

BAT CANDIDATES FOR PREVENTION AND REDUCTION OF EMISSIONS FROM HAZARDOUS CHEMICALS

PRESENTATION OF REPORTS FOR CHEM AND STM SECTOR 2020-04-27

HAZBREF



Agenda

- Sweco Project Organization
- Assignment
- Challenges
- Potential BAT-candidates
- Questions

Europe's leading engineering and architecture consultancy

- **#1** on the European market
- **16,000** employees
- Net sales **EUR 1.8 billion**

Sweco Project Organization

Assignment Manager



Christina Lundin

Responsible Industrial Sector

Surface Treatment



Jard Gidlund

Polymers



Kristoffer Karström

Fertilizers



Mats Lindgren

Industrial Experts



Josefine Friberg



Tuomas Noopila



Pertti Vuorinen



Sakari Riihimäki



Niclas Lindström

Project members



Elin Forsberg



Sara Thorén



Emelie Johnson

Assignment

“The supplier shall provide consultancy support for chemical and engineering consultants in the industrial sectors Surface Treatment of Metals and Plastics (STM) and Large Volume Inorganic chemicals (fertilizers), Polymers (CHEM).

The assignment consists of identifying and proposing BAT candidates with regard to used substances with negative health and environmental characteristics in each of the industrial sectors.

Necessary information must primarily be obtained from case studies carried out at facilities.

Other information can, for example, be obtained from other parts of the Hazbref project, from existing documents concerning current BATs and other literature.

The result shall be presented in the form of a report for each of the industrial sectors (STM and CHEM). The assignment means that cooperation with actors with different interests can occur.”

Challenges

- Hard to find new technical solutions as BAT-candidates
 - The majority of industries already comply with conditions and applicable existing BAT-recommendation in existing BREF-documents (IPPC)
 - No challenging requirement from authorities → no innovation
- Most industries are unwilling to give information on:
 - processes and possible technical improvements or
 - additional or potential abatement techniques.

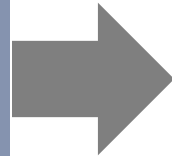
PROPOSALS

Potential BAT-candidates

Potential BAT-candidates

Management

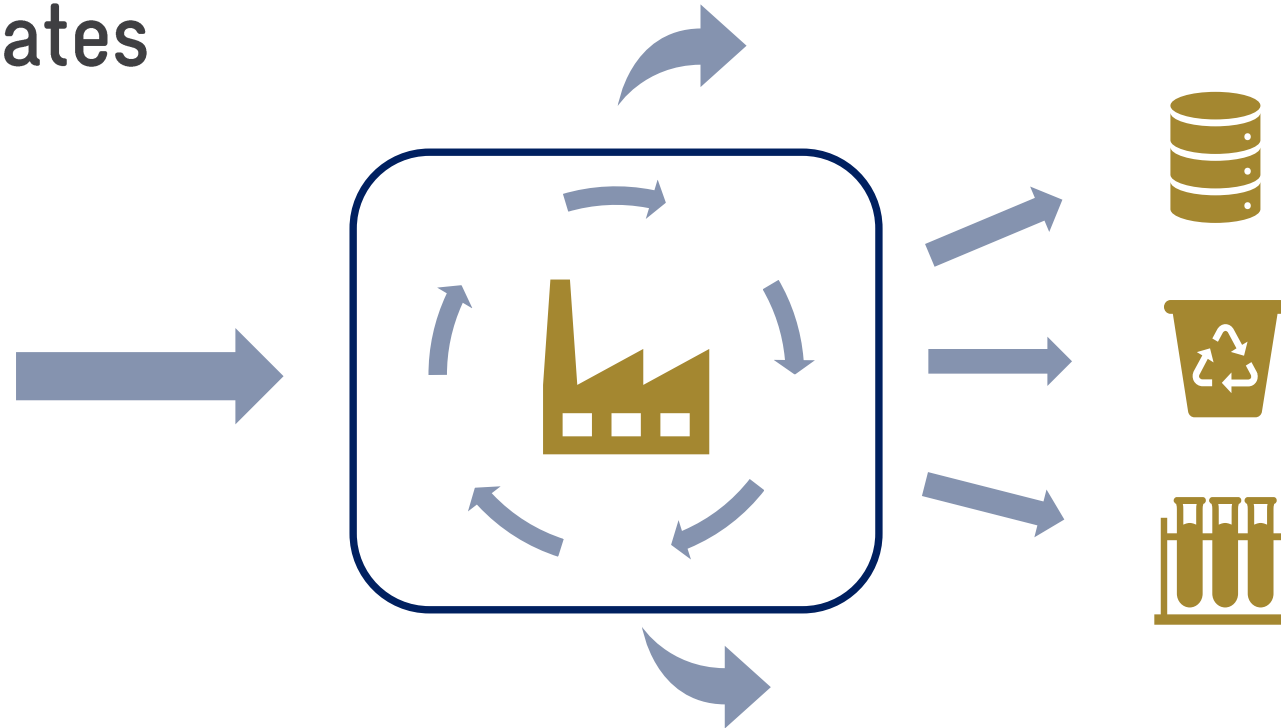
- Knowledge
- Routines
- Development



Technical measures

- Process related
- Abatement techniques

BAT-candidates



PREVENTION

- Knowledge, control and preventive work
- Chemical inventory
- Management of new chemicals
- Development of new production processes
- Purchase of new chemicals
- Training

