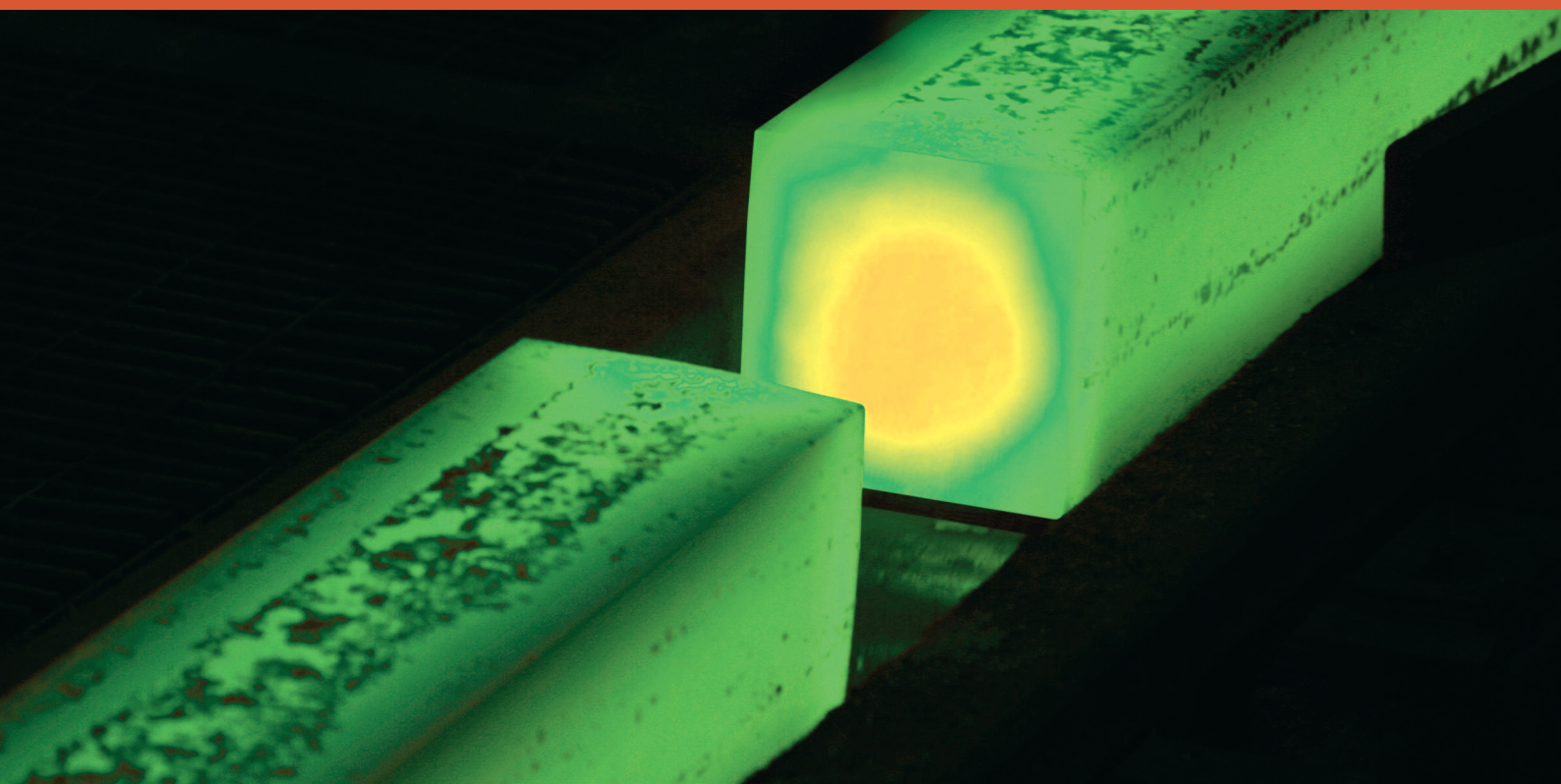


Report

Minerals and Metals Management 2020 Status report 2015

Materials Stewardship
September 2015

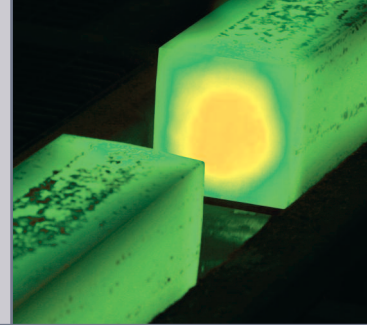


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This publication describes the progress made since the 2009 release of *Minerals and Metals Management 2020* – ICMC’s action plan for chemicals management in the mining and metals sector.





