



ArcelorMittal

Experience from metals risk assessment Eric Pezenec , H&S corporate

October 2th, 2008



Content

- **About ArcelorMittal**
- Definitions : hazard versus risk
- REACH dossier
 - **Data sharing ?**
 - Chemical management before REACH ?
 - Hazard classification
 - Exposure scenario & Chemical Safety Report
 - Exposure assessment
 - Risk characterisation
 - Key issues & recommendations



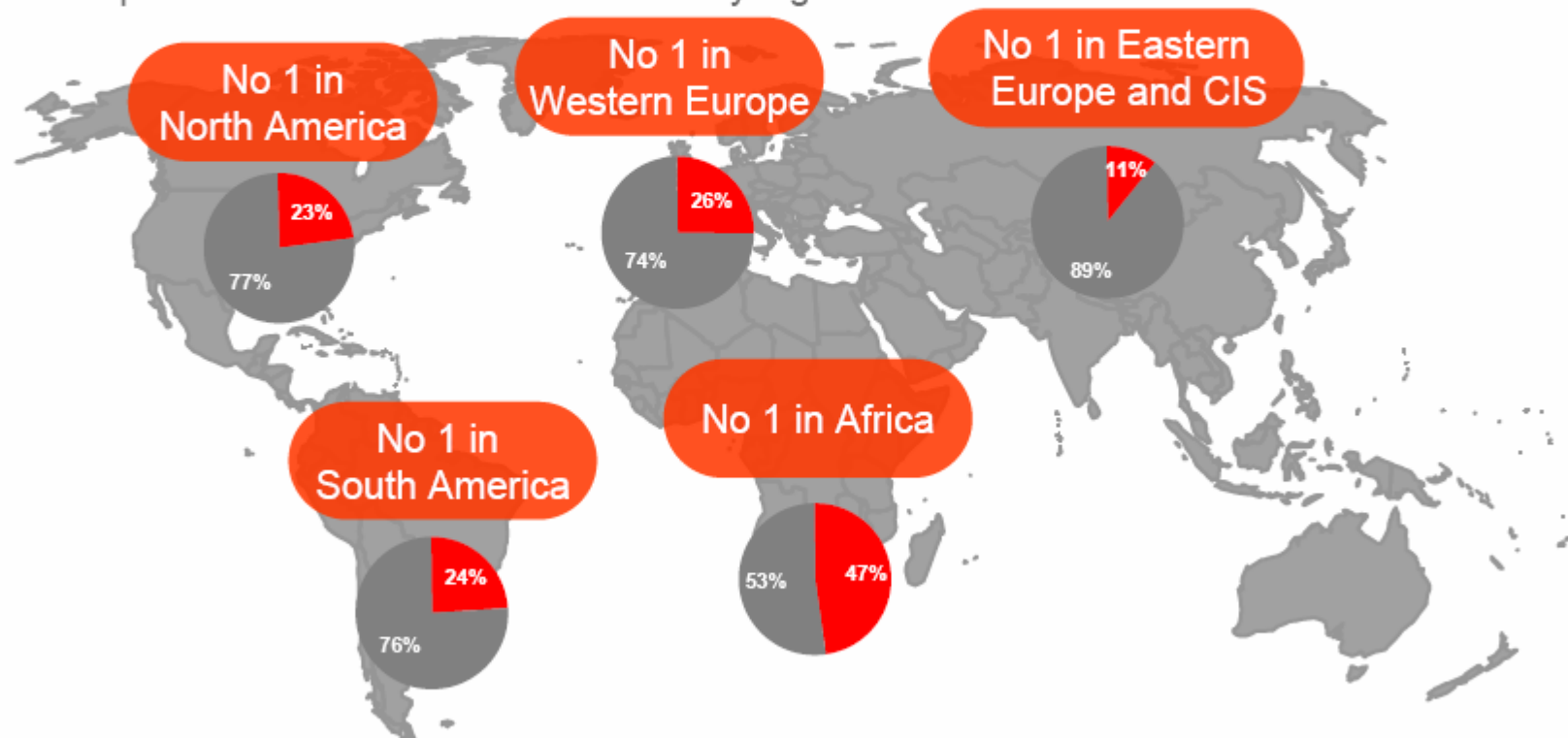
The world's number one steel company

- With around **310,000** employees in more than **60** countries and an industrial presence in **20** countries, ArcelorMittal is the only truly global steelmaker, leader in the steel sector.
- ArcelorMittal has outstanding financial strength and sustainability, with revenues in 2007 of **\$105.216** billion and crude steel production of **116** million tonnes.
- ArcelorMittal is not only a steel producer but an integrated Metals and Mining leader capturing opportunities along the value chain. **From mining to distribution, transformation and trading of finished products...**
- ArcelorMittal is the only producer offering, leveraging and developing the full range of steel products and services. **From commodities to value added products, from long to flat products, from standard to speciality products, from carbon steel to stainless steel and alloys...**

Leading position in the most attractive markets

A global steel production of 116 million tonnes (2007)

Market position and market share estimates by region*



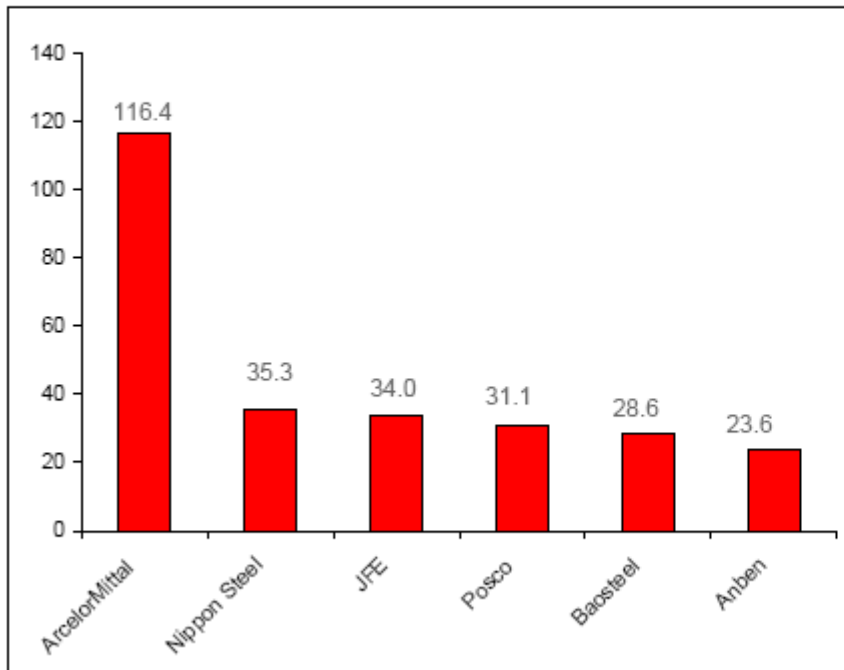
Number 1 in 5 regions and 4 continents

*Source ArcelorMittal estimates based on IISI crude steel production

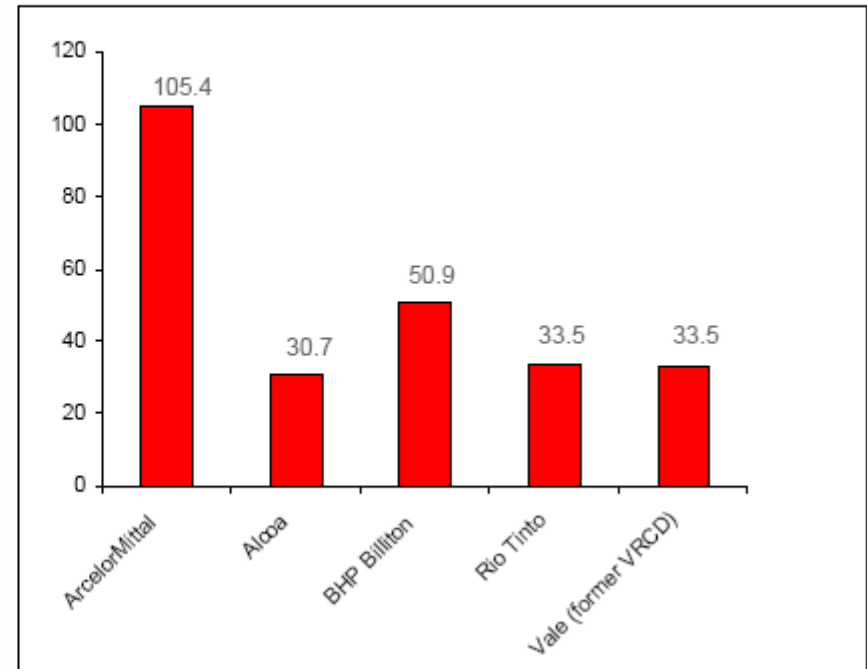


Not only leading the steel industry but the Metals and Mining sector

Crude Steel production in 2007 (MT)*



Sales in 2007 (US\$ billion)



