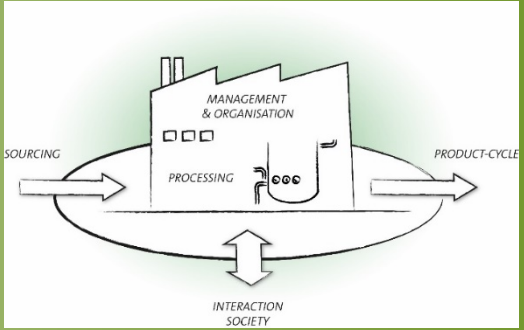
SEVESO versus REACH: "two faces of the same coin"

EPSC Webinar 23 October 2020

Nico Mulder & Jean-Marc Abbing

Open



Seveso & REACH legislation in force for over 10 years, still their focus area is very much alive these days

EUROPEAN
COMMISSION

Brussels, 14.10.2020
COM(2020) 667 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Chemicals Strategy for Sustainability
Towards a Toxic-Free Environment

{SWD(2020) 225 final} - {SWD(2020) 247 final} - {SWD(2020) 248 final} - {SWD(2020) 249 final} - {SWD(2020) 250 final} - {SWD(2020) 251 final}

EU COMMISSION : TOXIC FREE STRATEGY

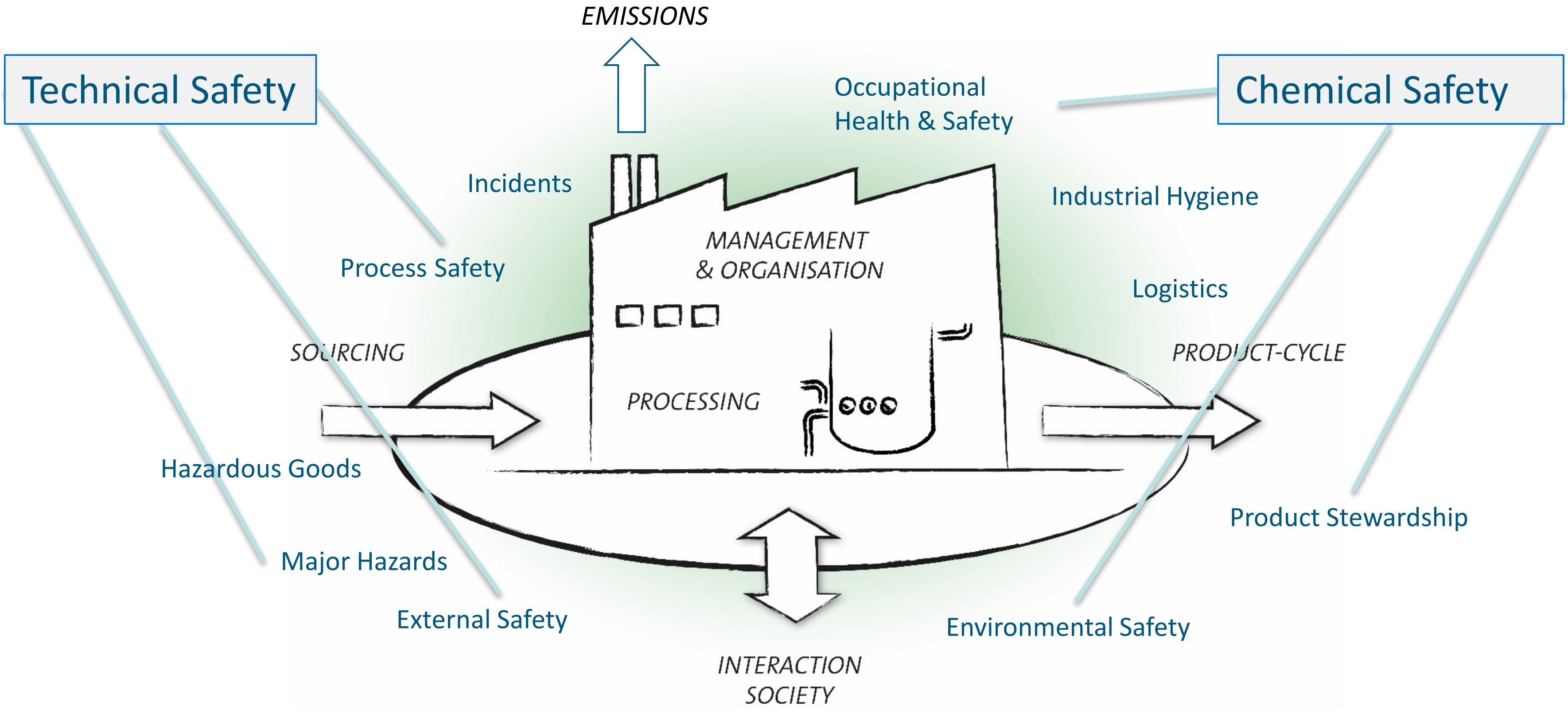
Likely result:

- More substances to be identified as having endocrine disrupting properties
- Speeding up the existing REACH processes

Likely consequence:

- more restrictive measures for substances with long term effects on humans and/or the environment

Industrial Safety focus areas within RHDHV



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Todays moderators

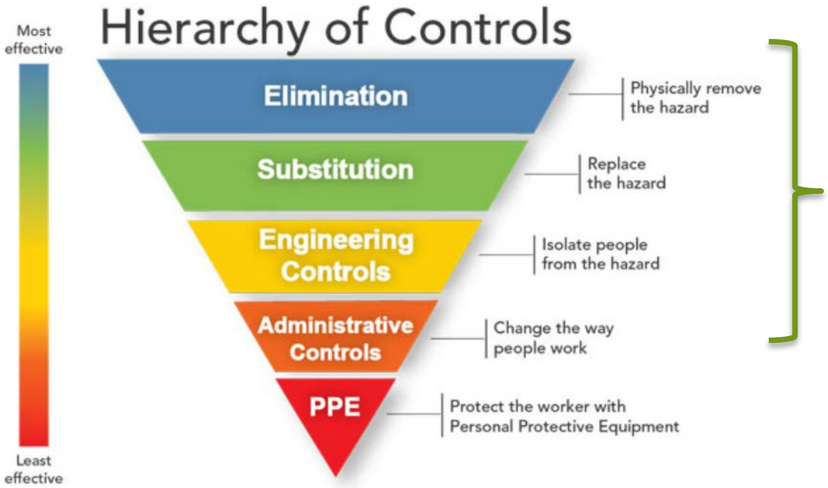
Jean-Marc Abbing

- Training: Geology, Environmental Sciences, Industrial Hygiene
- Experience: 30 years, mainly in consultancy
- Current role: Sr consultant EHS management
- Focus area: Chemicals based industry *(manufacturing and downstream users)*
- Languages: NL, EN, FR

Nico Mulder

- Training: Chemical Engineering, HSE management
- Experience: 30 years, mainly in industry
- Current role: Sr consultant process safety management
- Focus area: Chemical and (bio-)pharmaceutical industry
- Languages: NL, EN, FR

Common grounds, separate domains?



Ref: The National Institute for Occupational Safety and Health (NIOSH)

Focus area of both REACH and SEVESO legislation:

Protect workers, public and the environment from exposure to harmful substances by taking measures at the source *(i.e. at the processing installations)*

Still they seem to be separate domains/disciplines:

- REACH → Toxicology, environment, occupational safety
- SEVESO → Process safety management, technical safety

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Focus of this webinar

Brainstorming on the implications for Process Safety of the REACH phase out approach for Substances of Very High Concern

Agenda

1 Reach & CLP

- ❑REACH essentials: approach for risk reduction of SVHC
- ❑CLP essentials
- ❑Reach & CLP → 3 main categories of substances

2 SEVESO and Process Safety Management

- ❑SEVESO essentials: prevention and mitigation
- ❑Process safety in practice
- ❑Risk management approach: onion model and BowTie model

3 REACH and SEVESO: differences & overlaps

- ❑Compare classifications
- ❑Example of substances that may in near future be classed as SVHC
- ❑Case study of substance already phased out: timelines then and now

4 To what extent will Reach & CLP influence process safety?

- ❑Inherent safety: Process safety versus SVHC Control
- ❑Options for Inherently Safer Design in CAPEX projects
- ❑Discussion

