



Put chemical management into practice

DEALING WITH CHEMICAL EMERGENCIES

Dealing with chemical emergencies



Overview

- ZDHC CMS references and requirements
- Chemical emergency scenarios
- Analysing causes of emergencies
- Preparing for chemical emergencies

Requirements as per ZDHC

ZDHC CMS references

CMS 3.6 Emergency Procedures

- Procedures, emergency response plan, testing, drills

CMS 2.3.2 Identify Chemical suppliers

- For urgent technical support or other emergencies

CMS 3.5.2 Safety Data Sheet Management

- Reference to recommended emergency procedures



Requirements as per ZDHC

ZDHC CMS references

Expected CMS Deliverable:

- **Written and up-to-date Emergency Response Plan**
 - How to evacuate building and contact names/information for individuals in charge of evacuation
 - Primary and secondary escape routes with simple instructions
 - Assignment of emergency response leaders
 - Stairways should be kept free of materials
 - Regular fire drills conducted
 - ...
- Emergency provisions and facilities



Requirements as per ZDHC

ZDHC CMS references

Expected CMS Deliverable:

- Written and up-to-date Emergency Response Plan
- **Emergency provisions and facilities**
 - Emergency shower and eye wash station
 - First aid kit (clearly marked, easily accessible and protected against dust and water)
 - Fire fighting equipment
 - Leak control equipment
 - ...



Dealing with chemical emergencies

What chemical emergencies might be possible in your company?



What types you can think of ?
Any past experience in your or other companies?

Dealing with chemical emergencies

What chemical emergencies might be possible in your company?

- Fire/explosion involving/ affecting chemicals as well as follow-up effects such as structure/building collapse
- Spill and leaks
 - Localised
 - Release into environment (air, soil, water)
- Medical emergency following exposure to chemicals (inhalation, skin contact, ingestion, eye contact)

Understanding chemical emergencies

Common causes

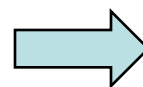
1. Unsafe acts
2. Unsafe conditions
3. “Force majeure”



Understanding chemical emergencies

Common causes

1. **Unsafe acts**
2. Unsafe conditions
3. “Force majeure”



- Most common, but also most difficult to address => Changing behaviour is challenging
- Best prevented by
 - Developing a “safety culture”
 - Defining safety responsibilities in your company
 - Establishing accountability for safety in your company



Understanding chemical emergencies

Common causes

1. Unsafe acts
2. **Unsafe conditions**
3. “Force majeure”



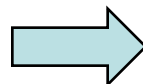
- Easiest to correct (and very cost effective)
- Easiest to prevent through
 - Conducting internal or external safety audits
 - Implementing regular safety inspections
 - Adhering to maintenance schedules for equipment
 - Encouraging employee to report
 - Following good housekeeping practices



Understanding chemical emergencies

Common causes

1. Unsafe acts
2. Unsafe conditions
3. “Force majeure”



- Examples: Flooding, storms, tsunami, off-site industrial accident in other company,...
- Preparedness for possible scenarios main option



Preparing for chemical emergencies

Prevention and preparedness

Main steps

- Identify and assess hazards/risks identification
- Eliminate and/reduce risk hazards
- Conduct safety training and foster safety culture at work
- Inform workers and community on chemical hazards and risks
- Prepare for possible emergencies (provisions)
- Strengthen emergency response capabilities (planning, practice and drills)



Preparing for chemical emergencies

Emergency planning and emergency plan

On-site and off-site emergency planning

On-site:

- Dealing with effects of accident/ incident confined to factory premises, involving only persons working in the factory and property inside the factory

Off-Site

- Dealing with effects uncontrollable inside the factory spreading outside the factory premises => to be coordinated with outside stakeholders (municipality, industrial zone)

For detailed guidance refer to UNEP APPELL
www.unep.org/apell/



Preparing for chemical emergencies

Information sources and references

- Safety data sheets
- Technical data sheets
- Chemical inventory
- Hazard and risk maps
- Incidence/Accident reports



