

Group Exercise on Hazard Identification and Risk Assessment: Responsible Production in Practice



- Examples: What can go wrong when delivering /picking-up chemicals
- Responsible Production risk assessment in practice: manufacturer of steel tubes
 - Group Exercise: You assess the risk



Accidents at SME Galvanization Plants in Germany: 2014

- Accident when transferring HCl (37%) to storage tank: 37 people injured
- Accident when transferring Nitric Acid to transport vessel: evacuation, several injuries
- Causes: not following SOP's and adhering to SDS information



1. IDENTIFY RESPONSIBLE PRODUCTION ISSUES

2. GET THE RIGHT PEOPLE INVOLVED

3. DEVELOP YOUR PLAN

4. PUT PLAN INTO PRACTICE, TRAIN AND COMMUNICATE

5. EVALUATE HOW WELL YOU DID



Tools for the first step of Responsible Production



Focus of this session

Tool 1.1
Prepare
process flow
chart

Tool 1.2
Chemical
inventory and
hazard
classification

Tool 1.3
Identify risks

Tool 1.4
Hazard
hotspots map

Tool 1.5
Legal register

Tool 1.6
Hazard
classification
(control
banding)



Tool 1.1 Prepare a process flow diagram

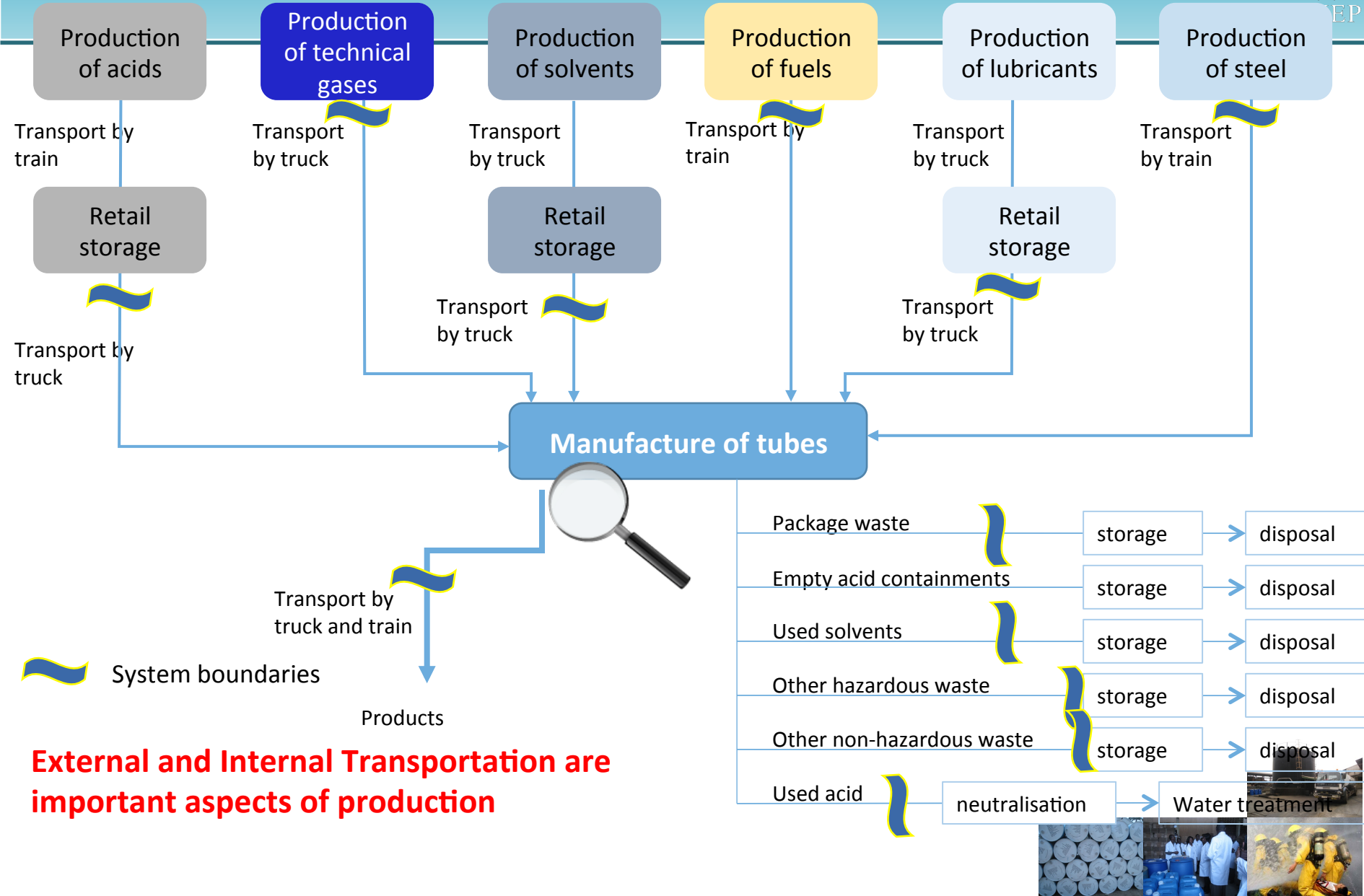
Step 1: Prepare your process flow diagram