* Metal bulletin

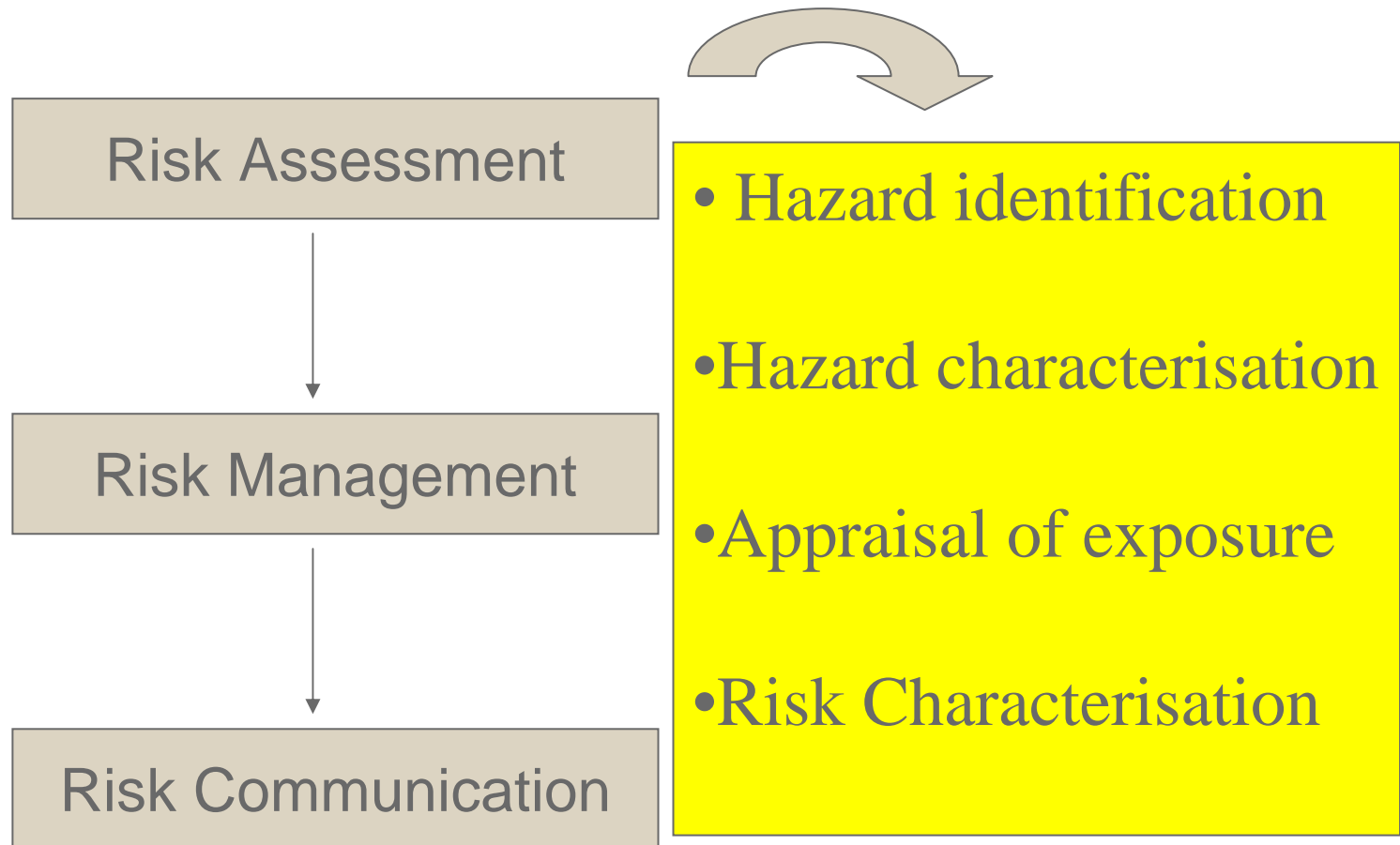
More than 3 times larger than our next competitor



Content

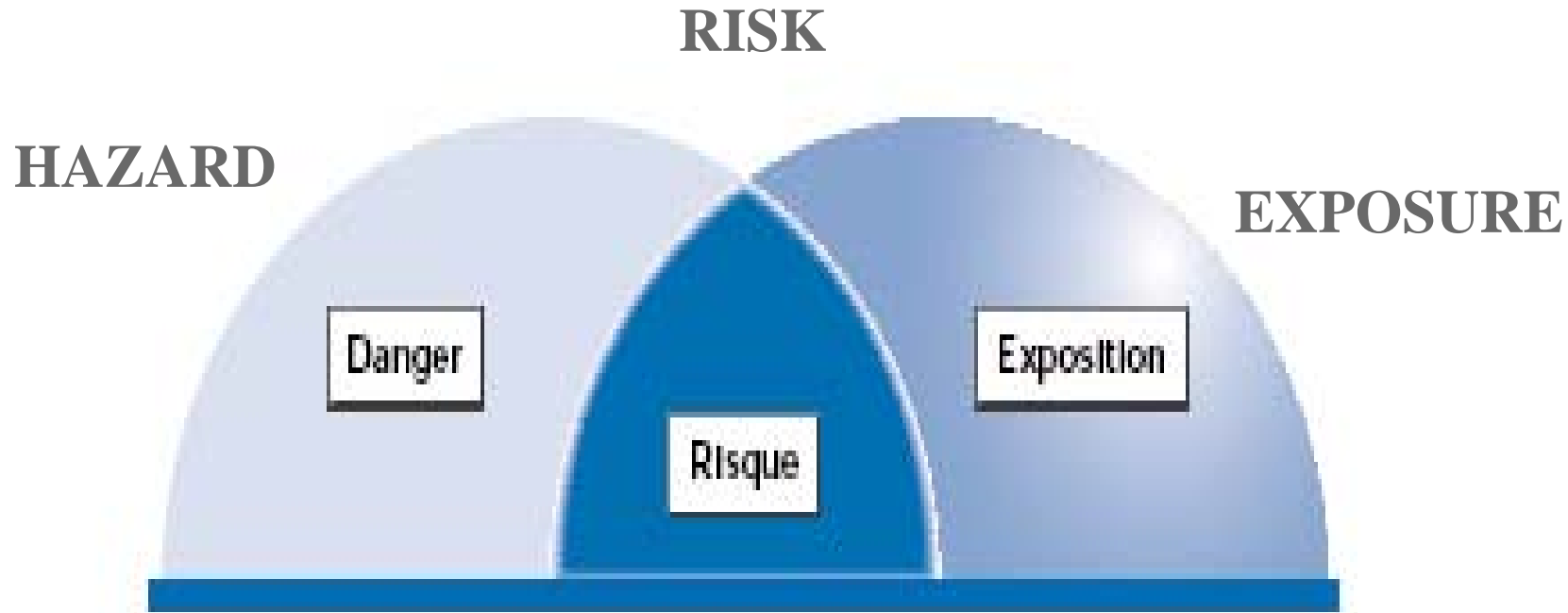
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Structured approach to the analysis of risk





Definitions: hazard versus risk



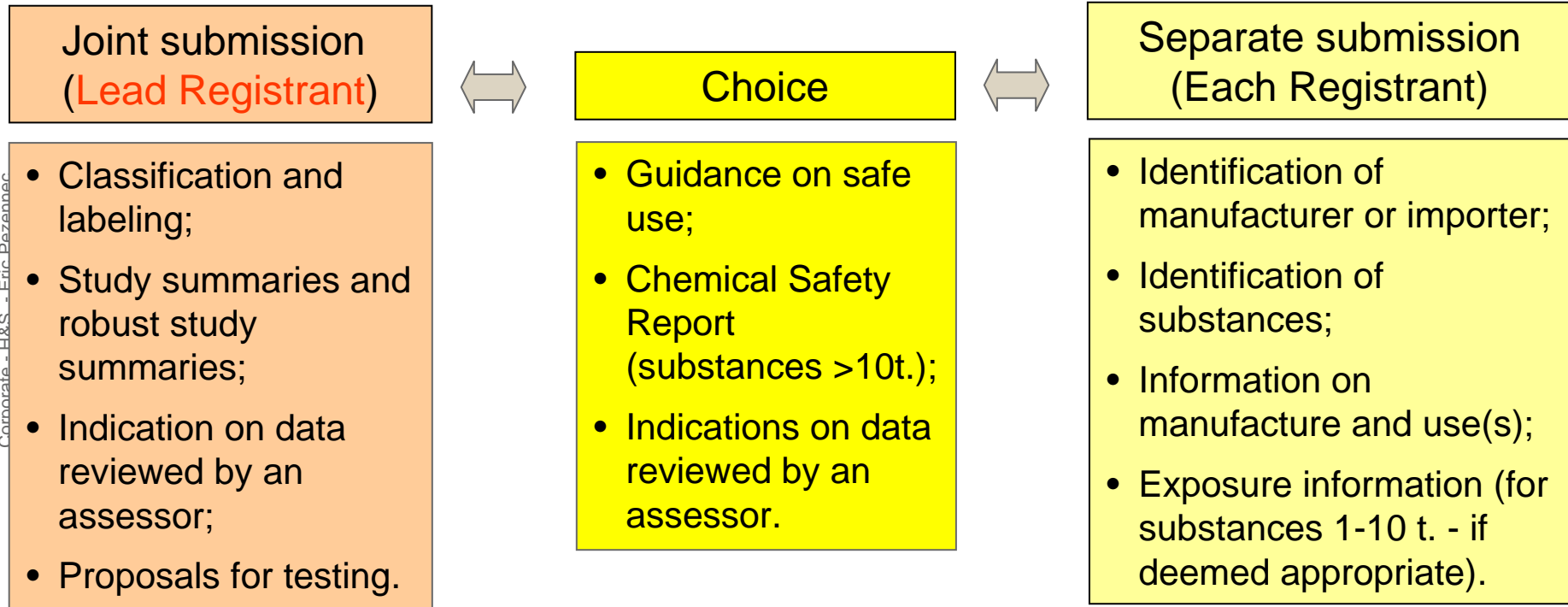
Source: Evaluation des risques chimiques . Hiérarchisation des risques potentiels, INRS, ND 2121-178-000,