PROCESS RELATED

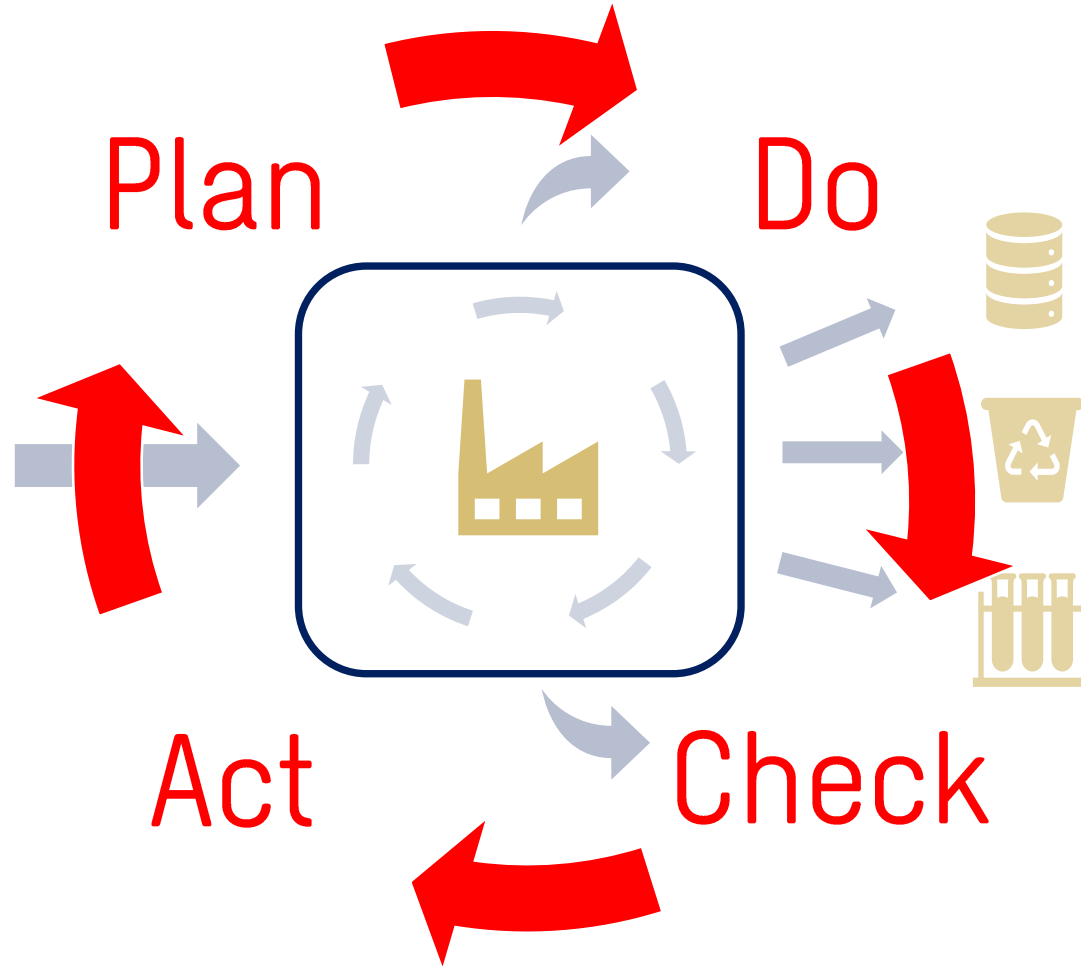
- Improvements in the existing process
- Chemical Storage
- Transportation
- Closed cycle
- Substitution
- Process mapping

END-OF-PIPE

- Waste stream management
- Waste Management
- Hazardous Waste
- Pre-treatment
- Air and water treatment
- Emergency preparedness

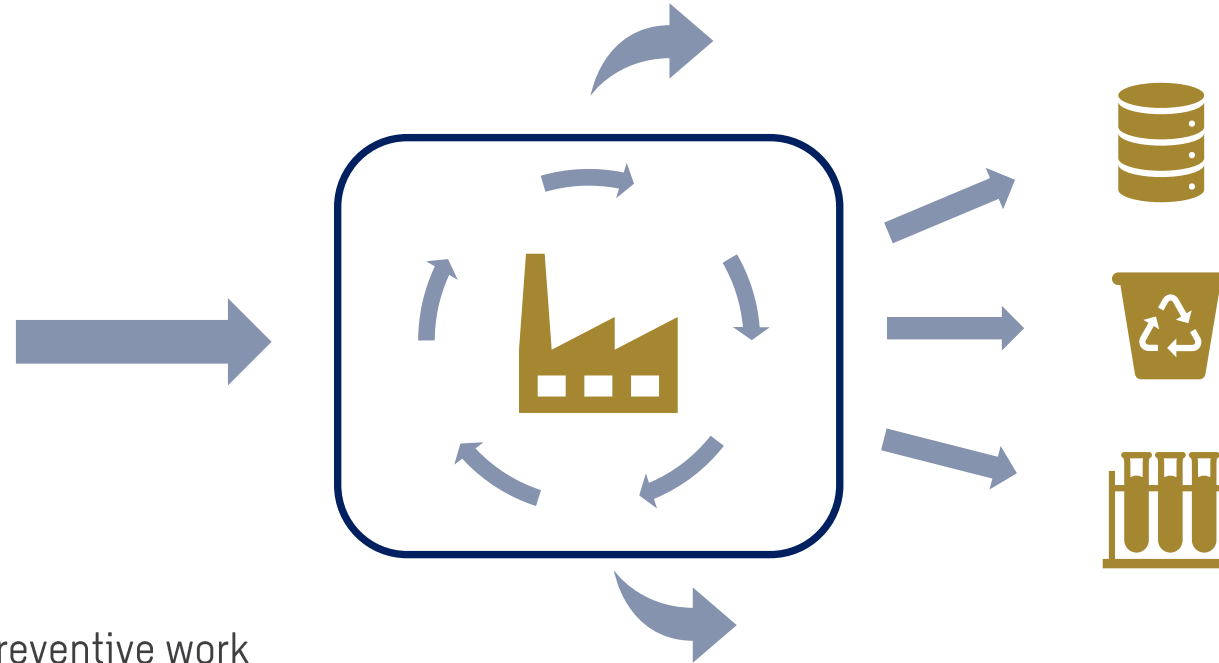
BAT-candidate CHEMICAL MANAGEMENT, GENERAL

