process defense

• ‘Emergency preparedness’ is the employer’s third line of defense that will be relied on along with the second line of defense, which is to control the release of chemical.

• Control of releases and emergency preparedness will take place when the first line of defense to operate and maintain the process and contain the chemicals fails to stop the release.
In preparing for an emergency chemical release, employers will need to decide the follow:

• Whether they want employees to handle and stop small or minor incidental releases;
• … to mobilize the available resources at the plant and have them brought to bear on a more significant release;
• … employees to evacuate the danger area and promptly escape to a pre-planned safe zone area, and then allow the local community emergency response organizations to handle the release; or
...employer shall decide

• to use some combination of these actions.

• Employers will need to select how many different emergency preparedness or third lines of defense they plan to have,
  – develop the necessary emergency plans and procedures,
  – appropriately train employees in their emergency duties and responsibilities,
  – and then implement these lines of defense.
## Comparison between process safety and personnel safety

<table>
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<tr>
<th>Process Safety</th>
<th>Personnel Safety</th>
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<tbody>
<tr>
<td>Process safety hazards typically give rise to major accidents involving release of potentially dangerous materials, release of energy (such as fires and explosions), or both. <em>(High consequence, low frequency)</em></td>
<td>Typically give rise to incidents such as injuries or fatalities as a result of falls, trips, crushings, electrocutions and so on. <em>(Low consequence, high frequency)</em></td>
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| Can have *catastrophic* effects and can result in multiple injuries and fatalities, as well as *substantial economic, property and environmental damage.* | ]

*High consequence* refers to situations where the potential impact is severe, whereas *low consequence* indicates situations with less severe impacts. *Low frequency* indicates the events are rare, whereas *high frequency* indicates frequent occurrences.
Process safety pyramid (Adapted from CCPS). The Center for Chemical Process Safety (CCPS), New York, USA, assists the industry in avoiding or mitigating catastrophic accidents.
Disaster management is a multi-stage process starting with prevention of major accidents ...

- identify hazards comprehensively
- avoid or control risks
- communicate remaining risks
- mitigate consequences
- remediate damages
- restore trust

... pursuing the goal to define and train as much as possible in advance
Safety of New and Existing Plants

- New plants: safety is generally not an issue of financial resources, but sometimes of a lack of professionalism
  - “Integrated Safety” is most effective and cheap, if considered right from beginning of design
  - “End of Pipe Safety” is less effective and/or expensive, as late design changes may be necessary

- Existing Plants need another approach to come close to today´s safety standards
  - Upgrading may be technically and economically difficult
  - Operating experience is major asset
  - (External) Safety Audit, Safety Review, Risk Analysis
Emergency Preparedness

- Accidents may happen even in most modern plants. They cannot be planned, but they should be considered.
  - Use the scenarios identified for prevention of major incidents for emergency planning and training, too.
  - Cover all relevant scenarios in the emergency plan.
  - Assign responsibilities rather than regulating details.
  - The emergency organisation is different from the normal organisation, but is empowered to use it.
– Clearly document all available resources (site, company, neighbouring sites, authorities, ...) for the different scenarios. Ensure that they can be used in emergencies (e.g. co-operative agreements).

– Before you rely on off-site resources, consider the time until availability.

– Industrial zones with many chemical companies close together need special attention („domino-effects“).

– Adjust the emergency organisation to the dimension of the incident (e.g. „blue, yellow, red alert“).
The Human Factor

- **Workers are risks and resources for safety**
  - They have to know the risks to cope with
  - Detailed written procedures are a tool both for workers and for management. They should ...
    - step by step procedure
    - language and expressions understood by the workers
    - highlight hazards, safety measures and critical process parameters (temperature, pressure, ...)
    - make independent double checks mandatory
    - include start-up, shut-down, maintenance and process-specific information for emergencies
  - Include normal and abnormal situations in training
Contract Workers

• Extended liability approach
• Change management
• Employee information maintenance
• Contract employee ‘safety’ training
• Behavioral aspects are important
• Visitor ‘safety’ training
Most encountered words from senior management?

“I do not want any surprises”

Hazard and risk analysis are a means to that end...
CAPACITY COMPONENTS

• **Resources**
  – Strategic and guiding
  – Non-structural and Intellectual
  – Structural and Material
  – Systemic and Functional
  – Human and Skill power

• **Motivational**
  – Insurance
  – Levees/taxes
  – Incentives/bonus
  – Awards/promotional
  – Facilitation

• **Deliveries/performance**
  – Knowledge
  – Skills
  – Attitude
HUMAN CAPACITY- SKILL POWER

• Professionals e.g. assessments, audits, planning, designs, monitoring, concept development, training, etc.

• Execution/coordinate of the tasks: planning, training, mock-drills, monitoring, etc.

• Administrative support functions – logistics, finance, ministerial, etc.
THANK YOU

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