Content

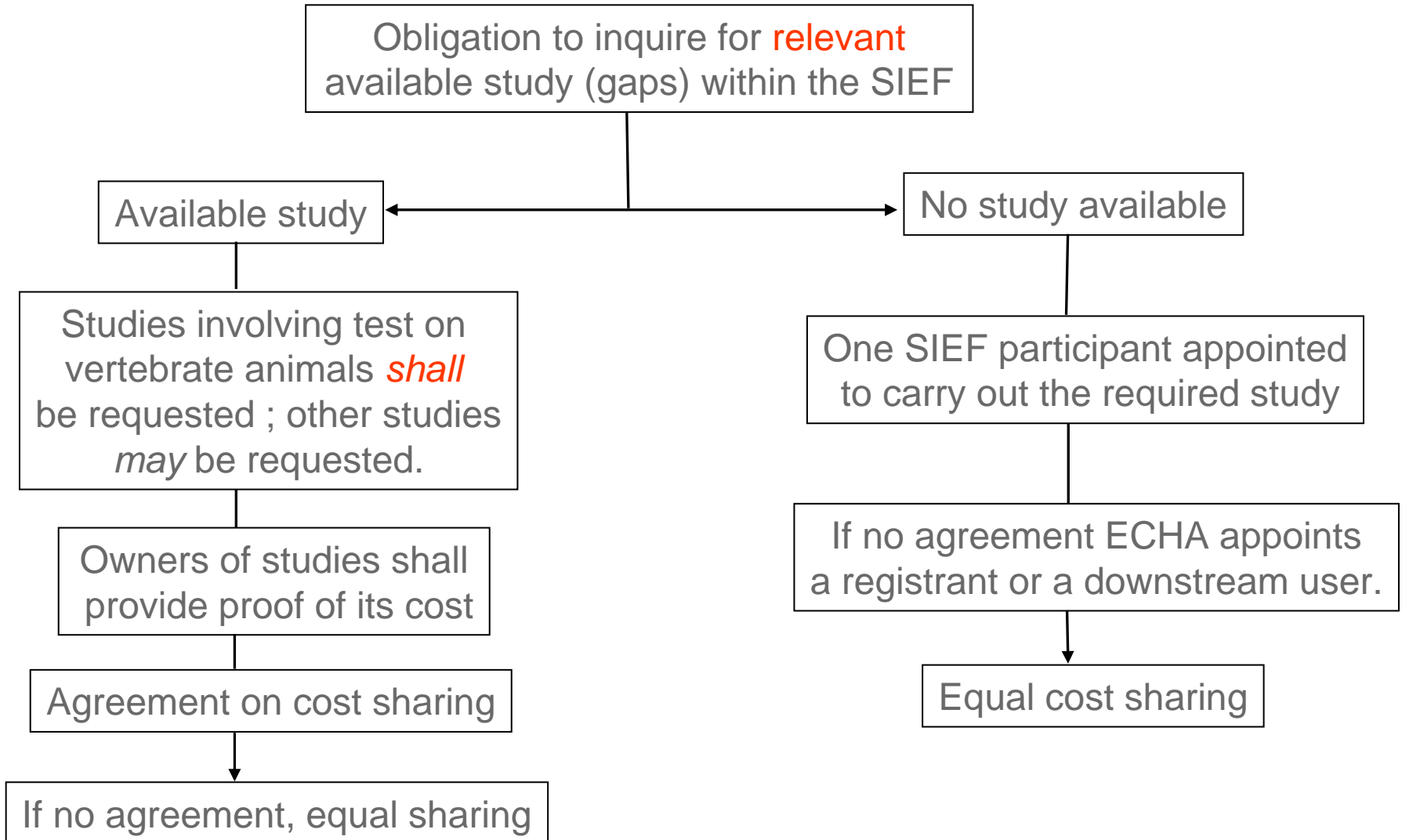
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REACH requirement: Joint submission of data: Implementation.



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Substance Information Exchange Forum: Implementation of data sharing.





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Chemical management before REACH ?

- What is 'DATA' to be shared ?
- Any data about Iron ?
 - A IUCLID IV dossier was already forwarded to the EU authorities in 2000 through the HEDSET
 - Iron, Furnace
 - Iron
- Do you have any data on Iron and iron oxides ?

ArcelorMittal is offering to be the lead registrant for Iron.



HEDSET for Iron furnace

Biocidal Products Directive (Directive 98/8/EC) Information:

There is no information in ESIS for this substance with respect to the BPD.

Classification and Labelling Information:

This substance is not classified in the Annex I of Directive 67/548/EEC.

Export and Import of Dangerous Chemicals (Regulation (EEC) No 304/2003) Information:

This substance is not listed in the Annex I of Council Regulation No (EC) 304/2003.

HPV-LPV (High and Low Production Volume) Information:

HPV Chemical : - List of Producers/Importers

ID	Company	Town
0001	AG DER DILLINGER HÜTTENWERKE	D-66763 DILLINGEN
0002	BADISCHE STAHLWERKE GMBH	77695 KEHL AM RHEIN
0003	BRITISH STEEL PLC	SE1 7SN LONDON
0004	CSI	33480 AVILÉS (ASTURIAS)
0005	EKO STAHL GMBH	D 15890 EISENHÜTTENSTADT
0006	HOOGOVENS GROEP BV	1970 CA IJMUIDEN
0007	HÜTTENWERKE KRUPP MANNESMANN GMBH	47259 DUISBURG
0008	PREUSSAG STAHL AG	38239 SALZGITTER
0009	SIDERURGIA NACIONAL-SGPS, SA.	1250 LISBOA
0010	STAHLWERKE BREMEN GMBH	28237 BREMEN
0011	THYSSEN STAHL AG	D-47166 DUISBURG

IUCLID & OECD Chemical Data Sheets and Export Files Information:

IUCLID Chemical Data Sheet : [view & save it](#)

IUCLID Export File : [view & save it](#)

OECD-IUCLID 5 Export File : Not available

European Priority Lists and Risk Assessment (Council Regulation (EEC) No 793/93) Information:

This substance is not listed in a priority list (as foreseen under Council Regulation (EEC) No 793/93 on the evaluation and control of the risks of existing substances.).



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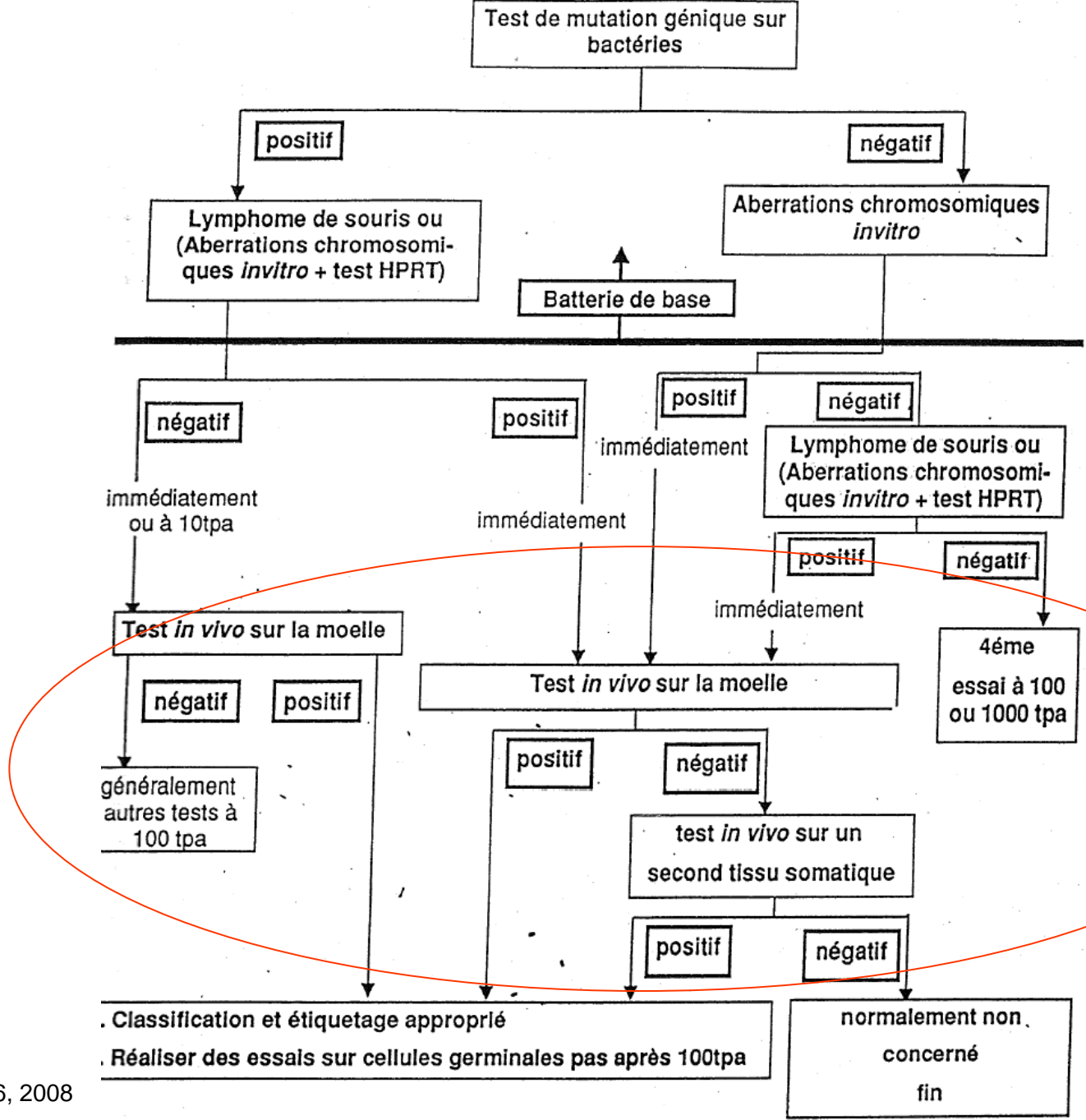
Physical- chemical properties

- Water solubility
- Physical state
- Melting point
- Boiling point
- Relative density
- Oxidising properties
- Molecular weight
- Particle size (granulometry)
- Flammability
- Absorption / desorption in soil
- Solubility in Solvents
- Stability in solvents

Toxicological Hazard information

- Skin Irritant
- Eye irritant
- Inhalation irritant
- Skin Sensitizer
- Short term toxicity effects (acute)
- Long term toxicity effects
- Toxicology kinetic information
- Reproductive toxicity
- Mutagenicity
- Carcinogenicity

1st step: hazard data gap analysis and proposal for testing.

