BACKGROUND DOCUMENT EUROMETAUX SPERCS

This document provides background information to the SPERC factsheets of Eurometaux. The SPERCs of Eurometaux were developed by experts from Eurometaux member companies and commodities in cooperation with consultants.

General Disclaimer

SPERCs are specific environmental release categories and are meant to specify broad emission scenario information (ERCs) as suggested for the use of substances throughout their life cycles (Reihlen et al., 2016). Although specific, SPERCs still reflect emissions of a broad application area of a substance within an industry sector. For their purpose SPERCs are overly conservative and, therefore, their emission estimates are not intended to reflect all regulatory requirements that may relate to environmental emission thresholds.

1 Purpose Statement

The ECHA Guidance R16 provides one default set of release factors for several life cycle steps. This document provides background information to the SPERC factsheets for the life cycle of metals and metal compounds, i.e. the so-called Eurometaux SPERCs. Thus, specific information is provided on operational use conditions relevant to exposure and on product application, on risk management measures and on the derivation method and justification of release factors.

The SPERC Factsheets covered in this document are:

Eurometaux SPERC Code	Underlying ERC	Type of ingredient	Application area
Eurometaux SPERC 1.1.v2	ERC 1	Massive metal and metal powder	Manufacture and recycling
Eurometaux SPERC 1.2.v2	ERC 1	Metal compounds	Manufacture and recycling
Eurometaux SPERC 3.1.v2	ERC 3	massive metal or metal powder in alloys	Formulation
Eurometaux SPERC 5.1.v2	ERC 5	metals and metal compounds	Industrial use (metallic coating)
Eurometaux SPERC 5.2.v2	ERC 5	metals (compounds)	Industrial use (batteries)
Eurometaux SPERC 5.3.v2	ERC 5	massive metal	Industrial use (shaping)
Eurometaux SPERC 10A.1.v1	ERC 10A	massive metal, alloys or metallic coating	Service life (construction)
Eurometaux SPERC 11A.2.v1	ERC 11A	metals (compounds)	Service life (batteries)
Eurometaux SPERC 11A.3.v1	ERC 11A	massive metal, alloys or metallic coating	Service life (metallic articles)
Eurometaux SPERC 2.2a.v2 Eurometaux SPERC 2.2b.v2 Eurometaux SPERC 2.2c.v2	These SPERCs* are obsolete because overlapping with other sector SPERCs. Reference is made to ETRMA, Textile, CEPE, ACEA and other sector SPERCs.		
Eurometaux SPERC 2.5-6a.v2 Eurometaux SPERC 2.5-6b.v2 Eurometaux SPERC 2.5-6c.v2			

* a CHESAR file was never published for these SPERCs

This background document provides information on the derivation of the relevant parameters of the above- mentioned factsheets. Some details refer to tertiary references, e.g. publications.

2 Scope for industrial life cycle stage SPERCs

The structure of the industry varies by metal. A significant number of installations produce or use a number of metals from different groups or may have associated processes integrated with them. Examples are the processing of bauxite at an alumina refinery to produce Aluminium oxide, which is transported to and processed at an aluminium smelter; or the production of a range of different metals from complex raw materials, in particular copper, lead, zinc and precious metals.

There has been a steady improvement in the environmental performance and energy efficiency of the industry over the last thirty years since the adoption of Directive 84/360/EEC on the combating of air pollution from industrial plants. Techniques for reducing the environmental impact of an installation can be described in three categories:

1. management techniques: relating to the systems and procedures for designing and operating a process and for training operators and other staff;

2. process-integrated techniques: relating to the use of techniques to prevent or reduce emissions from activities such as storage, reaction, separation and purification;

3. abatement techniques: relating to end-of-pipe techniques to reduce emissions to air, water and soil.

The non-ferrous metals industry has for many decades used numerous residues as raw materials for other processes and an extensive network of metallurgical operators has long been established to increase the recovery of metals and reduce the quantities of waste for disposal. It is also well-known that the metal-producing industries obtain one of the highest recycling rates in all industrial sectors (JRC BAT on non-ferrous industry, Oct 2014).

2.1 Emission relevance of operational conditions

More detailed information on the relevant activities leading to emissions to the environment for the manufacturing, formulation and processing of metals can be found in sections 2.4, 2.5 and 2.6 of the Best Available Techniques Reference Document for the non-ferrous metal industries (JRC, Oct 2014).

2.2 Application of risk reduction measures

Applied process and techniques to prevent: see respective sections in the Best Available Techniques Reference Document for the non-ferrous metal industries (JRC, Oct 2014):

- diffuse emissions from storage and handling of input materials: see section 2.12.4
- channelled air emissions: see section 2.12.5.
- wastewater: see section 2.12.6.

Information on obligatory RMMs including justification of the efficiencies assigned to them.

