Calculating substance reduction of disinfectants based on procurement data – the way of Vienna

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Facts and challenges for disinfectants

More than 400 tons of disinfectants are used in hospitals, nursing homes, schools and Kindergartens of the City of Vienna – consumption has increased in the last 15 years.

Chemical disinfectants are indispensable for healthcare and other areas of hygienic risk but pose health and environmental hazards:

- may cause allergies, eczema or asthma
- suspected to be carcinogenic or teratogenic
- in case of low biodegradability and high toxicity → risk for water organisms

With no eco-labels for disinfectants available it is very difficult to choose disinfectants not harmful to the environment and human health.

History & requested task

In 2014 the administration of the ecological procurement programme of Vienna „ÖkoKauf Wien“ asks all working groups to evaluate whether respectively to what extend the city departments avoid products with hazardous properties (ingredients). Regarding the working group „disinfectants“ the task in particular was:

1. Which departments procure significant amounts of disinfectants?
2. Who is responsible for selection?
3. Which products are procured in what quantities?
4. How hazardous are these products compared to other products available on the market for the same application?

Product benchmarking

Departments were identified and contacted: Kindergartens; ambulance services; spas; schools to get product names and quantities of used disinfectants on an annual basis.

a. The **toxicological profile** of the product was elaborated on the basis of ingredients

b. Quantities of **„very high concern" ingredients** contained in the product were calculated

c. Used (emitted) amounts of „very high concern" ingredients from best respectively worst available **market alternatives (benchmarking)**

Hazard statements - basis of evaluation

The preparation of the toxicological profile uses the **hazard classification based on EU-CLP regulation**. The hazard is the potential for a substance to cause harm and depends on their intrinsic properties.

Example:
hazard classification of biocide „glutaraldehyde“ (CAS 111-30-8)

ATP Inserted / Updated: CLP00/ATP09
CLP Classification (Table 3.1)

Classification	
Hazard Class and Category Code(s)	Hazard Statement Code(s)
Acute Tox. 3	H301
Skin Corr. 1B	H314
Skin Sens. 1A	H317
Acute Tox. 2	H330
STOT SE 3	H335
Resp. Sens. 1	H334
Aquatic Acute 1	H400
Aquatic Chronic 2	H411

https://echa.europa.eu/information-on-chemicals/cl-inventory-database

Defining hazards of very high concern

It was decided to determine three types of hazards (hazard statement codes) being of „very high concern“:

- **CMR hazard**: proven or suspected mutagenic, carcinogenic, reprotoxic hazard potential including chronic toxicity (H340, H341, H350, H351, H360, H361, H372)
- **Sensitizing hazard**: may cause allergy or asthma symptoms or breathing difficulties if inhaled or an allergic skin reaction (H334, H317)
- **Hazard to the aquatic life**: toxic or very toxic to aquatic life with long-lasting effects (H411, H410)

Product benchmarking - steps 1and 2

1. choose a product and its application conditions
2. choose product alternatives which are equally effective

Tested product	D	
Type of application	Surface disinfection + mechanical action; high organic load	
Spectrum of activity (efficacy)	baktericidal and fungicidal	
Contact time (efficacy)	1	hour
application concentration	1%	of concentrate
Consumption of concentrate (l/year)	2315	l/year
Product alternatives	46	

Data about tested product, product alternatives, application conditions, efficacy and product ingredients are gathered from the WIDES database!

The Vienna Database for disinfectants (WIDES)

Relevant tool of Ecobuy Vienna (ÖkoKauf Wien) programme for green public procurement

Industry-independent, user-friendly, publicly accessible without charge (www.wides.at/en)

Facilitates the main goal of the Working Group Disinfection which is **substitution** (selecting those disinfectants with the lowest hazard potential)

Vienna Database for disinfectants (WIDES)

includes

human & ecotoxicological data on **> 200 ingredients** of disinfectants (antimicrobial substances, surfactants, solvents, etc.) with references.

data regarding the composition, independently certified spectrum of activity (efficacy!), applications and material compatibility of **> 200 disinfectants** for surfaces, instruments, laundry, dishes, hands and skin. Mainly from manufacturers' data.

A **holistic assessment procedure** to compare human- and ecotoxicological properties of disinfectants.

Product benchmarking - steps 3 and 4

3. list ingredients of benchmarked product D together with their concentration
4. identify ingredients with „very high concern“ hazards (red)

Tested Product: D 100			
Product ingredients	**CAS-Nr.**	**% in product**	**Hazard statements**
Quaternary ammonium compounds, C12-18-alkyl[(ethylphenyl)methyl]dimethyl, chlorides	68956-79-6	5	H226, H302, H312, H314 , H400
Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, chlorides C12-C18 alkyl benzyl dimethyl ammonium chloride	68391-01-5	5	H302, H312, H314, H315, H318, H400, **H410**
Didecyldimethylammonium chloride	7173-51-5	5	H301, H314, H400, **H411**

Product benchmarking - step 5

5. calculate quantities of emitted „very high concern“ ingredients of D 100 based on annual consumption (2315 l ≈ 2315 kg)

vhc-emission (kg/year) = vhc ingredient (%/100) * annual consumption (kg/year)

Tested Product: D				CMR hazard	Sensitizing hazard	Water hazard
Product ingredients	**CAS-Nr.**	**% in product**	**Hazard statements**	H341, 351, 361, H372, H340, 350, 360	H317, H334	H410, H411
Quaternary ammonium compounds, C12-18-alkyl[(ethylphenyl)methyl]dimethyl, chlorides	68956-79-6	5	H226, H302, H312, H314 , H400			
Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, chlorides C12-C18 alkyl benzyl dimethyl ammonium chloride	68391-01-5	**5**	H302, H312, H314, H315, H318, H400, H410			116
Didecyldimethylammonium chloride	7173-51-5	**5**	H301, H314, H400, H411			116
			emitted vhc-substances (kg/year):			232

Conclusion: The use of product D generates an emission of 232 kg substances of very high concern per year.