Chemical Management, general



BAT-candidates, PREVENTIVE MEASURES

BAT-candidates, PREVENTIVE MEASURES



Knowledge, control and preventive work
Chemical and raw material inventory
Management of new chemicals
Development of new production processes
Purchase of new chemicals
Training

BAT-candidate CHEMICAL AND RAW MATERIAL INVENTORY

Chemical and Raw Material Inventory

- List of all chemical products
- Information added from MSDS (attachment of MSDS)
- Screening tool for hazardous substances
- Compilation of relevant data required for planning and implementing adequate storage and handling.
Flammability, Combability etc.
- Monitoring Allowable storage volumes

Chemical and Raw Material Inventory, example

Basic information from all MSDS					
Commercial Name	Producer	Process application	CAS	GHS hazard	SDS date

Advanced tox data used for more close evaluation and approvals						
Cont. haz. Substances in [weight-%] for indiv. subst.	Biolog. degradation/ elimination in [%] and test duration [d] and testing method	BOD/COD value	Toxicity to bacteria EC50	Toxicity to algae EC50	Toxicity to daphnia EC50	Toxicity to fish LC50

Storage		
Flash-point	Annual consumption (kg)	Max quantity stored

Chemical Management-chemical inventory, STM

- Chemical management and safe use of chemicals
 - Creation of a data base for all relevant data for products used for instance:
 - Chemical products with high acute toxicity
 - Relevant data for required for storage and handling of chemicals
 - Data relevant for communication
 - Systematically identification of substances with undesirable environmental and toxicological properties

BAT-candidate MANAGEMENT OF NEW CHEMICALS, APPROVAL PROCESS

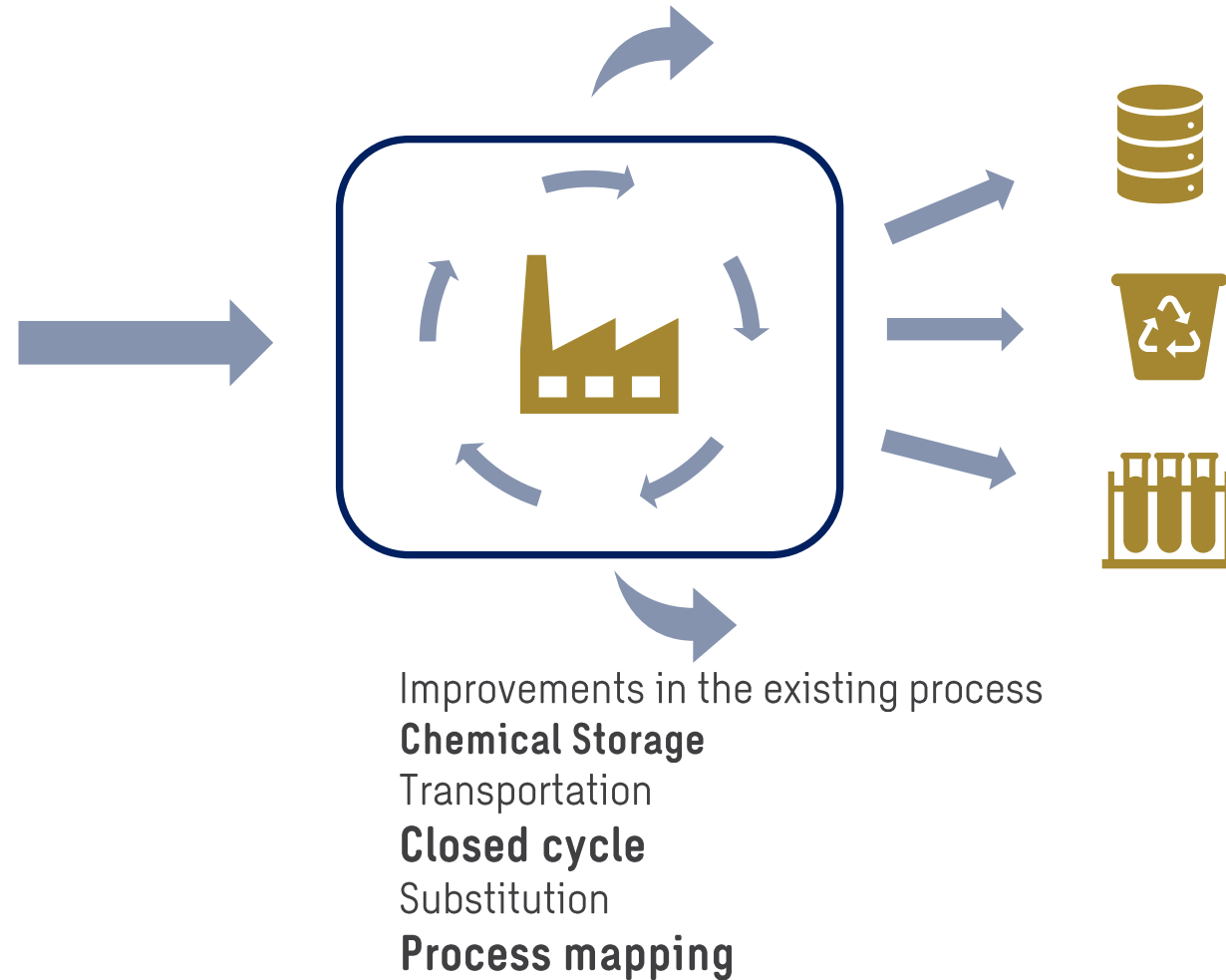
Management of new chemicals (and raw materials) Approval process