- Define boundaries of process
- Decision on level of detail to be included in the diagram
- Identify steps and activities in the process
- Describe sequence of activities
- Discussion and revision of flowchart with relevant stakeholders

e.g. Workers and supervisors
 Suppliers
 Transporters
 Customers
 Maintenance companies



Boundaries of the process



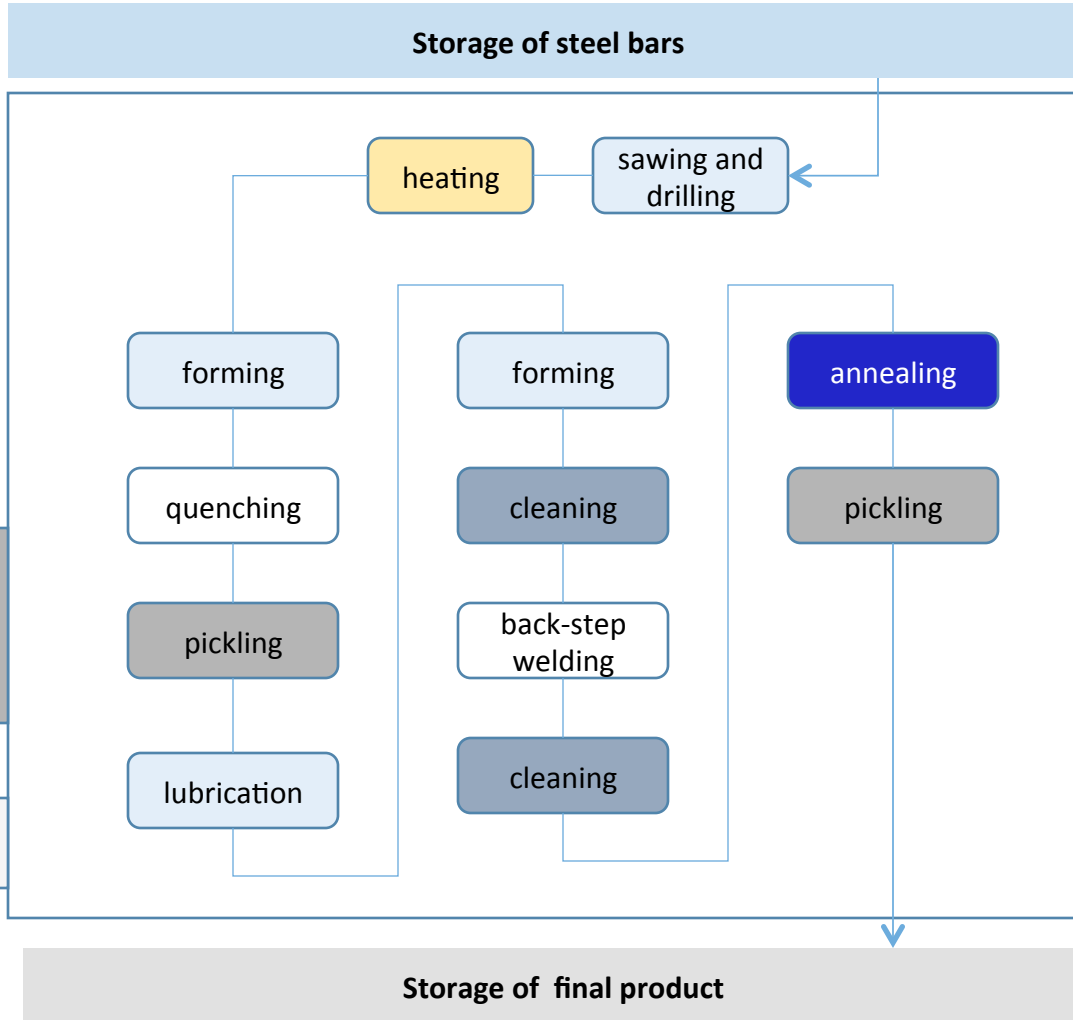
Level of detail to be included in the flow diagram



