



# CHEMICAL FLOWS

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November 2017



# LEARNING OUTCOMES & RESOURCES

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## Learning Outcomes

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- Introduction to NPOs and how these can be managed and identified.
- Analysis and documentation of chemical material flows in your company.

## Resources

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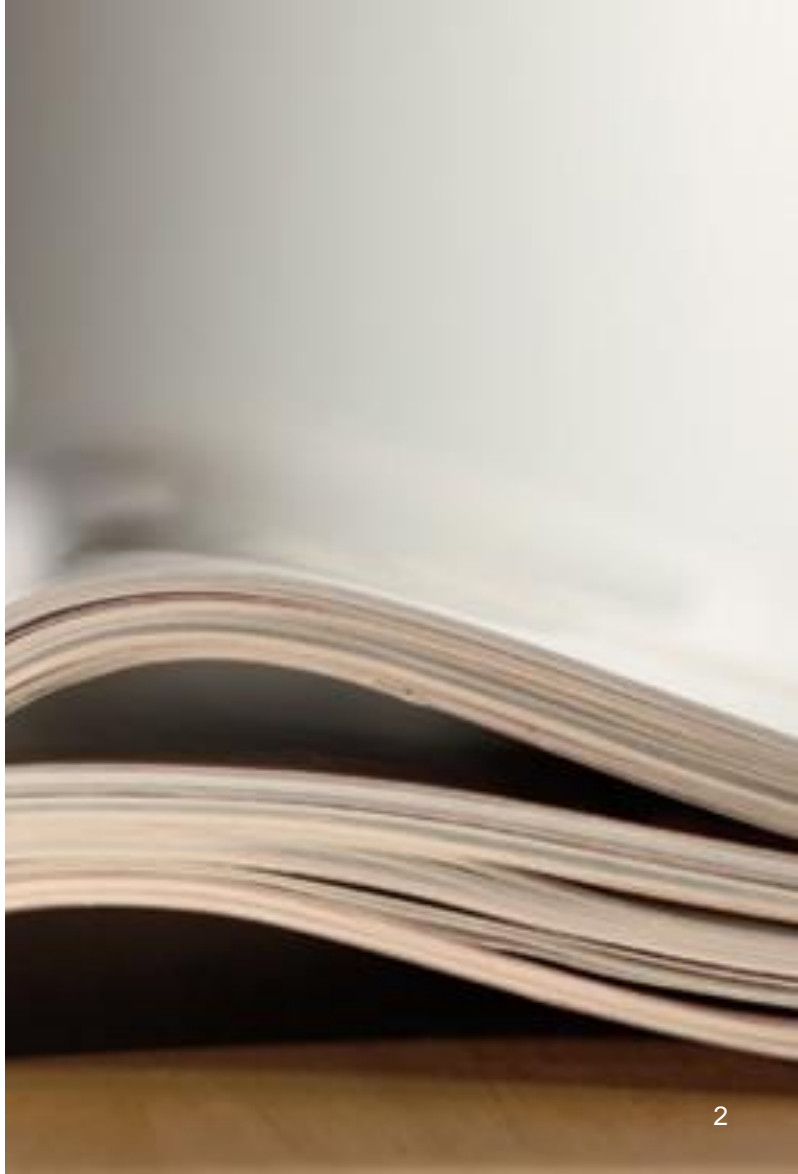
- REMC Company Handbook.
- ZDHC Chemical Management Systems Guidance Manual.

## Workbook

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Refer to complimentary excercises in your workbook.



# ZDHC REQUIREMENTS



## ZDHC CMS 2.1.2 - Facility Plan and Walk Through

- Factory Plan.

## ZDHC CMS 2.1.3 - Chemical Material Flow Diagrams

- Chemical Material Flow Diagrams.





**What problems can occur if you do not know the chemical flow in your facility?**



Brainstorm as a group and make notes in your workbook, exercise (4-1).

# Identifying Non-product Outputs (NPO)

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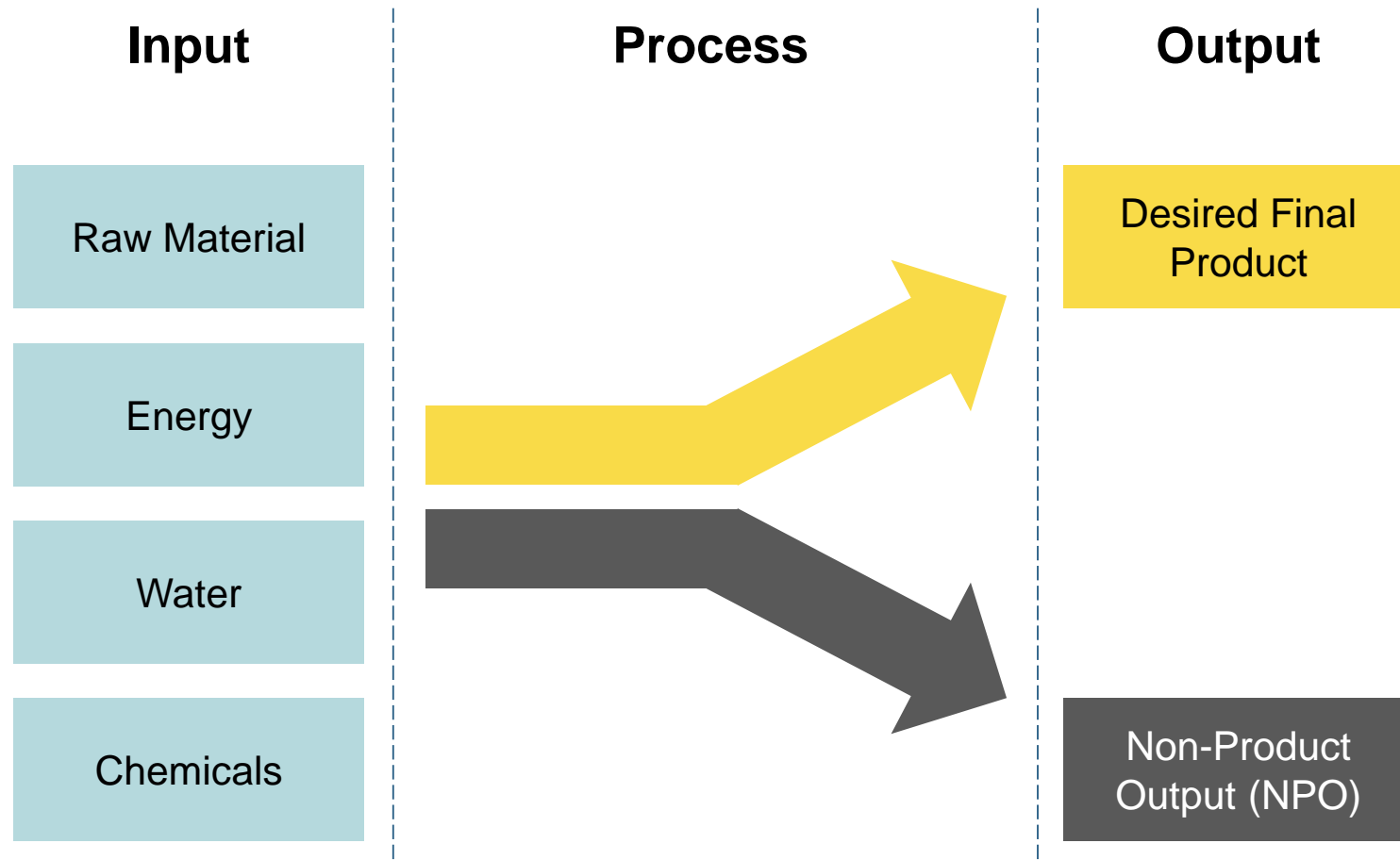
## EXAMPLES OF NON-PRODUCT OUTPUTS