Preparing for chemical emergencies

Information sources and references

- Safety data sheets
 - Technical data sheets
 - Chemical inventory
 - Hazard and risk maps
 - Incidence/Accident reports
- Information on possible emergency situations
 - Prone to catch/fuel fire or explode?
 - Adverse effects on health and environment when exposed to or released?
 - Adverse health effects as consequence of accidental mixing, exposure to heat, fire,...
 -
 - Information on preventive and response measures
 - Suitable fire fighting equipment
 - Leak control materials
 - First aid measures
 -

Preparing for chemical emergencies

Information sources and references

- Safety data sheets
 - **Technical data sheets**
 - Chemical inventory
 - Hazard and risk maps
 - Incidence/Accident reports
- Information on possible emergency situations
 - Concentration of the materials
 - Chemical properties
 - Toxicological data
 -
 - Information on preventive and response measures
 - Application area
 -



Preparing for chemical emergencies

Information sources and references

- Safety data sheets
 - Technical data sheets
 - **Chemical inventory**
 - Hazard and risk maps
 - Incidence/Accident reports
- Information on possible emergency situations
 - Storage quantity
 - Hazard type
 - Hazard group
 - Risk band
 - MRSL
 -
 - Information on preventive and response measures
 - Control approach
 - Risk assessment inventory
 -

Preparing for chemical emergencies

Information sources and references

- Safety data sheets
 - Technical data sheets
 - Chemical inventory
 - Hazard and risk maps
 - Incidence/Accident reports
- Information on possible emergency situations
 - Situation of hazardous chemicals
 - Situation of hazardous processes
 -
 - Information on preventive and response measures
 - Situation of emergency equipment
 -



Preparing for chemical emergencies

Information sources and references

- Safety data sheets
 - Technical data sheets
 - Chemical inventory
 - Hazard and risk maps
 - **Incidence/Accident reports**
- Information on possible emergency situations
 - Number of accidents
 - Severity of accidents
 - Number of victims
 -
 - Information on preventive and response measures
 - Type of measure
 - Remedy



Emergency planning - Safety responsibility examples

Employee responsibilities

- Recognizing safety hazards
- Reporting safety hazards
- Maintaining good housekeeping
- Working safely
- Using personal protective equipment (PPE)
- Making the most of safety training

Employer responsibilities

- Providing training
- Hazard Communications
- Annual & within first 30 days of employment, also when new hazards are introduced
- Special safety training



Emergency planning



Elements

- Planning how to mitigate before some thing occurring- recognition of possible emergency situations
- How to reliably and early detect and report an emergency
- Command, coordination and organisation structure along with trained personnel.
- Deciding on and providing resources for handling emergencies
 - Type of fire extinguisher
 - Spill control equipment
 - First aid provisions
 - Emergency breathing apparatus

Emergency planning

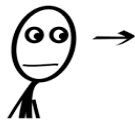


Elements (contd.)

- Establish procedures on how to appropriately respond in case of different emergencies
- Plan how to effectively inform/alarm and communicate with outside emergency services
 - Fire brigade, ambulance, hazardous material teams, experts
- Arrange for proper training of concerned personnel in line with training needs identified.
 - Conduct regular mock drills / rehearsal.
- Regularly review and update emergency plan

Preventing and responding to emergencies

- Active and passive **fire fighting facilities** and/or fixed fire Protection Installations
 - Suitable for particular chemicals or liquids or material
- Emergency **Leak Control Kit**
 - Suitable for particular chemicals or liquids or material
- Emergency **First Aid Kit**
 - Suitable for general and specific chemicals
- **Emergency Vessels** and containers to hold leaking material
- General and special **personal protective equipment** for emergency personnel



