KEY RESULTS OF THE INITIAL ENVIRONMENTAL RISK ASSESSMENT FOR CHROMIUM III COMPOUNDS AND CHROMIUM METAL

E. Pezennec

Arcelor Health & Safety, Product Safety Department, Florange, France
E-mail: eric.pezennec@arcelor.com

ABSTRACT

A voluntary comprehensive environmental Risk Assessment was launched at the end of 2004 by the International Chromium Development Association. The completion is scheduled for mid 2006.EURAS, a leading environmental consultancy, was commissioned for this project, as this firm wrote in particular the Metals Environmental Risk Assessment Guidelines, the reference document for the metals and metals compounds, in particular for the forthcoming European new Chemical Policy and the Globally Harmonized System for the Classification and Labelling of Chemicals (GHS).

This project follows a stepwise approach, comprising 3 distinct steps:

- Initial Risk Assessment: compilation, evaluation of the existing effects and exposure data for chromium III compounds and chromium metal. This information will be used for the compilation of an initial Risk Assessment Report.

- Data gap analysis: which type of additional effects data should be collected and/or which exposure scenarios merit a more detailed targeted risk assessment? Recommendations and/or suggestions for further research will be formulated.

- Road map: prioritization and ranking of the different proposed research programs.

The presentation will mainly focus on the results and recommendations of the initial environmental Risk Assessment from an International perspective and not from an European point of view.

- Hazard assessment – definition of the Predicted Non effect Concentration (PNEC) for each environmental compartment (water, sediment, soil)

- Exposure assessment – definition of the Predicted Environmental Concentrations (PEC) for each environmental compartment

- Comparison of the local PEC with PNEC for the chromium III compounds and chromium metal EU industry sectors covered in the project: mining of chromite, metallurgical production of chromium metal, chromium containing alloys production, production of trivalent chromium chemicals and the main applications (pigments, leather tanning, etc..).

The current status on the environmental Classification and Ranking for chromium III compounds, Chromium metal and its alloys in the GHS will also be covered.

1. INTRODUCTION

This chapter highlights the reasons why the International Chromium Development Association (ICDA) initiated an Environmental Risk Assessment on chromium III compounds and chromium metal in 2004.

1.1 Conclusions of the Compulsory Risk Assessment on 5 Hexavalent Chromium Compounds

5 different hexavalent chromium compounds were listed in the third priority list for risk assessment in 1997. The member state who acted as Rapporteur for these substances, i.e. the United Kingdom, carried out these risk assessments following the technical guidance for performing risk assessments for new and existing substances, i.e. the Technical Guidance Documents in support of Commission Directive 93/67/EEC in risk assessment for new notified substances and Commission Regulation (EC No1488/94) on risk assessment for existing substances (1996). The produced Rapporteur's final-draft Risk Assessment Report (RAR) was peer reviewed by the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE). They concluded that the Report has not provided transparent and scientifically justifiable information to support the conclusions stated in the RAR. Although the environmental exposure and effects assessments and the risk characterisation were conducted using procedures recommended by the TGD (1996), the CSTEE did not agree with the fact that the impact of Cr3+, which is often formed from the reduction of Cr6+, was not assessed in the environmental RAR. Therefore, for achieving a scientifically correct assessment of the risks of chromium to the environment, the CSTEE strongly recommended to account for fate and speciation effects related to both the exposure and effects.

1.2 Forthcoming Regulations on Chemicals Management: REACH and GHS

Two regulations on chemicals management will be put in place in the coming 2 years: REACH in Europe ("Registration, Evaluation, Authorisation and restriction of CHemicals") and GHS worldwide ("Globally Harmonised System on Classification and Labeling of chemicals"). REACH will integrate the GHS, when it will be implemented in Europe.

REACH takes into account all the Health and Environment aspects in the supply chain. GHS covers only the Classification, the Labeling of substances and preparations, and the content of the Safety Data Sheets.

The following paragraphs will focus on REACH, as the Risk Assessment process will be intensively used in this regulation, in particular for the constitution of the new version of the 'Safety Data Sheets'.

1.2.1 The Problems of the Current System

The present European legislative framework for chemical substances is a patchwork of many different directives and regulations which has developed historically.