- All new products passes a chemical revue (gate model)
- Predetermined grouping depending on Hazardous classification and other hazardous relevant markers
- Each group has its own demands of pre use measurements.
 - **Group 1 – Product without restrictions**
 - **Group 2 – Product whit restriction for classification**
 - **Group 3 – Product whit restriction for substances whit strategic supervisions**
 - **Group 4 – Product whit restriction for substances on SVHC or permits for use**
 - **Group 5 – The product is not approved for on sight use**

	Environmental Hazards	Work environment and fire	Process safety regulations	Laws and regulations
Group 1	No hazardous substances			
Group 2	Hazardous statement H400, H411, H412	H301, H311, H331 H315, H318, H319, H335, H226, H221		
Group 3	Hazardous statement H410, H413	H330, H310, H300, H370, H334, H317, H314, H372, H341, H240, H250, H252, H251, H270	H220, H221, H250, H260, H271, H241, H242	PRIO Risk-reduction Substances ² SIN list
	logKow>3 L(E)C50<0,1 mg/l LD50<2000 mg/kg Persistent: Not readily biodegradable			
Group 4	Hazardous statement EUH059 H420	CMR (H340, H350, H360)	GHS class 2.1 (H200, H201, H202, H203, H204, H205), H240- Organic peroxides type A	PRIO Phase-out ³ Substances SIN list ⁴ SVHC list ⁵
	PBT	Persistent: Half-life >60d sea water >40d freshwater >180d marine sediment >120d freshwater sediment Bioack: BCF>2000 log Pow>3 Chronic NOEC <0,01 mg/l or <30 mg/kg		
	vPvB	Persistent: Half-life >60 d sea water or freshwater >180 d marine sediment or freshwater sediment or soil Bioack: BCF>5000, logKow>3		
	Particularly hazardous metals:	Mercury, cadmium, lead and compounds with these metals		
Grupp 5				Substances with permits in REACH ⁶ RoHS

BAT-candidates, PROCESS RELATED MEASURES

BAT-candidates, PROCESS RELATED



BAT-candidate STORAGE AND HANDLING OF CHEMICALS

Chemical and Raw Material Inventory, STM

Handling and storage of chemicals

To reduce accidental release of chemical products

Segregation of chemicals:

- Check all chemicals' respective storage compatibilities utilizing the reaction matrix
- Chemical segregation charts should be used together with Material Safety Data Sheets

Other general measures:

- Storage facilities should be tight, bearing, robust and thermally and chemically resistant
- Leakage should easily be detected
- Catchment facilities should not have any drain
- Storage facilities should be equipped with sufficient lighting and ventilation
- All chemical products should be clearly and unambiguously labelled
- The entire staff should regularly receive competent training
- Emergency exits and escape routes shall be provided

Substance	Zinc (Zn)	Iron (Fe)	Hydrogen chloride (HCl)	Hydrogen peroxide (H ₂ O ₂)	Sodium peroxide (NaOH)	Ammonium chloride (NH ₄ Cl)	Zinc chloride (ZnCl ₂)	Di-ethanolamine ((CH ₂ CH ₂ OH) ₂ NH)	Water (H ₂ O)
Iron (Fe)									
Hydrogen chloride (HCl)	GF	GF							
Hydrogen peroxide (H ₂ O ₂)									
Sodium peroxide (NaOH)	GF	GF	H						
Ammonium chloride (NH ₄ Cl)				H	H				
Zinc chloride (ZnCl ₂)			H	H					
Di-ethanolamine ((CH ₂ CH ₂ OH) ₂ NH)			H	H	H				
Water (H ₂ O)					H		H		

Chemical and Raw Material Inventory, STM

Handling and storage of chemicals

➤ Handling and storage of chemicals

Examples of storage

Chemical containers are stored in an area with safety pools



Harmful chemicals are stored in a locked place with authorized access.



Tanks are built with materials enduring different chemicals.