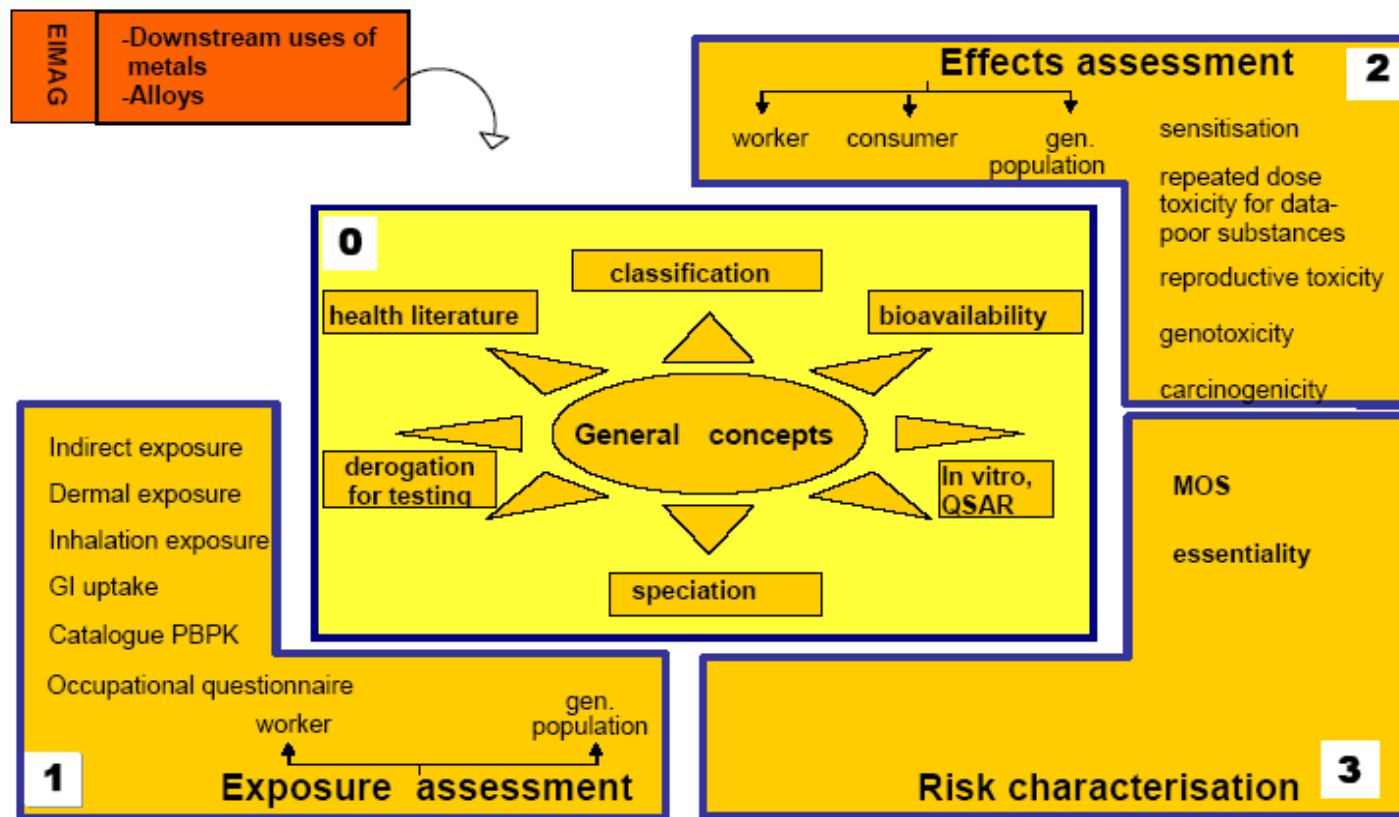


Test on vertebrates

Classification et étiquetage approprié
 Réaliser des essais sur cellules germinales pas après 100tpa

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HERAG: guidance for metals



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- <http://www.icmm.com/page/235/our-work/projects/articles/metals-risk-assessment>



Study case: classification of Ni and Ni compounds

- Concept and issues
 - Ion approach
 - Speciation
 - bioavailability
 - Read across

Classification of Ni compounds

7 Ni substances

15th ATP 1991

- NiO **Carc. 1**
- NiS **Carc. 1**
- Ni(OH)₂ **Carc. 3**

25th ATP 1998

NiSO₄, NiCO₃, NiCO₄ **Carc. 3**

3 Ni substances

30th ATP

NiSO₄ **Carc. 1**

KNR study → NiCO₃ **Derogation**

7 Ni substances

Assumed Similar Substance

Assumed Similar Chemical Structure

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(source ENIA,,08/08)

Read Across

Read Across

31st ATP

<u>Minerals</u> Millerite Haezelwoodite	<u>Operation Use</u> Nickel Matte	<u>Downstream Use</u> Nickel sulphamate, acetate, etc	<u>Commercial Use</u> Ni(OH) ₂
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-140 Ni substances

Carc. 1



30th ATP

- NiSO₄
 - Epidemiological studies conducted at Kristiansand (Norway) concluded that NiSO₄ is carcinogen cat 1
- NiCl₂ and NiNO₃
 - The wide dataset of NiCl₂ and NiNO₃ allowed to read across this endpoint
- NiCO₃
 - Derogation statement from 4 companies for waiving tests in the framework of risk assessment

(source ENIA,,08/08)



Draft 31st ATP

- From NiCO₃ to Ni(OH)₂
 - « similar chemical structure »
- From 5 nickel cpds to 140 Ni cpds
 - Based on water solubility
 - In the name of « coherence and competitiveness »
 - Skipping essential steps of the OECD Chemical Categories Monograph (i.e. scientific justification)
 - Removing endpoints and compounds where science disproved the EC read across approach, but no re-evaluation of method

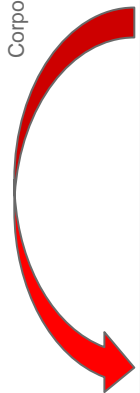
(source ENIA,,08/08)



Reminder

OECD 9-step methodology (2004)

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Step 1	Identification of structure-based category and its members
Step 2	Gather published and unpublished data for each category member
Step 3	Evaluate data for accuracy
Step 4	Construct a matrix of data availability
Step 5	Perform an internal assessment of the category
Step 6	Prepare category test plan
Step 7	Conduct necessary testing
Step 8	Perform an external assessment of the category
Step 9	Fill data gaps by read-across, extrapolation, interpolation, etc.

Scientific interrogations

- Carcinogenicity of NiSO_4 ? Reevaluation of **Kristiansand study (2000)**
- Is the cascading classification $\text{NiSO}_4 \rightarrow$ (derogation) $\text{NiCO}_3 \rightarrow$ (= structure) Ni(OH)_2 scientifically plausible ?
- No correlation of nickel exposure with reproductive toxicity and accidents in pregnancy

(source ENIA,,08/08)



Ecotoxicology Hazard information

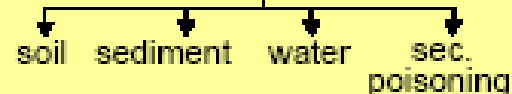
- Aquatic Toxicity
 - Short-term toxicity testing
 - on Daphnia
 - on algae
 - on fish
 - Long-term toxicity testing
 - on Daphnia
 - on fish
- Information on effects on **terrestrial organisms** (such as studies on earthworms, micro-organisms or plant. It could be long-term or short-term studies)
- Long-term toxicity to **sediment organisms**
- Long-term or reproductive toxicity to **birds.**

MERAG: Guidance for metals

1 Classification & ranking

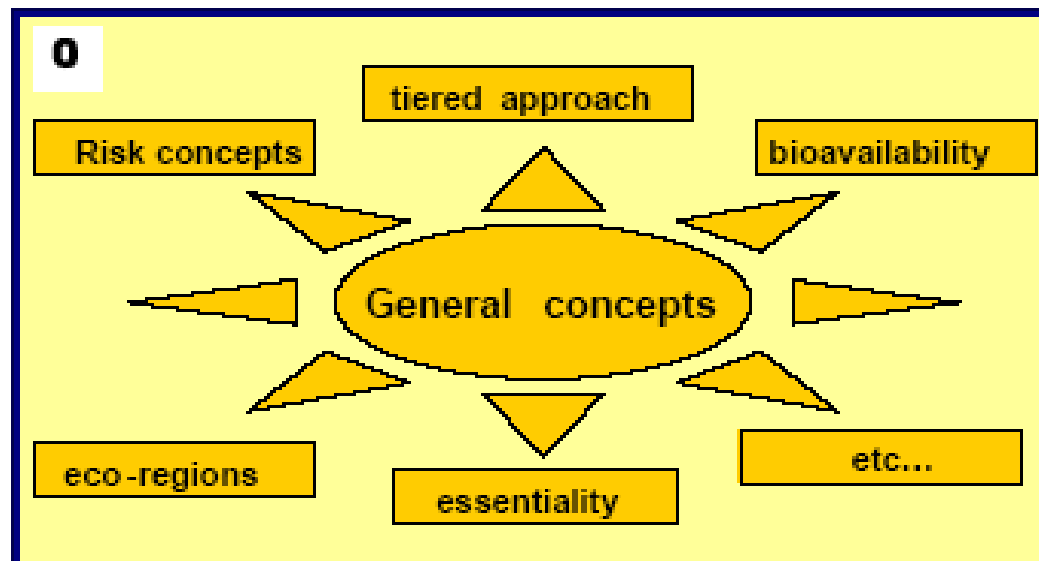
- Acute/ chronic aquatic toxicity ,
- Transformation /dissolution ,
- Particle sizes ,
- Ranking criteria ,
- etc...

2 Effects assessment



- Data selection ,
- Data handling ,
- Effects analysis ,
- Uncertainty management ,
- etc...