REACH & CLP essentials

REACH = Registration, Evaluation, Authorisation and Restriction of Chemicals

CLP = Classification, Labeling and Packaging of dangerous substances

REACH: Goals and tools

WHAT:

- **European regulation,** effective since 2007
- Phased approach (registration deadlines in 2010, 2013, 2018)

WHY:

- **Safe use** of all substances
- **Reduce** *(possibly phase out)* the use of the **most dangerous substances** *(identified as the "so called" Substances of Very High Concern - **SVHC**)*
- **Innovation**

HOW:

- **Safe use** of all substances => REGISTRATION DOSSIERS
- **Reduce** *(of the SVHC)* => RESTRICTION and AUTHORIZATION of SVHC
- **Innovation** as result of substitution efforts

WHO

- **Industry** and **European Chemicals Agency** *(ECHA, Helsinki)*

Regulation (EC) No 1907/2006	
European Union regulation	
Title	Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency (ECHA)
Made by	European Parliament and Council
Made under	Art. 95 (EC)
Journal reference	L396, 30.12.2006, pp. 1–849
History	
Date made	18 December 2006
Came into force	1 June 2007

CLP: goals and tools

WHAT:

- **European regulation,** effective since 2007
- **Fully implemented now**

WHY:

- **Reduce differences** between chemical substances hazard classification and the transport classification
- **Global Harmonisation** of hazard classes

HOW:

- **Hazard classification** based on physical/chemical & toxicity data *(environment and human)*:
  (in dossier REACH registration)

Regulation (EC) No 1272/2008	
European Union regulation	
Text with EEA relevance	
Title	Regulation on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006
Made by	European Parliament and Council
Made under	Art. 95 (EC)
Journal reference	L353, 31.12.2008, pp. 1–1355
History	
Date made	16 December 2008
Came into force	20 January 2009

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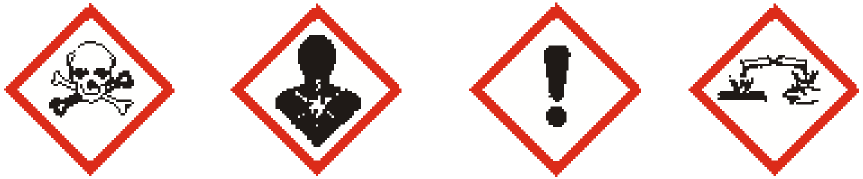
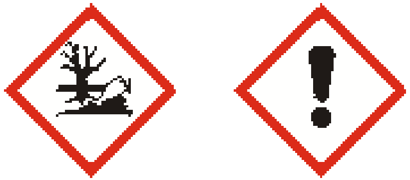
Hazard symbols

Physical

Health



Environment



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Hazard classes CLP and REACH:
SVHC (long term effects)

PHYSICAL
- Explosives
- Flammable gas and aerosol
- Flammable liquid and solid
- Oxidizing gas, liquid and solid
- Gasses under pressure
- Self-reactive substances and mixtures
- Self-heating substances and mixtures
- Pyrophoric liquid and solid
- Water reactive
- Organic peroxide
- Corrosive to metals

HEALTH
- Acute Toxicity
- Corrosive to skin
- Eye Damage
- Skin- / Eye irritation
- Sensibilization
- Carginogenic, Mutagenic & Reprotoxic (CMR)
- Specific Target Organ Toxicity (STOT)
- Aspiration
- Endocrine disruptors

ENVIRONMENT
- Acute Toxicity
- Chronic Toxicity
- Hazards to ozone layer
- Endocrine disruptors

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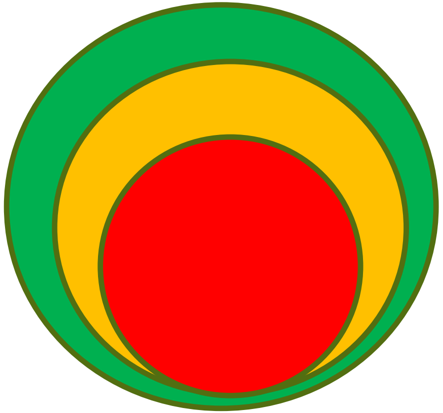
Result REACH & CLP: qualitative

REACH results in 3 main clusters of substances:

- Non hazardous substances (green);
- All hazardous substances,
  not meeting SVHC classification (orange);
- Substances of Very High Concern (red);



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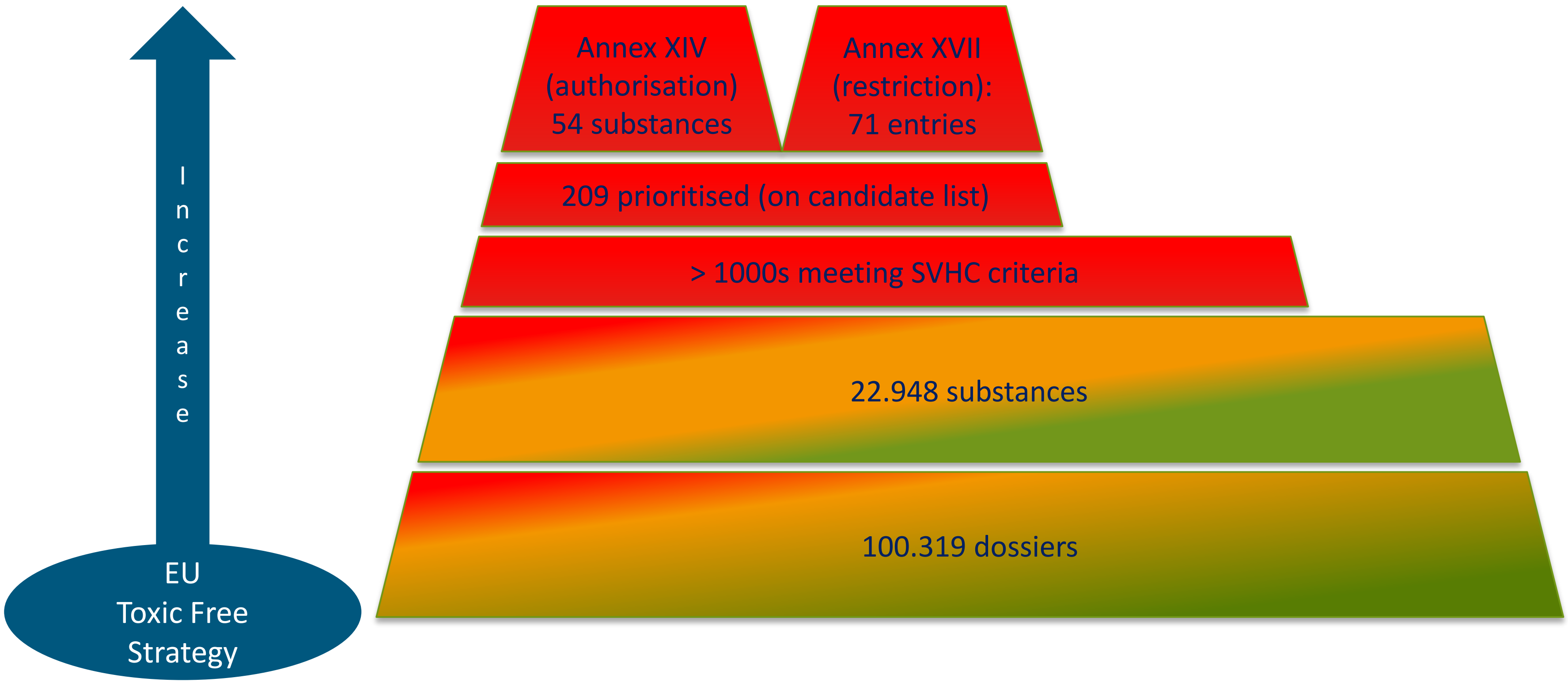
Result REACH & CLP: quantitative *(Sept 2020)*



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Seveso: Goals and tools

WHAT:

- **European Directive**, original version1982 *(Seveso I)*
  updated in 1996, 2008 and 2012

WHY:

- **To prevent major accidents** that may have an acute impact outside sites' boundaries *(e.g. toxic cloud, fire, explosion, environmental release)*
- **To ensure appropriate preparedness and response** should such accidents nevertheless happen.