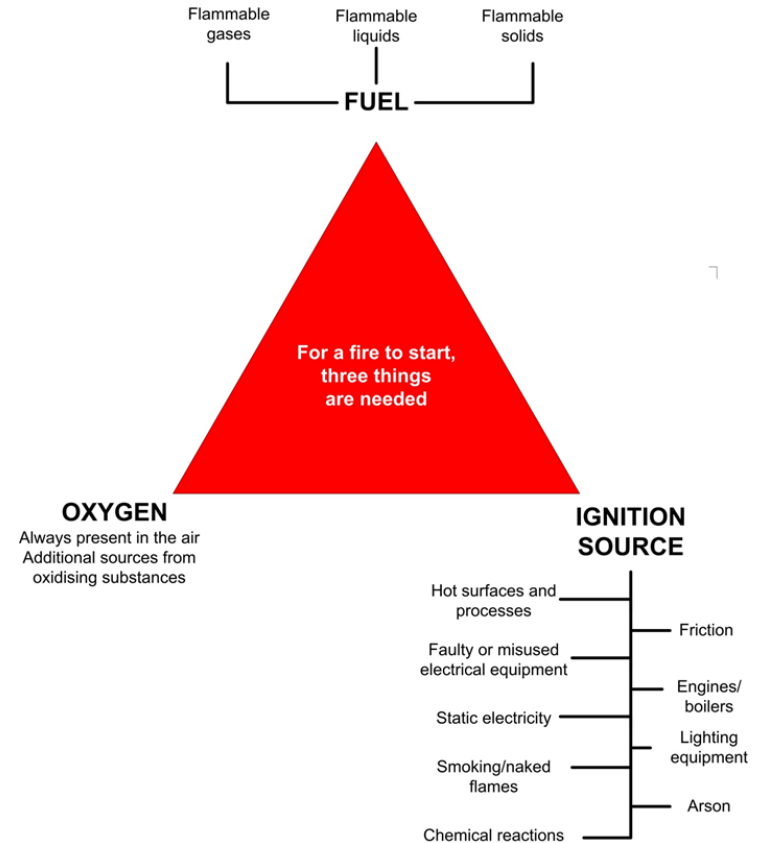
Look into safety data sheets for further guidance

Preventing and responding to emergencies

Fire and explosions

Risk of fire - three basic factors:

- (1) the availability of fuel
(differentiated by flammability degree of substance)
- (2) the availability of source of ignition/heat and
- (3) the ambient conditions such as the temperature and presence of oxygen.



Preventing and responding to emergencies

Classes of fire

Class A	Class B	Class C	Class D
Ordinary combustibles (wood, paper, trash, cloth)	Flammable and combustible gases and liquids	Energized electrical equipment	Combustible metals (e.g. Magnesium, titanium, potassium, sodium)
Routine housekeeping and cleaning	Good handling and storage practices	Good maintenance and prevention of misuse	Follow special advice
Make sure storage and working areas kept free of trash	<p>Reduce ventilation to prevent build-up flammable vapor or gas concentrations</p> <p>Storage of substances in tightly sealed containers</p> <p>Storage away from spark-producing sources</p> <p>Limit portable storage containers to 20 liters each</p> <p>Avoid storage of more than 100 liters of flammable liquids inside a building unless in approved storage containers</p>	<p>Regularly check electrical equipment for old/worn wiring or broken/damaged fittings. Report any hazardous conditions to your supervisor</p> <p>Prevent electric motors from overheating by keeping them clean and in good working order</p> <p>Never install a fuse rated higher than specified for a circuit</p> <p>Never overload wall sockets. One outlet should have no more than two plugs</p> <p>Don't plug more than one heat-producing appliance into an outlet</p> <p>Investigate any appliance or equipment that smells strange. This is often the first sign of a fire</p> <p>Use utility lights that have some type of wire guard over them. Direct contact with an uncovered light bulb can ignite combustible material</p>	



Preventing and responding to emergencies

Select fire fighting measures

Each fire extinguisher displays a rating on the faceplate showing the class of fire (see above) it is designed to put out. Some extinguishers are marked with multiple ratings such as AB, BC or ABC.