Delivery by train

Chemicals

- Acids
- Solvents
- Technical gases
- Lubricants
- Fuels



Storage fuels

Storage lubricants
and further
chemicals

Storage solvents

Storage of
technical gases

Storage
acid

Waste
storage

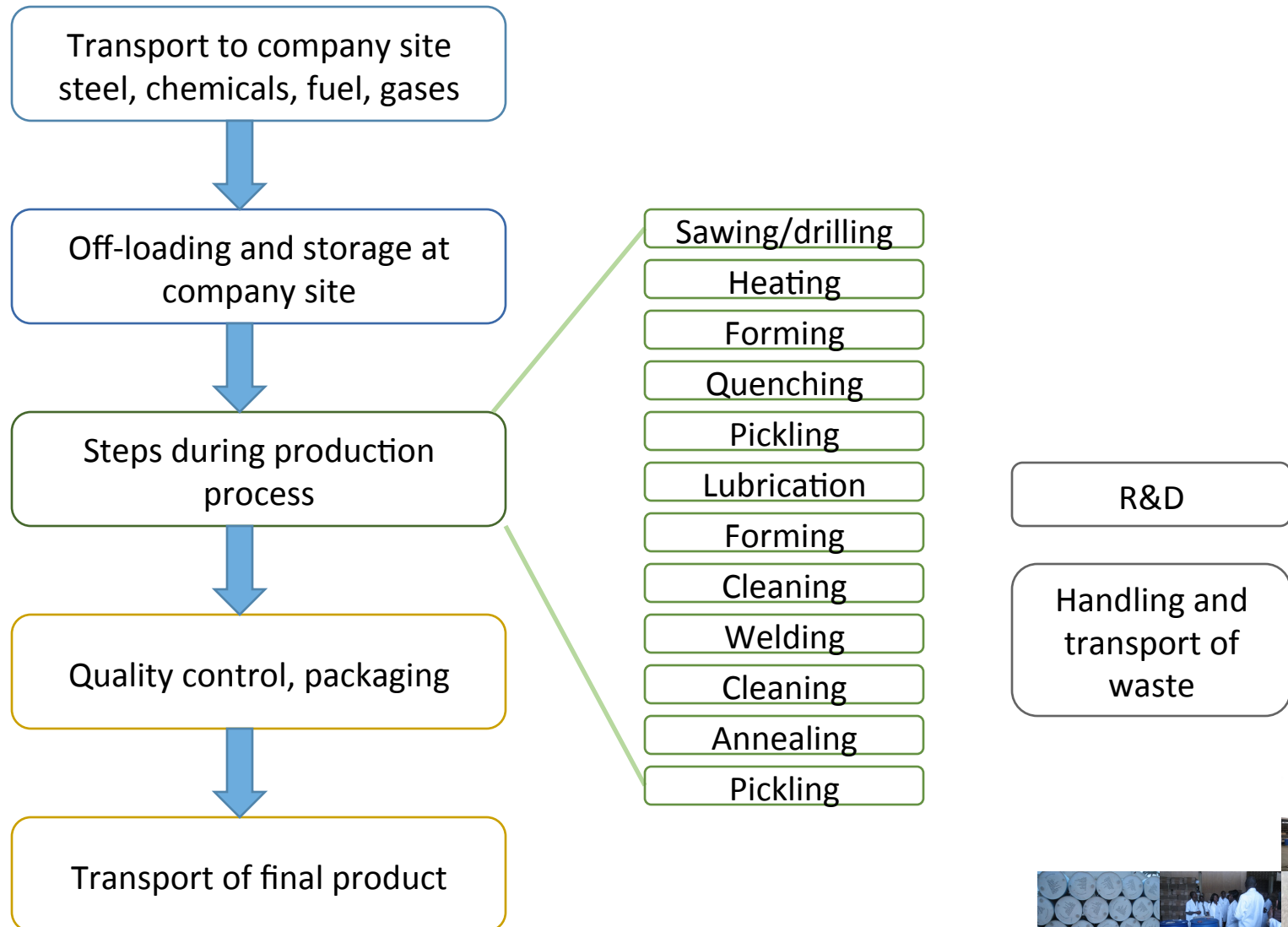
Delivery by truck



Delivery by truck



Identification of steps and sequence of activities in the process



Tool 1.1 Prepare a process flow diagram

Step 2: Identify the chemicals, their quantities and the hazards involved in the process

- Identification of chemicals and their quantities
- Identification of hazards associated with activities such as potential for a fire or an explosion
 - This information is explained in Material Safety Data Sheets (MSDS); should be made available by suppliers
- Identification of hazards for all chemicals (identification of hazardous properties such as flammability, corrosiveness, toxicity, etc)
- Mark hazards on flow-chart
- Repetition of this process through entire process flow-chart



Identification of chemicals and their quantities

Process steps at company site	Chemicals involved	Quantity of chemicals, e.g. t/a
Pickling	Acids , such as HCl, HNO ₃ , HF, H ₂ SO ₄	6 t
Cleaning	Naphta, perchloroethylene	10 t
Lubrication	Various lubricants, soaps	3 t
Heating	Petroleum, gas	100 t