HOW:

- **Operators of facilities handling quantities of hazardous materials over certain tresholds are to:**
  - Notify the competent authority about the inventory of dangerous substances
  - Compile a major accident prevention policy (MAPP)
  - Implement a MAPP by appropriate means and a Safety management System
  - Provide information to the competent authorities to identify the risks for domino effects
  - Produce a safety report
  - Produce internal emergency plans

} *Upper tier facilities only*

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Seveso legislation: origin = environmental concerns

Major incidents with large environmental impact:

Year	Location	Type of installation	Incident	Environmental implications
1976	Seveso, Italy	chemical plant	A runaway reaction in a chemical plant released 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	Contamination of locally grown food, widespread death of animals; emergency slaughtering of animals to prevent chemical entering the food chain
1984	Bhopal, India	chemical plant	An uncontrolled chemical reaction released methyl isocyanate gas and other chemicals	Broad-scale death of plants and animals created food shortages in the short term; long-term effects still impact plants, animals and people 30 years later
2010	Macondo, Gulf of Mexico	upstream oil	Blowout of wellhead and release of an estimated 650 million L of oil into Gulf of Mexico	Described as the "worst environmental disaster in American history" by the US Natural Resources Defence Council (NRDC), the oil and dispersants had a devastating impact on marine plants (including death of seaweed beds), animals and birds, and severely impacted fishing and tourism

Ref: Kerin, T. (2019). Managing Process Safety. In *The Core Body of Knowledge for Generalist OHS Professionals*. 2nd Ed. Tullamarine, VIC: Australian Institute of Health and Safety.

SEVESO is applicable to many sites all over the EU

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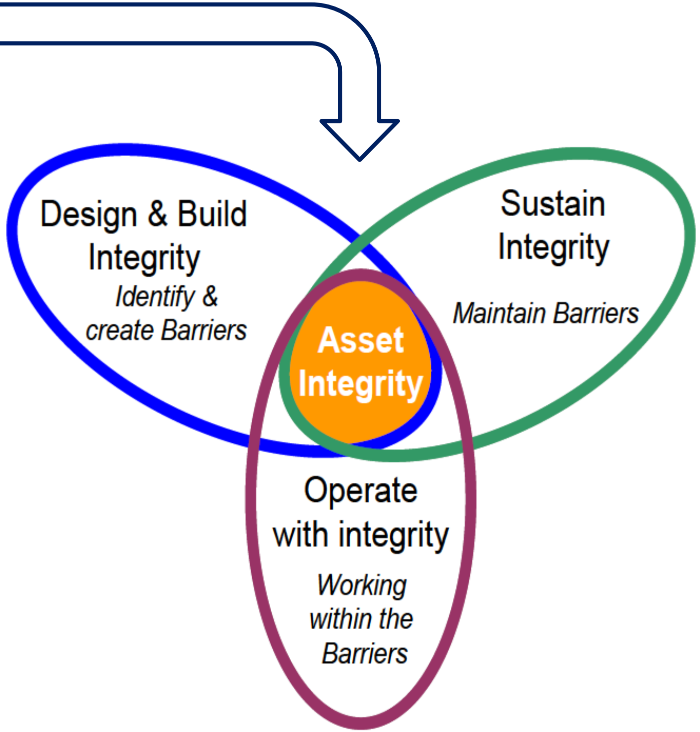
Process safety management in practice

Process Safety as "toolbox" that chemical industry applies for addressing SEVESO objectives

Process Safety – Definition

- *Process safety* is about **managing the integrity of operating systems** by applying inherently safer design principles, engineering and disciplined operating practices.

- It deals with the **prevention and mitigation** of incidents that have the potential for a *loss of control* of a hazardous material or energy.
- *Such loss of control* may lead to **severe consequences** with fire, explosion and/or toxic effects, and may ultimately result in loss of life, serious injury, extensive property damage, environmental impact and lost production with associated financial and reputational impacts.



Ref: Kerin, T. (2019). Managing Process Safety. In *The Core Body of Knowledge for Generalist OHS Professionals*. 2nd Ed. Tullamarine, VIC: Australian Institute of Health and Safety.

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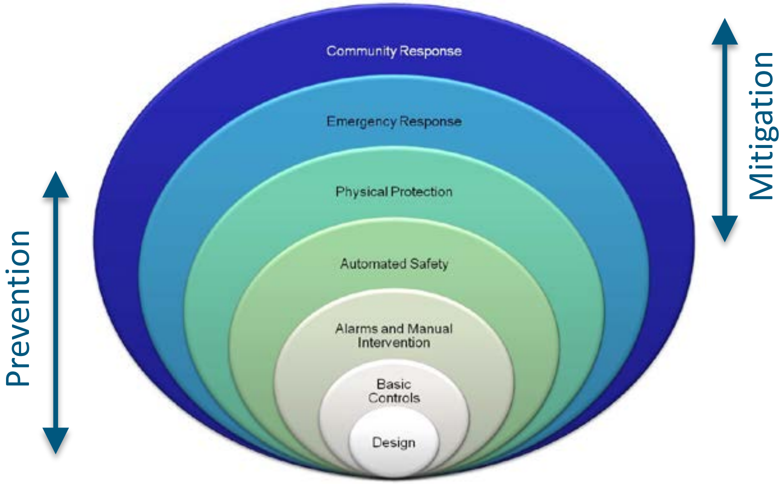
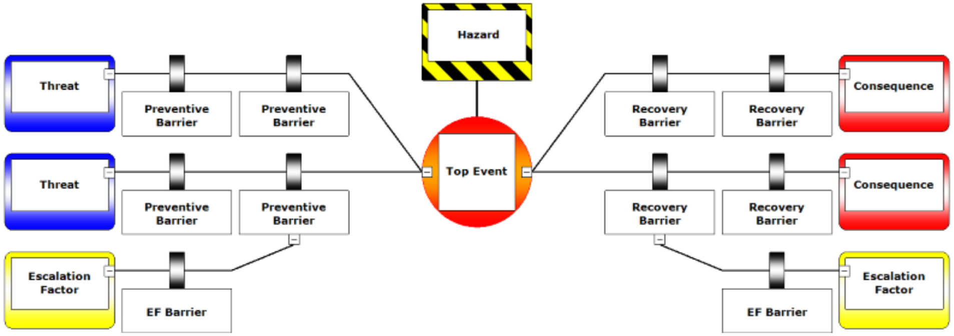
Process safety to a large extent relies upon installing and managing successive (technical) barriers



Layers of protection: **onion model**



BowTie model

Hazard = the processing of a toxic or highly energetic material in an industrial plant

Top Event = loss of containment of such material

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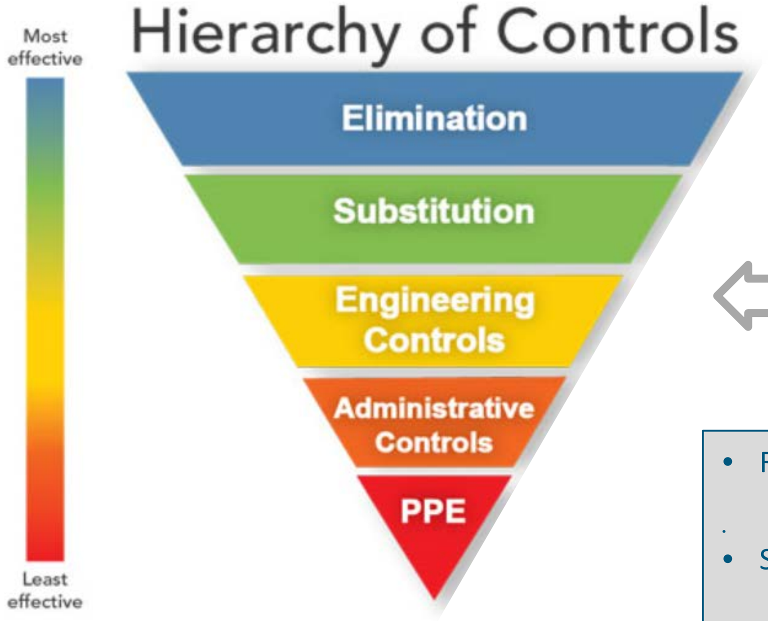
REACH SVHC versus Seveso approach

Plotting on a bow-tie distinguishes their focus

Common grounds, however:

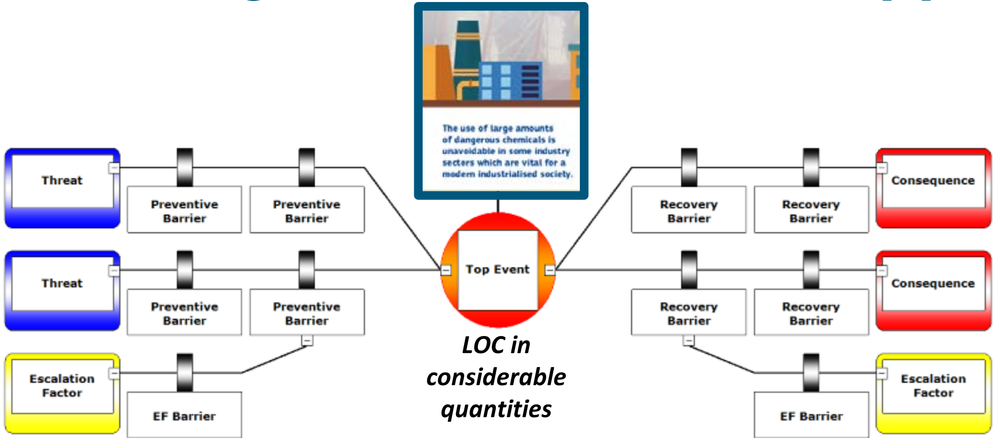


REACH SVHC main focus

Process safety main focus
(existing installations)

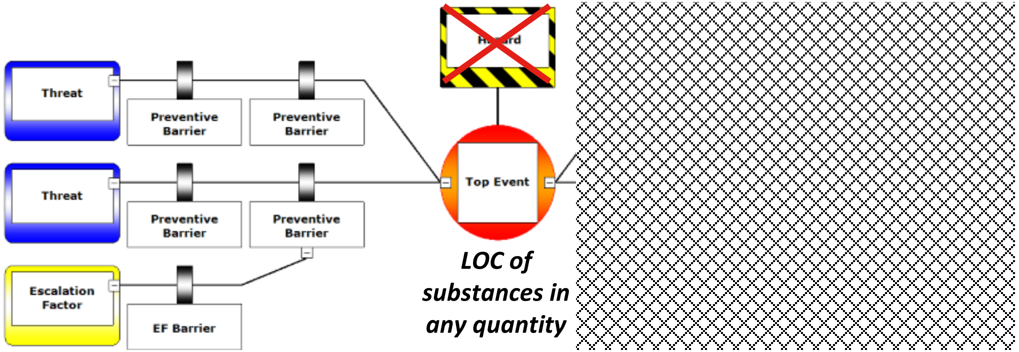
- REACH: safe use of **all chemicals** in Europe
  & minimize use of SVHC (mainly with long term effects)
- SEVESO: preventing major incidents
  with **dangerous substances in scope** *(Annex I, part 1 & 2):*
  - Selected substances *(mainly with short term effect)*
  - Site inventory over treshold quantities

Plotting Seveso & REACH approach on a Bow-Tie diagram



Process safety / PSM philosophy:

- given the hazard, focus on preventive as well as mitigating barriers



Reach philosophy:

- for SVHC
  → eliminate the hazard
- for other hazardous substances
  → focus on preventive barriers

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Hazard classes CLP : SVHC

PHYSICAL

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- Oxidizing gas, liquid and solid
- Gasses under pressure
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- Self-heating substances and mixtures
- Pyrophoric liquid and solid
- Water reactive
- Organic peroxide
- Corrosive to metals

HEALTH

- Acute Toxicity
- Corrosive to skin
- Eye Damage
- Skin- / Eye irritation
- Sensibilization
- Carginogenic, Mutagenic & Reprotoxic (CMR)
- Specific Target Organ Toxicity (STOT)
- Aspiration
- Endocrine disruptors

ENVIRONMENT

- Acute Toxicity
- Chronic Toxicity
- Hazards to ozone layer
- Endocrine disruptors

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Hazard classes CLP : SEVESO

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- Corrosive to metals

HEALTH

- Acute Toxicity
- Corrosive to skin
- Eye Damage
- Skin- / Eye irritation
- Sensibilization
- Carginogenic, Mutagenic & Reprotoxic (CMR)
- Specific Target Organ Toxicity (STOT): Single Exposure
- Aspiration

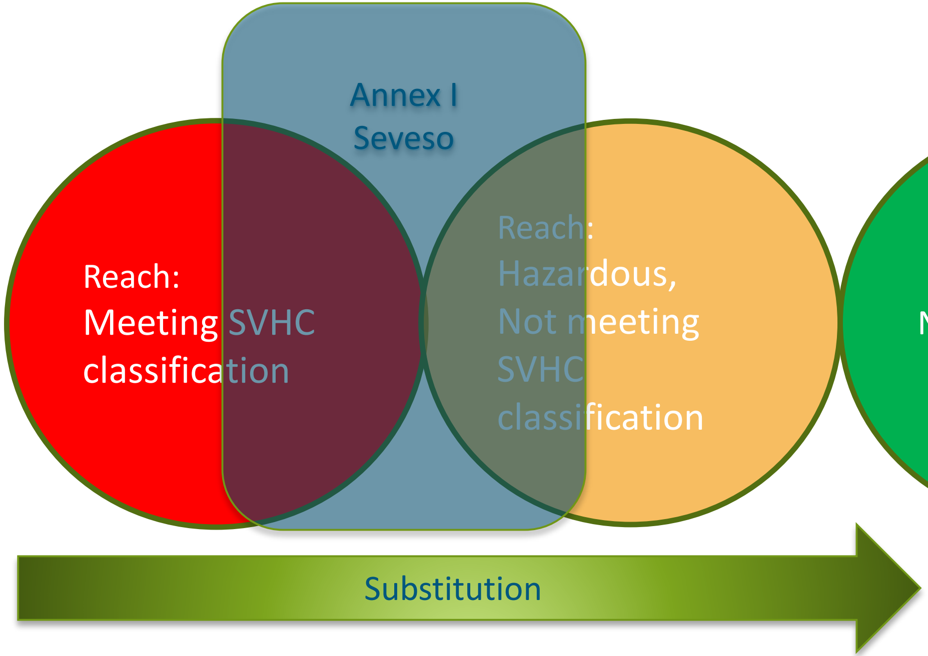
Some named dangerous substances

ENVIRONMENT

- Acute Toxicity
- Chronic Toxicity
- Hazards to ozone layer

Substances on the production site

Meeting classification of a SVHC (only)
Meeting classification Annex I Seveso (only)
Meeting both classifications *(i.e. within scope of both obligations)*



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Examples of substances currently under evaluation

Substance	CAS / EINECS nr	Actual classification	Concern in the RMOA
Benzyl Alcohol (As one of the solvents in pure or technical form, or as UVCB or as impurity. Others are: xylenes etc.)	100-51-6 / 202-859-9	H332, H302	Carcinogenic H350 Mutagenic H340 Toxic for reproduction H360 Respiratory sensitiser, STOT RE (under development in 2020)
Vinyl Acetate	108-05-4 / 203-545-4	H225, H351, H332, H335	Carcinogenic Mutagenic (under development in 2020)

In order to remain aware (and ahead) of such evaluations and their outcomes one can monitor :

- Ongoing dossier evaluations ECHA on the CORAP list,
- RMOA list (Risk management option analysis)
- Harmonised classification and labelling consultations

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Vinyl acetate - Regulatory manag | Benzyl alcohol - Regulatory man

https://echa.europa.eu/rmoa/-/dislist/details/0b0236e184ff4aa4

Regulatory management option analysis

The regulatory management option analysis (RMOA) list includes substances for which an RMOA either is under development or has been completed since the start of the implementation of the SVHC Roadmap in February 2013.

For each substance, the table shows the assessing Member State (submitter), the concern, the outcome and the suggested follow-up from the RMOA, and the date of the latest update to the list entry.

Other process details and relevant documents are also available and can be accessed through the 'Details' icon for the list entry.

› Disclaimer to the RMOA list

Further information

- Understanding RMOA
- Risk management and evaluation (RiME+) platform
- PACT
- Registry of Intentions

Benzyl alcohol

EC / List no: 202-859-9 **CAS no:** 100-51-6

Concern	Carcinogenic Mutagenic Respiratory sensitiser STOT RE Toxic for reproduction
Status	Under development
Outcome	Under development
Follow-up	No suggestion yet
Date of intention	11/06/2020
Date of RMOA conclusion	
RMOA conclusion document	
Full RMOA document	

This is an RMOA in particular for consumer products, articles and mixtures, containing the below mentioned solvents, as currently the risks to consumers caused by those solvents cannot be excluded as detailed information on the type of consumer products and their applications is currently lacking.