Under the International Council on Mining and Metals (ICMM) Sustainable Development Framework, ICMM has a clear mandate to facilitate and encourage responsible product design, re-use and recycling of our products. ICMM recognises that chemicals management is a vital component of materials stewardship:

The products of the mining and metals industries are classified and regulated as chemicals... Thus, a large part of the management of mining and metal production is the management of chemicals: their sourcing, transport, storage, use, production, and the management of their occupational health and environmental risks through their life cycles. ICMM, 2012

ICMMs work to ensure responsible use of chemicals, is in clear alignment with the societal expectations reflected in the objectives of the Strategic Approach to International Chemicals Management (SAICM).

To this end, ICMM and its member companies developed the “Minerals and Metals Management 2020” (MMM2020) action plan, responding to the challenges of SAICM. The plan links to the specific objectives of SAICM and outlines 23 specific goals.

This most recent report – our third – not only revisits those goals and the projects that will deliver them, but includes a number of case studies on chemicals management that brings those goals to life. Progress is best observed and made real in the field.

Both SAICM and ICMM are on track to ensure that, by the year 2020, chemicals are produced and used in ways that minimise significant adverse impacts on the environment and human health. While we have clear plans in place, our understanding of what is important (and our technical capacities to respond) is not static, our member companies know that chemicals management is a journey that goes beyond SAICM and the 2020 deadline.

As producers of the minerals and metals that sustain society, chemicals management is a constant and continuing responsibility to society.

Tom Butler
Chief Executive Officer, ICMM

SECTION 1

The story so far

It has been 23 years since the Rio Earth Summit and Agenda 21, 16 years since nine of the largest mining companies launched the Global Mining Initiative to prepare for the World Summit on Sustainable Development, 14 years since the International Council on Mining and Metals (ICMM) was established, and 13 years since the World Summit on Sustainable Development and the Johannesburg Plan of Implementation. It has been 9 years since SAICM was formally established by the Dubai Declaration, and there are five years to go to reach the targets set.

The SAICM objective

The Dubai Declaration, itself a consequence of the outcomes of the 2002 Johannesburg World Summit on Sustainable Development, represents the most politically developed statement of purpose and objectives for chemicals management. The four central SAICM objectives are reviewed in this document to determine to what extent the global mining industry and the members of ICMM in particular, are managing chemicals responsibly.¹ This includes actions so far and actions envisaged between now and 2020 at which time “chemicals [are to be] used and produced in ways that lead to the minimisation of significant adverse effects on human health and the environment.”²

Mining and metals industry developments to date

The MMM2020 programme was developed as the mining and metals industry response to the challenges of SAICM and adopted in 2009. It has four organisational principles – “taking a system perspective”, “building new and strengthening existing relationships”, “optimising the production and application of minerals and metals”, and “contributing to a robust and accessible base of information to support decision-making”. These are given substance by 23 specific commitments to action. These, in abbreviated form, are presented with their current status on page 13.

The MMM2020 programme does not exist in isolation nor is it the first ICMM undertaking in chemicals management. It is part of a continuum that flows from the high-level statements contained in the 10 principles of the ICMM Sustainable Development Framework, agreed to by the members of ICMM in 2003. At least six of those principles are directly relevant to SAICM and all ten of them are compatible with, and supportive of, SAICM objectives.³

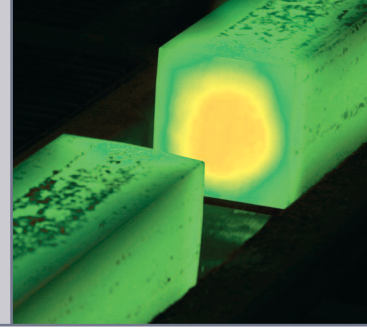
The concordance of ICMM Principles and SAICM objectives is presented on the next page. Subsequent pages show examples of what increased scientific understandings and new tools are accomplishing on the ground.

The 2020 objective was always going to be a challenge in terms of the time and capital requirements of science research, and the development, testing and deployment of appropriate tools. Now, with five years remaining, it is impressive what is being accomplished even in the face of challenging financial circumstances. Starting on page six examples of chemicals management in real environments and actual sites show the difference that new science and science-based tools are making.

