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A joint initiative of the ETH domain and Swiss Federal Offices

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International Workshop on Quality of LCI data 2003
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Comparison of different approaches how to deal with cumulative LCI data in a unit process database

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Challenges

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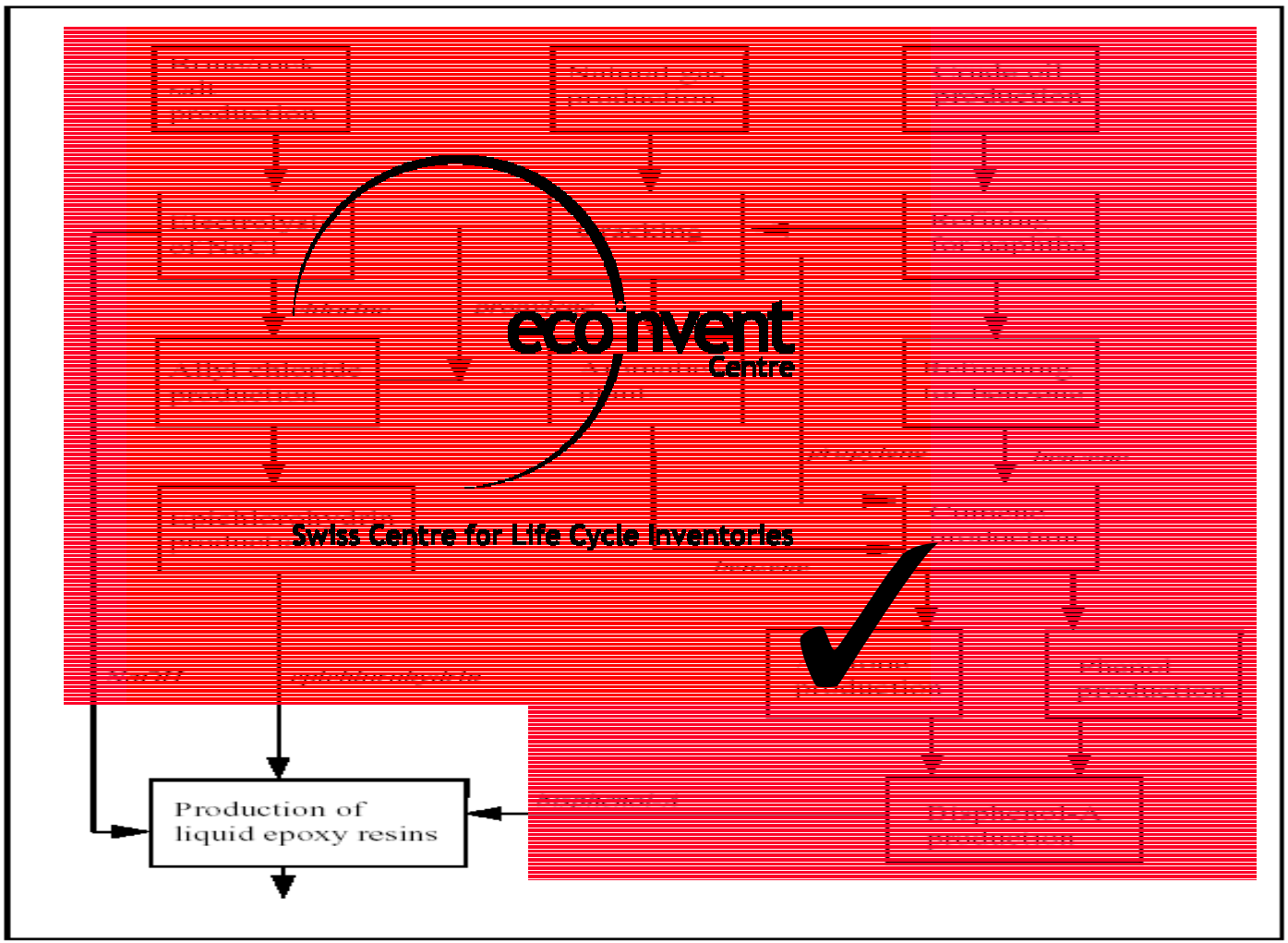
- Quality guidelines for ecoinvent require
  - data on a unit process basis
  - full range of elementary flows
  - full linkage to background data
  - standardized assumptions for infrastructure, transports, waste models, allocation, etc.