Annealing	Technical gases, e.g. H ₂ , N ₂	100 gas cylinders
Off-Loading	All chemicals	
Storage	All chemicals	
R&D	Laboratory chemicals	



Identification of hazards for all process steps

Process steps at company site

Pickling

Cleaning

Lubrication

Heating

Annealing

Off-Loading

Storage

R&D

Potential accident hazards

Leaking

Leaking, explosion,
vapor emissions

Leaking

Burning

Explosion

Leaking, reaction

Leaking, explosion

various



Identification of hazards for all chemicals

Chemicals involved	Classification	Chemical hazards
Acids , such as HCl, HNO ₃ , HF, H ₂ SO ₄	e.g. Skin Corr. 1A; H314	Corrosive effects, danger for health, potential fatalities
Naphtha, perchloroethylene	e.g. Carc. 2; H351, Aquatic Chronic 2; H411	Explosive properties, danger for health, potential fatalities
Various lubricants, soaps	e.g. Skin Sens. 1; H315	Irritating effects
Petroleum, gas	e.g. Asp. 1; H304	Flammable properties
Technical gases, e.g. H ₂ , N ₂	e.g. Flam. Gas 1; H220 Press. Gas	Explosive properties, danger for health, potential fatalities
Off-Loading	e.g. Asp. 1; H304	Flammable properties
Storage	e.g. Flam. Gas 1; H220 Press. Gas	Explosive properties, danger for health, potential fatalities
Laboratory chemicals	Acute Tox. 4; H302, Aquatic Chronic 1; H410	Various small scale hazards