- Unqualified raw materials.
- Consumables.
- Rejects, off-specification products (any type) and reprocessing costs.
- Waste (solid, liquid, toxic, non-toxic).
- Wastewater (amount, degree of contamination = all water not contained in the final product).
- Energy (not contained in the final product), e.g. coal, steam, electricity, oil, diesel, fuel, waste heat).
- Emissions (including noise and odours).
- Losses in storage.
- Losses during handling and transport (internal, external).
- Packaging material (unless for perfumes or similar products).
- Client reclamations and trade returns.
- Losses due to lack of maintenance.
- Losses or health and environmental problems.
- Capacities occupied by reprocessing (opportunity costs).
- Machine downtimes.

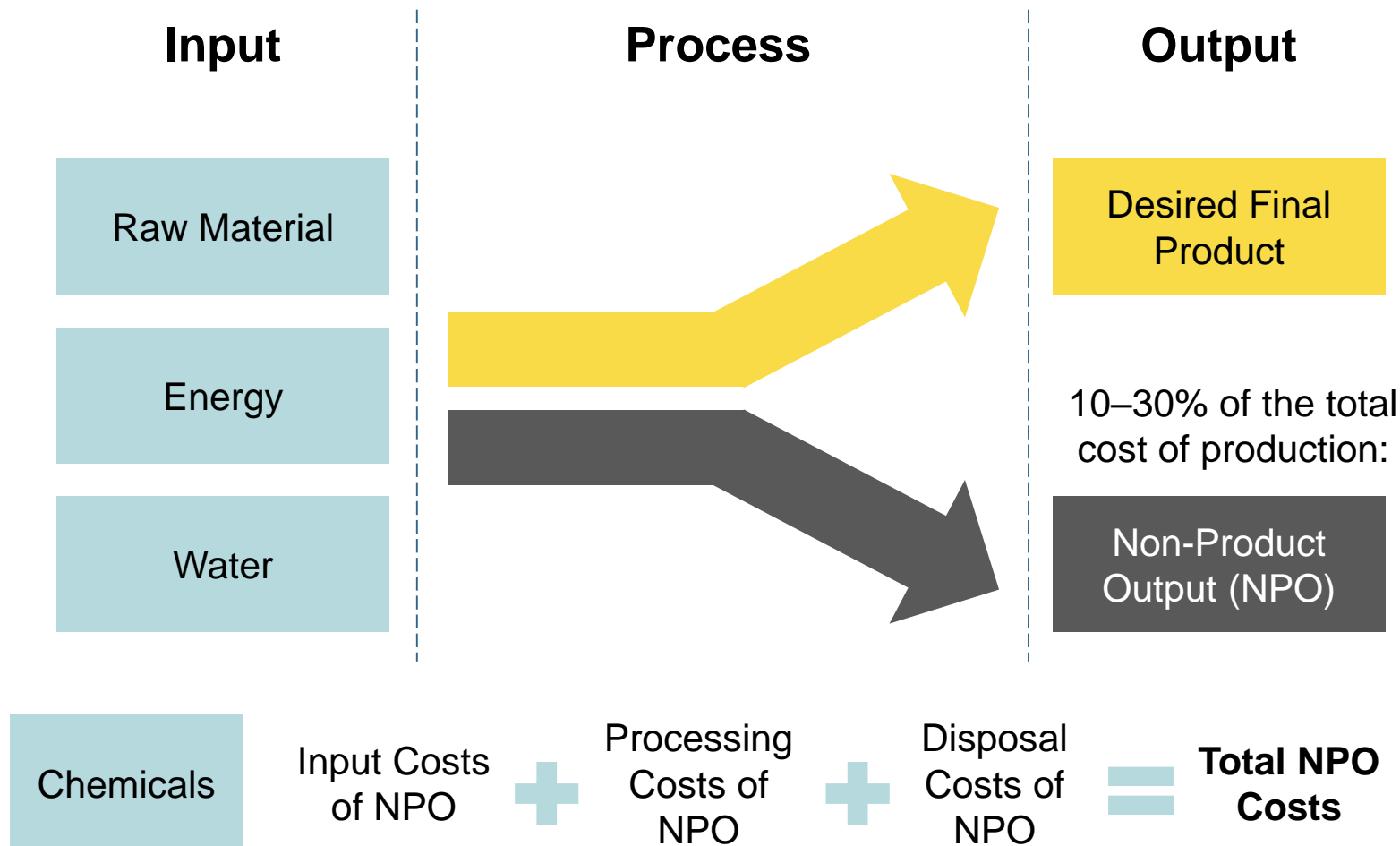




# NON-PRODUCT OUTPUT (NPO)



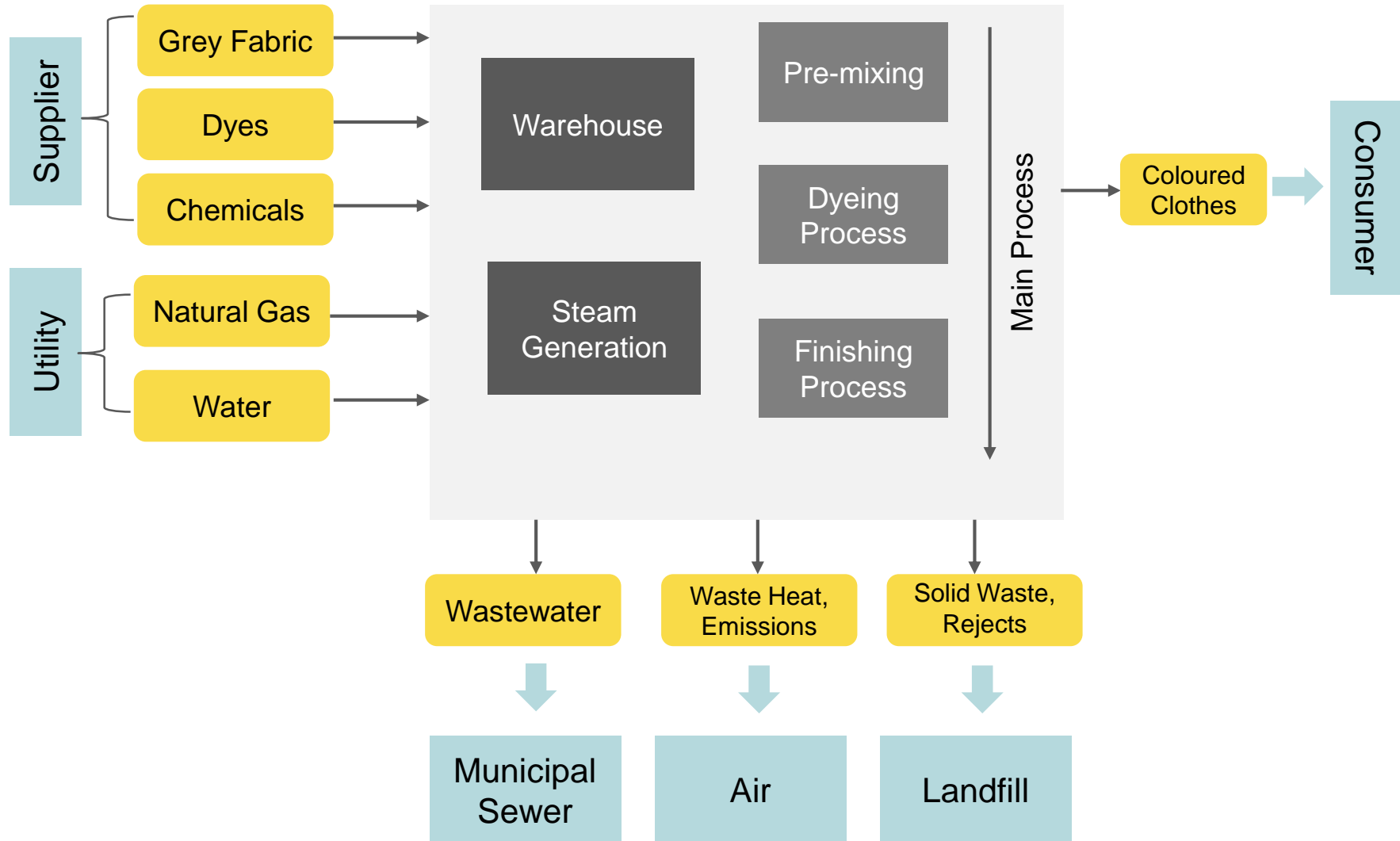
# POTENTIAL FOR EXTRA PROFITS FROM MANAGING NON-PRODUCT OUTPUTS (NPOs)



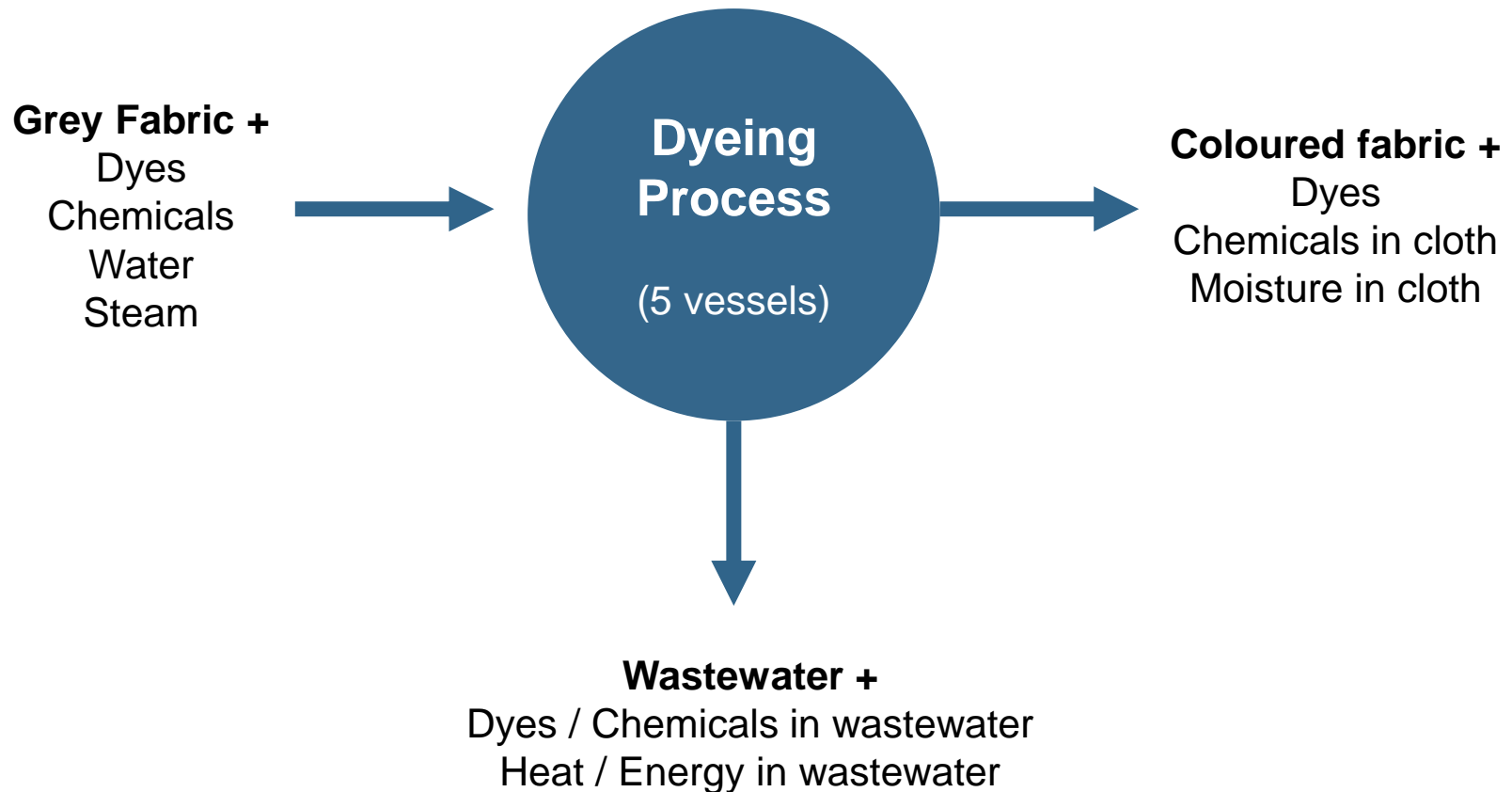
NPO = All material, energy and water which is used in the production process but does not end up in the final product.