- Problems with inventory data published in a cumulative format
  - Important modelling questions cannot be harmonized
  - No possibility to use standard background data, e.g. for transports, electricity use
  - No update for new developments (e.g. emission control for lorries)

Life cycle for epoxy resin



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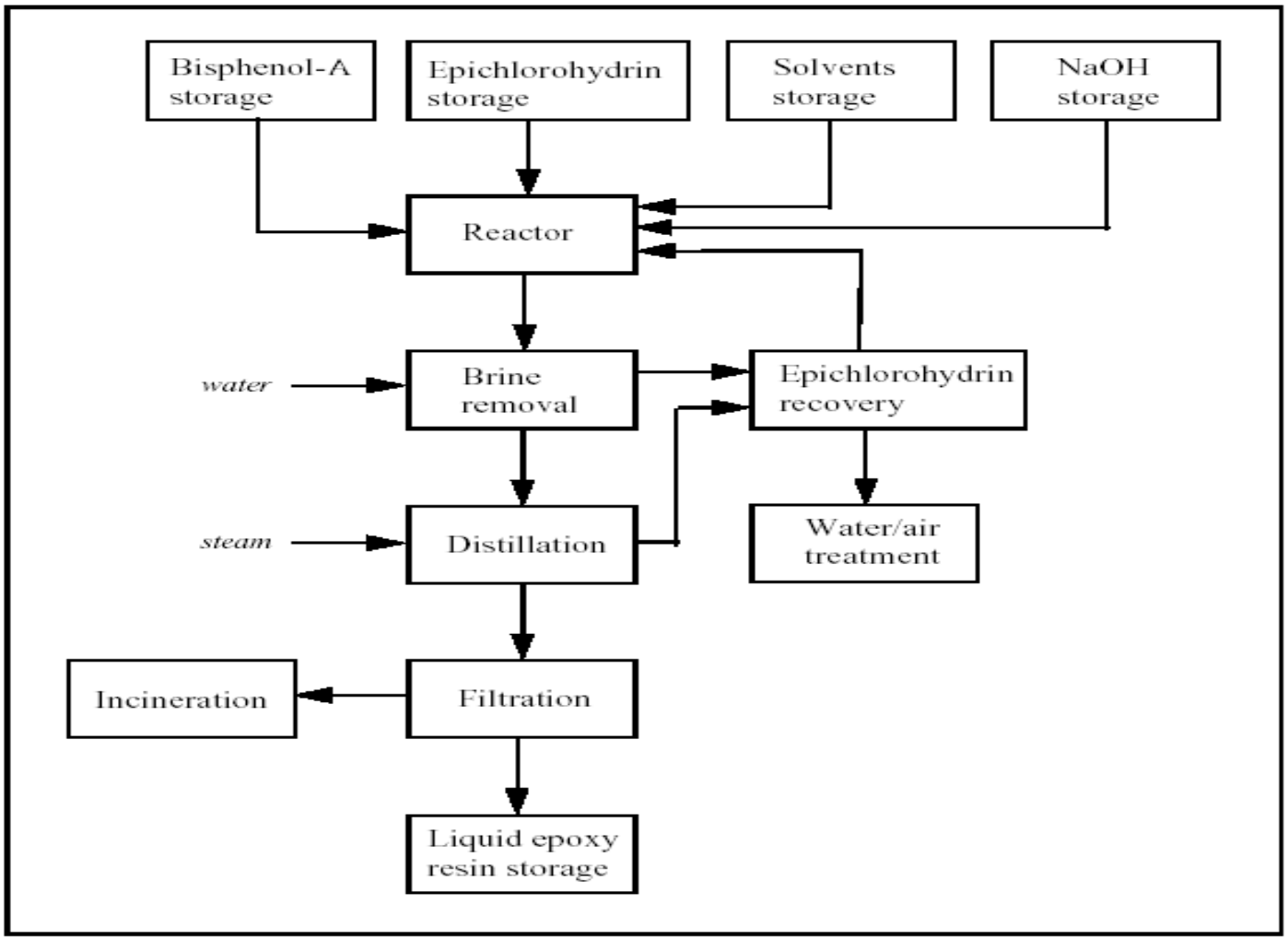
Missing process data



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Example APME data

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Gross air emissions in mg arising from the production of 1kg liquid epoxy resin

Emission (mg)	Fuel production	Fuel use	Transport	Process operation
Dust	5'500	2'800	21	7'100
CO2	1'600'000	3'600'000	34'000	650'000
N2O	<1	<1	-	-

First approach (aggregated data)

Name	Location	Infrastructure	Process	Unit	*epoxy resin, liquid, at plant*
					RER
					0
					kg
disposal, hard coal mining waste tailings, in surface backfill	GLO	0	kg		3.00E-1
Oil, crude, in ground	-	-	kg		6.70E-1
Carbon dioxide, fossil	-	-	kg		5.90E+0
Dinitrogen monoxide	-	-	kg		5.00E-7

(...)