1 As noted in our previous report, the Dubai Declaration has a fifth objective: the suppression through various means of the international traffic in toxic, hazardous, banned and severely restricted chemicals. While an important issue, it is narrower in scope than the four principle objectives, has its own international instruments such as the Basel Convention, and is less relevant for the global mining and metals industry.

2 “Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002”, Chapter 1, Resolution 2, Annex III.

3 For more on the ICMM Sustainable Development Framework and the 10 Principles, see: www.icmm.com/our-work/sustainable-development-framework



Alignment of SAICM Objectives and ICMM Organisational Principles

The SAICM objectives are not numbered nor, in SAICM documentation, are they weighted. This reflects the SAICM view that all are important and all would be compromised if one or more of the objectives were not achieved. Our 2012 progress report focussed heavily on the development of new scientific concepts for the sound management of metals. In 2015 we are busy applying those concepts through the tools and models that we have built. For the purposes of this latest ICMM review, the SAICM objectives are addressed not as they appear in the Dubai Declaration but in a way most appropriate to the issues faced by the mining and metals industry – as described in the table below.

SAICM objective	Mining and metals industry response
“Risk reduction...is a key need in pursuing the sound management of chemicals throughout their entire life cycle including, where appropriate, products and articles containing chemicals.”	Applying the tools and optimising the production and application of minerals and metals: MMM2020 commitments to develop guidance, promote integration, workshops, best practices, supply chain outreach, hazardous waste minimisation and mercury stewardship.
“Governance is an important issue that needs to be addressed through a multi-sector and multi-stakeholder approach in pursuing the sound management of chemicals.”	Building new and strengthening existing relationships: convene/support workshops, develop guidance, materials stewardship and engage stakeholders.
“Capacity-building and technical assistance in relation to all aspects of the sound management of chemicals are among the essential elements of the successful implementation of the Strategic Approach.”	Sharing the tools and contributing to a robust, accessible base of information to support decision-making: MMM2020 commitments to publish risk assessment and LCA data, publish methodologies, convene/support workshops, publish emission data and maintain database of occupational exposure limits.
“Knowledge, information and public awareness are basic needs for decision-making for the sound management of chemicals...”	Building the tools in the context of a systems perspective: MMM2020 commitments to develop tools, develop guidance and provide scientific input.

“ICMM MEMBERS REMAIN FOCUSED AND COMMITTED TO MAKING A CONTRIBUTION TO THE ACHIEVEMENT OF THE SAICM GOAL. NOW AS NEVER BEFORE, THE SECTOR HAS THE STRUCTURES IN PLACE AND EXPERTISE AT HAND TO ENSURE THAT THE CHALLENGE IS MET.”

SECTION 2

Realising the MMM2020 commitment

The following case studies are just a sample of the projects being undertaken by our member companies and associations.

Once a methodology or tool achieves maturity, adoption becomes universal among leading companies, or provokes further innovation. They can also become models for regulatory bodies to standardise what was initially innovative and an advancement in performance. Leadership raises expectations and standards generally, and in this way, the investments of time, human and financial capital by the mining and metals industry can have application in other industry sectors, beyond these case studies.

The early years of MMM2020, and the years leading up to the formal commitment, were focused on science: testing, reviewing and verifying the science, and putting the results into practical forms that put reliable instruments into the hands of operators. These instruments are making quantitative and qualitative differences. The impact of this is that there has been a systematic reduction in the likelihood of human and environmental risks being exaggerated, underestimated or entirely missed.

CASE STUDY 1

Application of metals specific principles at a copper mine site in the US

The issue

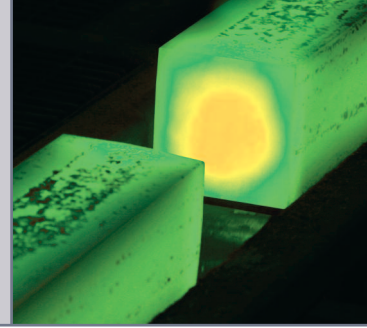
A need to understand the short and long term impacts of the presence and bio-availability of metals of concern at levels above background, in areas impacted by mining operations. The findings could then be used as the basis for investments in management and remediation commensurate with the risk.