While 'new' chemicals (introduced to the market after 1981, more than 3800) have to be tested before they are placed on the market, there are no such provisions for 'existing' chemicals (more than 100 000 different substances). Thus, although some information exists on the properties and uses of existing substances, there is generally a lack of sufficient information publicly available in order to assess and control these substances effectively.

The current allocation of responsibilities is also not appropriate: public authorities are responsible for undertaking risk assessments of substances rather than the enterprises that manufacture, import or use the substances; and these risk assessments are required to be comprehensive, rather than targeted and use-specific. Since 1993, only 141 high-volume chemicals have been identified as priority substances for RA and possible recommendations for risk reduction, of which only a limited number (28) have completed the whole evaluation under regulation (EC)793/93.

1.2.2 REACH in Brief

REACH is based on the idea that industry itself is best placed to ensure that the chemicals it manufactures and puts on the market in the EU do not adversely affect human health or the environment. This requires that industry has certain knowledge of the properties of its substances and manage potential risks. Authorities should focus their resources on ensuring industry are meeting their obligations and taking action on obligation on substances of very high concern or where there is a need for Community action.

REACH will create a single system for both what are currently described as 'Existing' and 'New' substances.

REACH is the acronym for the New Chemicals Management Policy Project of the EU.

- R.egistering of all substances produced or imported in Europe by Industry (within 3 years for big volumes)
- E.valuation of the registering dossiers and of the risks related to the production and use of each substance
- A.uthorisation needed to put on the market substances evaluated of « high concern » (and study of possible Substitution)
- CH. For Chemicals

2. ENVIRONMENTAL RISK ASSESSMENT ON CHROMIUM III COMPOUNDS AND CHROMIUM METAL

2.1. Details on the Research Project

ICDA commissioned the consulting company EURAS a comprehensive environmental Risk Assessment at the end of 2004 to complete the Hexavalent Chromium compounds Risk Assessment and to prepare the scientific dossiers for the implementation of the new EU chemicals regulations. The completion is scheduled for the end of 2006. A ICDA steering committee managed by A. Cant (Elementis) and P. Koundakjian (ISSF), including in particular G. Darrie (ICDA), F. Pilger (Lanxess), S. Visser (Xstrata) and myself, reviews regularly the progress of the project.

2.2 Methodologies and Outcomes

The present research project proposes to perform the environmental part of the risk assessment of $Cr3+$ (and compounds) based on the experience of the contractors EURAS, University of Ghent and ECOLAS with currently ongoing EU risk assessment of metals and metals compounds, which has been compiled in the Metals Environmental Risk Assessment Guideline (MERAG) document.

The MERAG document is an International technical cookbook to perform RA on metals and metals compounds. It will indeed be part of the Technical Guidance Documents for the implementation of REACH.

This project follows a stepwise approach, comprising 3 distinct steps:

- Initial Risk Assessment: compilation, evaluation of the existing effects and exposure data for chromium III compounds and chromium metal. This information will be used for the compilation of an initial Risk Assessment Report.
- Data gap analysis: which type of additional effects data should be collected and/or which exposure scenarios merit a more detailed targeted risk assessment? Recommendations and/or suggestions for further research will be formulated.
- Road map: prioritization and ranking of the different proposed research programs.

This presentation will focus on the first step.

2.3 Definitions and general principles of an EU Risk Assessment

2.3.1 Definitions of the key terms in Risk Assessment-

- <u>Risk assessment</u> is the determination of the relationship between the predicted exposure/concentration and adverse effects in four major steps: hazard identification, dose-response assessment, exposure assessment and risk characterization.
- <u>Hazard identification</u> is the identification of the adverse effects which a substance has an inherent capacity to cause. This step is also referred to as 'effects assessment'

- Dose –response assessment is the estimation of the relation between dose or concentration and the incidence and/or severity of an adverse effect.
- Exposure assessment is the determination of the emissions, pathways and rates of movement of a substance in the environment, and its transformation or degradation, in order to estimate the concentrations/ doses to which ecological systems, populations and organisms are or may be exposed.
- Risk characterization is the estimation of the incidence and severity of the adverse effect likely to occur in an environmental compartment due to an actual or predicted exposure to a substance, i.e. integration of hazard identification, dose-response assessment and exposure assessment.
- Hazard identification simply determines whether or not a substance could cause an adverse effect. Risk assessment incorporates hazard identification to determine the probability that an adverse effect could occur.