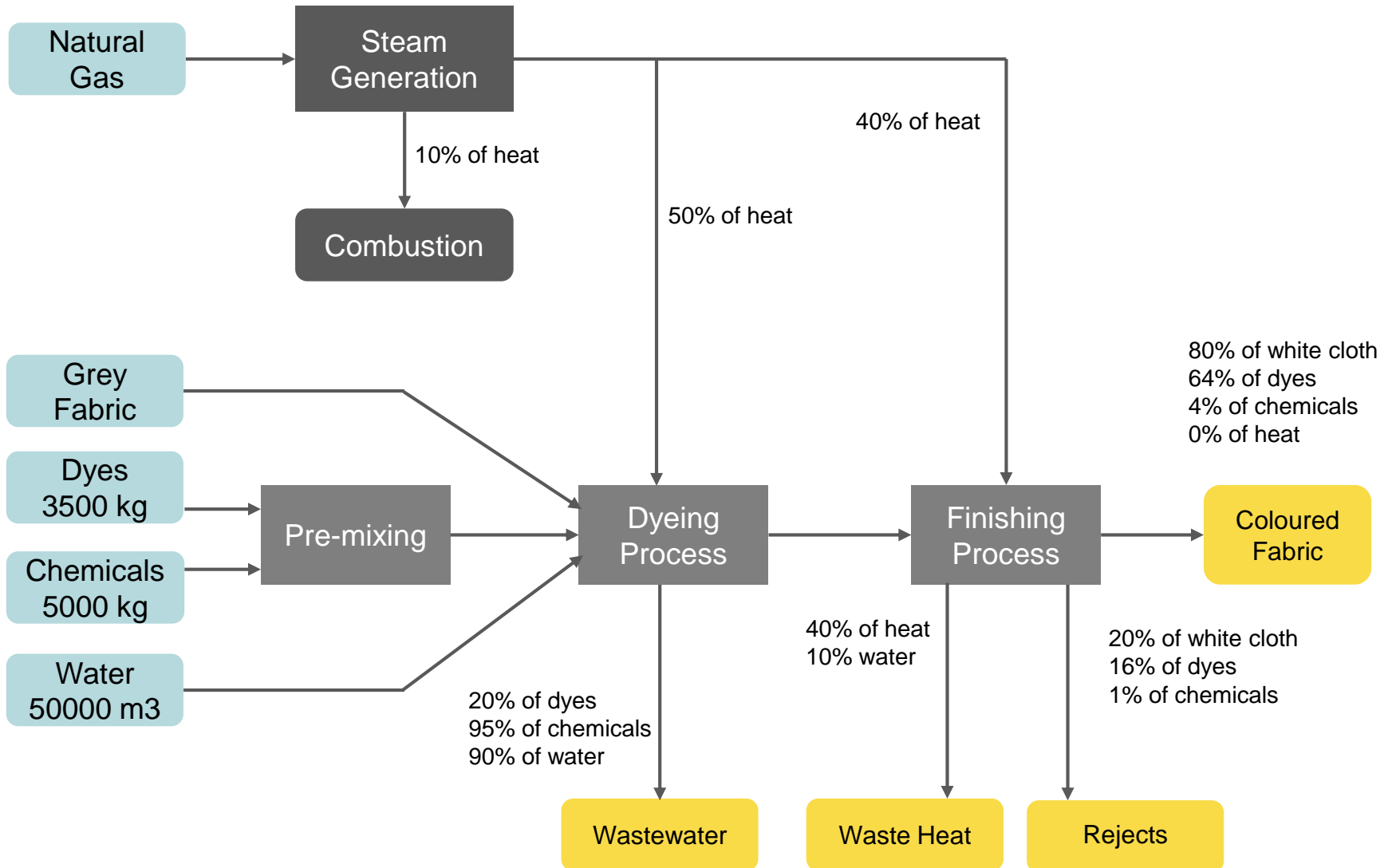
# APPROACH TO NPO IDENTIFICATION FROM HIGH LEVEL TO SINGLE PROCESS (1/3)



# APPROACH TO NPO IDENTIFICATION FROM HIGH LEVEL TO SINGLE PROCESS (2/3)



# APPROACH TO NPO IDENTIFICATION FROM HIGH LEVEL TO SINGLE PROCESS (3/3)





## REFLECTION

Workbook,  
exercise (4-2).

Work in pairs and identify potential cost savings from the NPO examples shown on the pictures.

Present your results to the group.

# **Analysis and Documentation of Chemical Material Flows In Your Company**

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## PURPOSE OF PROCESS FLOW MAPPING

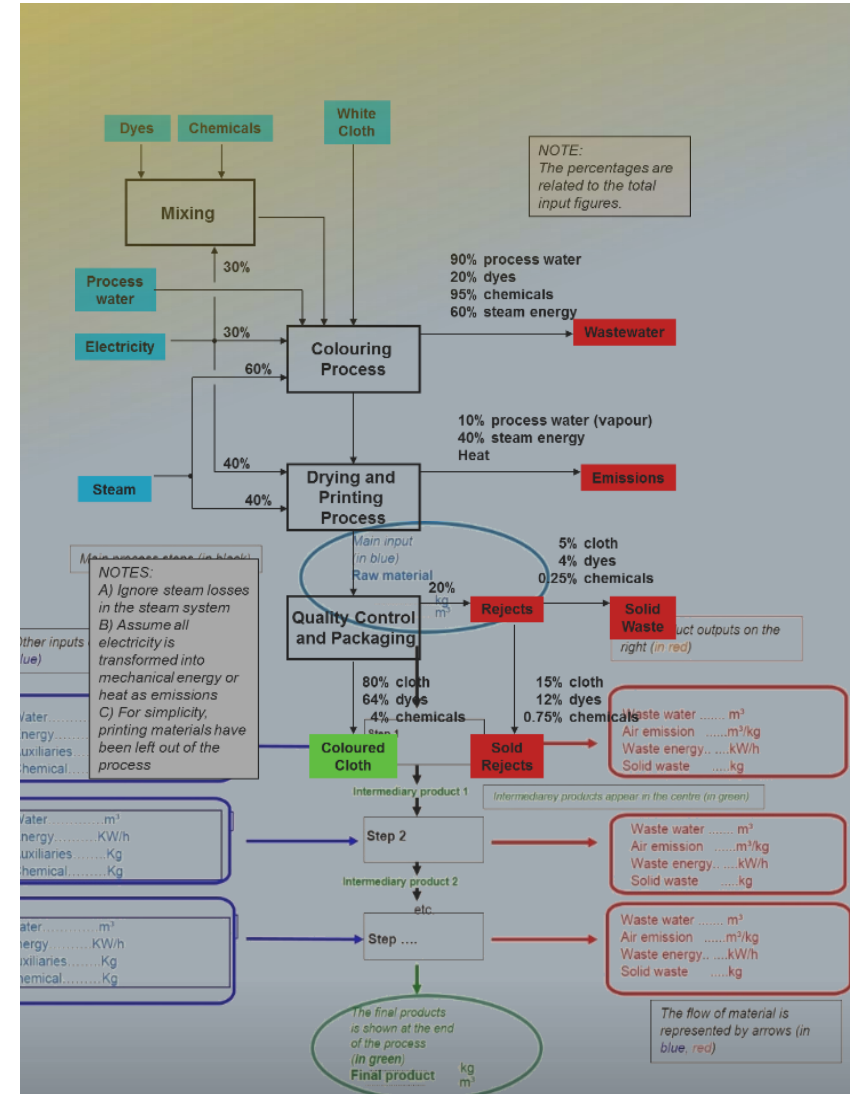
- To lay ground work for inventory of chemicals.
- Establish **chemical management system framework**.
- Promoting **responsible usage** and **prevention of adverse impacts** on the environment, health and safety.
- To **support the identification and documentation of hazard/risks** related to entire range of production processes, products and non-product outputs (NPO).