The response

The bioavailability of arsenic, copper, lead and selenium in soils, surface waters and wetlands was assessed. The principles laid out in the ICMM/Eurometaux Metals Environmental Risk Assessment Guidance (MERAG) Fact Sheets on bioavailability, exposure assessment, effects assessment, uncertainty analysis and risk characterisation were used to make decisions regarding possible effects on birds, other wildlife and the aquatic resources of impacted areas for purposes of determining remedial actions. Metal monitoring was performed across 35,000 ha. The outcome of the risk assessment identified a limited number of areas where arsenic and lead soil removals were required; a groundwater plume requiring monitoring; selenium sediment concentrations in wetlands placing shorebirds (American Avocets and Black-necked Stilts) at low levels of risk; and an artesian well containing selenium which required treatment. Soil and sediment removals were completed and a treatment system (fluid bed bioreactor) was built to remove selenium from the artesian well discharge.

The outcome

A remediation response commensurate to the risk was identified with a high level of scientific and technical confidence.



CASE STUDY 2

Preventing pollution of the marine environment in the transport of mined products

The issue

Marine trade is vital to the world economy and is capable of moving vast amounts of material and merchandise at low unit cost. However, a number of environmental concerns have been identified in recent years. Two are independent of the cargo (high sulphur diesel fuel emissions and discharges to the marine environment by the pumping from bilges of oily wastes or other substances harmful to the marine environment).

A third issue concerns cargo residues that may be discharged when holds are washed out in preparation for the next cargo. Non-ferrous ores and concentrates, some with known ecotoxic potentials are important marine cargos, and it is essential to know when residues in wash waters from holds pose unacceptable risks requiring active management. Metal concentrates – obtained from mining operations and shipped in bulk to the metal producing industries (smelters/refiners) were a prime candidate for regulatory attention.

The response

On 1 January, 2013, International Maritime Organization (IMO) brought in changes to MARPOL (International Convention for the Prevention of Pollution from Ships) that aims to prevent the pollution of the marine environment from solid bulk cargos. The challenge for ICMM members was then to apply the latest science to determine the real hazards posed to the environment by the complex mixture of minerals that make up a concentrate. This meant looking to each constituent mineral in a range of concentrates from around the world and modelling the degree to which metal ions would be released (the driver for ecotoxicity) consistent with the criteria defined in the MARPOL Convention.

The predictive power of tools such as MERAG and MeClas and early engagement by all concerned parties was brought to bear.

The outcome

The testing and modelling carried out by mining companies and facilitated by metals commodity associations determines quickly and accurately whether there is insufficient release of metal ions to cause toxicity – meaning that risk management measures can be targeted where they are really needed. In addition – and significant beyond the regulatory objectives of the MARPOL requirements – is the avoidance of unnecessary costs for the majority of ports (to provide facilities for the receiving of metal concentrate wash water) and the shippers and receivers of the concentrate.

CASE STUDY 3

Characterising complex products – the Metals Classification Tool (MeClas)

The issue

The UN Global Harmonised System for hazard classification and labelling (GHS) includes specific rulings for metals, metal compounds and alloys. These however are complex and not available under any (commercial) assessment tools or software. In addition, hazard datasets for metals – while usable at the worldwide level – are often large, complicated and access to them can be an issue.