This RMOA is aimed at gathering information on products containing the below mentioned solvents in pure or technical form, as UVCB or as impurity.

Solvents of interest in the RMOA:

benzyl alcohol (CAS no: 100-51-6; EC no.: 202-859-9)

1,3-dioxolane (CAS no.: 646-06-0; EC no.: 211-463-5)

Vinyl acetate - Regulatory manag × Benzyl alcohol - Regulatory man × +

https://echa.europa.eu/fr/rmoa/-/dislist/details/0b0236e184671495

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Vinyl acetate

EC / List no: 203-545-4 **CAS no:** 108-05-4

Concern	Carcinogenic Mutagenic
Status	Under development
Outcome	Under development
Follow-up	No suggestion yet
Date of intention	09/01/2020
Date of RMOA conclusion	
RMOA conclusion document	
Full RMOA document	
Remarks	
Authority	Sweden
Submitter organisation	Swedish Chemicals Agency
Submitter email	rmo@kemi.se
Submitter phone	
Submitter address	

Vinyl acetate

From Wikipedia, the free encyclopedia

Vinyl acetate is an organic compound with the formula $CH_3CO_2CH{=}CH_2$. This colorless liquid is the precursor to polyvinyl acetate, an important industrial polymer.[3]

Production [edit]

The worldwide production capacity of vinyl acetate was estimated at 6,969,000 tonnes/year in 2007, with most capacity concentrated in the United States (1,585,000 all in Texas), China (1,261,000), Japan (725,000) and Taiwan (650,000).[4] The average list price for 2008 was $1600/tonne. Celanese is the largest producer (ca 25% of the worldwide capacity), while other significant producers include China Petrochemical Corporation (7%), Chang Chun Group (6%), and LyondellBasell (5%).[4]

It is a key ingredient in furniture glue.[5]

Polymerization [edit]

It can be polymerized to give polyvinyl acetate (PVA). With other monomers it can be used to prepare various copolymers such as ethylene-vinyl acetate (EVA), vinyl acetate-acrylic acid (VA/AA), polyvinyl chloride acetate (PVCA), and polyvinylpyrrolidone (Vp/Va Copolymer, used in hair gels).[8] Due to the instability of the radical, attempts to control the polymerization via most 'living/controlled' radical processes have proved problematic. However, RAFT (or more specifically MADIX) polymerization offers a convenient method of controlling the synthesis of PVA by the addition of a xanthate or a dithiocarbamate chain transfer agent.

Other reactions [edit]

Vinyl acetate undergoes many of the reactions anticipated for an alkene and an ester. Bromine adds to give the dibromide. Hydrogen halides add to give 1-haloethyl acetates, which cannot be generated by other methods because of the non-availability of the corresponding halo-alcohols. Acetic acid adds in the presence of palladium catalysts to give ethylidene diacetate, $CH_3CH(OAc)_2$. It undergoes transesterification with a variety of carboxylic acids.[9] The alkene also undergoes Diels-Alder and 2+2 cycloadditions.

With an iridium catalyst, vinyl acetate can undergo transesterification, giving access to vinyl ethers:[10][11]

$$ROH + CH_2{=}CHOAc \rightarrow ROCH{=}CH_2 + HOAc$$

Toxicity evaluation [edit]

Tests suggest that vinyl acetate is of low toxicity. For rats (oral) LD50 is 2920 mg/kg.[3]

On January 31, 2009, the Government of Canada's final assessment concluded that exposure to vinyl acetate is not harmful to human health.[12] This decision under the Canadian Environmental Protection Act (CEPA) was based on new information received during the public comment period, as well as more recent information from the risk assessment conducted by the European Union.

It is classified as an extremely hazardous substance in the United States as defined in Section 302 of the U.S. Emergency Planning and Community Right-to-Know Act (42 U.S.C. 11002), and is subject to strict reporting requirements by facilities which produce, store, or use it in significant quantities.[13]

See also [edit]

- Polyvinyl alcohol
- Vinyl propionate

- Acetic acid ethenyl ester
- 1-Acetoxyethylene

Identifiers	
CAS Number	108-05-4 ✓
3D model (JSmol)	Interactive image
ChEBI	CHEBI:46916 ✗
ChemSpider	7616 ✗
ECHA InfoCard	100.003.224
EC Number	203-545-4
KEGG	C19309 ✓
MeSH	C011566
PubChem CID	7904
UNII	L9MK238N77 ✗
CompTox Dashboard (EPA)	DTXSID3021431
InChI	[show]
SMILES	[show]
Properties	
Chemical formula	$C_4H_6O_2$
Molar mass	86.090 g·mol^{-1}
Appearance	Colorless liquid
Odor	Sweet, pleasant, fruity; may be sharp and irritating[1]
Density	0.934 g/cm^3
Melting point	−93.5 °C (−136.3 °F; 179.7 K)
Boiling point	72.7 °C (162.9 °F; 345.8 K)
Magnetic susceptibility (χ)	-46.4·10^{-6} cm^3/mol
Hazards	
Safety data sheet	ICSC 0347
R-phrases (outdated)	R11
S-phrases (outdated)	S16, S23, S29, S33
NFPA 704 (fire diamond)	
Flash point	−8 °C (18 °F; 265 K)
Autoignition temperature	427 °C (801 °F; 700 K)

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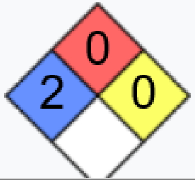
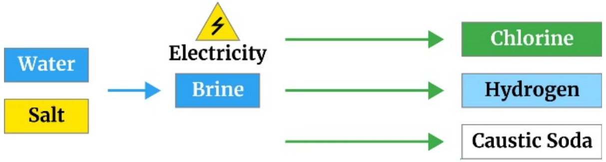
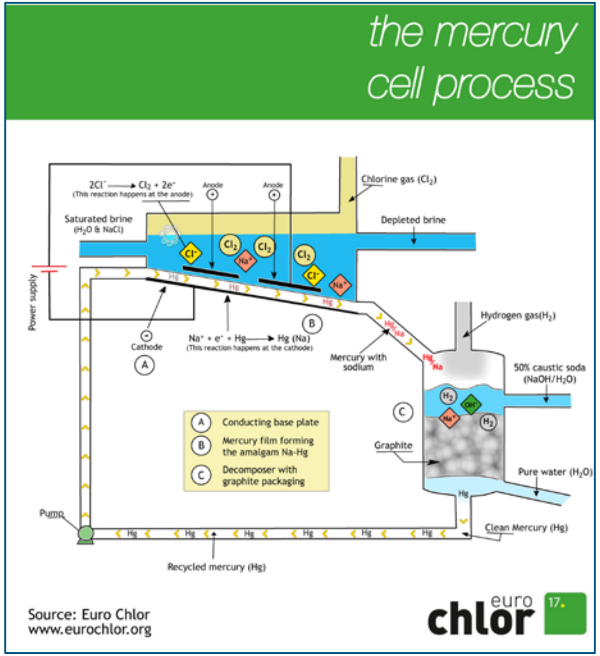
Case study

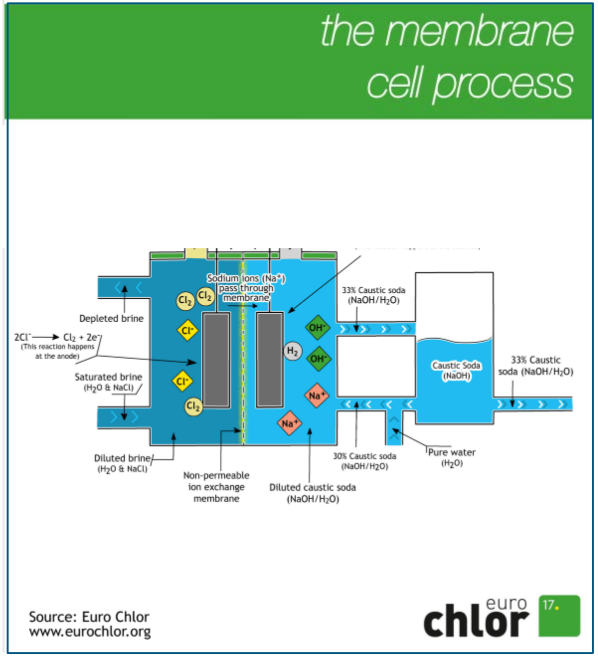
Phasing out mercury cell electrolysis in Europe