Extinguisher	Description
Class A	Class A extinguishers are effective on ordinary combustibles. The extinguisher cools the temperature of the burning material below its ignition temperature. The extinguishers use pressurized water, foam or multi-purpose dry-chemical agents. Class A extinguishers carry a numerical rating that indicates how large a fire you can safely put out with that extinguisher.
Class B	Class B extinguishers should be used on flammable liquids or gases. Class B extinguishers may come in several types including foam, carbon dioxide, ordinary dry-chemical, multi-purpose dry-chemical or halon replacements.
Class C	Class C extinguishers are to be used specifically on electrical fires. Class C extinguishers may contain carbon dioxide, ordinary dry-chemical, multi-purpose dry-chemical or halon replacements. Carbon dioxide or halon replacements, which do not leave a harmful residue, are preferable for computers and other sensitive equipment. Never use water extinguishers or any extinguishing agent capable of conducting electricity on Class C fires. Class C extinguishers carry a letter rating only to indicate that the extinguishing agent will not conduct electricity.
Class D	Class D extinguishers should only be used on combustible metals. Class D extinguishers are made with agents specially designed for the material involved. In most cases, they absorb heat and cool the material below its ignition temperature. Class D fires react violently to water and other types of chemicals. Class D extinguishers carry only a letter rating to indicate their effectiveness on certain amounts of specific metals.

Preventing and responding to emergencies

Select fire fighting measures

Display fire extinguisher charts for further guidances

Extinguisher		Type of Fire				
Colour	Type	Solids (wood, paper, cloth, etc)	Flammable Liquids	Flammable Gases	Electrical Equipment	Cooking Oils & Fats
	Water	✓ Yes	✗ No	✗ No	✗ No	✗ No
	Foam	✓ Yes	✓ Yes	✗ No	✗ No	✓ Yes
	Dry Powder	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ No
	Carbon Dioxide (CO ₂)	✗ No	✓ Yes	✗ No	✓ Yes	✓ Yes



Only use a fire extinguisher when it is safe to do so. If the fire is too big, if it is spreading or threatening to block your path to escape leave the area immediately.

If necessary, do not hesitate to use the extinguisher to clear an escape path.

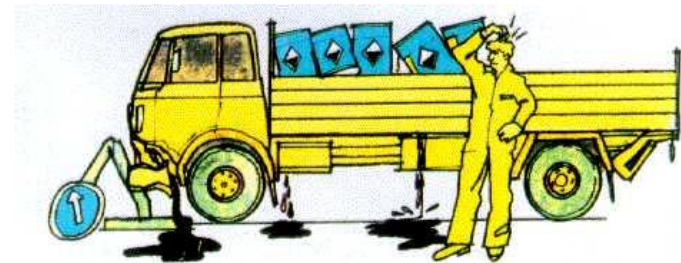
As part of your planning, also assess how long it would take for external fire fighting services to reach your location.

Preventing and responding to emergencies

Spillages and leaks

Fact

Even in the best run chemicals stores and areas, where chemicals are repacked, transferred into other containers or mixed, there will occasionally be spills.



Small spills from many cars daily: when counted together make...

Preventing and responding to emergencies

Spillages and leaks

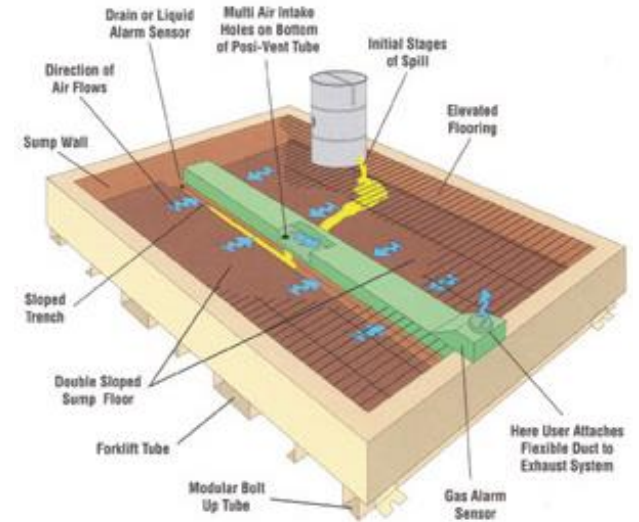
- Check containers on delivery
- Use good quality containers
- Ensure good and careful handling practices
- *Bad handling and long storage under bad conditions => risk of spills and leaks*
- Inform yourself in advance on measures and provisions in case of spillages or leakages
 - Refer to material Safety Data Sheet and manufacturer's instructions for corrective action.