- All data are directly taken from the publication
- Data <1 estimated with 0.5
- Only waste disposal linked to background processes
- No uncertainty ranges

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Second approach (disaggregated data)

Name	Location	Infrastructure	Unit	epoxy resin, liquid, disaggregated data, at plant
Location				RER
InfrastructureProcess				0
Unit				kg
electricity, medium voltage, production UCTE, at grid	UCTE	0	kWh	2.19E+0
heavy fuel oil, burned in power plant	RER	0	MJ	1.10E+1
disposal, municipal solid waste, 22.9% water, to sanitary landfill	CH	0	kg	2.98E-1
transport, lorry 32t	RER	0	tkm	6.06E+1
Carbon dioxide, fossil	-	-	kg	6.50E-1

(...)

- Linkage of data to background processes (e.g. fuel oil use)
- Disposal of process specific wastes linked to background processes
- Process specific emissions from publication, other emissions from database
- Own assumptions for infrastructure and transports
- No uncertainty ranges

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Third approach (stoichiometric calculation)

bisphenol A, powder, at plant	epichlorhydrin, at plant	sodium hydroxide, 50% in H2O, production mix, at plant
RER	RER	RER
kg	kg	kg
0.83	0.33	0.14

- Use of 3 pre-products in the stoichiometric ratio
- No process specific data for: yield, emissions, energy uses, infrastructure, process wastes, etc.
- Uncertainty can be assessed

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Inventory Results (excerpt)

	Unit	aggregated kg	disaggregated kg	stoichiometric kg
cumulative energy demand	MJ-Eq	125.0	290.0	125.9
Land occupation	m2a	0.003	0.168	0.053
Carbon dioxide, fossil	kg	5.92	15.63	4.26
Nitrogen oxides	kg	0.035	0.093	0.013

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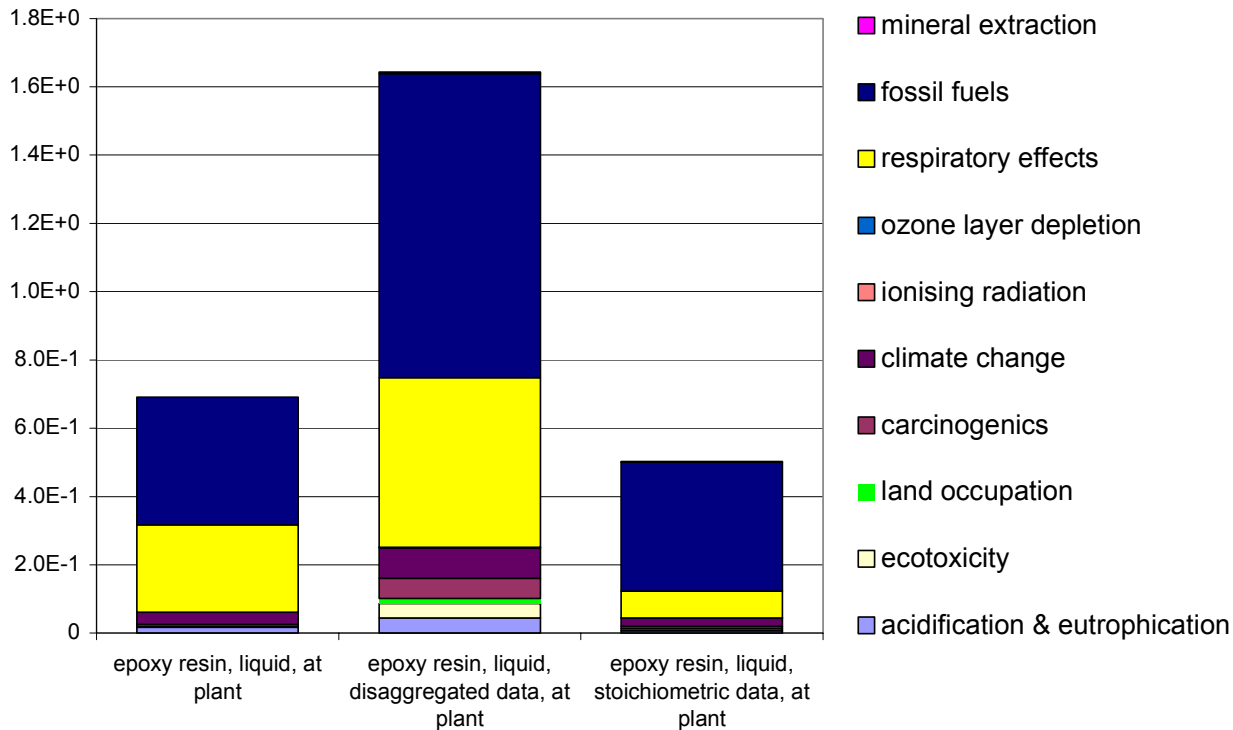
- Fossil energy use and CO2 much higher for disaggregated data
- ➢ Lower distances for transports seem to be used by APME
- Land use is much lower for aggregated data
- ➢ Only from waste disposal, but no direct data available
- NOx emissions higher for disaggregated data
- ➢ Emissions from transport and differing assumptions for combustion?
- ➢ For stoichiometric calculated emissions are sometimes higher, energy is similar