2.3.2 General Principles of an EU Risk Assessment and Outcomes

For the environment, the protection goals are aquatic ecosystems (including sediment), terrestrial ecosystems, top predators, micro-organisms in the sewage treatment systems, and atmosphere. The environmental risk characterisation entails comparison of the Predicted Environmental Concentrations (PEC) with the Predicted No Effect Concentrations (PNEC) for the corresponding environmental compartment.

If the PEC exceeds the PNEC, then it has to be decided whether further information and/or testing are required to clarify the concern or to refine the risk assessment (conclusion 1) or whether (further) risk reduction measures are necessary (conclusion 3). If the PEC is lower than the PNEC, then the risk is considered to be negligible (conclusion 2).

2.4 Key Results from the Human Health Risk Assessment on Metallic Chromium, Chromium Oxide and Basic Chromium Sulphate

Chromium is an essential element. Chromium is required for normal carbohydrate and lipid metabolism. Chromium improves insulin function. Insufficient intake of chromium leads to increase in risk factors associated with diabetes and cardiovascular diseases. Trivalent chromium is one of the least toxic nutrients. No negative effects of supplemental chromium occur at intakes up to 1000 µg/day. Recommended Daily Intake of chromium is 50-200 µg.

Metallic chromium carries a surface layer of chromium oxide and thus data for chromium oxide were used for chromium metal. No hazard classification and labelling is required and no need for further testing is identified. Finally, some scenarios where exposure can be above regulatory limits were highlighted.

Regarding basic chromium sulphate, the classification 'harmful: danger of serious damage to health by prolonged exposure through inhalation" is proposed. Testing for skin sensitisation (dermatitis) is necessary. A particular data gap is identified regarding developmental toxicity, but the levels of occupational exposure are not of concern.

3. DETERMINATION OF THE PREDICTED NO EFFECT CONCENTRATIONS

3.1 General Approach to Determine the PNEC Value

The first step consists in effect data compiling and quality screening. Chronic Non Observable Effect Concentration (NOEC) or Lethal (Effect) Concentration (L(E)C)10% data for Cr III compounds are extruded from the scientific literature, ecotoxicological data base and reports from official authorities. The data are then checked for quality (reliability and relevancy).

The data are classified in 3 categories. Only category 1 data (Q1-data, high quality data, relevant studies that comply with all the quality criteria) and category 2 data (Q2-data, satisfactory quality data, i.e. relevant studies for which no or insufficient information is given on one of a set of reliability criteria), are considered for the PNEC calculation.

The data are then interpreted (for example to research any bioavailability translation), aggregated, and the PNEC value is calculated after the application of a final safety factor to take into account the remaining uncertainty.

3.2 PNEC for Surface Water Compartment

When a large data set for different taxonomic groups is available, which is the case for trivalent Chromium compounds, the PNEC can be calculated using the statistical extrapolation method in which the susceptibility of a set of species for a given toxicant can be described by some statistical distribution (i.e. Species Sensitivity distribution or SSD). A SSD can be visualized as a cumulative distribution function (see figure 1). The cumulative distribution function curve follows the distribution of the sensitivity data obtained from ecotoxicological testing, plotting effect concentrations derived from chronic toxicity tests.

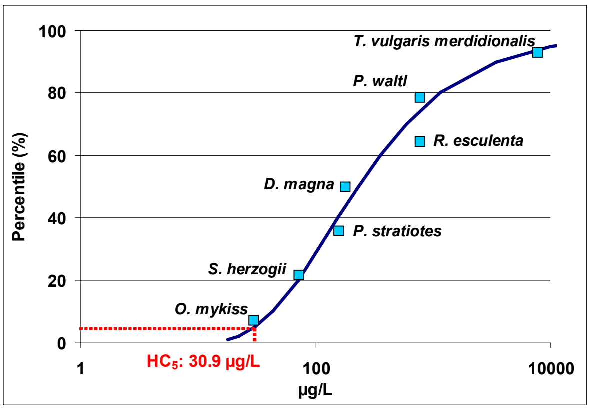

Figure 1: Species sensitivity distribution of trivalent chromium in the aquatic environment, based on bounded NOEC data only (Q1/Q2 data)

The most common current approach is to derive the PNEC from the 5th percentile of SSD. The 5th percentile of a chronic toxicity distribution has been chosen in the earliest methods as a concentration that is protective for most species in a community (namely 1-p %), but the value of p is a policy decision, not science. A confidence or uncertainty interval on the HC5 is determined, mainly because the median HC5 is a conservative estimate of the HC5 calculated without uncertainty.