# BENEFITS FROM PROCESS FLOW MAPPING

- Gain a general overview of production processes.
- Identify all relevant process steps, intermediary products, most important and/or critical materials.
- Create basis for:
  - Systematic analysing of inputs and outputs, (both desired products and NPOs/wastes).
  - Visualising quantities and costs (for mass balancing).
  - Documenting hazards/risks and areas with chemicals and process of concern.
- Localise optimisation potentials and areas.
- Improve process communication inside your company.
- Establish reference for planning, monitoring and reporting.







## CONCEPT OF PROCESS FLOW MAPPING

- **Systematic step-by-step approach** towards understanding process and chemical flows.
- **Understand where chemicals and chemical (containing) waste are present and stored** within your site.
- **Set boundaries regarding external operations** that your company can/should/wants to influence, e.g.:
  - Procurement of chemicals and products containing chemicals.
  - Transport/shipment and delivery of products and chemicals to/from the company.
  - Disposal of waste products (air emissions, solid waste, wastewater).





# RELEVANT INFORMATION TO BE REFLECTED IN PROCESS FLOW



- Inputs (raw materials, chemicals, water and energy).
- Product and non-product outputs.
- Sources of non-product outputs.
- Intermediary products considered.
- Inputs and outputs are quantifiable.
- Costs are assigned to different types of waste.

**Chemical material flow diagrams should be reviewed annually and updated as needed due to operational changes.**



# MAPPING YOUR PROCESSES AND CHEMICAL FLOWS: BOUNDARIES



Procurement

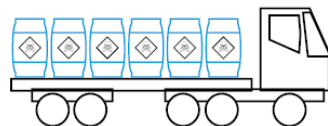
Delivery

Reception/  
unloading

Storage

Packing/ repacking

Laboratory testing

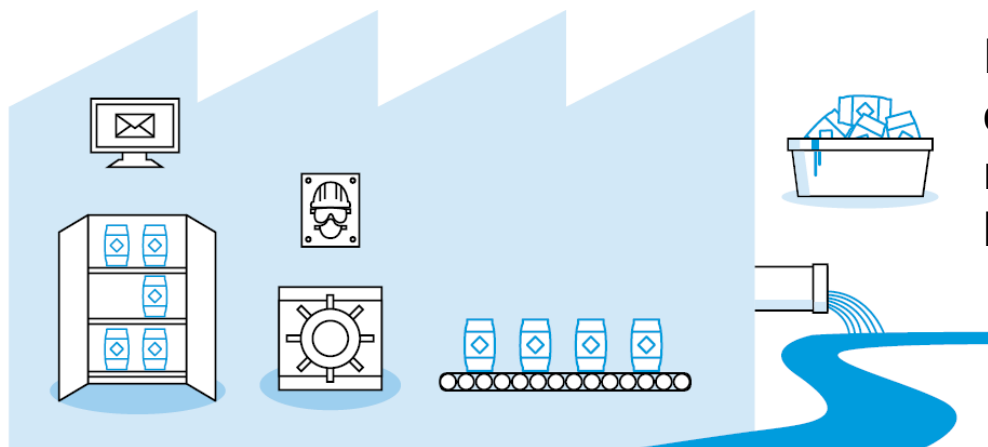


Product warehouse

Product loading

Product transport / shipment and distribution

Product use and final disposal



Internal waste  
collection and  
removal  
Maintenance

Internal transfer  
Formulation / Mixing  
Dosing  
Production

Emission control  
Treatment and  
disposal of waste  
Other...

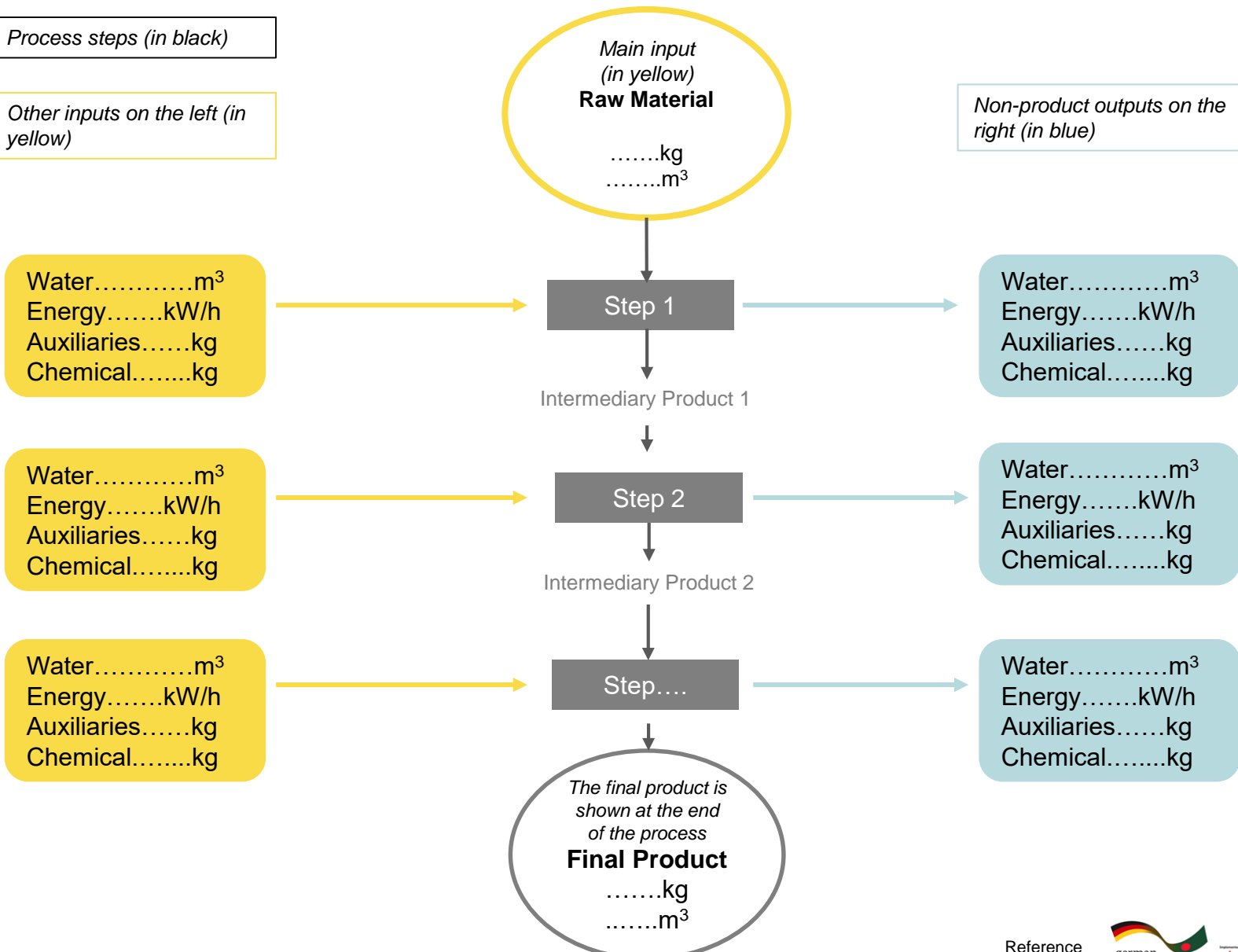
# PRACTICAL MAPPING TOOLS: PROCESS FLOW DIAGRAM