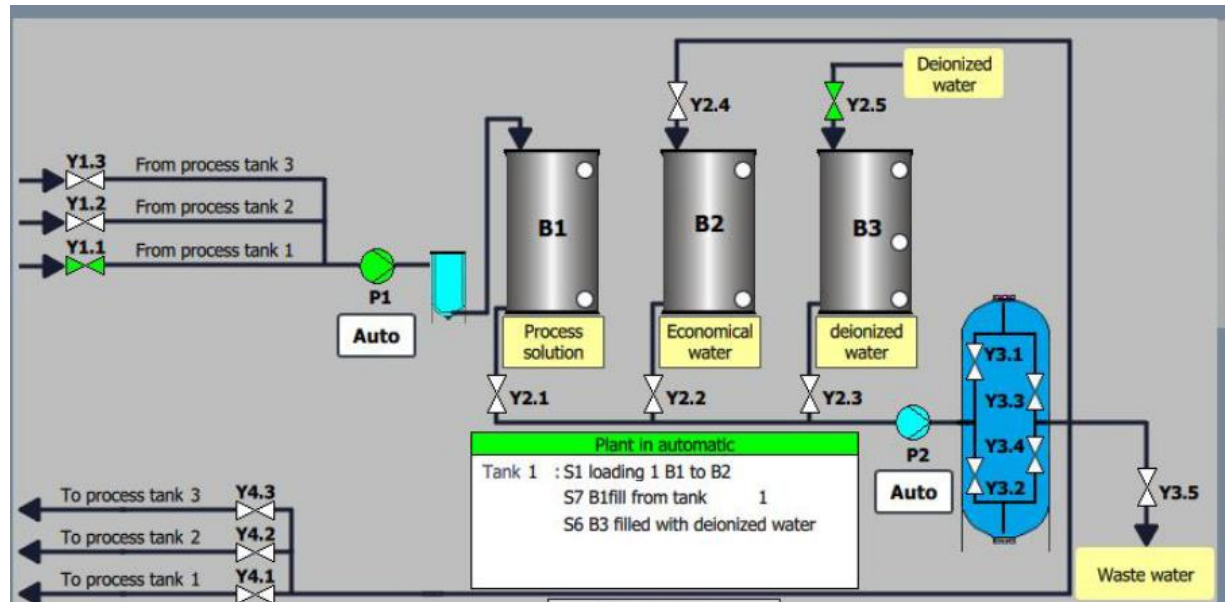
Small tanks are placed on catchment facilities that contain parts total volume.



BAT-candidate CLOSED CYCLE

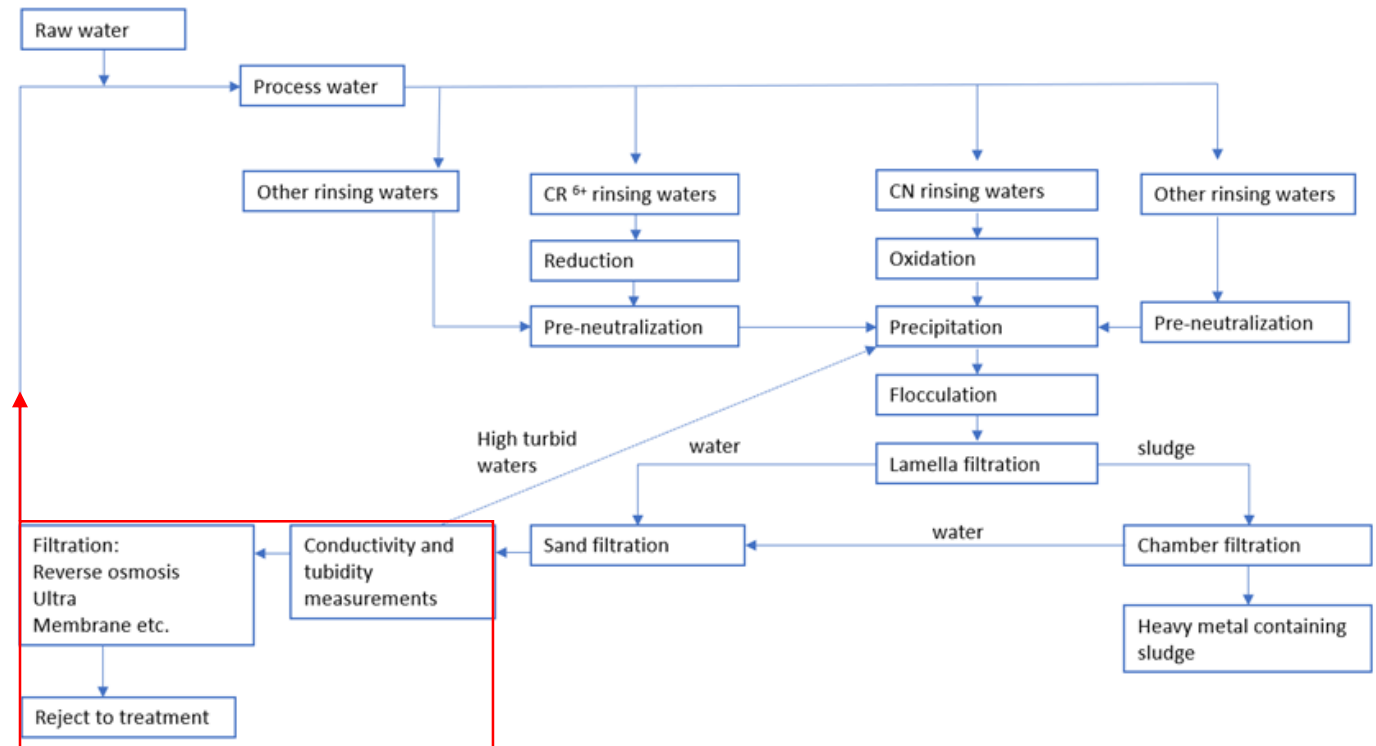
Closed Cycle, STM

- Retardation plan for recycling of Al-Anodizing process solution
 - Reduced use of chemicals