Release to air: One or more of the RMMs in the fact sheet (of which fabric or bag filters and wet scrubbers are more common) were reported to be present in more than 90% of the sites. Overall range of reported RMM efficiencies ranged between 90% and 99.98%.

Release to water: one or more of the RMMs in the fact sheet were reported to be present in >90% of the sites for massive metal production. The 50th percentile of reported site-specific removal efficiency for 40 sites is 99% (range between 90% and 99.98%).

Reported efficiencies were stored in multi-metal background database together with measured site-specific release factors collected from peer-reviewed EU Risk Assessment Reports under the former Directive of New and Existing Substances and REACH 2010 and 2013 registration dossiers.

3A SPERC Information Sources and Justification for industrial life cycle stage SPERCs

3A.1 Justification of release factors

The derivation of the release factors is mainly based on measured data usually collected under national and regional environmental legislations.

- The methods and instruments used for sampling and analysis are the relevant European, national or international methods (e.g. European Committee for Standardisation (CEN); ISO).
- Factors should be taken into account such as variations of the process, the nature and potential hazardousness of the emissions, and the time needed to obtain a measurable amount of pollutant or representative information. These factors can then form the basis for the selection of operating conditions at which the highest emissions may be recorded, the number and duration of the measurements, the most appropriate method of measurement and the position of the measurement locations. For waste water emissions, qualified random samples can be used or 24-hour composite samples based on flow-proportional or time-averaged samples can be taken.

See peer reviewed publication (annexed to this background document) that explains the overall methodology of RF derivation:

Verdonck FAM, Van Assche F, Hicks, K, Mertens J, Voigt A, Verougstraete V. 2014. Development of realistic environmental release factors based on measured data: approach and lessons from the EU metal industry. Integrated Environmental Assessment and Management, 10(4), 529-538.

A database consisting of more than 1,300 site-specific release factors to air and water for 18 different metals and their compounds from 21 EU Member States was compiled. The base data set is not published to general public nor within metal industry for reasons of confidential business information. The release to water was found to mainly depend on the solid/water partition coefficients for suspended matter. Because the metal and metal compound release factors are based on real-world measured release data, the estimations are more realistic and relevant for present-day industrial operations in the EU and are therefore considered as an improvement compared to the existing defaults (e.g. ERCs). The proposed metal release factors still provide a conservative estimate of environmental emissions of the metals industry because metal and metal compounds release factors are based on the 90th percentiles, are integrative of all on-site processes and all metal species rather than focusing on the single substance being assessed, and are based on recent (2007-2012) and older (1993-2007) data (considering the overall tendency of decreased emissions over time).

3A.2 Justification of days emitting

Default number of emission days are derived from a multi-metal background database of measured site-specific release factors collected under the former Directive of New and Existing Substances and REACH 2010 registration dossiers (see Verdonck et al., 2014).

Recommended starting reasonable worst-case value is the 10th percentile of reported site-specific number of emission days.

3B SPERC Information Sources and Justification for service life cycle stage SPERCs

3B.1 Justification of release factors

The justification is given in the respective fact sheets. For Eurometaux SPERC 11A.2, more information on the EU battery directive is given in Annex II. For Eurometaux SPERC 10A.1.v1, additional justification is given here for the release factor to water.

A literature study was conducted to collect runoff data and emission rates from metallic roofs of Cu, Zn, Pb, Cr, Al, Ni (in steel). The collected information is given in Annex I.

Worst-case runoff rates were selected. Specific mass (kg/m2) was taken from GaBi LCA software. A service life of 25 years was assumed. This results in a worst-case release fraction to water (after service life) of 1.25%.

	specific mass (kg/m2)	Runoff factor (mg/m2/yr)	Release factor/yr	Release factor (after 25 years)
Pb	19,2	5000	0,02604%	0,65104%
Al	2,7	10	0,00037%	0,00926%
Steel	7,8	0,4	0,00001%	0,00013%
Cu	5,3	1300	0,02453%	0,61321%
Zn	5,8	3000	0,05172%	1,29310%

4 Conservatism for industrial life cycle stage SPERCs

There is a significant amount of conservatism implemented in the derivation of the release factors from (measured) company data via the following approaches:

- Use of 90th percentiles of reported release factors (instead of best practice or average release factors)
- Integration of all on-site processes resulting in coverage of all related processing steps of the use;
- Inclusion of older data in the data base (it is assumed that emissions from installations used to be higher in the past than now, because of modernisation and improvement of efficiency and risk management technologies);
- Coverage of multiple substance speciation (different metal species, e.g. MeSO4, MeO, Me, MeS,…) despite REACH is a “one substance” at a time regulation
- Linking best case OC/RMMs (from BREF) with worst-case RF (from database)

7 Applicability of SPERCs

7.1 Tiered assessment

Due to this set of characteristics we consider the Eurometaux SPERCs suitable for use in standardized, lower tier REACH assessments of the vast majority of their substances. Their envisaged use is for risk assessors to distinguish trivial substances and emission situations from problematic ones based on standardized emission estimates. Based on this distinction, additional efforts can be focused on assessments of situations beyond the defined scope.