The response

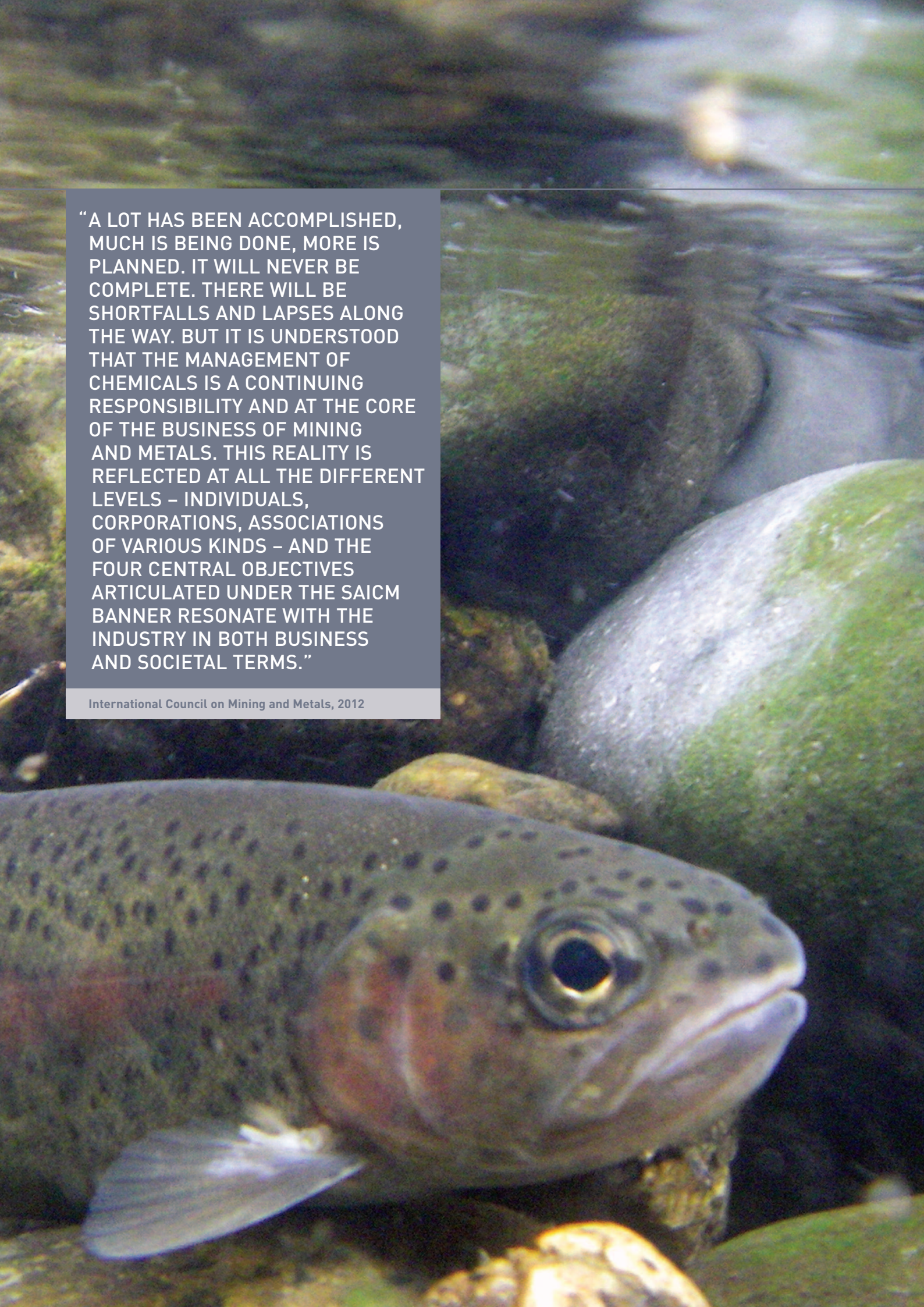
To address those challenges, ARCHE⁴ and Eurometaux⁵ have developed an automated system for the hazard identification and classification/labelling of complex inorganic materials like ores and concentrates, complex intermediates and slags and alloys under the GHS. The MeClas tool is a web-based, flexible and user-friendly hazard identification tool. It recognises the specific properties and assessment techniques for inorganics and uses the most updated information on (eco)toxicity references and self-classifications available. The tool was launched in 2010 and extensively used for the EU's Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) registration and the notifications under the EU Classification, Labelling and Packaging Regulation that concluded in 2010. In view of the 2015 deadlines for classification of mixtures, the tool has recently been improved to address the specificities of various alloys. In addition, the GHS database of industry self-classifications and the United States implementation of GHS mixture rules have been included.

The outcome

Two decades of research, testing and validation are in regular use. MeClas is regularly updated, and can be downloaded without cost for non-commercial use. More information on the principles behind the methodologies can be found at www.meclas.eu.

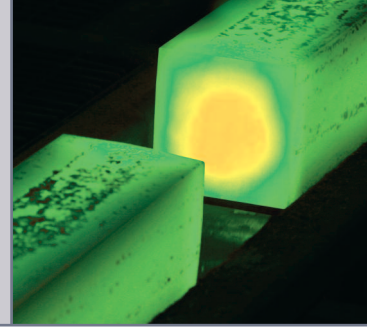
4 ARCHE ("assessing risks of chemicals") is a consulting firm with its origins in the European Centre for Risk Assessment (EURAS) at Ghent University.