Closed Cycle, STM

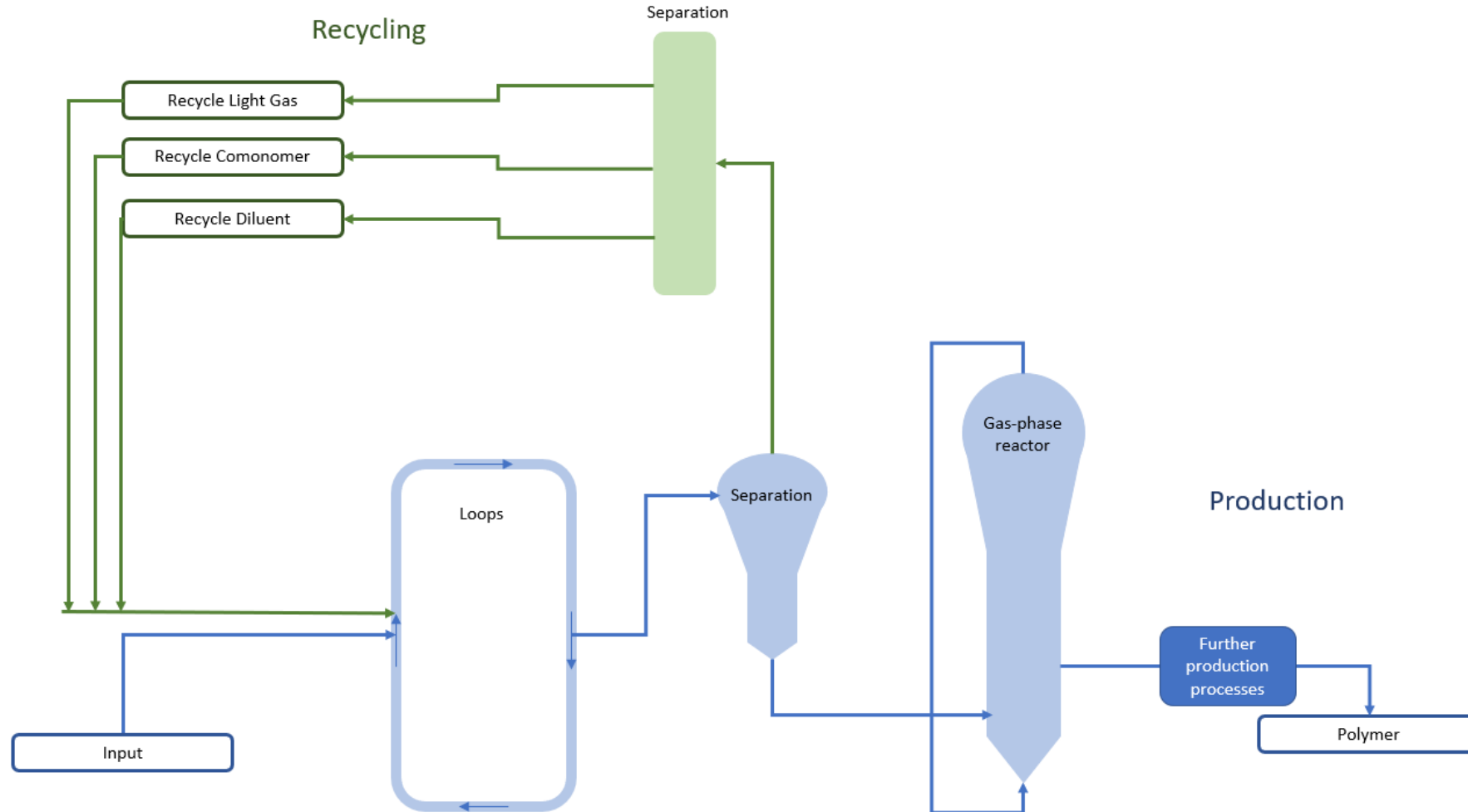
- Recirculation of treated water back to process
 - Reduction of releases of hazardous chemicals to the environment
 - Cost reduction for raw water and waste water treatment



Closed Cycle, Polymer

- Recirculation of chemicals in the production of polyethylene
 - Separation of residual hydrocarbons with potential for material recovery
 - Further separation lighter and heavier hydrocarbons
 - Hydrocarbons recycled back into the loop
- Environmental benefits
 - Decreased emissions to air
 - Reduced emissions of hazardous substances