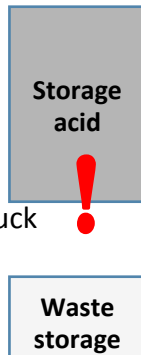


Mark hazards on flow chart

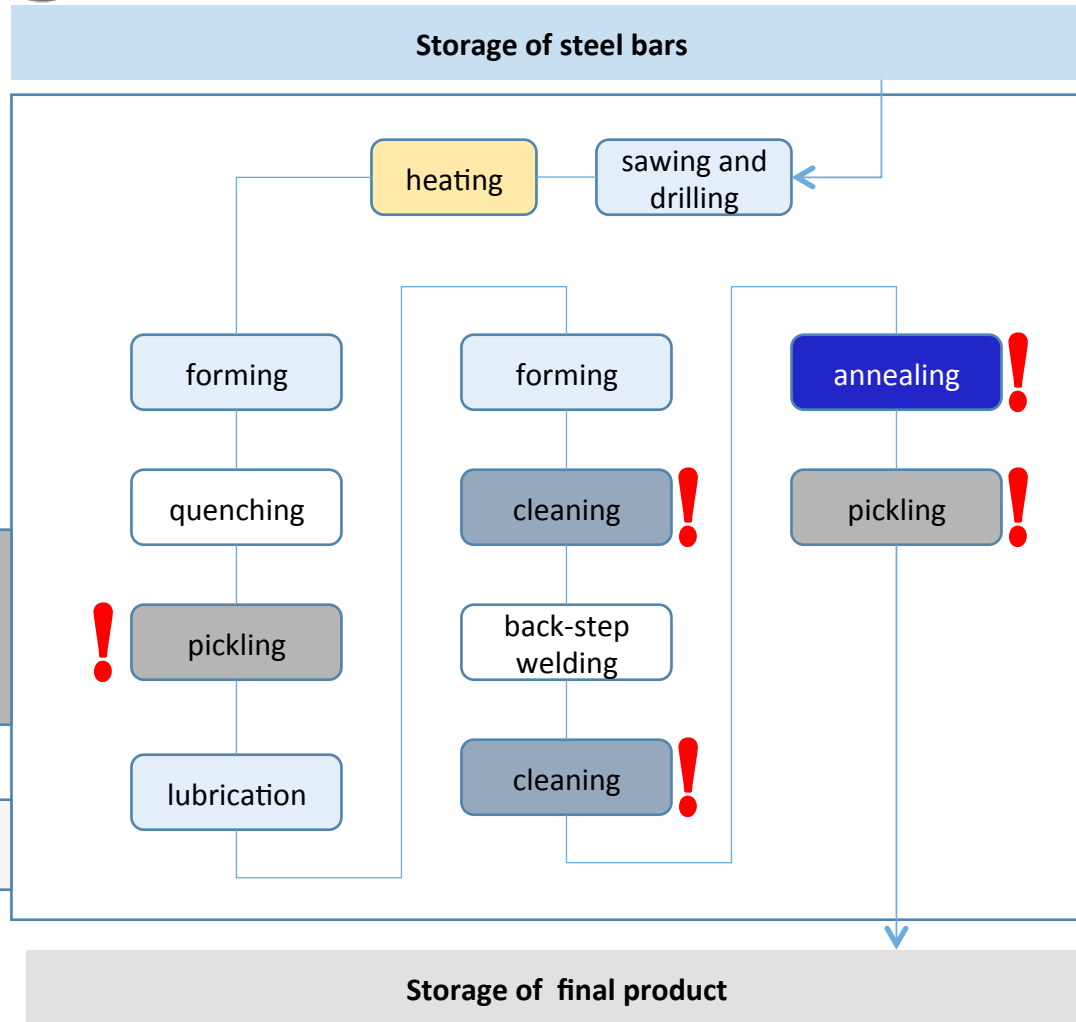
! Relevant for risk analysis



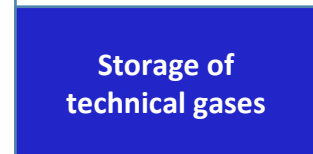
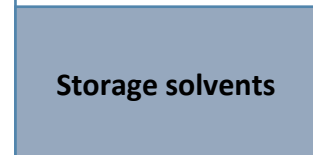
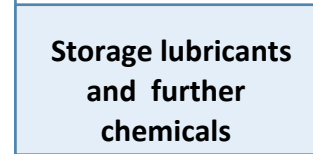
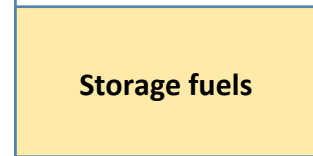
Chemicals	
Acids	
Solvents	
Technical gases	
Lubricants	
Fuels	



! Delivery by truck



Delivery by train



Tool 1.2 Chemical inventory and hazard classification

Step 1: Review existing information on chemicals stored and used at site

- Establish what information already exists within the company regarding chemicals, e.g.
 - Purchasing records
 - Stock control cards
 - Inventories
 - Suppliers' product information,
 - (Material) Safety Data Sheet - (M)SDS
- Review

Step 2: Prepare an inventory

List all chemical substances in an inventory

- e.g.:
- Where located
 - Chemical name
 - MSDS availability
 - GHS
 - Amount in use
 - Notes about handling, use, storage, disposal conditions, etc.



Tool 1.2 Chemical Inventory and Hazard Classification

GHS Regulation

Harmonised labelling: GHS and transport pictograms

- GHS classification criteria are based on UN recommendations on the transport of dangerous goods

Hazard classes	Old EU hazard symbols	GHS pictograms	Transport pictograms
Explosives			
Flammables			
Oxidisers			
Corrosives			
Acute toxicity			



Tool 1.3 Identify health, environmental, social and economic risks

Step 1: Create a risk assessment team



e.g.

- Employees
- Transporters (train, truck)
- Insurance company
- Representatives of community
- Local authorities
- Other (industrial neighbours)

Step 2: Review your hazard hotspots

- Pay particular attention to areas or process steps where large quantities of hazardous chemicals may be stored or handled



Review your hazard hotspots



Relevant for
risk analysis



Office and
Canteen

Storage of steel bars



Delivery by train

Chemicals

- Acids 
- Solvents 
- Technical gases 