4 SSD scenarios based on different datasets (bounded Q1/Q2 data only, Bounded Q1/Q2 data + studies to be evaluated, etc..) were considered for the determination of HC5 as when this document is produced, some effect dataset are still under evaluation .The log-normal distribution, the log-logistic and the Log-Pearson VI distribution are pragmatic choices because of its mathematical properties.

The table 1 summarises the derived PNEC-values and the confidence limits for the 4 different SSD-scenarios.

Table 1: Derived PNEC-values and confidence limits for the 4 different SSD-scenarios

Used Data	*Distribution*	*HC5 (+ conf. limits)*
Bounded Q1/Q2 data only	Log-Pearson VI	35.4 µg/L (15.8 – 52.8 µg/L)
Bounded Q1/Q2 data + studies to be evaluated	Log-Normal	9.6 µg/L (1.9 – 18.6 µg/L)
Bounded and unbounded Q1/Q2 data only	Log-Logistic	29.0 µg/L (3.7 – 53.7 µg/L)
Bounded and unbounded Q1/Q2 data + studies to be evaluated	Log-Pearson VI	12.5 µg/L (5.9 – 18.1 µg/L)

According to agreed criteria, there is a substantial lack of reliable chronic toxicity data in the trivalent chromium data set. This lack of information adds to the degree of uncertainty, and may therefore lead to the application of an additional assessment factor ranging between 1 and 5.

In a worst case approach, the PNEC *will thus* be comprised between *1.9 and 7.1 µg Cr 3+/L*.

The worst-case PNEC of 1.9 µg/L is almost a factor of 2 lower than the PNEC of 4.7 µg/L that was derived for Cr3+ in the EU-RAR for hexavalent chromium compounds.

3.3 PNEC for Terrestrial Compartment

The determination of the PNEC for the terrestrial compartment follows exactly the methodology presented for the surface water compartment. 2 different SSD scenarios were considered: one on all reviewed Q1/Q2 data and one of all data including data not yet reviewed. The table 2 presents the derived PNEC-values (+ confidence limits) for 2 different SSD-scenarios.

Table 2: Soil PNEC-values (+confidence limits) for 2 different SSD-scenarios

Used Data	*Distribution*	*HC5 (+ conf. limits)*
Q1/Q2 data only	Log-Normal	32.8 mg/kg (10.7 – 34.9 mg/kg)
Q1/Q2 data + studies to be evaluated	Log-Normal	29.2 mg/kg (8.7 – 31.3 mg/kg)

Following the same reasons developed for the determination of the PNEC for the surface water, an additional assessment factor ranging between 1 and 5 should be applied for the soil compartment. In a worst case approach, the PNEC for the soil compartment will be comprised between **29.2** and **5.8 mg/kg dry wt.**

The worst-case PNEC of 5.8 mg/kg dry wt is almost a factor of 2 higher than the PNEC of 3.2 mg/kg that was derived for Cr3+ in the EU-RAR for Cr6+.

3.4 PNEC for Sediment Compartment

There is only a few effect data available for chromium III compounds for the sediment compartment. The consultant has not yet determined the PNEC for this compartment.

3.5 Food Chain Transfer. Secondary Poisoning

Trivalent chromium is an essential micronutrient, needed for optimal growth and development of micro-organisms, animals and humans. It is an essential trace dietary element for mammals, influencing the chemobiokinetics and metabolism of glucose. There is no conclusive evidence yet of an essential role of trivalent chromium in plant metabolism. To ensure appropriate chromium tissue levels without causing toxicity from chromium excess, it is expected that internal chromium levels are homeostatically regulated. Therefore, the rules on bioaccumulation, bioconcentration and secondary poisoning, generally used for organic substances, do not necessarily apply to trivalent chromium.