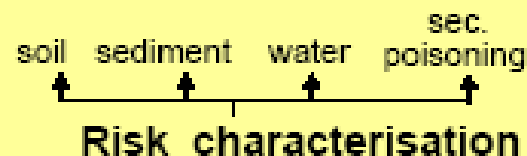
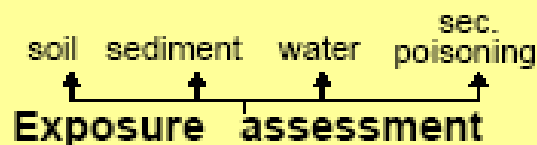
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- Data selection ,
- Data handling ,
- Local scenario ,
- Regional scenario ,
- Waste scenario ,
- etc...

- Probabilistic ,
- Local scenario ,
- Regional scenario ,
- Waste scenario ,
- etc...

3



4

<http://www.icmm.com/page/235/our-work/projects/articles/metals-risk-assessment>



Are metals and metal compounds are PBT substances ?

- Persistent (P) ? YES, metallic ion will remain metallic ion in the environment.
- Bioaccumulation (B) ? Yes, fortunately. Most of the metals are essential elements for living species.
- Toxicity (T) versus Deficiency ? YES/NO

The PBT criteria don't work for metal and metal compounds. (see REACH annexe XIII)

- Transformation/dissolution protocol
- Specific strategy of classification



Non-classification of iron sulphate (ATP 30th)

- **Critical review on acute and chronic aquatic ecotoxicity data to be used for classification purposes of iron sulfate, Marnix Vangheluwe & Bram Versonnen, EURAS, August 2004 (ECBI/14/01 Add. 12)**
- **Review of the Oxidation of Ferrous Ion in Aqueous Media , J.M. Skeaff, CANMET, August 2004 (ECBI/14/01 Add. 13)**
- **Dossier for the Classification of Ferrous Sulphate, Bill Adams , Rio Tinto (ECBI/14/01 Add. 14)**

Sponsors: Arcelor, CEFIC, Eurofer, Eurometaux, Rio Tinto

Table 1: Overview of the retrieved toxicity data for different iron compounds

Compound	Initial chemical species	No. of references
$\text{FeSO}_{4.7\text{H}_2\text{O}}$	Fe^{2+}	9
FeSO_4 not further specified	Fe^{2+}	6
$\text{FeCl}_{3.6\text{H}_2\text{O}}$	Fe^{3+}	7
FeCl_3 not further specified	Fe^{3+}	2
$\text{Fe}(\text{NO}_3)_3$	Fe^{3+}	1
$\text{Fe}(\text{OH})_3$	Fe^{3+}	1
$\text{Fe}_2(\text{SO}_4)_3$	Fe^{3+}	2
Fe^{3+}	Fe^{3+}	1



Iron toxicity considered reliable based on reliability

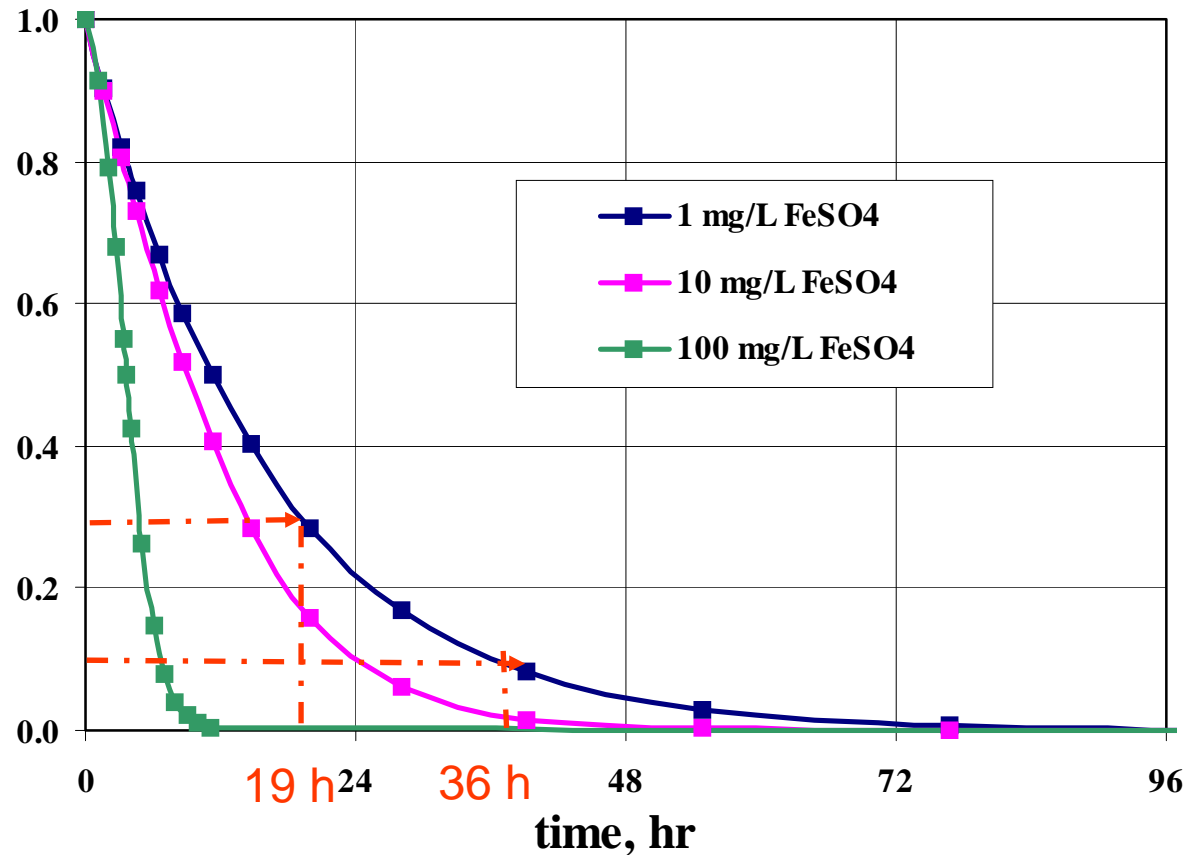
Test substance	Test organism	Test medium	Test conditions	Nominal/Measured	Duration	Endpoints	NOEC (mg Fe L ⁻¹)	LOEC (mg Fe L ⁻¹)	L(E)C ₅₀ (mg FeL ⁻¹)	Reference
STANDARD SPECIES: fish										
FeSO _{4.7H2O}	<i>Oncorhynchus mykiss</i>	Dechlorinated /carbon filtered tap water	pH: 6.0-7.1; H: 56-60; Alk: 32 ^a	TD ^c	96h	Survival			16.6	Mattock 2002a
Fe ₂ (SO ₄) ₃	<i>Oncorhynchus mykiss</i>	Dechlorinated/carbon filtered tap water	pH: 6.9-7.0; T: 13-15; H: 64-97	TD ^c	96h	Survival			pH adjusted: >27.9	Mattock 2002b
FeCl _{3.6H2O}	<i>Pimephales promelas</i> <i>Lepomis macrochirus</i>	reconstituted ASTM water	pH: 6.7; T: 22; H: 100; Alk: 30 pH: 7.7; T: 25; H: 103 Alk: 56 pH: 6.3; T: 22; H: 100; Alk:24	To To, TD, T2 To	96h 33 days 96h	Survival Length Weight Survival	1.00 (measure d To) 1.61 (measure d To)	1.61 (measured To) 2.81 (measured To)	21.8 (measure d To) 20.3 (measure d To)	Birge et al. 1985

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Fate of Fe II

$$\frac{[Fe^{2+}]_t}{[Fe^{2+}]_o}$$



$\frac{[Fe^{2+}]_t}{[Fe^{2+}]_o}$ as a function of time in 10X dilute OECD 203, $I = 0.00087 M$, at pH 6 for loadings of 1, 10 and 100 mg/L FeSO₄(s)



Non environmental classification for Fe 2+

- The removal rate was 70% at pH 6. (rapid degradation, GHS criteria)
- All the data in terms of chronic toxicity that means all No Observable Effect Concentration were greater than 1 mg/l. This argues for lack of concern for long term chronic toxicity.
- R53 was not applicable and therefore no classification was warranted.
- The data for acute toxicity were all in the R52 range, i.e. 10 mg/l <LC50≤100 mg/l .

NO ENVIRONMENTAL CLASSIFICATION for iron sulphate, most soluble form of iron.



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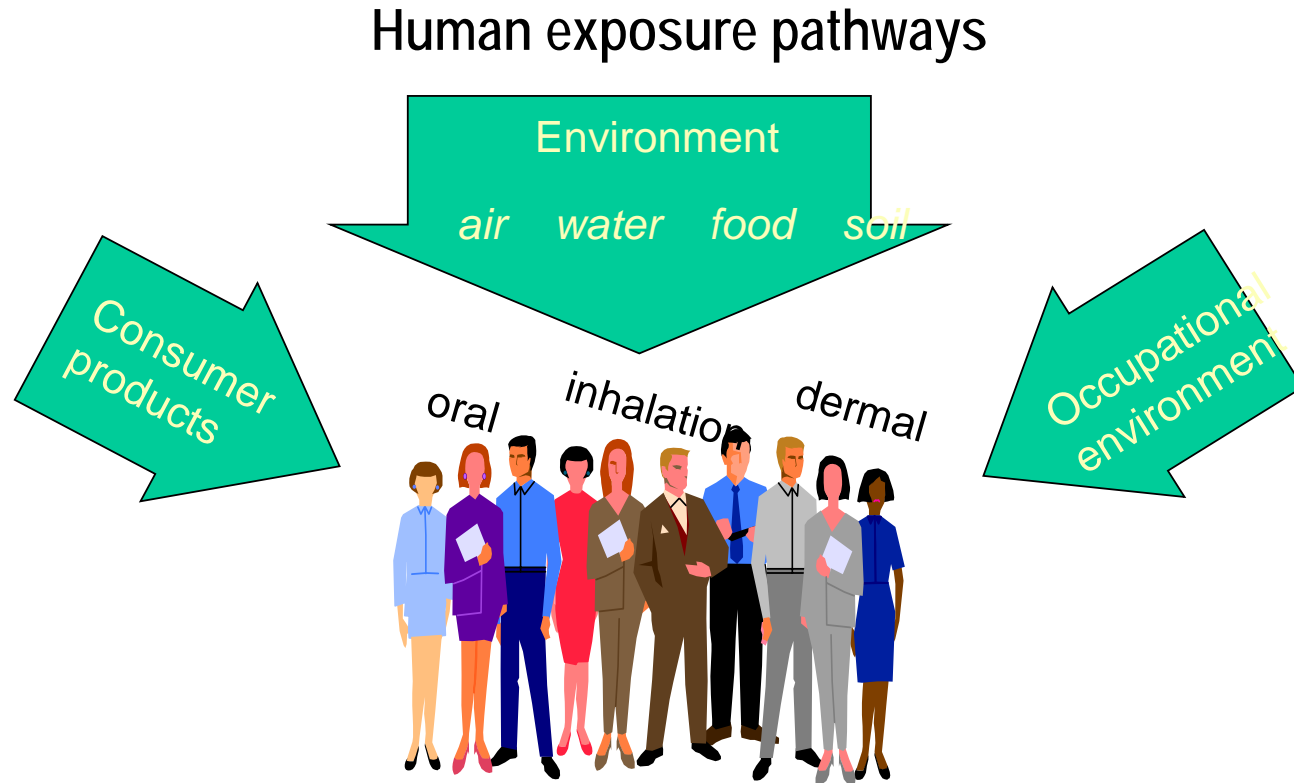


What contains an exposure scenario?