- Lubricants 
- Fuels 

Waste
storage

Drums
transport

Storage acid
(Dilution of acid
In containers)

Transfer of 37% HCl
to Storage Tanks



Delivery of tanks by truck

Internal path
with high traffic



Visitors parking

Storage of final product

heating

sawing and
drilling

forming

quenching

pickling

lubrication

forming

cleaning

back-step
welding

cleaning

annealing

pickling

Drums
transport

Storage fuels

Storage lubricants
and further
chemicals

Storage of
technical gases

Storage solvents
(Transfer to
containers)

Offloading of tanks with solvent



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Tool 1.3 Identify health, environmental, social and economic risks

Step 3: Identify risk-prone and vulnerable groups, areas and assets in case of an accident

- Identification of threatened objects (people, environment and property) in case of accident

Step 4: Identify potential accident scenarios related to the hazard hotspots you have identified

- Identification and analysis of past accidents in the sector
- List potential accidents related to the Hazard Hotspots which have been already identified
- Consider following types of accidents (or 'accident scenarios')
 - e.g.:
 - Toxic release
 - Explosions
 - Chemical fire
 - Leakage of hazardous chemicals from storage and process areas, or during transport



Tool 1.3 Identify health, environmental, social and economic risks

Step 5: Identify the severity of related health, environmental, social and economic impact in an accident situation

- Assign a 'severity' (importance) factor
- Discussion and agreement in risk assessment team

1. Negligible

2. Limited

3. Serious

4. Very Serious

5. Catastrophic

Scale should be adapted to both the country and the local context

- Consider impact on
 - Health of community and workers
 - Agriculture and fisheries
 - Water resources and quality of air
 - Site facilities and transport infrastructure
 - Community and social infrastructures
 - Company image