Preventing and responding to emergencies

Spillages and leaks

- Containing spill and leaks - Secondary containments
- Dealing with spill and leaks - Responding



Secondary containments

- Recommended capacity 110% of the maximum capacity of the largest tank or drum
- Bunds or drip trays

Note: Check your local regulations for specific requirements.



Preventing and responding to emergencies

Keep spill control kits ready

- adequate with additional provisions needed to clean up materials that may spill
- to be ready for use in the store at all times.

Spill control kits are commonly available from chemicals or other specialized distributors.

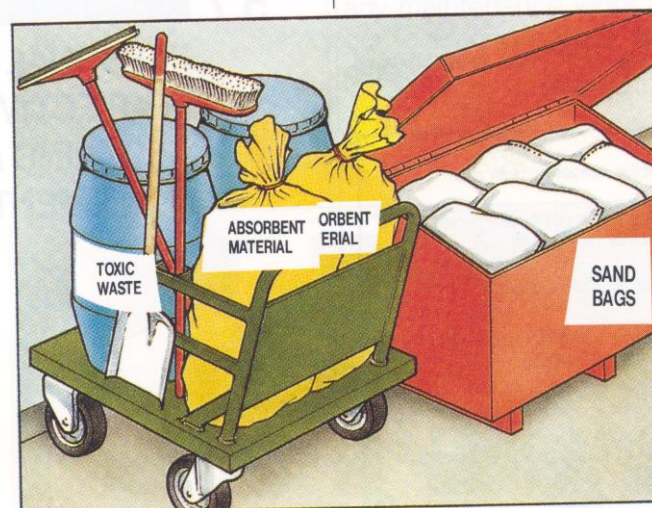


Preventing and responding to emergencies

Spillages and leaks

Recommended equipment:

- Personnel protective equipment
- Absorbent materials (Sand, clay, sawdust or special chemical absorbers)
- Empty open drums and oversized or open-top drums
- Labels for marking drums
- Detergent solution (lime)
- Brooms, shovel, metal funnel
- Electric solvent resistant and explosion proved drum pump



All safety and emergency related equipment must be frequently and regularly checked and maintained to ensure that its condition is satisfactory.

Preventing and responding to emergencies

Liquid spillages be treated as soon as possible

- Collect with solid absorbent (in clay, sand, sawdust) - refer to recommendation in (M)SDS
- Decontaminate area according to information in (M)SDS
- Do not use water to wash away liquid spills!



Preventing and responding to emergencies



Dealing with solid spills:

- Remove with industrial vacuum cleaners.
- Collect solid contaminated materials in “old-open Top drums” until final disposal
- Dispose waste according to manufacture’s instruction and/or legal requirements.



Preventing and responding to emergencies

Check in advance:

- Some chemical releases can be cleaned up, whereas other releases create an emergency (evacuate).
- Determine what can and cannot be cleaned up should a release occur.
- Materials used to clean-up chemical spills must be treated as hazardous waste, placed in the proper container, labeled, and provided to the responsible department.
- Do not place paper towels or other materials used for clean-up in the trash.
- Oily rags must be placed in a metal safety can that has a self closing lid until provided to chemicals management in a proper waste container.



Preventing and responding to emergencies Did you know...

Did you know...

...cat litter is an excellent all purpose absorbent and should be kept in stores where high volumes of solvents are stored



Preventing and responding to emergencies

Dealing spills and leaks beyond your factory boundaries (e.g. leak of fuel or chemicals into water bodies, release of toxic fumes into air)

Plan for external emergencies

- How and which external agencies to alert?
- How to cooperate with emergency services?
- How to contain further releases?
- How to respond to outside emergencies?



Preventing and responding to emergencies

Medical emergencies involving chemicals

Assessing possible medical emergency situations in your company

- Review information in the (M)SDS and chemical inventory
- Map out areas with risk of medical emergencies in the factory

Example - Provisions for dealing with

- Chemical burns
- Chemical poisoning
- Asphyxiation
- Confined space accidents (e.g. effluent treatment plants, underground tanks, closed vessels)



Preventing and responding to emergencies

Eye/wash station emergency shower



Are emergency eye wash/showers located close to work areas where chemicals with irritant/corrosive properties to skin and eye are used?