7.2 Regional assessment

The Eurometaux SPERCs are meant for local sources and assessment. For a regional assessment, it is recommended to run a mass balance flow and/or diffuse source analysis in combination with a collection of environmental monitoring data at regional and continental level.

More information can be found in the ECHA Guidance on environmental exposure assessment for metals and metal compounds (ECHA, 2008).

8 References

Berggren D, Bertling S, Heijerick D, Herting G, Koundakjian P, Leygraf C, Odnevall Wallinder I. 2004. Release of chromium, nickel and iron from stainless steel exposed under atmospheric conditions and the environmental interaction of these metals. A combined field and laboratory investigation. Report Oct 2004. KTH. Div. Corrosion Science, KTH, Dr. Kristinas v. 51 SE-100 44 Stockholm, Sweden.

Dijkstra J, van Zomeren A, van der Sloot H, Vatavalis P. 2011. Evaluation of impact of Aluminium construction products on soil, surface and groundwater. Energy research Centre of the Netherlands. ECN-0-08-000.

ECHA. 2008. Guidance on information requirements and chemical safety assessment Appendix R.7.13-2: Environmental risk assessment for metals and metal compounds. https://echa.europa.eu/documents/10162/13632/information_requirements_r7_13_2_en.pdf

European Commission. 2001. Integrated pollution prevention and control (IPPC): Reference document on Best Available Techniques in the Non Ferrous Metals Industries. [cited 2014 June 13]. Available from: http://eippcb.jrc.ec.europa.eu/reference/BREF/nfm_bref_1201.pdf

Faller & Reiss. 2005. Runoff behavior of metallic materials used for roofs and facades - a 5 year field exposure study in Switzerland. Materials and Corrosion 56, 4, 244-249.

Herting G, Odnevall Wallinder I, Leygraf C. 2005. A comparison of release rates of Cr, Ni and Fe from stainless steel alloys and the pure metals exposed to simulated rain events. Journal of the electrical society, 152, B23-B29.

Persson & Kucera. 2001. Release of metals from buildings, constructions and products during atmospheric exposure in Stockholm. Water, Air and Soil Pollution: Focus 1: 133-150.

Rheilen, A.; Bahr, T.; Boegi, C.; Dobe, C.; May T.; Verdonck F.; Wind, T.; Tolls J.; Zullo, L. 2016. SPERCS – a tool for environmental emission estimation. Intergr Environ Assess Manag. 12(4): 772-81.

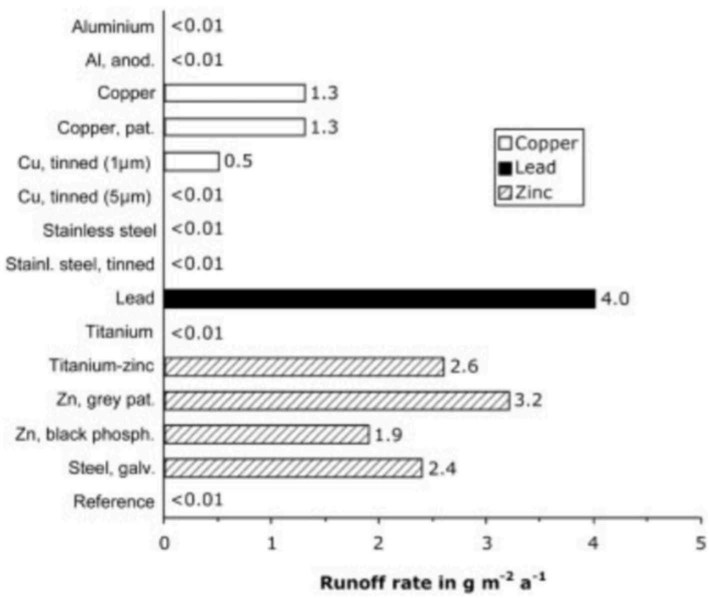
Van Sprang et al. 2019. Diffuse source publication: in preparation. Personal communication.

Verdonck FAM, Van Assche F, Hicks, K, Mertens J, Voigt A, Verougstraete V. 2014. Development of realistic environmental release factors based on measured data: approach and lessons from the EU metal industry. Integrated Environmental Assessment and Management, 10(4), 529-538.