5 Eurometaux: association servicing and representing the European non-ferrous metals industry.



“A LOT HAS BEEN ACCOMPLISHED, MUCH IS BEING DONE, MORE IS PLANNED. IT WILL NEVER BE COMPLETE. THERE WILL BE SHORTFALLS AND LAPSES ALONG THE WAY. BUT IT IS UNDERSTOOD THAT THE MANAGEMENT OF CHEMICALS IS A CONTINUING RESPONSIBILITY AND AT THE CORE OF THE BUSINESS OF MINING AND METALS. THIS REALITY IS REFLECTED AT ALL THE DIFFERENT LEVELS – INDIVIDUALS, CORPORATIONS, ASSOCIATIONS OF VARIOUS KINDS – AND THE FOUR CENTRAL OBJECTIVES ARTICULATED UNDER THE SAICM BANNER RESONATE WITH THE INDUSTRY IN BOTH BUSINESS AND SOCIETAL TERMS.”

International Council on Mining and Metals, 2012



CASE STUDY 4

Evaluation and remediation of a legacy mining site in the United States

The issue

The copper and cobalt Blackbird Mine in the United States near Salmon, Idaho, operated in the 1940s and 50s. Extensive amounts of tailings were placed in Blackbird Creek, a small tributary to the larger Panther Creek.

The response

In 1994 a wastewater treatment system was installed on Blackbird Creek designed to remove metals from both mine surface waters and water coming from an underground mine portal. Approximately 100,000 tons of material was removed from Blackbird Creek.

The outcome

The environmental challenge and the industry response pre-dated both SAICM and MMM2020. Biota in Panther Creek have been monitored since 1992 and now show complete recovery of the fish species (Mebane et al., 2015, *Recovery of a mining-damaged stream ecosystem*). Beyond the entirely positive measurements, the bioavailability estimates and effects assessment as discussed in the MERAG Fact Sheets have been used to assess protective levels in Panther Creek for aquatic species. Working tools such as MERAG have assisted with understanding what contributed to the positive outcomes, and predicting future instances of actual or anticipated environmental challenges, supporting pre-emptive planning.

PAGE 8

A rainbow trout rests among cobble substrate in Panther Creek, central Idaho.

U.S. Geological Survey
Department of the Interior/USGS
Photo by Christopher Mebane

CASE STUDY 5

Accurately modelling metal releases to the environment

The issue

There is a long history and experience with assessing organic chemicals and compounds and ways of measuring and evaluating environmental impacts on different biota in air and bodies of water. With increasing attention being paid to metals and metallic compounds, it was found that methodologies developed for organics often gave wildly inaccurate or improbable predictions of releases and thus predictions of environmental exposures and impacts.

The response

Specific Environmental Release Factors (SPERCs) for metals and metal compounds were developed by Eurometaux and ARCHE to provide a realistic approach for characterising the environmental releases of metals and metal compounds from the manufacture, processing and downstream uses in the EU. The metal SPERCs are based on a database of more than 1,300 recent (1993–2010) site-specific measured release factors to air and water of 18 different metals and their compounds. The sites were in various Member States of the EU.

The first version of the metal SPERCs was published in 2010 and used extensively in the development of the 2010 REACH registrations. The SPERCs underwent a review process conducted by Luskow et al. (2011) on behalf of the Federal Environment Agency of Germany (UBA) and a second version of the metal SPERCs was published for the purpose of the 2013 REACH registration deadline. The metal SPERCs were also included in a further validation exercise led by the European Chemicals Agency to identify 'Best Practices' in the use of SPERCs.

The outcome

Although developed in the European Union, the metal SPERCs principles and methodology approach can be used in other regions, and in other chemical management systems that include metals and metallic compounds. This potential was examined in the object of a peer-reviewed publication (Verdonck et al. 2014, *Development of Realistic Environmental Release Factors Based on Measured Data*). It has also been proposed to include the metal SPERCs in an OECD project aimed at making a "cross-walk" between the Emission Scenarios Documents developed by several countries and the EU SPERCs. The metal SPERCs are downloadable for non-commercial use without cost from www.arche-consulting.be/Metal-CSA-toolbox/spercs-tool-for-metals.