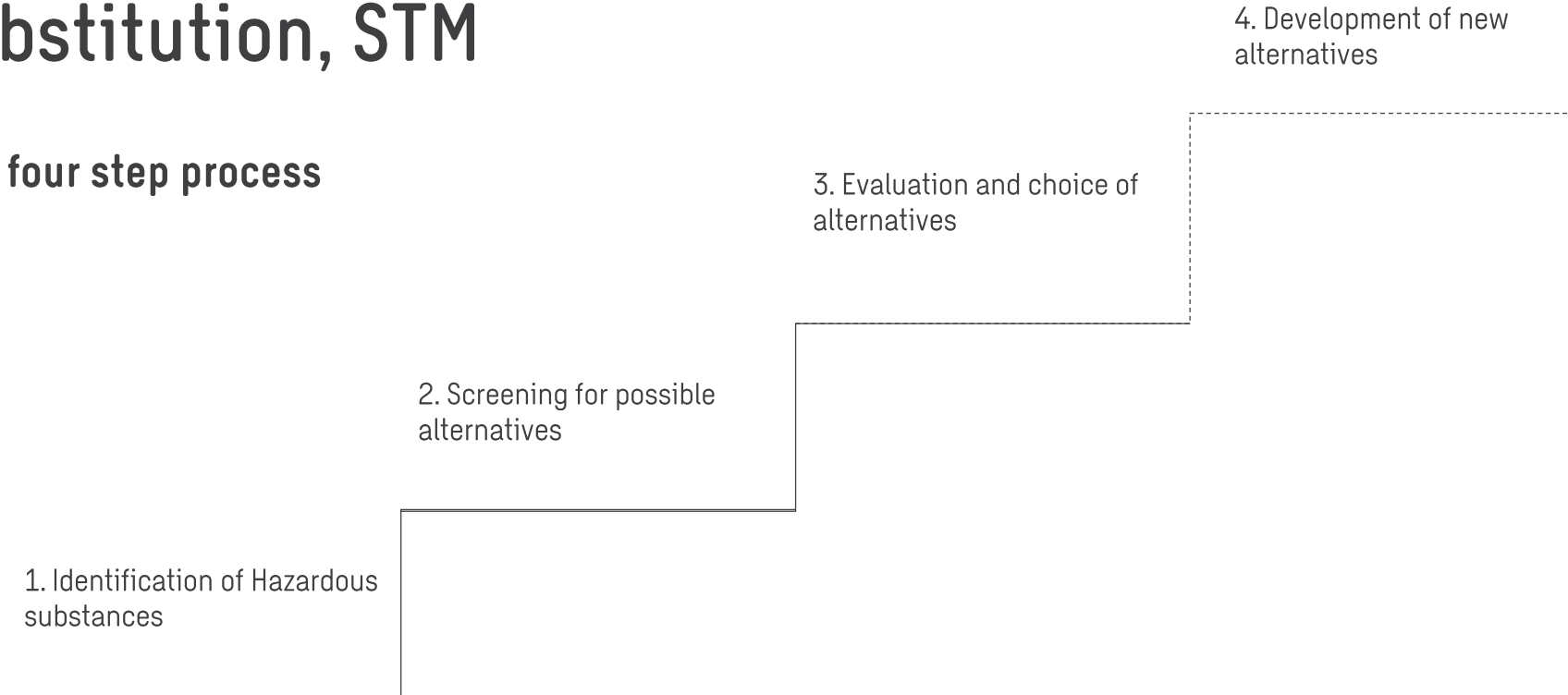
Closed Cycle, Polymer



BAT-candidate SUBSTITUTION

Substitution, STM

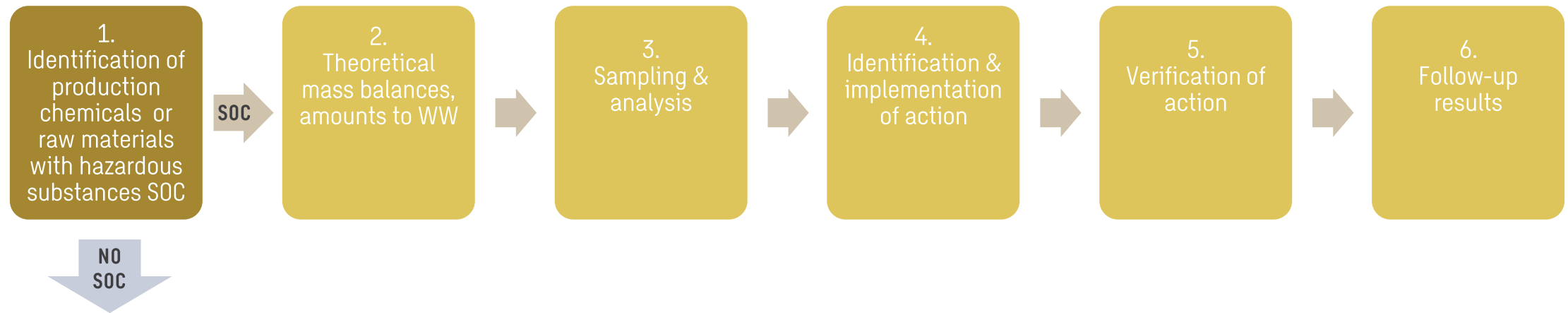
– A four step process



- Utilization of installation specific substitution scenarios
 - Evaluation of environmental benefits from substitution of whole system rather than a single substance
 - Decision based on comparison of all hazardous chemicals involved

BAT-candidate PROCESS MAPPING OF HAZARDOUS SUBSTANCES

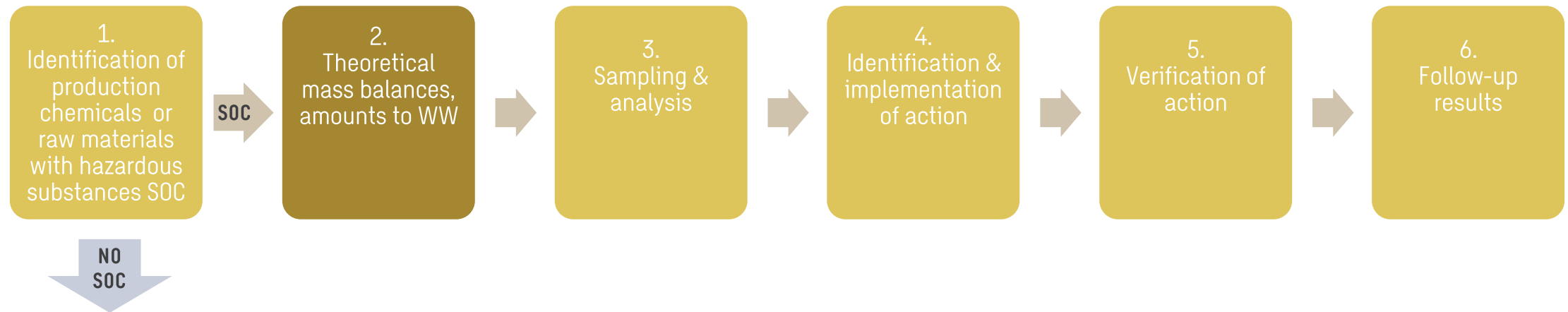
Process Mapping of Hazardous Substances



Identification and classification

SOC/NSOC	Category number	Description	Further handling
SOC	1	- Harmful to the aquatic environment, Carcinogenic & organ toxic - PEC/PNEC > 1	Need more detailed investigations and analysis (theoretically & by sample testing). Mitigating actions may be needed.
SOC	2	Metals Solvents	Ensure handling, volumes, etc.
SOC	3	Bioaccumulation, biodegradability	1. Review the concentration of outgoing water 2. Check for binding in sludge
SOC	4	Other chemicals that is not included above but potentially could have a negative effect on the recipient.	Need of further investigations regarding potential negative effect in recipient.
Micro plastics	MP	Micro plastics	Does not need any investigations at the moment but may need further focus in the future
Not SOC	N/A	Other chemicals with no negative effect on the environment	N/A