Mercury	
Hazards	
GHS pictograms	
GHS Signal word	**Danger**
GHS hazard statements	H330, H360D, H372, H410
GHS precautionary statements	P201, P260, P273, P280, P304, P340, P310, P308, P313, P391, P403, P233[92]
NFPA 704 (fire diamond)	

Case study: chlor alkali electrolysis process







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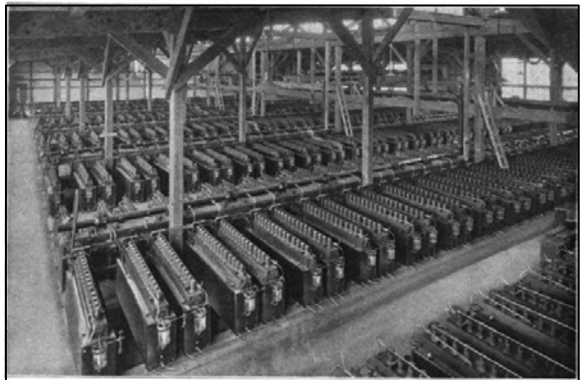
Case study: mercury cell electrolysis

The phasing out of the mercury cell electrolysis process in the EU took decades:

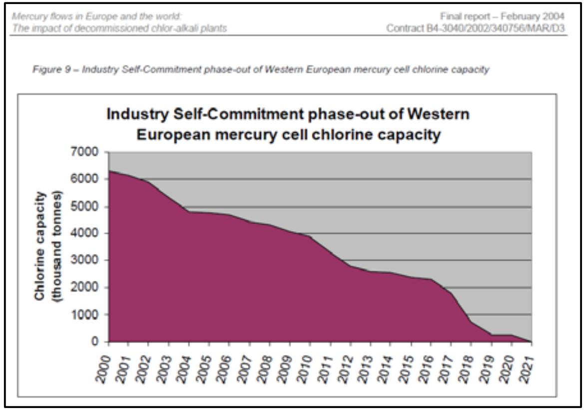
- Patented in 1892, industrial scale production since approx. 1900
- Side-effect: environmental releases of mercury
- The diaphragm process was developed from 1950 onwards. Commercial scale production was operational in Japan since 1975. This process was regarded a superior method both in its energy efficiency and lack of harmful chemicals.

- *“In 2001, the European chlor-alkali sector voluntarily committed to phase-out of mercury cell technology by 2020. Meanwhile, however, under the Industrial Emissions Directive, the BAT conclusions (Best Available Techniques) became legally binding. This meant that, by 11 December 2017, mercury-based production technology should cease”*
- *“As a result, European chlor-alkali producers using the mercury technology converted or dismantled such facilities. Any resulting mercury-containing wastes were also addressed.”*

“…..” : Ref: EuroChlor website



Cell room of a chlor-alkali plant ca. 1920



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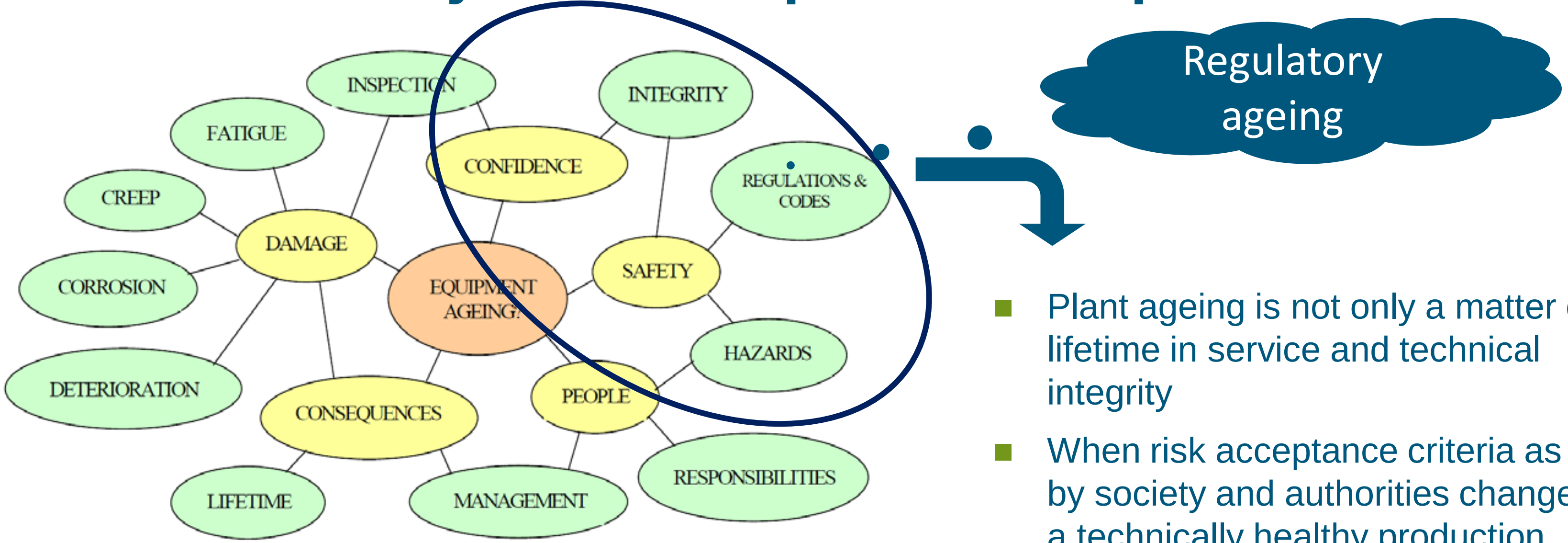
Conclusion:
Reach & CLP may result in “premature” plant retirement



- Plant ageing is not only a matter of lifetime in service and technical integrity
- When risk acceptance criteria as held by society and authorities change, a technically healthy production process/installation may soon become “outdated”
- In such case, economical payback period of the original investment will hardly be considered

Agenda

1 Reach & CLP

- ❑REACH essentials: approach for risk reduction of SVHC
- ❑CLP essentials
- ❑Reach & CLP → 3 main categories of substances

2 SEVESO and Process Safety Management

- ❑SEVESO essentials: prevention and mitigation
- ❑Process safety in practice
- ❑Risk management approach: onion model and BowTie model

3 REACH and SEVESO: differences & overlaps

- ❑Compare classifications
- ❑Example of substances that may in near future be classed as SVHC
- ❑Case study of substance already phased out: timelines then and now

4 To what extent will Reach & CLP influence process safety?

- ❑Inherent safety: Process safety versus SVHC Control
- ❑Options for Inherently Safer Design in CAPEX projects
- ❑Discussion

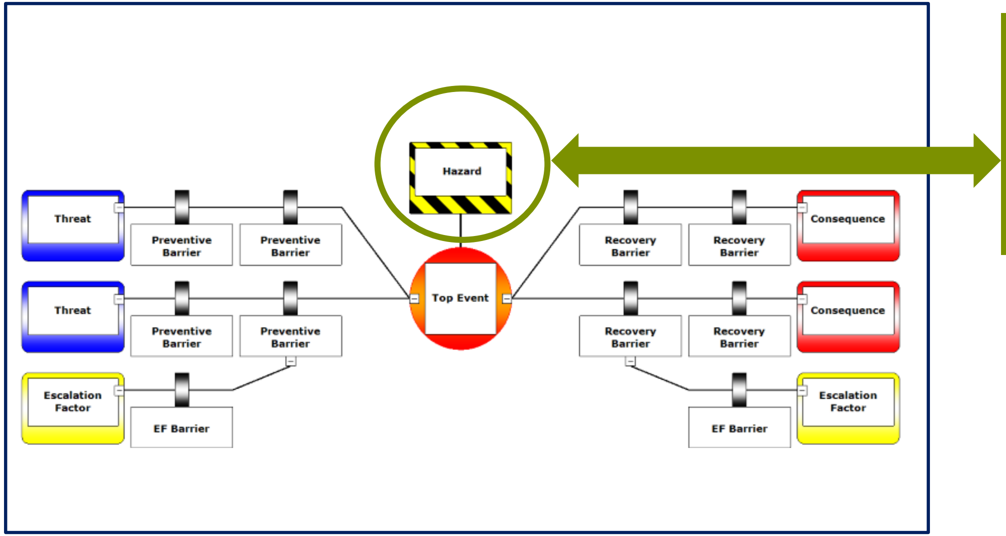
Should we adapt our PSM approach and put more emphasis on Inherently Safer Design ?