What contains an exposure scenario?

- An ES is a set of conditions for use including:
- A process description (with quantity used),
- The operational conditions (OCs, with frequency and duration of specified operations),
- The Risk Management Measures (RMMs, process and emission control, personal protective equipment, good hygiene ...).
- And some other relevant information as the factors affecting the exposure level.

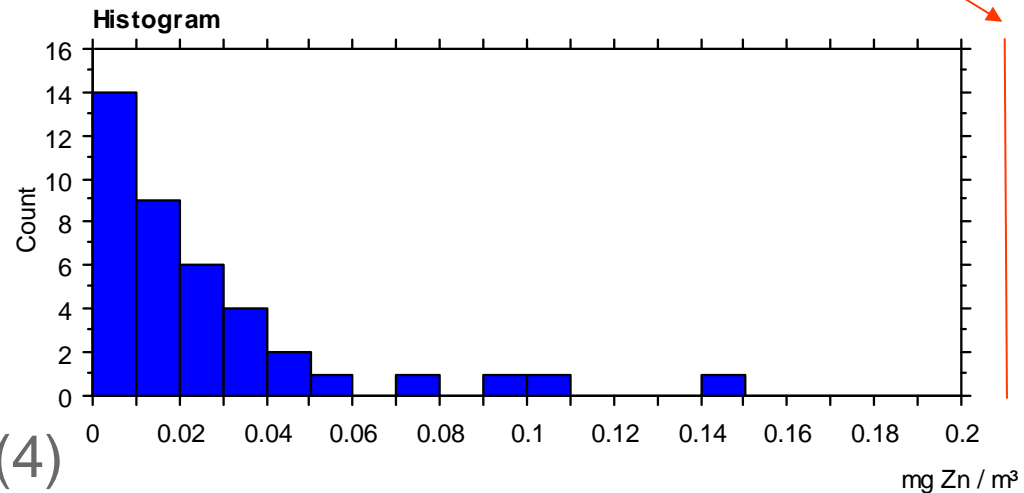
Human exposure



Zinc RA : continuous galvanising line (CHDG)

Tox reference value: 5 mg/m³

- Temper mill operator (7)
- Shift master (7)
- Shift master assistant (2)
- Galvanisor 1 (2)
- Zinc pot operator (9)
- Whole process, 1st alternate (4)
- Whole process, 2nd alternate (7)
- Exit section, inspector (2)



Count:	40
Min:	0,001
Max:	0,140
Median:	0,013
90th Percentile:	0,016

EBRC (2001e). Evaluation of Workplace Exposure Data During Continuous Hot-Dip galvanising and continuous, Electro galvanizing .
EBRC April 2001, Hannover, Germany.

Human Health Risk characterisation

Clarification on the exposure

- Process :
 - Distinction between the general and continuous galvanising
 - Distinction between the continuous hot dip galvanising and electro-galvanising
- Nature of the chemicals

Process	Zinc compounds used	Zinc compounds emitted at working place.
CHDG	Zinc metal (zinc pot)	Zinc oxide
EG	Zinc metal (soluble anode) Zinc chloride (electrolyte solution)	Zn ²⁺ (soluble and in soluble compounds) Zinc chloride

- Risk Characterisation:

No risk identified in the HH Risk Assessment report

Environmental exposure

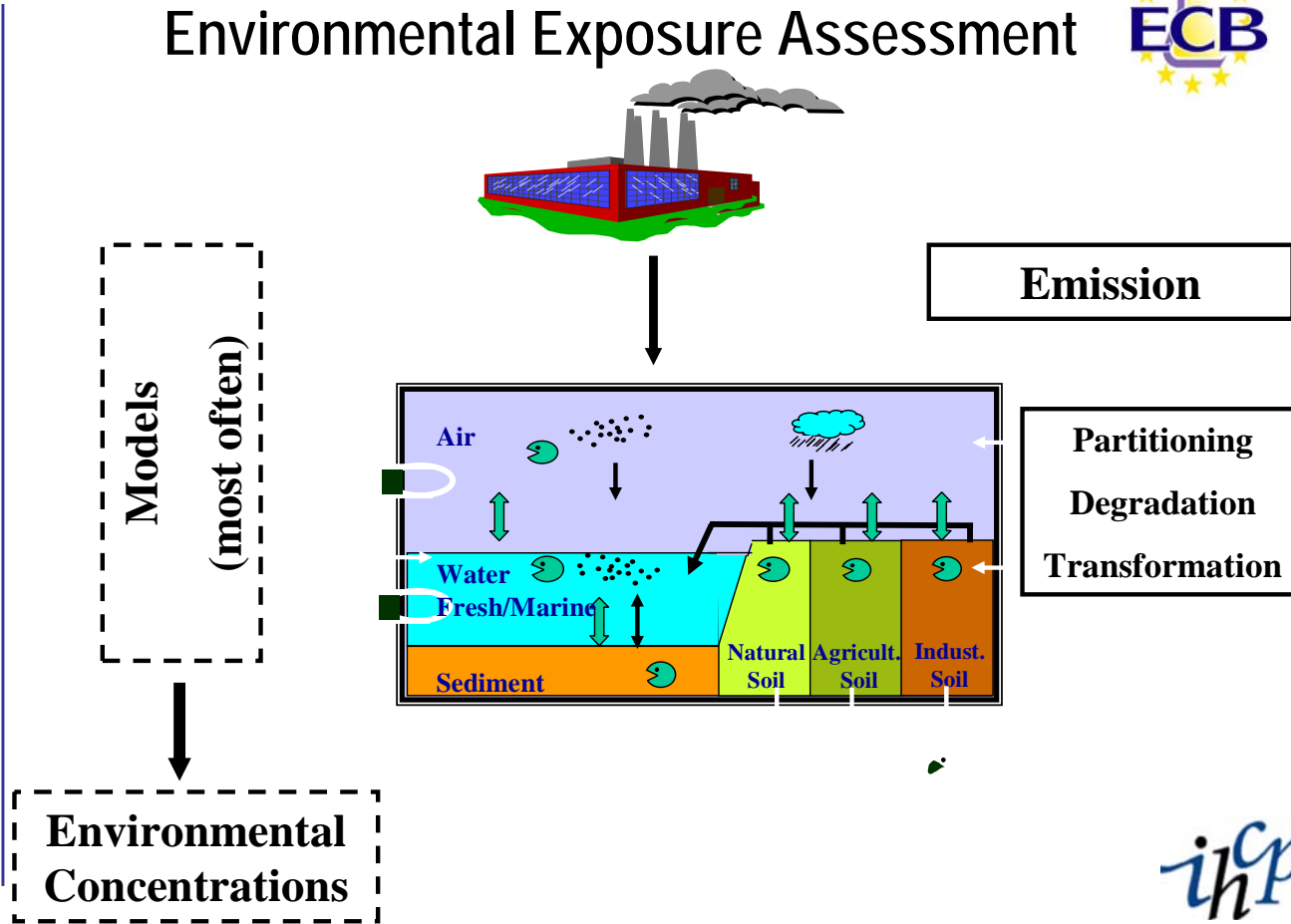


Environmental Exposure Assessment



Joint Research Centre

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Environmental exposure

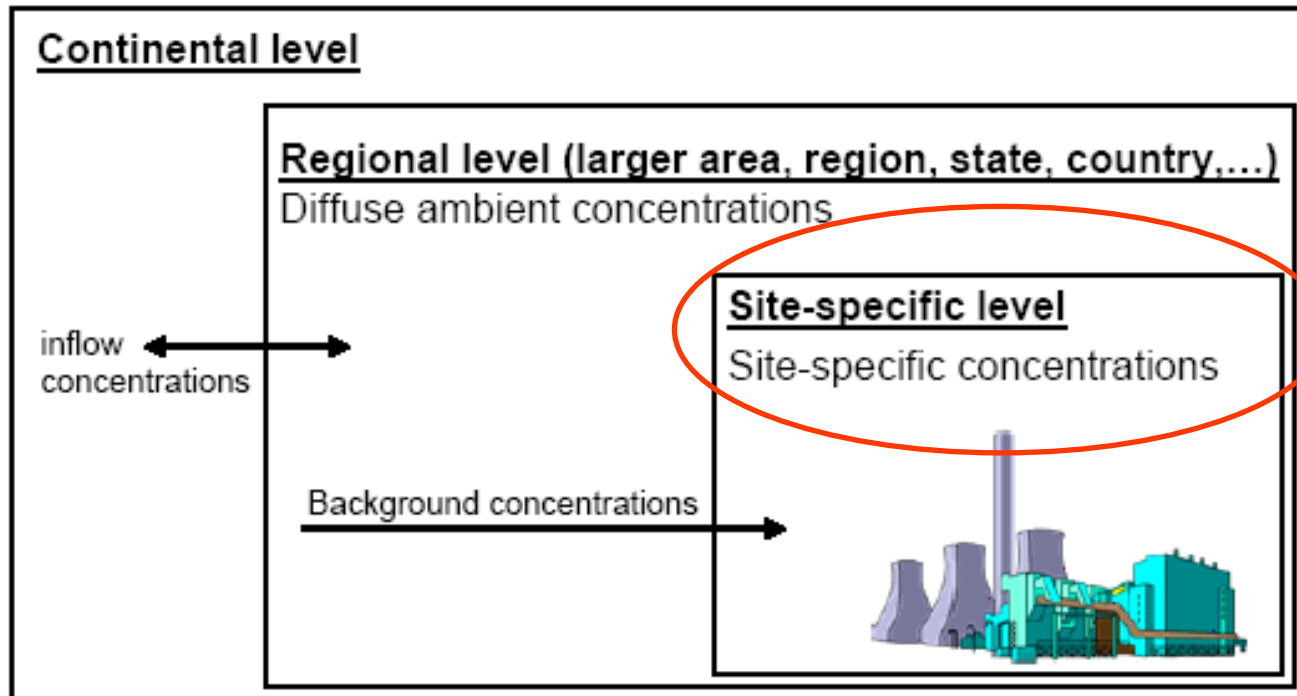


Figure 2: The relationships between the exposure assessments at the different spatial scales

Zinc Risk Assessment

- The environmental risk assessment started in 1998
- The environmental part of the risk assessment has just been published this year.
- The EU steel continuous galvanising companies fulfilled Questionnaire in 2000, and 2002 to update the information (bioavailability concept).



Submitted data for continuous hot dip galvanising (CHDG) sites in the EU

No	Company	Additional information	Total Zn processed in 1998	No. of working days	Emission to air	Emission to water (1998)	Largest emission to water (before 1998)	Flow local WWTP	Flow receiving water
			<i>t Zn/y</i>	<i>day/year</i>	<i>kg Zn/y</i>	<i>kg Zn/y</i>	<i>kg Zn/y</i>	<i>m³/d</i>	<i>m³/d</i>
1	Company A	2 lines	26,096	-	no data	11.32	18.25	14.88	lake
2	Company B	1 line	14,960	-	0	21.3	-	-	sea
3	Company C	4 lines	40,072	320	negl. ⁴⁾	60.5	147.8	1,700	16,243,200
4	Company E1	plant 1	14,433	-	negl. ⁵⁾	0	-	No WWTP	500
5	Company E2	plant 2	8,200 ¹⁾	-	idem	196 ¹⁾	-	No WWTP	1,300
6	Company G1	plant 1	7,214	-	< det limit ³⁾	30 ⁷⁾	-	430 ⁹⁾	large river
7	Company G2	plant 2	11,089	-			-		
8	Company H	1 plant	22,984	365	0	938.82	-	18,353	-
9	Company I	1 plant	12,000	-	no data	5.04	-	unknown	-
10	Company J1	3 lines	57,077	-	0 ²⁾	0	-	unknown	-
11	Company K1	line 1	9,126	315	0 ²⁾	15	1,858	240	187,500
12	Company K3	3 lines	23,600	317	52.2 ⁶⁾	175	-	900	1,000,000
13	Company L1	plant 1	13,615	348	32	3.5	-	8	1,200

Risk characterisation (Zinc metal Draft of 29 June 2001)



Company	PEC effluent STP (dissolved) (µg/l)	C _{add} water (dissolved) (µg/l)	C _{add} sediment (mg/kgwwt)	PEC _{add} agricultural soil (mg/kgwwt)	PEC/PNEC STP	C _{add} /PNEC _a water	C _{add} /PNEC sediment	PEC _{add} /PNEC _a agr. soil
<i>Production companies:¹⁾</i>								
Continuous Hot Dip Galvanising (CHDG): additional assessment	4,787	290	6,935	888	34	34	224	49
CHDG Company A	590	95.7	2,288	0.5	44	11	74	0.028
CHDG Company B	8.3	1.34	32	0.5	0.16	0.16	1.03	0.028
CHDG Company C	25.8	0.00439	0.105	0.5	0.50	0.0005	0.0034	0.028
CHDG Company E1	0	0	0	0.5	0	0	0	0.028
CHDG Company E2	76.0	12.3	295	0.5	4.5	1.4	9.5	0.028
CHDG Company G1 and G2	54.2	8.78	210	27.4	4.0	1.0	6.8	1.5
CHDG Company H	32.6	5.29	126	16.7	0.63	0.62	4.1	0.93
CHDG Company I	4.95	0.317	7.58	1.47	0.04	0.04	0.24	0.082
CHDG Company J1	0	0	0	0.5	0	0	0	0.028
CHDG Company K1	46.0	0.0957	2.28	0.500	0.89	0.011	0.074	0.028
CHDG Company K3	443	0.208	4.98	0.514	2.7	0.024	0.16	0.029
CHDG Company L1	292	3.14	75.1	0.508	5.6	0.37	2.4	0.028
CHDG Company L2	24.4	0.131	3.14	0.500	0.47	0.015	0.10	0.028
CHDG Company M	no data	no data	no data	no data	no data	no data	no data	no data
CHDG Company O	4.16	0.188	4.51	1.08	0.022	0.022	0.15	0.060
CHDG Company P	207	16.1	386	104	4.0	1.9	12	5.8
CHDG Company Q	423	20	477	60.5	2.4	2.3	15	3.4
CHDG Company R	0	0	0	0.500	0	0	0	0.028
CHDG Company T	445	18.6	445	57.4	2.2	2.2	14	3.2

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October 6, 2008

II SI Workshop on REACH

Environmental exposure

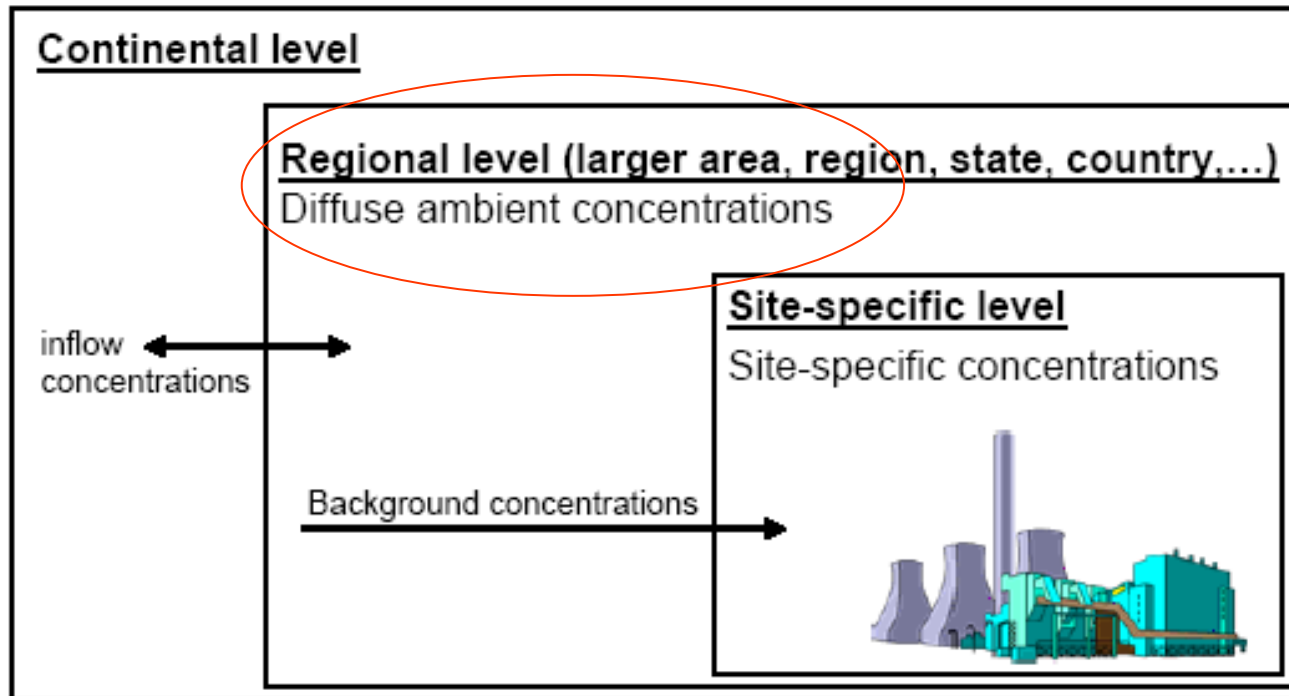


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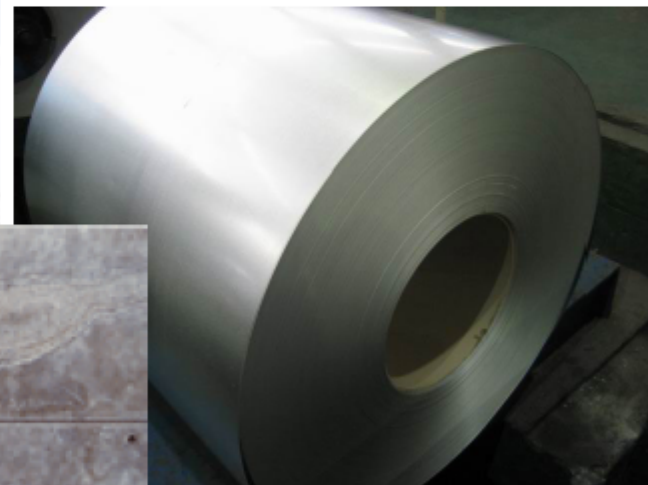


Prof. Inger Odnevall Wallinder, Ph.D.