Product benchmarking - step 6 and 7

6. Choose products which you assume to superior (best case) and products which you assume to be inferior (worst case), which are foreseen for the same application, equally efficient (against specified germs) and available on the market. In the simplest compare it to one chosen product alternative.

6. Do steps 3, 4, 5 for each of the choosen products

Prerequiste for correct benchmarking

The benchmarked products have to be foreseen for the same application conditions and fullfill the same (minimum) efficacy! Common application conditions are hand disinfection, skin antisepsis, surface disinfection, instrument disinfection, linen disinfection.

Efficacy = Ability of a product to reduce bacteria, fungi or viruses according to defined testing conditions. A certificate is needed as proof!

Certificate providers (A, D)

- Austrian Society for Hygiene, Microbiology and Preventive medicine http://oeghmp.at/
- Association for Applied Hygiene http://www.vah-online.de/

The WIDES products entries provide information about application conditions and efficacy.

Important for correct benchmarking

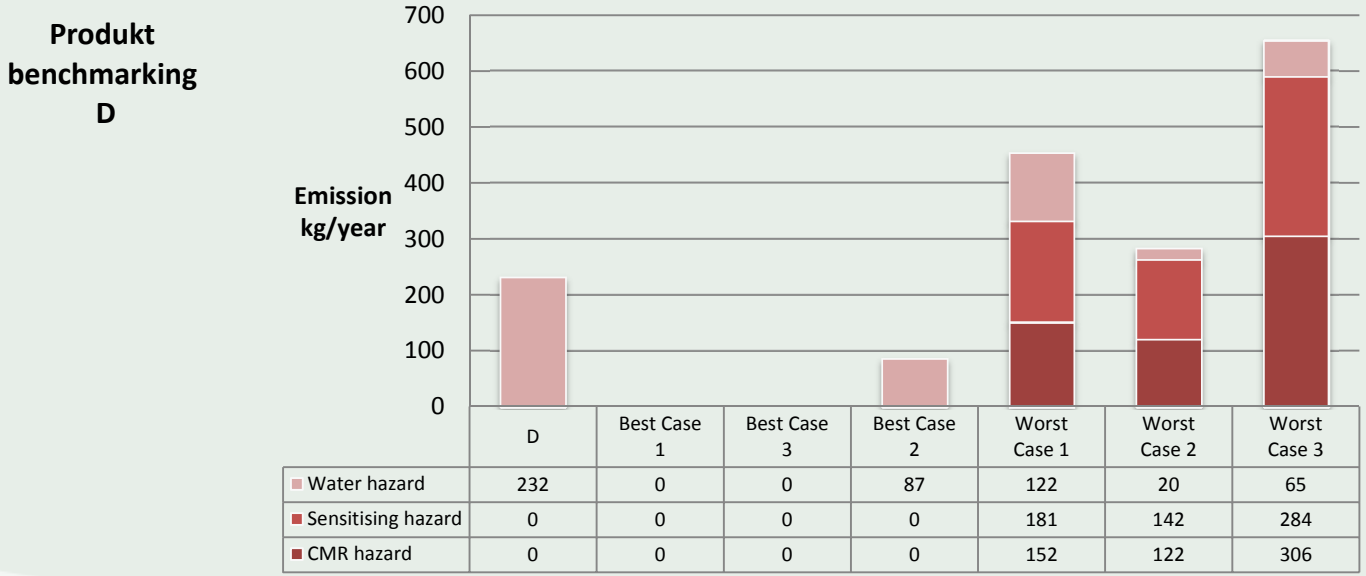
Same amounts of application solution have to be compared!
If the tested product is diluted prior to application then the alternative/s has/have to be referred to the same amount of application solution.

Example:
Product D: 2315 liters per year; used in dilution of 1%
application solution: 231500 liters

Product X: Used in dilution of 2.5 %. Therefore 5786 liters of X are needed to generate an application solution of 231500 liters.

Product Y:Used in dilution of 0.5 %. Therefore 1158 liters of Y are needed to generate an application solution of 231500 liters.

Product benchmarking example - result



	D	Best Case 1	Best Case 3	Best Case 2	Worst Case 1	Worst Case 2	Worst Case 3
Water hazard	232	0	0	87	122	20	65
Sensitising hazard	0	0	0	0	181	142	284
CMR hazard	0	0	0	0	152	122	306

Provisional conclusion: The use of product D generates an emission of 232 kg substances of very high concern per year.
There are products available for the same application and with the same efficacy which emit 0 kg substances of very high concern.
A substitution should be taken into consideration but does not appear to be urgent (distance to worst case products is substantially).

Thank you for your attention

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