Experiences in developing Sector Use Maps

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Background - ECMA

- ECMA is a sector group of Cefic, comprised of 18 member companies
- These companies are both manufacturers and downstream users of substances in the production of catalysts
- Catalysts are substances or mixtures that speed up a chemical reaction by lowering barriers to activation
  - This means dramatically reduced energy use as pressures and temperatures are lower than would be required without a catalyst
- Typical catalyst manufacture requires the use of multiple substances and manipulation of mixtures

Background – Catalyst Production

- Catalyst manufacture can be divided into emissions catalysts and process catalysts (only the latter to be discussed here)
- Process catalysts are used in the chemical or petrochemical industry to improve efficiency, lower operating temperature or pressure and improve product quality
- Most process catalysts are made up of a combination of metal species, sometimes in combination (common combinations include NiO and NiS, NiO and Al_2O_3, CoO and MoO_3
- In addition, typical catalyst facilities produce multiple types of catalyst, in separate production ”runs”
- In many cases the catalysts are a considered a mixture of metal oxides (as per ECHA guidance)
  - It should be noted some classes of catalyst fall outside of this derogation

Background – Catalyst Production

- **Example – Hydrotreating in refineries**
- **HDS catalysts are used to remove sulfur from gas or petroleum feedstocks**
- **Typically made up of molybdenum sulfide in combination with other metal species, eg nickel or cobalt compounds**
- **Thus, a factory producing this catalyst will be handling molybdenum and nickel based raw materials, modifying these by producing other substances and then producing a product, which may go directly to an end-user or to another firm for activation**

Preparing the use maps

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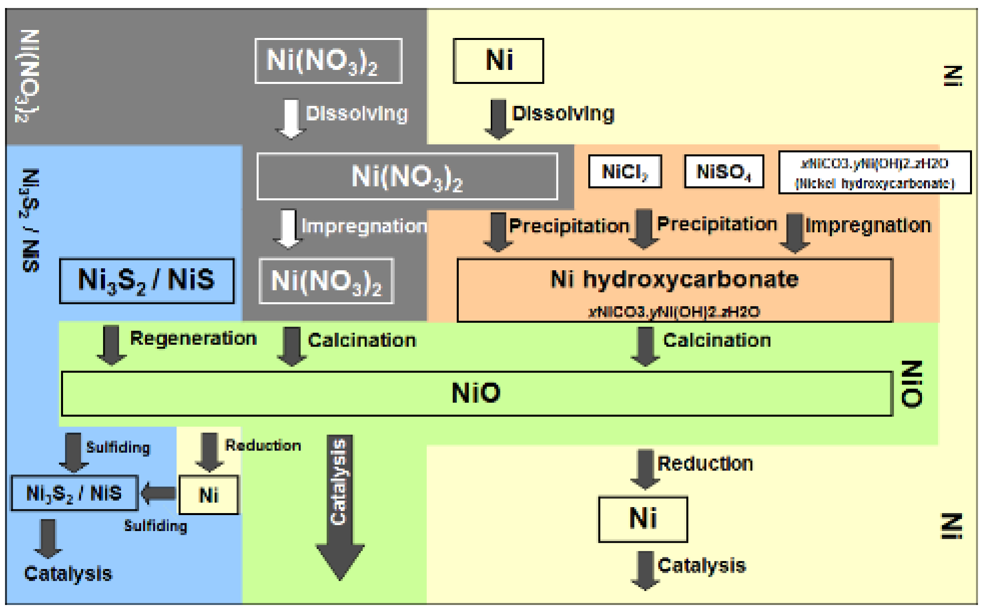
- ECMA produced a series of SPERCs in 2012
- The catalyst use scenarios were examined in 2014, and it was agreed that these should be updated with further details
- First step – considering how each metal is used
- Example - Nickel



Manufacture

- One substance is transformed into another substance
- Can take place through a variety of reactions
  - Dissolution (nickel metal in nitric acid to give a solution of nickel nitrate)
  - Precipitation (reaction of nickel nitrate with a base to precipitate nickel hydroxycarbonate)
  - Calcination (reaction of nickel hydroxycarbonate with oxygen under heat to give nickel oxide)
  - Reduction (reaction of nickel oxide under hydrogen atmosphere to give nickel metal)
  - Sulphidation (reaction of nickel metal with hydrogen sulphide gas to give nickel sulphide)
- Often includes intermediates
- Catalyst production can include some or all of these steps
- Ancillary tasks are also included (loading, mixing etc)

Formulation

- Only occurs in very specific cases, where a substance is manipulated without being transformed, and is then provided to another Legal Entity
- Is often the case for substances that are themselves are inert, but another substance in the mixture undergoes a reaction
- Activities are similar for manufacture
  - Forming
  - Calcining (where registered substance does not react)
  - Loading and unloading
  - Mixing

Downstream use

- Use of the substance in a catalyst product
- Quite different contributing activites than manufacture or formulation
- Bulk of the use life is in sealed reactor vessels
- Activites include:
  - Transport and storage
  - Loading and unloading
  - Use in reactor

Contributing activities

- **A list was created of all expected activites, and these were linked to exposure scenarios**
  - **Manufacture – where a new substance is manufactured (Ni metal to Ni nitrate)**
  - **Formulation – where a substance is manipulated (eg zeolite, coated in nickel nitrate and then calcined to nickel oxide – the zeolite itself does not change)**
    - **NB in this case, the nickel oxide is considered to be manufactured**
  - **Downstream Use – use of the final substance in a produced catalyst**

- **Each contributing activity was assigned a PROC, duration, PPE, containment, work pattern and potential route of exposure**

			Life Cycle		HH Exposure routes			HH Exposure Modifier			
Contributative ES (Short description of process or activity)	**Process Category (PROC)**	**Environ-mental Release Category (ERC)**	**Manufacture**	**Level of containment**	**Inhalation**	**Dermal**	**Ingestion**	**Duration and frequency (exposure time)**	**Work pattern**		**Outdoor or Indoor Operation**
Bulk delivery of solid RM (e.g. tank, silo, car)	PROC 8a/ 8b	ERC1	x	open	X	X	NA	2h/week to 1h/month	8h/shift	220 days/year	Both
	PROC 8a/ 8b		x	closed	X	X	NA	2h/week to 1h/month	8h/shift	220 days/year	Both
Semi-bulk delivery of solid RM (bags, drums..)	PROC 8a/ 8b	ERC1	x	open	X	X	NA	2h/week to 1h/month	8h/shift	220 days/year	Both
	PROC 8a/ 8b		x	closed	X	X	NA	2h/week to 1h/month	8h/shift	220 days/year	Both
Dellivery of liquid RM	PROC 8a/ 8b	ERC1	x	open	X	X	NA	2h/week to 1h/month	8h/shift	220 days/year	Both

Contributing activities

- These could then be bought into complete exposure scenarios, providing the complete use descriptor list for each ES

- Complete list of ES and contributing scenarios available at: http://www.cefic.org/About-us/How-Cefic-is-organised/Fine-Speciality-and-Consumer-Chemicals/European-Catalyst-Manufacturers-Association-ECMA/

Communication with consortia

- Acceptance from consortia varied wildly
- Sometimes took much longer to introduce than expected
- In some cases we considered producing sector specific exposure scenarios to deal with catalyst specific issues

Next steps

- Begin the process again…
- Update the contributing activites and exposure scenarios using new R12 guidance
- Approach consortia with the changes
- Update dossiers