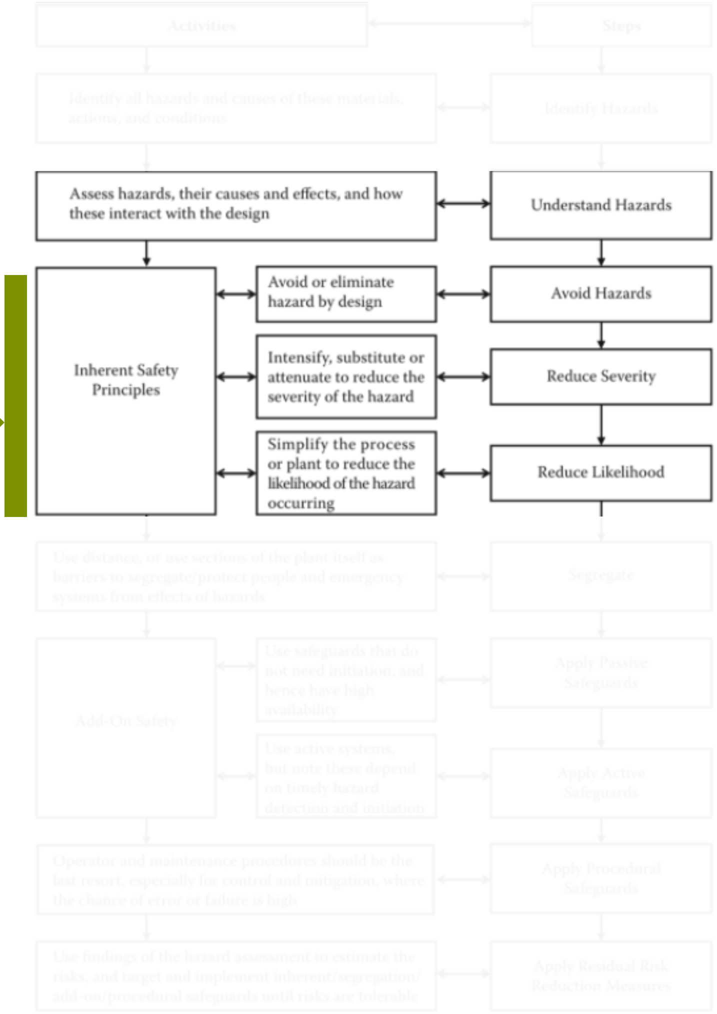
Origin of the notion inherent safety: lecture by Dr. Trevor Kletz (ICI), 1977: "What You Don't Have Can't Leak"

Inherently safer design summarised in four main strategies:

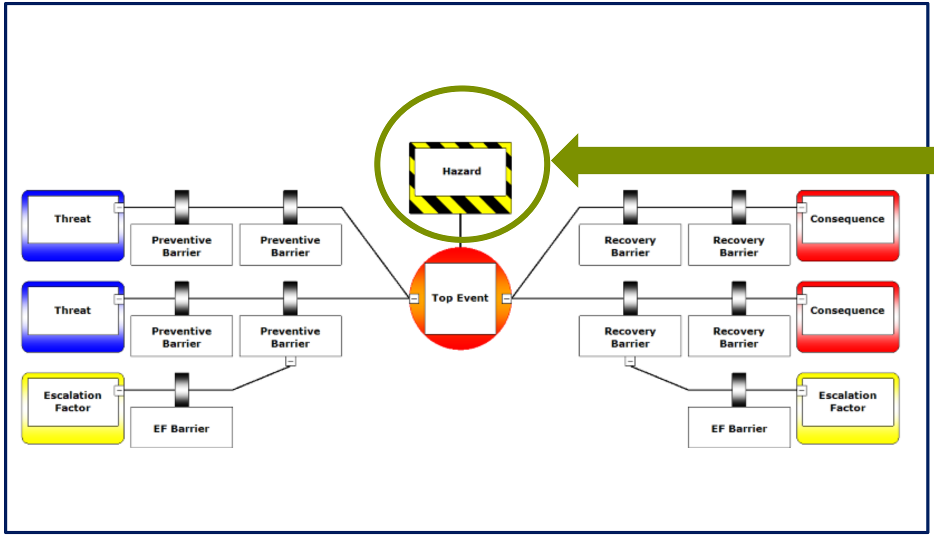
Keyword	Description	Alternative Keyword
Minimise	Using or having smaller quantities of hazardous substances	Intensification
Substitute	Replacing a chemical/material with a less hazardous substance or Replacing a process or processing technology with a less hazardous one	
Moderate	Using: • less hazardous or energetic processing or storage conditions, • a less hazardous form of material, • or facilities that minimise the impact of a release of hazardous material or energy	Attenuation and Limitation of effects
Simplify	Designing facilities which eliminate unnecessary complexity and make errors less likely, and which are forgiving of errors that are made	Error tolerance

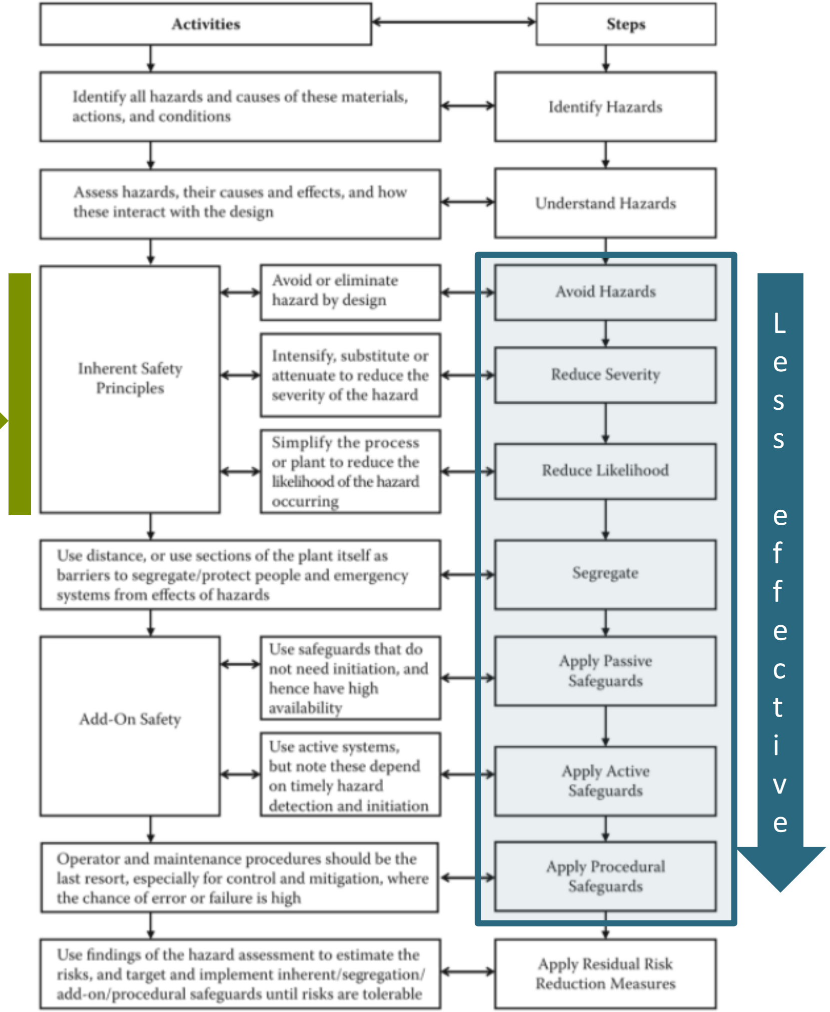
Incorporating inherent safety into process risk management





Incorporating inherent safety into process risk management





Ref: Kletz, T.A., Amyotte, P., 2010. Process Plants: A Handbook for Inherently Safer Design. CRC Press.