SECTION 2

Realising the MMM2020 commitment

CASE STUDY 6

Globalisation of tools and assessment methods

The issue

Mainly in the European Union and driven by the needs of REACH, enormous progress has been made in understanding mechanisms related to the interaction of metals with humans and the environment. Many non-EU OECD countries are involved in hazard and risk assessment programs in line with their commitment with the SIACM goals and objectives. Metals and inorganics are often high on priority lists due to their volume, potential for exposure and identified hazards. The environmental assessment of metals, however, often poses significant issues because they can be very data rich, and require different scientific tools and even different assessment strategies than those available for organics. There is real opportunity for the investments that have been made in the context of the European Union to more quickly and efficiently find reflection in other chemical management regimes.

The response

The metals sector in the EU, with global support, has developed state-of-the-art guidance to ensure high quality environmental hazard and risk assessments for chemicals management, EQS setting and other purposes. This is the ICMM/Eurometaux Metals Risk Assessment Guidance (MERAG) project. It has received significant support from the Government of the United Kingdom and has been peer-reviewed by leading scientists from many countries.

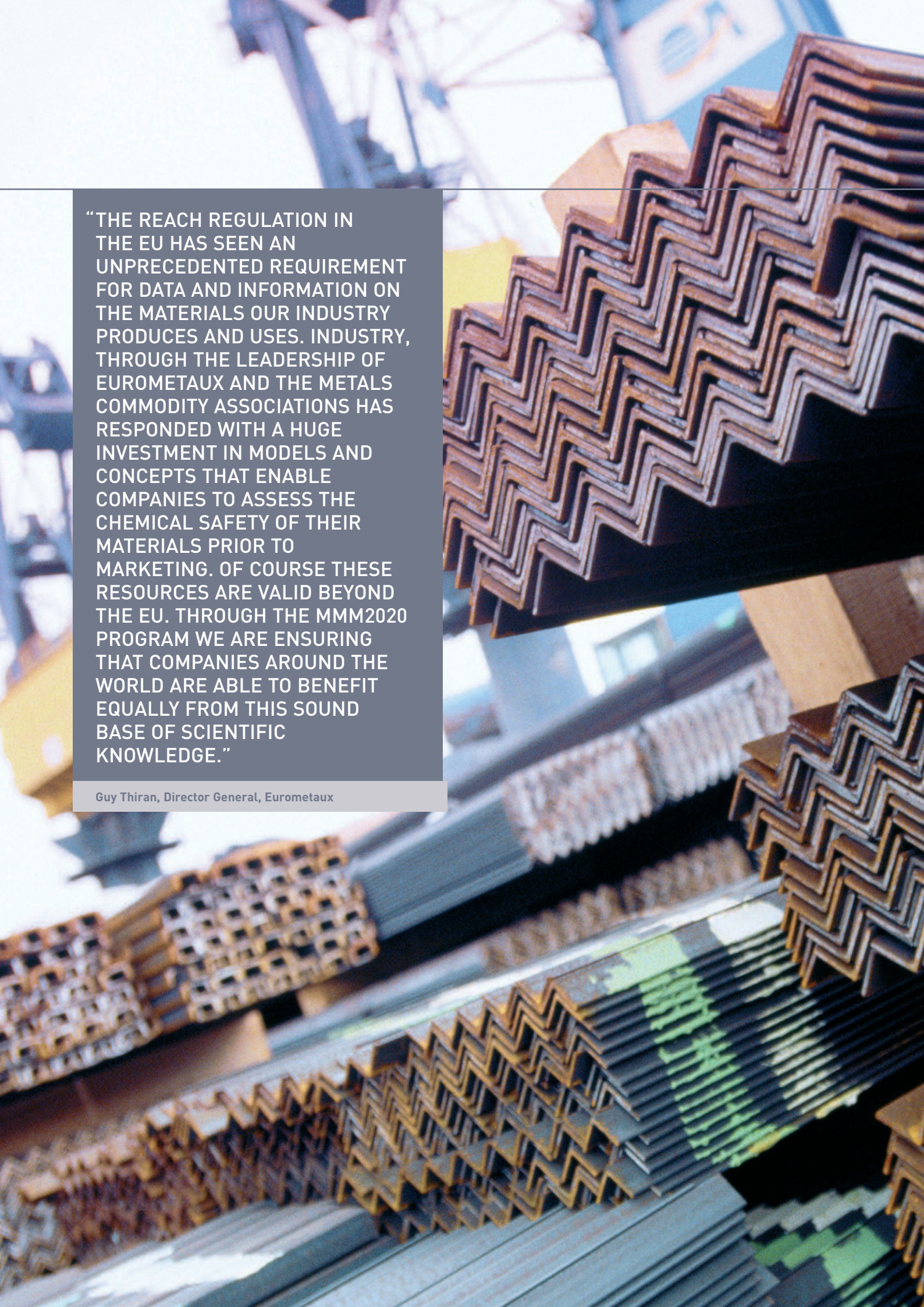
MERAG was driven by the need to understand specific properties of metals as well as by their natural occurrence requiring specific data selection and relevance techniques, assessment technologies and tools. Examples of this are the correction for bioavailability, the added risk approach (an approach to handle varying natural background levels), assessment schemes for bio-accumulation and bio-concentration. These metal specific guidance recommendations have already been included and used in some jurisdictions such as the EU-REACH system and Water Framework directive.