Impact Assessment (EI'99 H,A)



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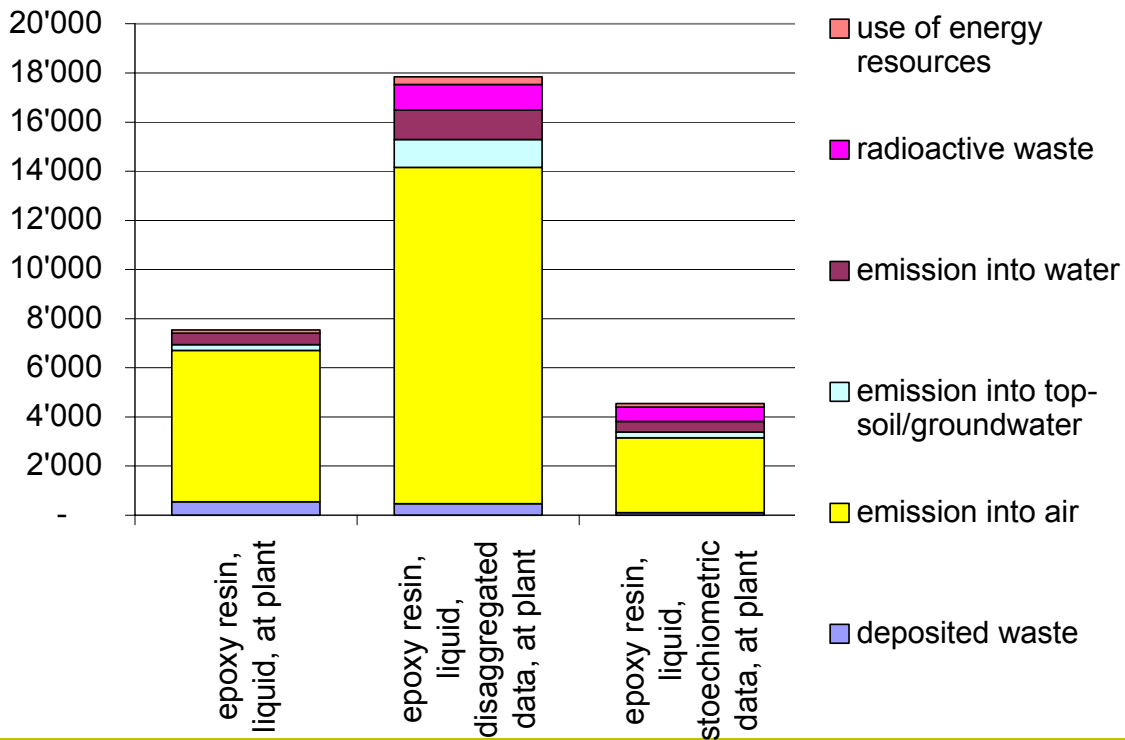
➢ Main difference: Energy use, respiratory effects (NOx)

Impact Assessment (ecological scarcity 97)



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- Main difference: NOx emissions, radioactive waste

Summary

- No good solution for the integration of cumulative data
- Cumulative data might neglect important aspects
- Disaggregated data get a poor quality rating because important aspects like type of combustion, transport device, etc. are not known, assumptions might be wrong
- Stoichiometric data might miss important direct process impacts

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- ecoinvent uses the original cumulated data (first approach)
- It is recommended to use these as background data but not for comparison with materials investigated in detail

Outlook

- Industrial data and averages are an important and necessary part of LCI databases
- Industrial data should be published as far as possible on a unit process base
- Keep confidentiality only were absolute necessary
- Horizontal industry averages for unit processes are no problem
- Vertical accumulation decreases data quality and comparability
- Good examples for industrial databases are e.g. study by European Aluminium Association

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