Contradictory findings on transfer through the aquatic food chain have been reported. But it could be concluded that trivalent chromium is not biomagnified across the trophic chain. The concentrations in aquatic organisms decrease with increasing trophic level. In general, concentrations up to 10 and 5 mg Cr/kg fresh weight have been reported in invertebrates and vertebrates (fish) respectively.

Chromium levels in plants growing on “normal” soils are usually less than 1 mg/kg dry wet, rarely exceed 5 mg/kg and typically in the order of 0.02-0.2 mg/kg dry wet. Chromium is a relatively immobile element in plant. A “Soil –Plant barrier” exists for trivalent chromium. Trivalent chromium is one of the elements, which are strongly bound to soil or retained in plant roots, and are not translocated to plant foliage in injurious amounts, even when soil are greatly enriched. On the basis of available data for worms, trivalent chromium is not concentrated from the soil by the organisms.

From the above, bioconcentration and biomagnification of trivalent chromium are not issues for both freshwater and soil organisms, and as such, no attempt has been made to derive a PNEC for secondary poisoning.

4. ENVIRONMENTAL EXPOSURE ASSESSMENT

First of all, the exposure assessment should cover 2 types of scenarios:

- the local environmental exposure assessment related to the emissions released by the chromium industry.

- the environmental exposure assessment related to all the point and diffuse sources. The assessment is performed on a local, regional and continental scale.

4.1 Local Environmental Exposure Assessment for the Chromium Industry.

The table 3 provides the preliminary conclusions of the local environmental concentrations for the different sectors of the chromium industry in the 15 - European Union.

Table 3: Local environmental concentrations for the different sectors of the chromium industry

Local concentrations/Activities & number of sites.	*Water (µg/l)*	*Sediment (mg/kg dw)*	*Soil (mg/kg dw)*	*Air (ng/m3)*
Mining (1) and metallurgical production of chromium metal (1)	0.0041-1.37	1.24-410	0.0003-0.03	0.67-74.6
Ferrochromium production (2)	0.49	147.3	1.36	3090
Production of Cr III chemicals (3)	0.10-14.7	30.0-4412	0.04-0.59	89-1344
Production (1) & processing (2) of Cr containing pigments	0.0033-8.6	0.98-2564	0-1.25	0
Stainless Steel production (23)	0-215	0-64527	0.0002-4.03	0.4-9140
Leather tanning (12)	0.05-400	16.4-120017	0-4781	0

The figures between the brackets are the number of production sites of the corresponding sector. These concentrations in the receiving local environment are calculated based on the annual emission of the sites, the removal rate in sewage treatment plant, the dilution factor (ratio between the emission and the receiving water body flowrates) and the physico-chemical characteristics of the receiving water body.

But the results are only preliminary since in particular:

- •some sites need to submit clarification with regard to emission information. In addition, site specific dilution factor, crucial to obtain reliable local concentration, is often lacking.
- The partitioning values used and removal rate in sewage treatment plant are preliminary, extracted from the hexavalent chromium Risk Assessment report.
- Regional backgrounds are not used yet, because the evaluation is still in progress.
- Some sectors have generic exposure scenario, because of lack of reliable data.

4.2 PEC derivation of Chromium Concentrations in EU Surface Water, Sediments and Soils

Due to the inherent variation of metal concentration in the natural environment (e.g., different natural background concentrations) and the variations of anthropogenic input, large differences in observed metal levels can be observed among different locations. The exposure assessment is performed using modelled data and/or measured data. At the end of the research project, the results of the 2 approaches will be compared to select the most appropriate approach for the case of chromium III compounds and chromium metal.

4.2.1 Exposure Assessment Using Modelled Data

With regard to the modelled exposure analysis for risk assessment purposes, a distinction can be made between different spatial scales. The 'site-specific' scale considers the protection goals in the vicinity of a point source. The assessment of the risks due to all releases from point and diffuse sources in a larger area (country, state, and region) is performed on a so-called regional scale. A third spatial scale – the continental scale – is the sum of all regional scales within a continent, and is for example used as background for the regional system in exposure models such as EUSES.

Table 4 gives the resulting total EU-15 chromium emissions aggregated per source category.