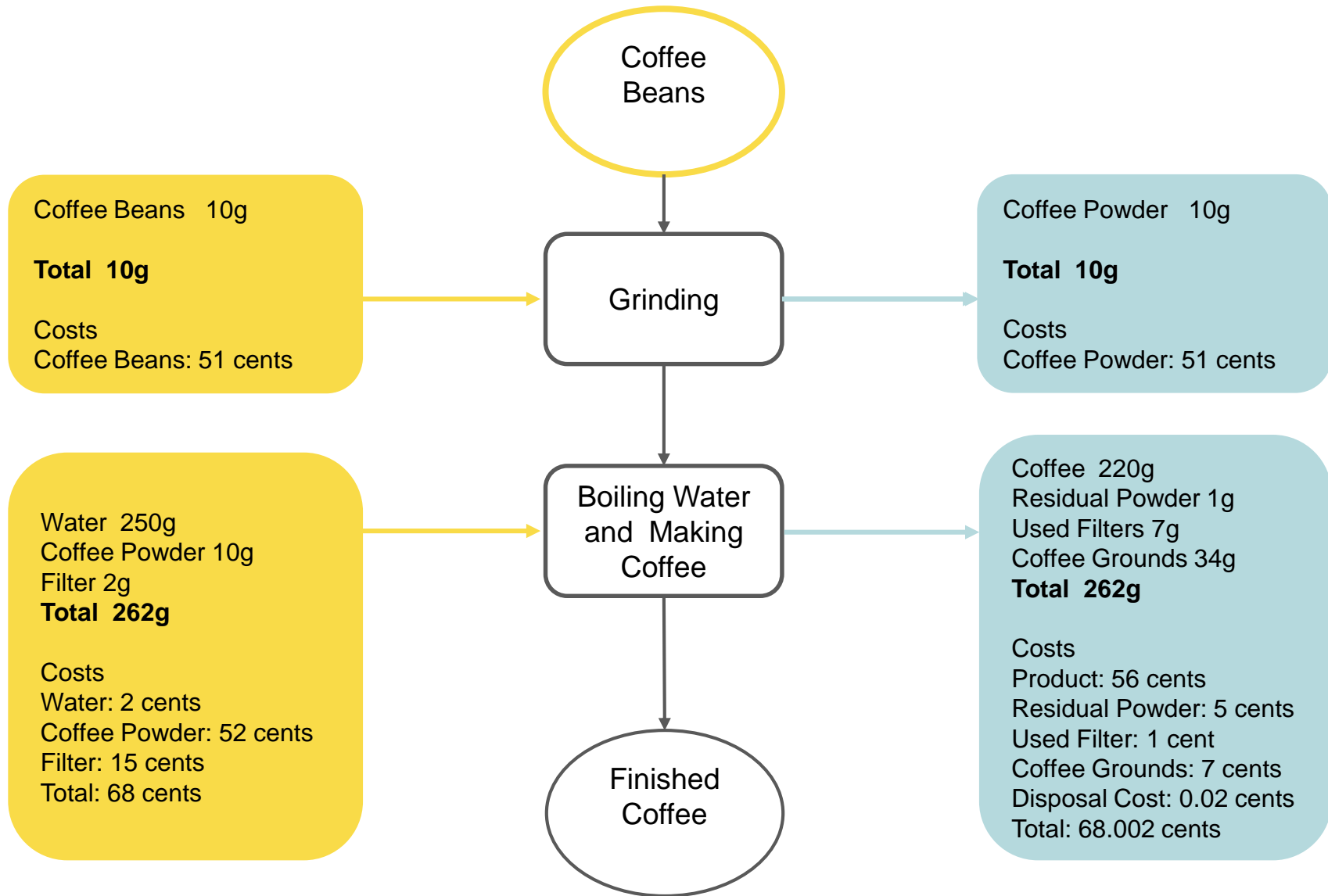
Process steps (in black)

Other inputs on the left (in yellow)