9 Annexes

9.1 Annex I: Environmental releases of metals from construction during service life

Metal	Material	Run-off factor Rm in mg/m2/y	Releas e fraction	Run-off equation and driver	Reference
Cu	Roof	1300		(0.97 + 0.95 x V x $10^{-0.62pH}$) x COS(q)/COS45° with V the annual precipitation volume (mm/y), pH and q the angle of inclination	Van Sprang et al.
Mo	Stainless steel*	0,4		n.a.	
Ni	Stainless steel*	0,4		n.a.	
Pb	Flashings	880		n.a.	
	Sheets	**5000**		n.a.	
Zn	Roofs	2100-**3000***		Run-off rate = 1.36+0.16 [SO_2] x x COS(q)/COS45°and q the angle of inclination with SO2 a measured regional year-average concentration level (µg/m3)	
Cr	stainless steel		0,0001		Palm PhD, 2002
Ni	stainless steel		0,0001		
non-volatile subst.	Construction chemicals, outdoor		0,0001		EFFC SPERC 8f.1a.v1
Ni	Stainless steel roofs	0.1-0.8		atmospheric conditions	Berggren et al., 2004
Cr		0.2-0.7			
Fe		10-200			
Cr	Stainless steel	17,5		artificial simulated rain events (after 8 hours)	Herting et al., 2005
Ni	Stainless steel	8,7			
Cr	Pure metal	13,			
Ni	Pure metal	1182			
Al	Anodised or coated Al	3			Dijkstra et al. (2011)



From: Faller & Reiss (2005)

TABLE IV

Estimated one year metal emission rates from different materials

Material	Metal emission rate resp. atmospheric metal deposition				
	Cu	Zn	Cr	Ni	Pb
	(mg m^{-2}, year)				
Copper roof, 1/2	849/689				
Galvanized steel, 1/2		2742/3014			
Lead					940
Asphalt roofing felt				1.5	
Concrete tiles			<0.1	<0.08	
Impregnated wood	660				
Painted steel		720			
Dry and wet deposition collector	17	29			4
Inert surface, PE		23/21	–	–	17/3

From: Persson (2001)

9.2 Annex 2: Obligations outlined in Battery Directive 2006/66/EC for the service life and end-use of batteries

<u>Legal Requirements set up for the batteries, which ensure "zero" emissions to the environment during the service life and waste stage[1]:</u>

Batteries and accumulators and waste of batteries and accumulators are regulated by the Battery Directive 2006/66/EC in Europe. This Directive establishes rules regarding the placing on the market of batteries and accumulators and specific rules for the collection, treatment, recycling and disposal of waste batteries and accumulators to supplement relevant Community legislation on waste and to promote a high level of collection and recycling of waste batteries and accumulators.

The Battery Directive creates a set of obligations on Member States (MS). It requires that MS set up a legal framework, by means of National Transposition Laws and Regulations (NTLR) to ensure the goals and requirements of the directive are implemented.

The main innovation introduced by the battery directive is the concept of "Extended Producer Responsibility" under which producers are obliged to take an active role in the financing and operations of schemes set up to deal with the end of life phase of batteries.

National Transposition Laws and Regulations (NTLR) in each Member State implement the directive goals by creating obligations on economic operators (essentially producers, distributors and end-users of batteries) involved in the battery business in that Member State. According to the Battery Directive and its national implementation, the following examples are implemented:

<u>Producer Responsibility:</u>

In line with the 'producer responsibility principle', battery producers, or third parties acting on their behalf, must finance the net cost of collecting, treating and recycling collected waste batteries (Article 16(1)).

- Producers have to set up one or several bring back points which are required to receive, usually free of charge, waste products they have initially placed on the market (French decree).

[1] The information is based on information provided by Downstream Users and the Battery Directive 2006/66/EC and published background documents by the European Commission (Available via: http://ec.europa.eu/environment/waste/batteries/ [13.9.2013]).

- Producers have to collect at end-user (and possibly WEEE[2] dismantler) premises and the related logistical cost is to be charged to the producer (UK instrument).

Collection and Recycling:

- Batteries and accumulators incorporated in waste electrical and electronic equipment (WEEE) can be collected on the basis of the WEEE Directive. However, after collection, they must be removed from the appliance (electronic equipment) and they count towards the collection targets laid down in the Batteries Directive. All these batteries and accumulators must be recycled as required by the Batteries Directive (unless they contain mercury, cadmium or lead).
- Efficient national collection systems must be set up to allow consumers to return waste batteries free of charge in their neighborhood. Distributors are obliged to take back waste batteries. Collection and Recycling targets are outlined in the Directive and have to be monitored by MS.
- Disposal of industrial and automotive batteries and accumulators in landfill sites or by incineration should be prohibited.
- Consumers should be able to return waste batteries to accessible collection points in their neighbourhood, free of charge.
- It is required to label the battery with a crossed out wheeled bin, which indicates \`separate collection\` and recommendations for bring-back points. MS has to ensure that consumers are aware of label meaning and recycling scheme.

[2] WEEE: waste electrical and electronic equipment