Table 4: Overview of total EU-15 chromium emissions (kg Cr/year)

SOURCE	*Emission (kg Cr/year)*		
	Air	*Water*	*Soil*
INDUSTRY	234,290	829,667	188
Process emissions	234,290	829,667	/
Corrosion of stainless steel	/	47	188
Combustion processes	/	/	/
HOUSEHOLDS	6,476	20,805	10,247
Residential heating	6,476	/	/
Wastewater discharge	/	20,805	10,247
Combustion in public services	/	/	/
SOURCE	Emission (kg Cr/year)		
WASTE MANAGEMENT	1,912	179,226	0
Wastewater treatment plants	/	171,733	/
Waste incineration and landfills	1,912	7,493	/
AGRICULTURE	270	0	2,428,900
Combustion (heating of greenhouses)	260	/	/
Use of manure, mineral fertilizers	/	/	2,428,900
Machinery used in agriculture – exhaust fumes	10	/	/
TRANSPORT	11,069.2	4,625	11,442
Road - Exhaust fumes	5,691	/	/
Road - Road wear	1,248	2,501	9,997
Road - Brake wear	4,076	502	915
Road - Tyre wear	47	725	409
Road - Leakage motoroil	0	30	121
Water transport - Exhaust fumes	0.2	867	/
Rail transport - Exhaust fumes	7		/
OTHER SOURCES		18,573	
Storm water overflow/separate sewage system	/	18,573	/
TOTAL EMISSIONS	254,017	1,052,896	2,450,777

This table shows that "industrial processes" is the most important source for air and water. As on a regional scale, emissions from the use of manure and mineral fertilisers on agricultural soil, are the most important chromium emitting sources to the soil.

These emission sources will be used as input data in the EUSES model for the final calculation of the PEC regional for the different environmental compartments.

4.2.2 Regional PEC Based on Monitoring Data

This section will provide an overview of the methodology used for the surface water compartment and the preliminary findings. The same methodology applies for the sediment and soil compartments. The background and the ambient concentrations for the different compartments will also be presented.

4.2.2.1 Regional PEC for Surface Water in Europe

The aim is to obtain an overview of chromium distribution in the EU surface waters. The Cr data are collected from various water monitoring programs and are then checked for quality.

From the selected monitoring data, it is possible to generate realistic distributions of environmental parameters that follow a statistical distribution. From these environmental concentration distributions (ECD), it is possible to assign probabilities to the likelihood that a measure will exceed a certain value. In a probabilistic framework, the whole ECD in itself is used in the risk characterization instead of 10th, 50th or

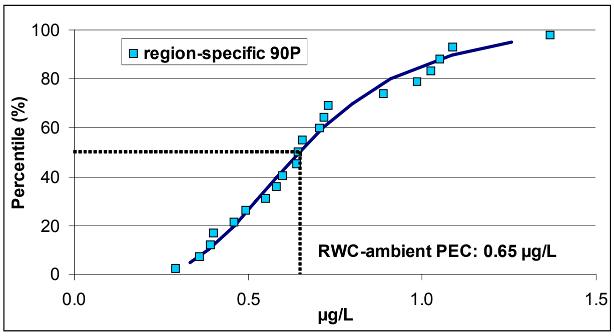

Figure 2: Reasonable Worst case ambient PEC value based on the total Cr concentration in Swedish lakes

90th percentiles. A deterministic framework will only derive a Predicted Environmental Concentration (single PEC value) from the ECD that is constructed with monitoring data.

An example of the determination of reasonable worst case (RWC) PEC value is provided in the figure 2, based on the total Chromium concentration in Swedish reference lakes.

The table 5 gives an overview on the country-specific RWC-ambient Cr-concentrations (total/dissolved)

Table 5: Country-specific RWC-ambient Cr-concentrations (total/dissolved)

Country	*RWC-ambient Cr-PEC*	
	Total Cr (µg/L)	Dissolved Cr (µg/L)
Belgium		
Flanders	7.0	--
Walloon	--	1.73
England	1.86	0.96
Finland		1.5
France		
Rhône-Mediterranean	3.2	--
Seine	--	0.68
Germany		
Elbe	4.47	1.8
Hess. Landesamt	5.49	--
Average	4.98	1.8
Portugal	4.67	3.79
The Netherlands	2.59	1.34
Scotland	2.35	1.38