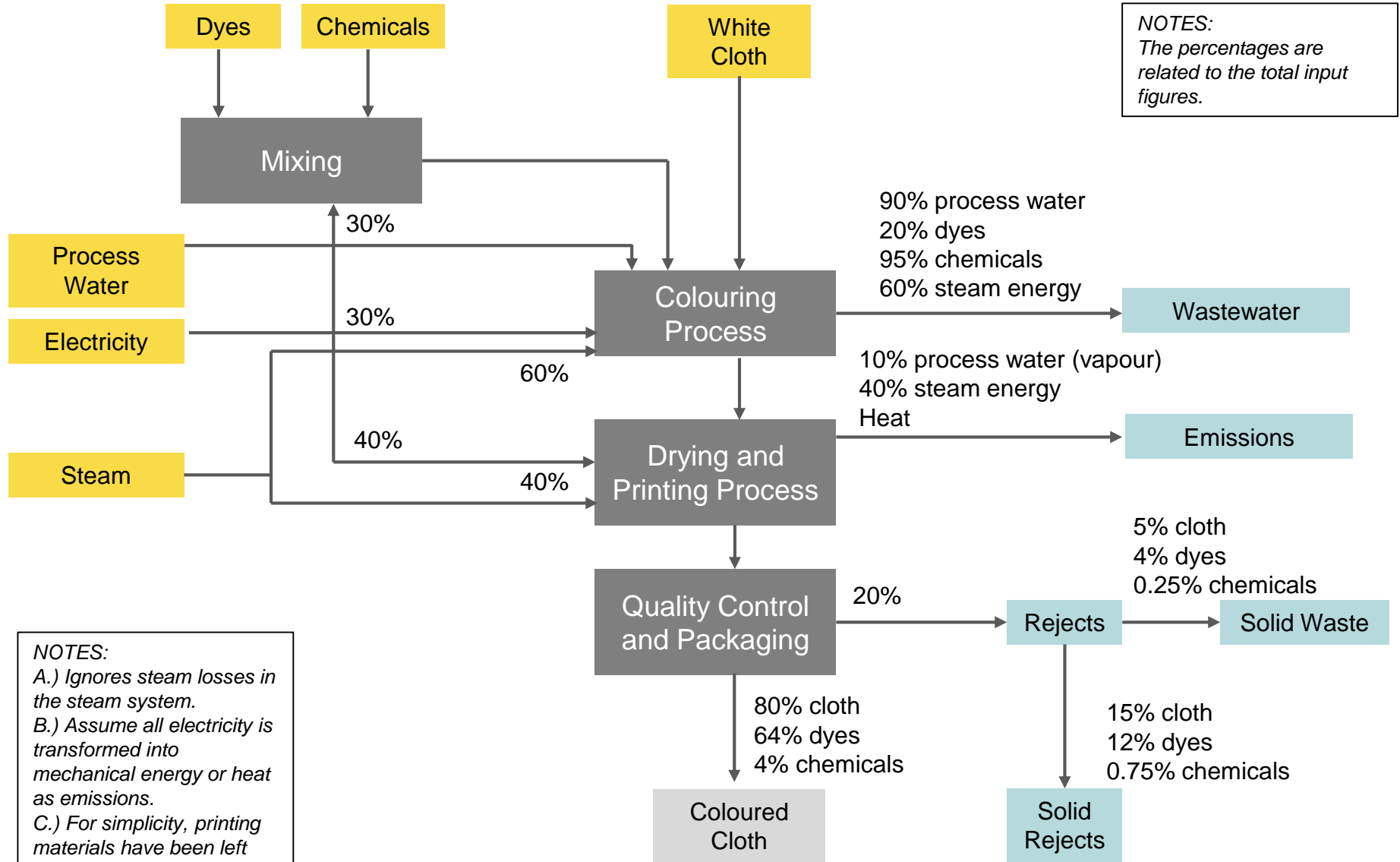
Non-product outputs on the right (in blue)



# EXAMPLE: USING YOUR FLOWCHART INFORMATION (1/2)



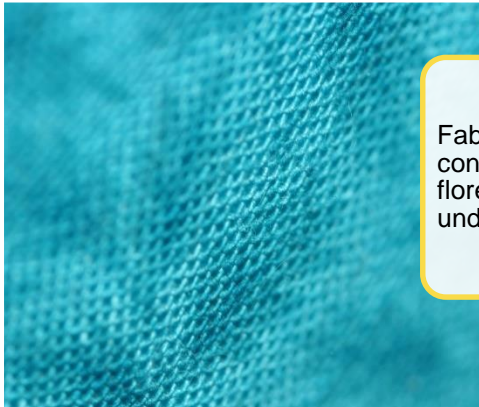
# EXAMPLE: USING YOUR FLOWCHART INFORMATION (2/2)



# IDENTIFYING OPPORTUNITIES FOR SUBSTITUTION BASED ON IDENTIFICATION OF NPO (1/2)



## 1) TYPE OF NPO



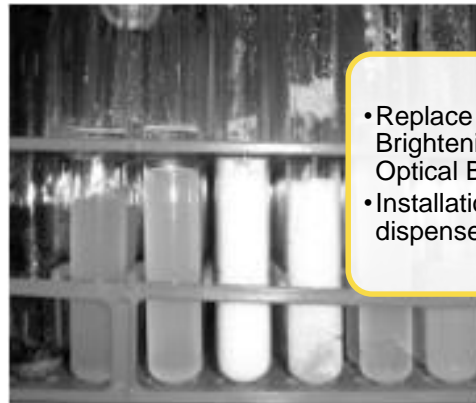
Fabric showing contamination of florescent colour under UV light

## 2) ROOT CAUSE



Contamination observed from powder Optical Brightening Agent (OBA) used in the store

## 3) ACTION



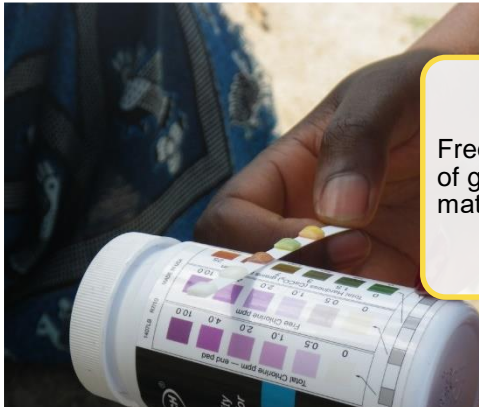
- Replace powder Optical Brightening Agent by a liquid Optical Brightening Agent.
- Installation of a powder dispenser system.



# IDENTIFYING OPPORTUNITIES FOR SUBSTITUTION BASED ON IDENTIFICATION OF NPO (2/2)



## 1) TYPE OF NPO



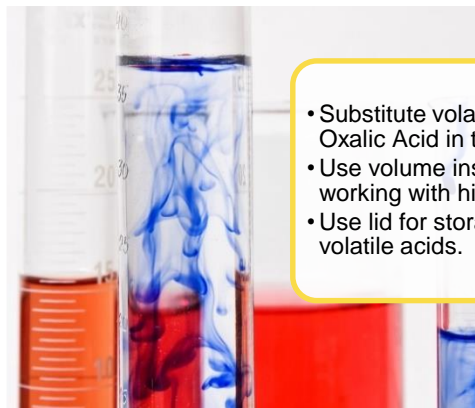
Frequent failure of garment materials' pH.

## 2) ROOT CAUSE



Use of volatile acid such as Acetic Acid in the final neutralisation step.

## 3) ACTION

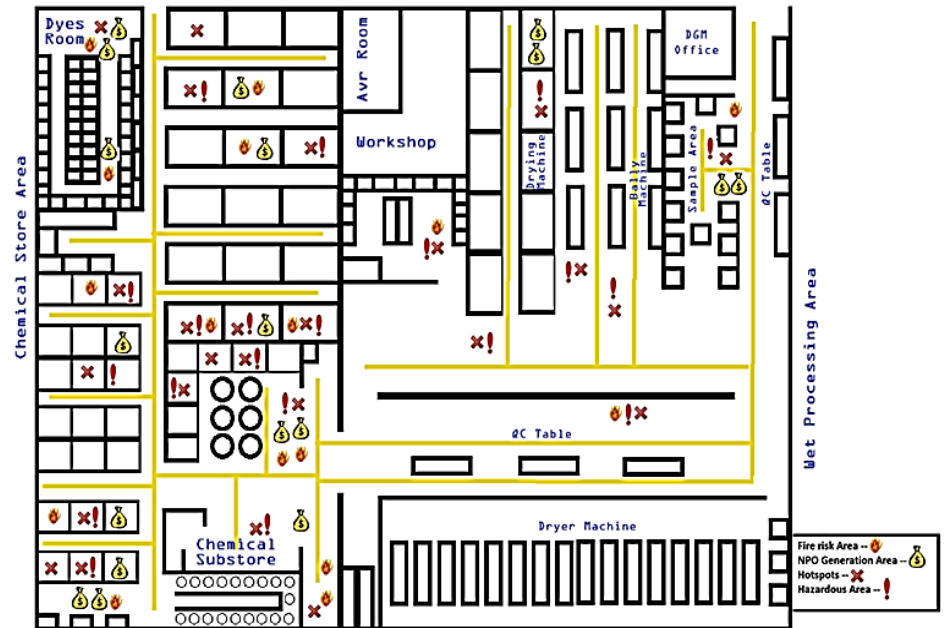


- Substitute volatile acid with Formic Acid or Oxalic Acid in the final neutralisation step.
- Use volume instead of weight in case of working with high density liquids.
- Use lid for storage and transportation of volatile acids.