Tool 1.3 Identify health, environmental, social and economic risks

Step 6: Estimate the likelihood of each of the identified accident situations actually taking place

1. Practically impossible
2. Unlikely
3. Rarely
4. Regularly
5. Frequently

Step 7: Assign a risk factor to each hazard hotspot

- Assign each hazard hotspot a risk factor from 1/1 (lowest) to 5/5 (highest)
- Consider different possible hazard scenarios related to hot spots when assigning risk factors
- Repeat this for each activity in the process
- Mark the risk factor on your flow chart



Tool 1.3 Identify health, environmental, social and economic risks

Frequency 5	5/1	5/2	5/3	5/4	5/5
Frequency 4	4/1	4/2	4/3	4/4	4/5
Frequency 3	3/1	3/2	3/3	3/4	3/5
Frequency 2	2/1	2/2	2/3	2/4	2/5
Frequency 1	1/1	1/2	1/3	1/4	1/5
	Severity 1	Severity 2	Severity 3	Severity 4	Severity 5

- Area where risks are critical and require monitoring/control
- Area where risks are considered unacceptable



Tool 1.3 Identify health, environmental, social and economic risks



Step 8: Prioritise your hazards hotspots

Highest priorities

- Can separate into:
- Unacceptable
 - Critical

annealing

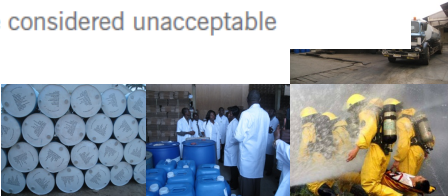
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All others

Frequency 5	5/1	5/2	5/3	5/4	5/5
Frequency 4	4/1	4/2	4/3	4/4	4/5
Frequency 3	3/1	3/2	3/3	3/4	3/5
Frequency 2	2/1	2/2	2/3	2/4	2/5
Frequency 1	1/1	1/2	1/3	1/4	1/5
	Severity 1	Severity 2	Severity 3	Severity 4	Severity 5

- Area where risks are critical and require monitoring/control
- Area where risks are considered unacceptable