Table 5: Country-specific RWC-ambient Cr-concentrations (total/dissolved) (Continued)

Country	*RWC-ambient Cr-PEC*	
Sweden	0.67	--
Wales	1.33	0.69
EU-Median	2.79 (0.67 – 7.0) Log-Extreme Value	1.27 (0.68 – 3.79) Log-Beta

Based on total chromium concentrations, the country-specific RWC-ambient PECs vary between 0.67 µg/L (Sweden) and 7.0 µg/L (Flanders; Belgium), resulting in a typical concentration of 2.79 µg/L for Europe. Dissolved country-specific RWC-ambient PECs range between 0.68 µg/L (Seine, France) and 3.79 µg/L (Portugal), and a typical concentration of 1.27 µg/L is derived for Europe.

4.2.2.2 Background –estimated country- specific values for surface water in the EU

The estimated dissolved Cr-background country-specific background levels are derived from the data and maps from the FOREGS- EU monitoring program

The table 6 provides an overview of the concentrations in the European countries.

Table 6: Estimated dissolved Cr-background concentrations in EU-countries

Country	*Typical Cr background (50th percentile, µg/L)*	*Country*	*Typical Cr background (50th percentile, µg/L)*
Austria	0.19	Italy	0..45
Belgium	0.34	Luxemburg	0.18
Denmark	0.43	The Netherlands	0.46
Finland	0.73	Portugal	0.57
France	0.24	Spain	0.59
Germany	0.30	Sweden	0.38
Greece	0.69	United Kingdom	0.35
Ireland	0.40	Range	0.18-0.73 µg/L

These results are preliminary results, as the raw monitoring data were not now available at the time of the writing of the paper.

According to the values given in the table 6, the highest background chromium levels are found, in Southern European countries (Spain, Portugal, Italy, Greece) and in some Scandinavian regions (Southern Sweden, Finland). The lowest values were found for Luxemburg and Austria (0.18 and 0.19 µg/L, respectively).

Each of these country-specific background levels are below the RWC-ambient PEC of dissolved Chromium that were derived for the respective countries – if data were available. The highest RWC-ambient PEC was derived for Portugal, and this is in line with the high background that was derived for this country. Similarly, low RWC-ambient PECs were observed in countries/regions with a low Cr-background (France, Wales (< 0.21 µg/L)).

4.2.3 Comparison Between the Background and Ambient PEC

The methodology presented in the previous section for the water compartment applies to the sediment and soilcompartments.

The table 7 provides an overview of typical background and ambient PEC for the 3 compartments.

Table 7: Typical background and ambient PEC for the water, sediment and soils in the EU-15

Compartment	*Typical background*	*Ambient PEC (average)*
Water (µg/l)	0.38	1.27
Sediment (mg/kg)	22	49.7
Soil (mg/kg)	22	33.7 (forest) 45.3 (grassland) 42.5 (agriculture)

5. CONCLUSIONS

This paper provides an overview of the findings of the initial environmental Risk Assessment for trivalent chromium compounds and chromium metal at this stage of the research project. An important part of this document focuses on the methodological approaches.

The findings are preliminary: indeed at the date of the writing of this paper, some effect data and exposure monitoring data are still under evaluation and integration in the calculations. Thus it is too premature to perform any risk characterisation for any of the environmental compartments.

But data gaps already appear. Additional effect data tests for the sediment and soil compartments may certainly be needed to decrease the uncertainties attached to the determination of the ecotoxicological reference value (PNECs). The proposal for environmental hazard classification under GHS, based on the acute effect data generated in normalised tests and the dissolution/transformation protocol, is still under preparation. The industry is indeed waiting for the recommendations on the practical implementation of the GHS in Europe, in particular for the alloys issue.The soil exposure scenario will certainly merit also a more detailed analysis.

The final version of the draft Risk Assessment report will be discussed at the end of 2006 and the validated final report should be available beginning of 2007, which is perfectly in line with the dates of the entering in force of the new chemicals regulations in Europe.

This environmental Risk Assessment follows the current European methodology for Risk Assessment, but the general approach is adaptable and transposable to the rest of the world as it is based on the recommendations of the MERAG document, which is recognised at the international level.

This research project will also provide validated ecotoxicological reference values to perform life cycle impact analysis (LCIA) more rigorously in the future.

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