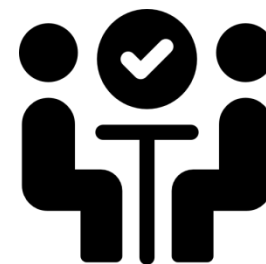
As per OSHA (Example)

- no more than 10 seconds to reach (=> Consult a medical professional to determine appropriate distance for harsh acids and caustics (high hazard = closer distance))
- in a well-lit area and identified with a sign
- located on the same level as the hazard
- Functioning to be check at least once a week

Preventing and responding to emergencies

First aid provisions

- Has the company checked the (M)SDS for any first aid requirements going beyond the standard content of first aid kits?
- Are these additional provisions available?
- Do the work instructions in such work locations reflect the first aid recommendations of the respective (M)SDS?
- Has the company verified how long it will take for medical emergency service to reach?
- Has the company doctor been informed about which hazardous chemicals are used in the company?



Dealing with chemical emergencies

Exercise

Your tasks in groups:

To prepare for possible chemical emergencies at “Beautiful Colors”, the management has called your team to a meeting to discuss how “Beautiful Colors” could prepare for possible emergencies.

Review the situation described and complete the assigned tasks.



A hot day at „Beautiful Colours

It is a hot summer day and work in “BC” is in full swing. One of the workers has noticed that in the store room of “BC” one of the barrels containing cleaning solvent has developed a leak. As it is only a small wet batch on floor, he does not pay any more attention to it. It seems that one of the other workers in the store had accidentally hit the barrel with the newly acquired forklift when reversing in the storage area.

The sun is shining onto the roof of the store room. The small wall mounted fan hardly makes a difference to ease the hot air inside. The store-in-charge has placed an old stand fan in the store to increase the air circulation. As he had not found a proper plug point, he had plugged the blank wires into a socket, near the chemical containers. Unknown by the store-in-charge, the barrel’s side has been cracked quite severely and more liquids are spilling out and collecting near the stand fan. Due to the heat the solvent is quickly evaporating.

A hot day at „Beautiful Colours

Suddenly, there is a flash and the floor around the stand fan is on fire. Quickly the fire makes its way to the barrel with the solvent, which blows up in flames with a loud crackling sound. The store-in-charge rushes out into the open yard in panic. There is a fire extinguisher somewhere, which has been installed by the management some months ago. So far, he had not received any training on how to use it. Shouting loudly he runs into the production areas to alert the other workers. Confused the workers try rushing to different exits from the work area. Eventually the production supervisor alerted by all the running around emerges from his office. Somehow he is able to extract the information from the store-in-charge about what has happened. Quickly he runs back into the office and calls the fire brigade. Then he joins the other workers who have gathered outside the factory building in different locations. It appears that somebody is still inside the building.....

This is what might happen at “Beautiful Colors”.

To prepare for possible chemical emergencies at “Beautiful Colors”, the management has called your team to a meeting to discuss how “Beautiful Colors” could prepare for possible emergencies.

Dealing with chemical emergencies

Exercise

Your tasks in groups:

1. Identify possible chemical emergency scenarios in the case study “Beautiful Colors” (use different documents you have prepared so far, in particularly floor plans, flow charts and inventory table)
2. Decide what and where emergency equipment may be required in the company, in particular in terms of
 1. Active and passive fire fighting facilities (e.g. type of fire extinguishers)
 2. Emergency leak control kits and provisions (e.g. dyking, clean-up)
 3. Emergency vessels and containers to hold leaking material
 4. Medical first aid provisions
 5. General and special personal protective equipment for emergency personnel
3. Compile your group’s findings for presentation in the plenum.

Time: 45 min



Dealing with chemical emergencies

1. Prevention
2. Preparation
3. Response
4. Recovery

**Prevention is always
better than cure!**