Process Mapping of Hazardous Substances



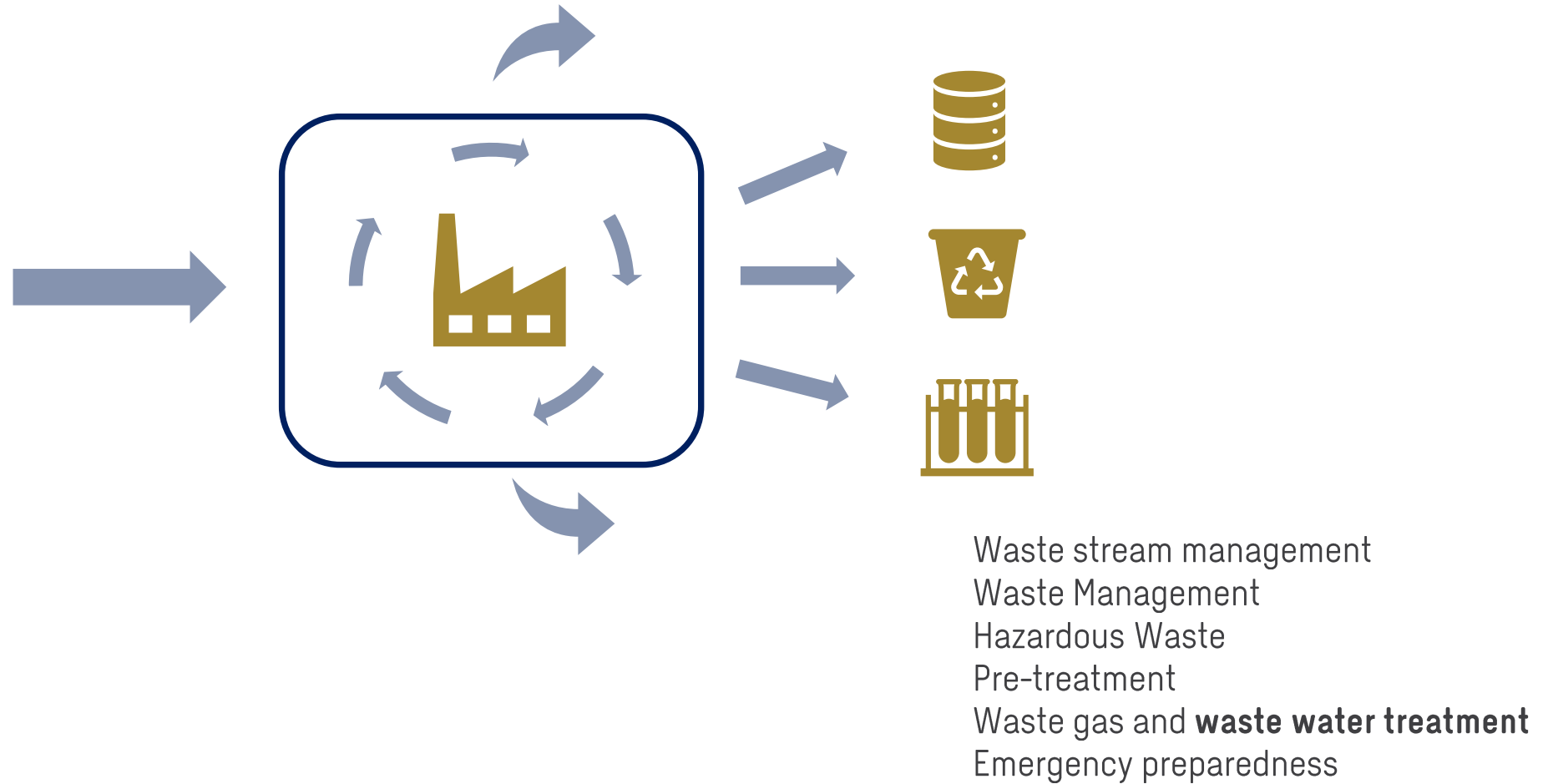
Process Mapping of Hazardous Substances, STM

➤ Utilization of installation specific exposure scenarios

- Risk ratio calculations for the specific hazardous chemicals used in a process
- Calculations of substance flow over the process to estimate emissions to the environment
- Benefit: Monitoring and abatement measures can be focused on the relevant substance

BAT-candidates, END-OF-PIPE MEASURES

BAT-candidates, END-OF-PIPE



BAT-candidate END OF PIPE SOLUTIONS

Waste Water Treatment, Polymer

Specific to one of our interviewed plants a newly installed drum filter is an added technique for wastewater treatment to prevent pollutions of plastic particles from a LD/HD-production plant.

This added wastewater treatment is part of the plant's project "Zero pellets lost". The filter is a technical solution that can remove micro particles down to 10 μm . This technical adjustment can be added in wastewater treatment of all polymer producing plastic pellets.

Waste Water Treatment, STM

- Closed process
 - Evaporation (and condensation) of waste water

- Environmental benefits
 - No discharge to water from the plant
 - Reduction in raw material and chemical consumption
 - Hazardous chemicals in the waste
 - No pollution to surface and groundwater
 - Recycling of metals
 - Decreased water use

QUESTIONS

HAZBREF



SWECO