Tool 1.4 Map the hotspots

Step 1: Map your Hazard Hotspots

On-site

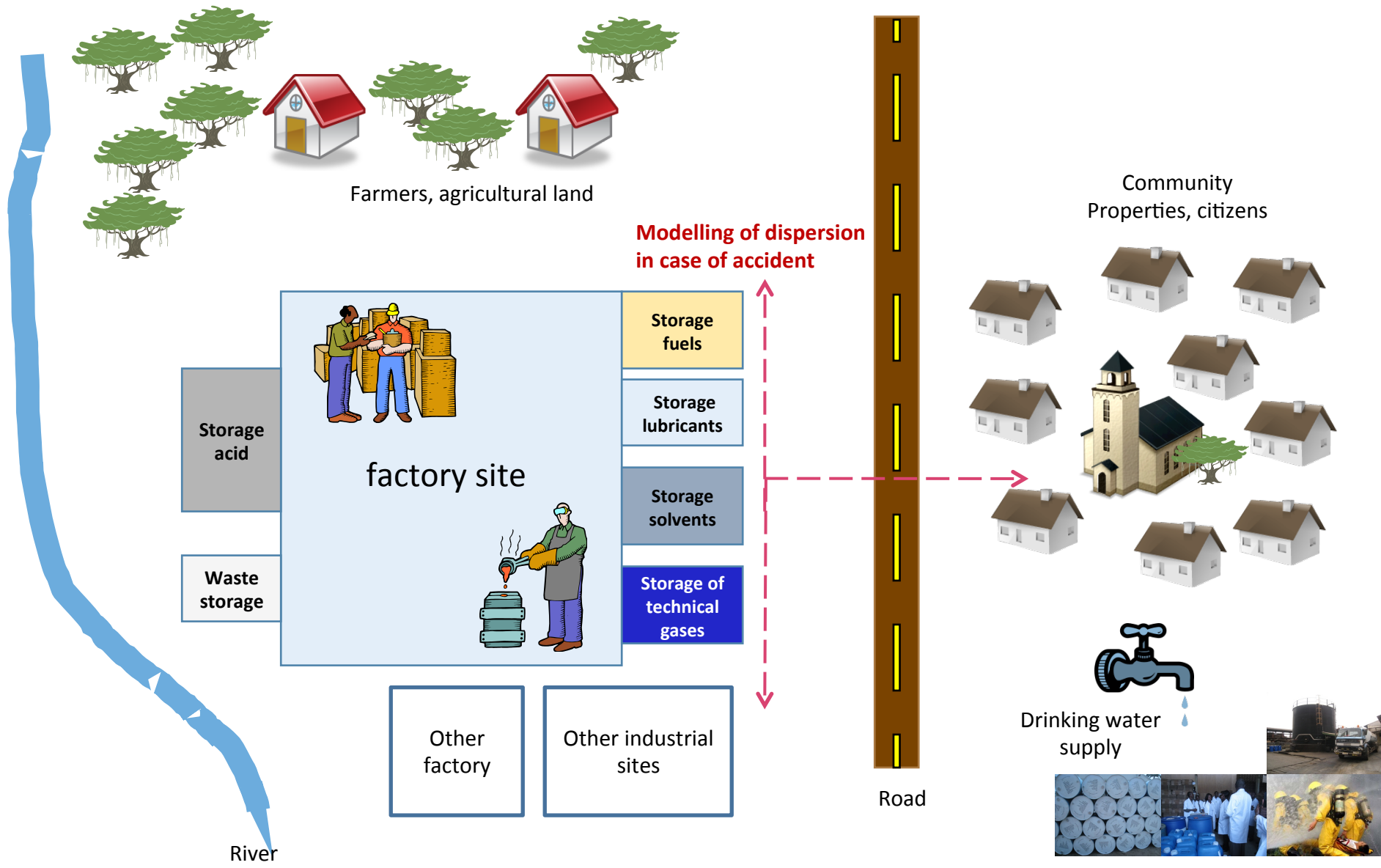
- Ground plan of the company or existing company floor plan
- Main areas and departments

Off-site

- Plan of the region and mark your site
- Identification of routes of your suppliers for delivering chemicals
- Identify routes used to transport your chemical products
- Locate external activity with its associated risk factor



The Factory and Surroundings



Continue to.....

Identify accident scenarios with



threatened objects and stakeholders

for

Manufacture of Steel Tubes

.... Now it's your turn



Group Exercise: Quick Risk Assessment

- Identify potential accident scenarios
- Assign severity to Health, Property, & Environment (together)
- Assign likelihood of accident
- Identify high priority Hotspots (use Tool 1.3) and map Hotspots on Block Flow Diagram
- Bonus: Choose highest priority Hotspot & propose effective risk reduction measure



Together: Specification of potential accident scenarios



Annealing

Risk of explosion and fire

- Entering of oxygen into the hydrogen furnace will cause immediate explosion and fire



Transport of acid



Pickling

Risk of bath overflow with (diluted) acids; leakage of diluted acid

- Adverse acute effects for workers, fatalities possible, damage to property; containment of environment



Cleaning

Risk of explosion; risk of fire; risk of leakage

- Killing or adverse effects for workers; damage to property; contamination of environment (in particular drinking water)



Group Exercise: Quick Risk Assessment

BREAK INTO GROUPS



Review Hotspots



Relevant for
risk analysis



Office and
Canteen

Storage of steel bars



Delivery by train

Chemicals

- Acids 
- Solvents 
- Technical gases 
- Lubricants 
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Waste
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Drums
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Storage fuels

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Storage of
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**Storage solvents
(Transfer to
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Offloading of tanks with solvent



The First Step is taken...

Continue the Responsible Production journey to reduce risk