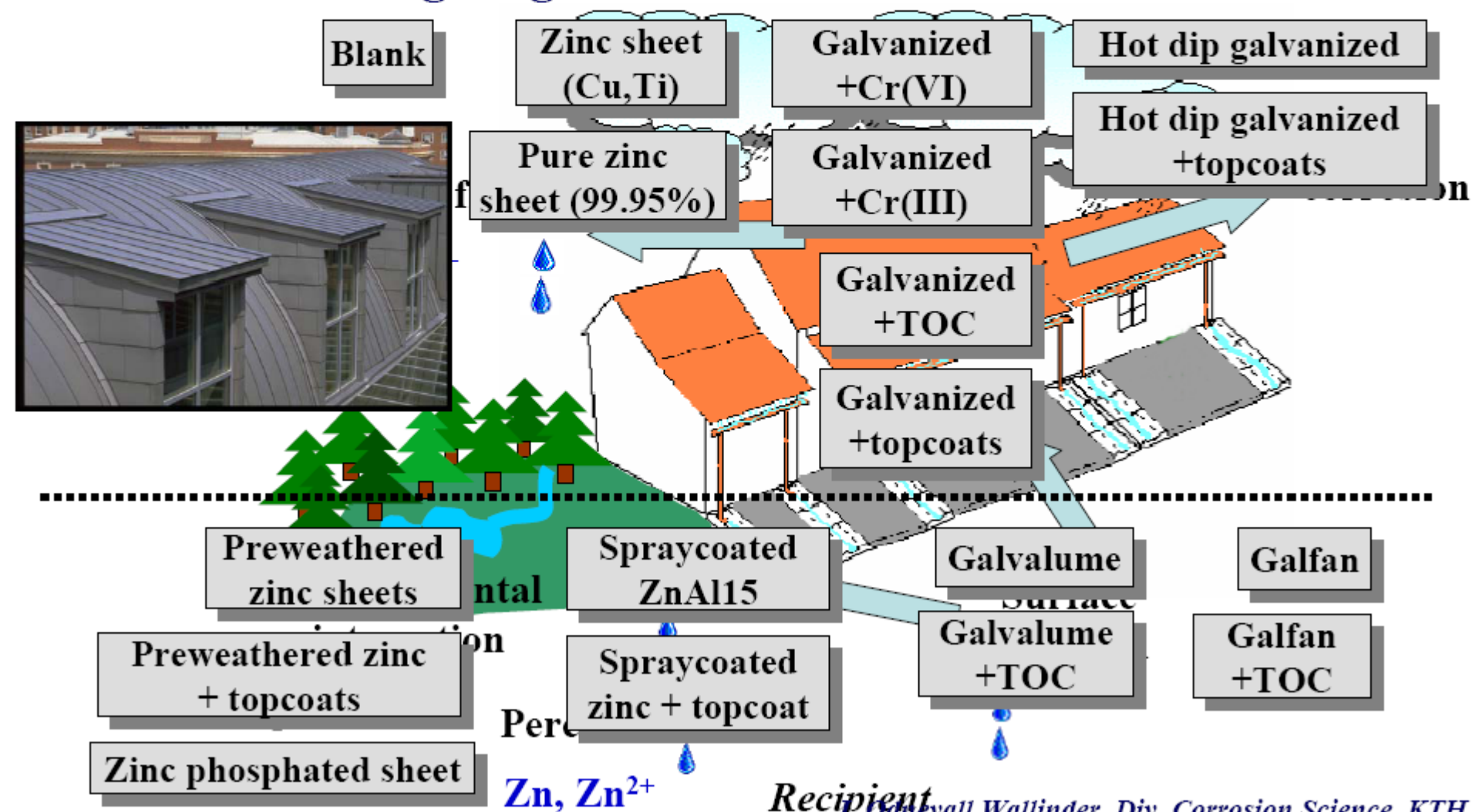
D. Lindström, J. Sandberg, S. Bertling

Div. Corrosion Science, KTH, Stockholm, Sweden

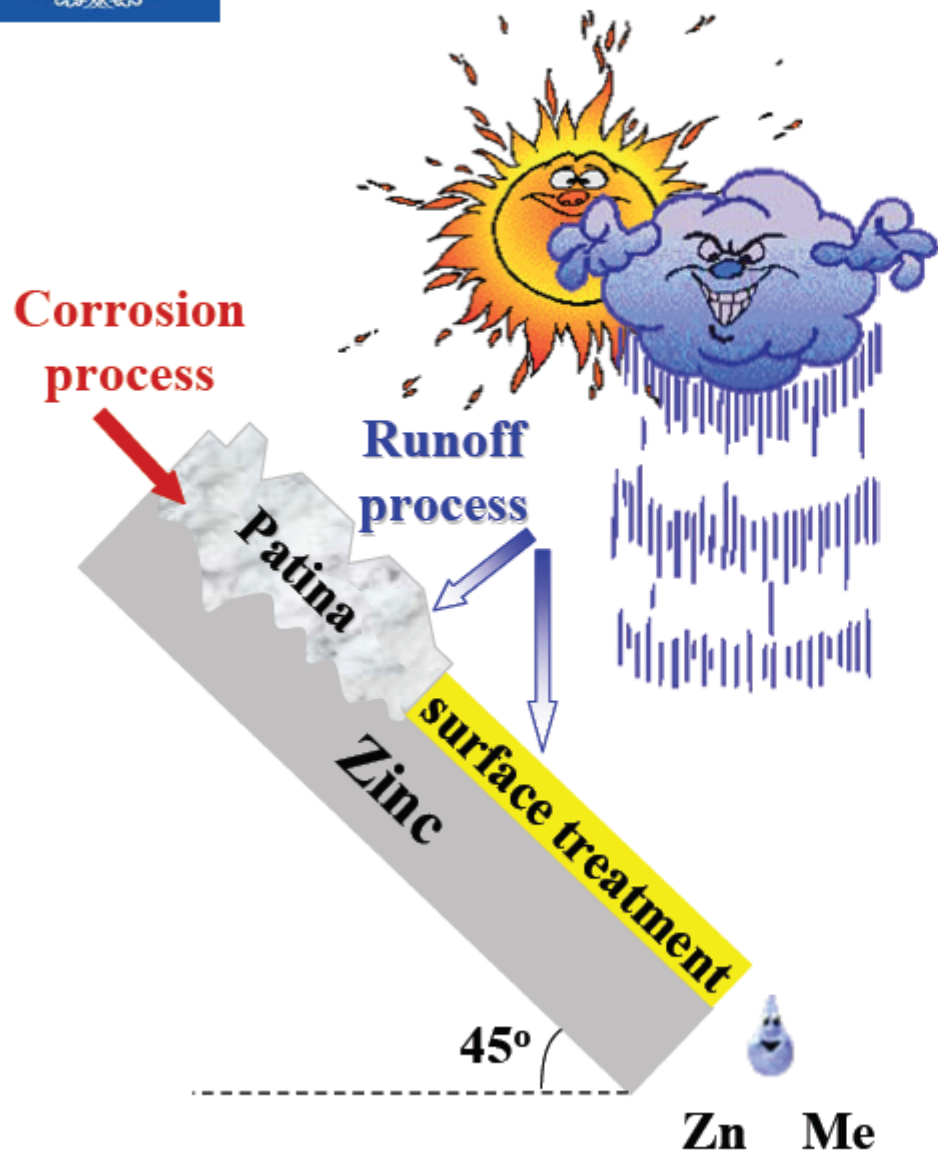
www.corrosionscience.se / ingero@kth.se



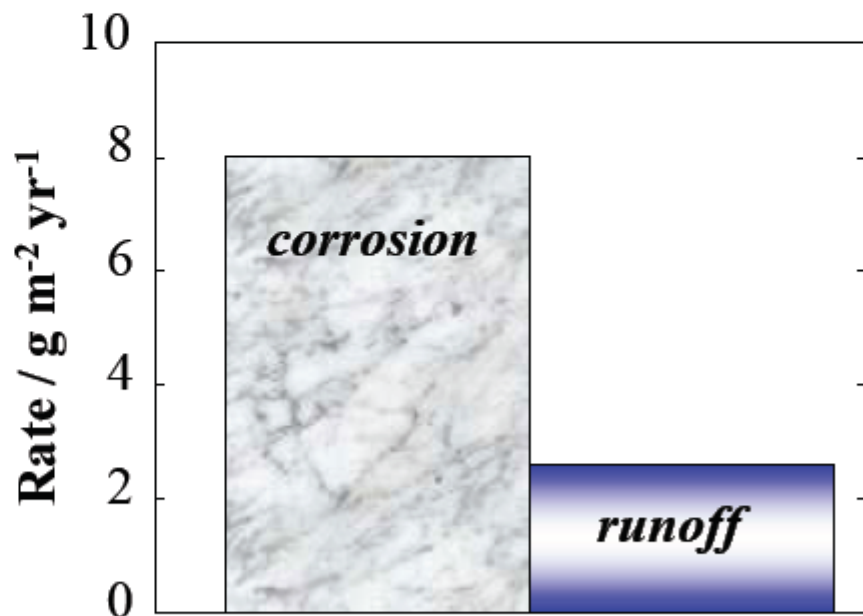
Long-term field studies of zinc runoff from commercial zinc-based materials for outdoor constructions, and its environmental interaction. On-going research activities since 1998.



Corrosion and metal runoff are totally different processes that occur independent of each other.



*Example:
Zinc sheet – one-year exposure
in Brest, France (marine site)*





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↑ **SIDMAR**

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Key issues & recommendations

- Metals are special; our preparations are special.

We have to move from the general framework (organic chemistry) to the metal framework (MERAG, HERAG).

- REACH is about improvement of Health and Environment.
 - Good science is needed
 - NO robust (scientific) data = NO good registration dossier.
 - Understand what ECHA is asking
 - Common effort from the industry, even in the supply chain.
- But science is essential, but not sufficient. Classification is influenced by political discussions.