# PRACTICAL MAPPING TOOL – ECO MAPPING

- Simple, practical tool for visualisation of process flows.
- Good to use in resource efficiency, OSH and/or chemical management for:
  - Identifying and documenting the prevalent situation and issues.
  - Identifying and analysing common issues and priority.
  - Selecting and planning areas for improvement.
  - Monitoring progress of implementation.
  - Auditing and reporting.



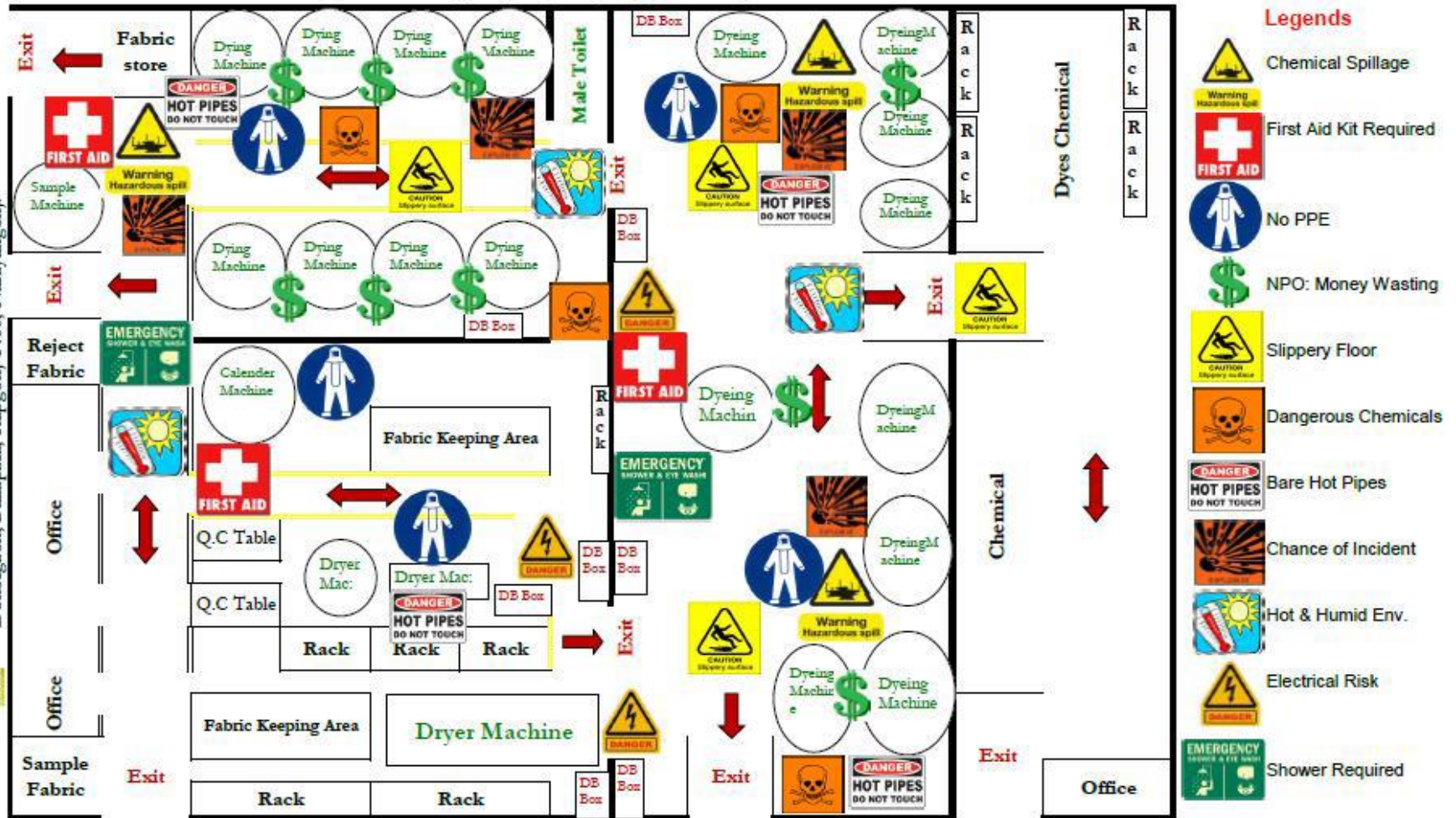


# EXAMPLE ECO MAP: TEXTILE UNIT, NARAYANGANJ, BANGLADESH



## Evacuation Plan

### Eco-Map: Dyeing, Dyeing Finishing





## GET STARTED

- Use existing **ground and floor plans to facilitate identification and visualisation of environmental problems** (“critical situations/ hot spots”) within a company.
- Consider using different maps to **create a useful multi layer set of graphical information** (e.g. for chemicals, water, energy, air, wastes).
- Prepare or verify during an **initial company/site walk-through**.
- Collect and fill in additional information, using **guiding questions and observations on site**.
- Decide and agree on your **own standard symbols beforehand** and use **consistently** in all maps.
- Indicate gravity of observed “hotspots”:
  - **Hatched lines:** small problem (area to be monitored, problem to be studied).
  - **Circle:** large problem (stop, corrective action).
  - The more serious the problem, the thicker or larger the circle or symbol.



Noise hazard



Danger  
Electric shock risk



## CASE STUDY

Follow the instructions. Workbook, exercise (4-3).

In groups of 6, review information provided to you and:

- Identify the location and flows of chemicals and chemical (containing) waste.
- Document the process flow.
- Identify possible NPOs.
- Present your findings to the management team – one process flow diagram, one eco-map.

# Open To Questions

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# SUMMARY

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Every participant to feedback one key learning from this session.



Take notes in your workbook, exercise (4-4).



V1, 2017, Prepared by **MADE-BY** and STS  
on behalf of the Strategic Alliance on Sustainable Chemicals and Environmental Management in the Textile Sector by

Based on the GIZ REMC Toolkit; adapted by **MADE-BY** and STS  
on behalf of Rewe Group, Tchibo GmbH and GIZ in cooperation with developPPP.de and the Partnership for Sustainable Textiles