Inherently safer design serves both REACH & Seveso

However, hierarchy aspects still to be bridged

	#		SEVESO - PSM	REACH SVHC
	1	Identify hazards	Major accident resulting in LOC *(> threshold hold-up on site)*	Any LOC of SVHC
Inherently Safe Design	2	Avoid hazards	Through alternative process design	Through alternative substances
Inherently Safe Design	3.1	Reduce consequence severity	**Intensify, Substitute or Attenuate** process or plant	Puts priority on reducing likelihood of release over reducing consequences of release
Inherently Safe Design	3.2	Reduce likelihood	**Simplify** process or plant	
	4	Segregate facilities	• Segregate people and emergency systems from hazards within the plant • Avoid impact of incidents in plant A on adjacent plant B	• Avoid impact of fugitive emissions on surroundings → double containment, mag drive pumps, minimum # flanges
Layers of Protection	5.1	Passive safeguards	Blow-off to safe location	• Safe the surroundings from any blow-off
Layers of Protection	5.2	Active safeguards	Measure T, p → flanges & fittings automated block valves	See item 4
Layers of Protection	6	Procedural safeguards	Operating & maintenance procedure	Operating & maintenance procedure
	7	Residual risk reduction	Iterate steps 1-6 until acceptable risk	Aim for no residual risk

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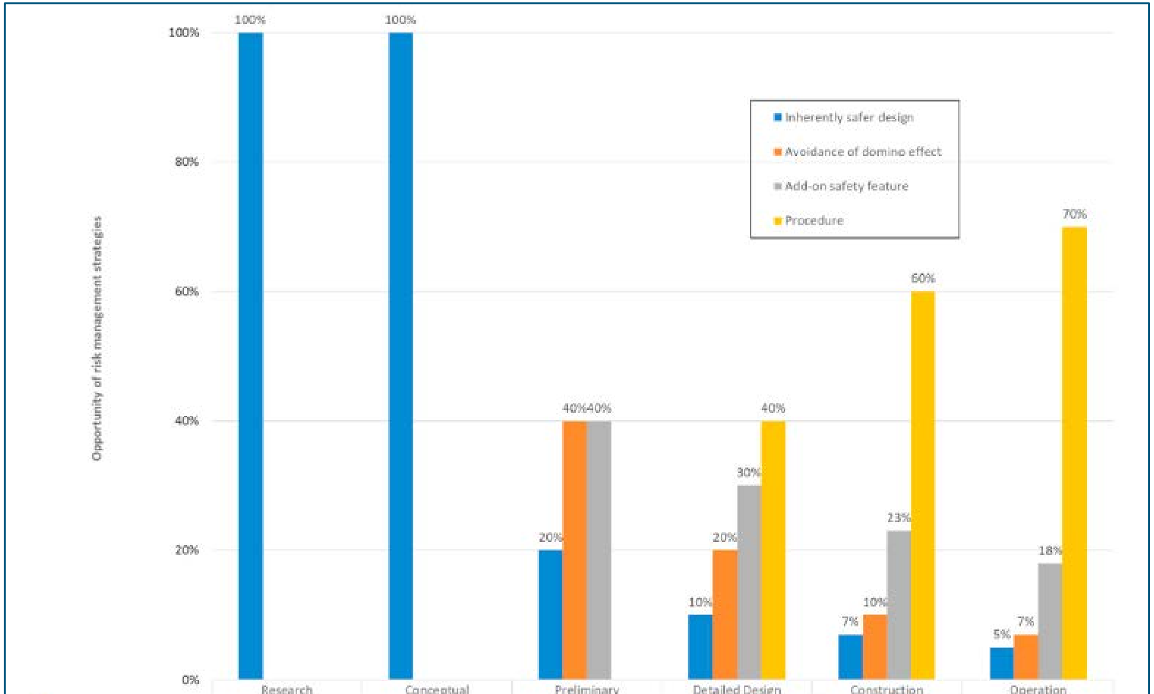
HSE, ISD and CAPEX Lifecyle

Opportunities of risk management strategies during CAPEX projects



	Research	Conceptual	Preliminary	Detailed Design	Construction	Operation
Inherently safer design	100%	100%	20%	10%	7%	5%
Avoidance of domino effect			40%	20%	10%	7%
Add-on safety feature			40%	30%	23%	18%
Procedure				40%	60%	70%

Ref: Park, Xu, Rogers, Pasman, El-Halwagi Journal of loss prevention in the process industries 63 (2020) 14040

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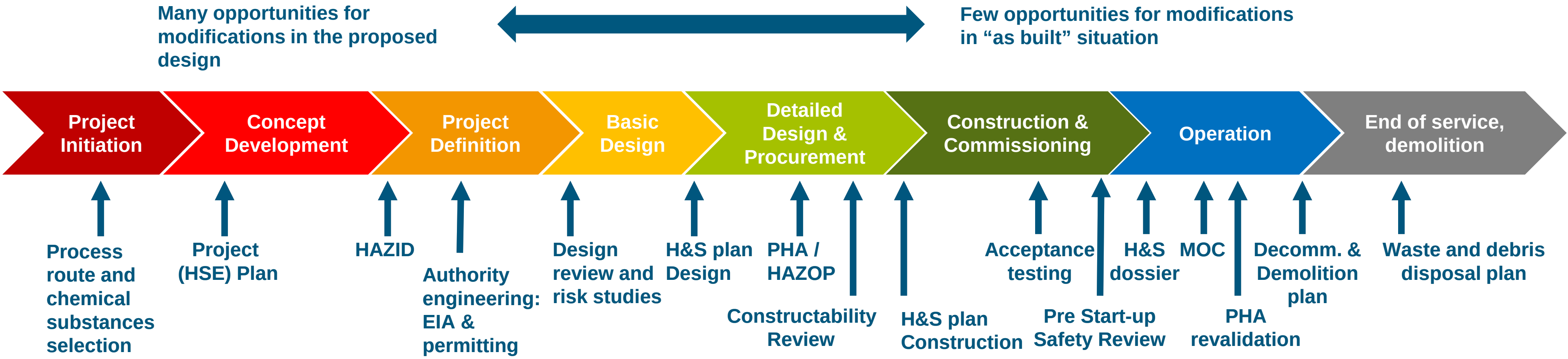
CAPEX project lifecycle & inherent safety options



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CAPEX project lifecycle & inherent safety options

Many opportunities for modifications in the proposed design ⟷ **Few opportunities for modifications in "as built" situation**

Project Initiation	Concept Development	Project Definition	Basic Design	Detailed Design & Procurement	Construction & Commissioning	Operation	End of service, demolition

Process route and chemical substances selection

Project (HSE) Plan

HAZID

Authority engineering: EIA & permitting

Design review and risk studies

H&S plan Design

PHA / HAZOP

Constructability Review

H&S plan Construction

Acceptance testing

Pre Start-up Safety Review

H&S dossier

MOC

PHA revalidation

Decomm. & Demolition plan

Waste and debris disposal plan

SVHC

Regulatory ageing

- Chemical toxicity hazards
- Reactivity hazards
- Fire/explosion hazards
- Environmental hazards
- **Inherent safety review:** *minimise / substitute / moderate / simplify*
- **Process intensification**
- Permit limits & siting criteria

- **Hazardous material inventories**
- **Flanges, seals, sampling points**
- Layout spacing
- Corrosion resistance and Integrity Operating Window

- **Consider ISD options** during MOC and PHA

Inherent safety guideword matrix - example

	Eliminate	Minimise	Substitute	Moderate	Simplify
Raw material					
In-process storage					
Product inventory					
Process chemistry					
Process controls					
Process piping					
Process equipment					
Process conditions					
Maintenance					
Siting					
Transportation					

Wrap-up and discussion

Summary

- REACH has known a long ramping-up period (2007 - 2018), but is now in full swing
- Substances in common use in process industries are or may one day become SVHC
- For substances classified as SVHC, two 'flavours" exists as per REACH:
  Phasing out unless authorised *(now > 50 entries)* or **restricted use** *(now > 70 entries)*
- In case of SVHC additional layers of protection ("add-on safety") may not suffice
- Inherent safety and process intensification therefore deserve renewed attention
- Whereas previously timelines for implementation of phasing out could span decades (*i.e. amortisation period*), some 5 years now seems more probable
- EU Commission toxic free strategy is likely to give a boost to the above observations

REACH and process safety (Seveso) seem to be largely independent, however they merit being regarded as two faces of the same coin, the side of which could bear the inscription: toxic free strategy

We thank you for your participation

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