It has been recognised that these investments in science, reinforced by peer-review and experience, could greatly assist regulatory authorities beyond the borders of the European Union. Consequently, the mining and metals industry is now actively engaging intergovernmental bodies such as the OECD and APEC to build awareness and capacity for implementation.

The outcome

In 2015, elements of the updated MERAG publication were agreed to be relevant to national guidance development by a number of OECD members. Work is proceeding in the Task Force on Hazard Assessment (TFHA), which has identified those concepts most suitable for inclusion into OECD resources and reviewed initial draft guidance.

The year also saw the first activity to build capacity for improved assessment of metals delivered through the APEC Chemicals Dialogue. A workshop held during the third Senior Officials' Meetings in the Philippines in August provided training to over sixty regulatory and industry personnel from 15 APEC economies.



“THE REACH REGULATION IN THE EU HAS SEEN AN UNPRECEDENTED REQUIREMENT FOR DATA AND INFORMATION ON THE MATERIALS OUR INDUSTRY PRODUCES AND USES. INDUSTRY, THROUGH THE LEADERSHIP OF EUROMETAUX AND THE METALS COMMODITY ASSOCIATIONS HAS RESPONDED WITH A HUGE INVESTMENT IN MODELS AND CONCEPTS THAT ENABLE COMPANIES TO ASSESS THE CHEMICAL SAFETY OF THEIR MATERIALS PRIOR TO MARKETING. OF COURSE THESE RESOURCES ARE VALID BEYOND THE EU. THROUGH THE MMM2020 PROGRAM WE ARE ENSURING THAT COMPANIES AROUND THE WORLD ARE ABLE TO BENEFIT EQUALLY FROM THIS SOUND BASE OF SCIENTIFIC KNOWLEDGE.”

Guy Thiran, Director General, Eurometaux

SECTION 3

Charting our progress

The industry has more and better science and science-based tools than ever before. This status report provides examples of what this is meaning in operational terms.

Much has been accomplished and while a lot is being done, more will be needed. The understanding of “best practice” will continue to evolve in light of experience with known chemicals, and will be driven by the need to integrate new processes and process chemicals into management systems.

The chart opposite gives a subjective assessment of where the industry is at in terms of the 23 commitments made in 2009.

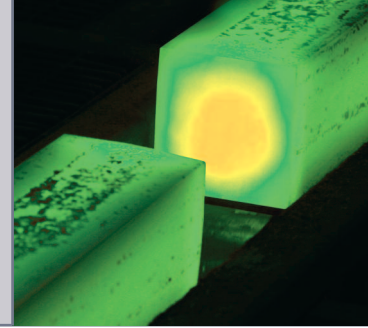
How is the industry doing?

The 2015 matrix shows progress compared to 2012. It is not dramatic progress but it is substantive. With five formal years left there are both projects that are “works in progress” and others not even started.

This reflects the reality that the ambitious list of 23 projects committed to in 2009 was, in fact, ambitious. If the matrix was all green (“completed”) in 2015, it would suggest that the objectives were too easy. In addition, six years after the list was finalised, the importance and understanding of some of the 23 commitments has evolved. If a new list were created now, it would likely include items that were not then recognised as important back in 2009. Nonetheless, the next five years will see all, if not more, of the 2009 commitments completed, which will be a huge achievement by all those involved.

The importance of this is that the mining and metals industry is integrating “responsible and integrative chemicals management” into its culture and business. The management of chemicals is a continuing responsibility and essential to the business of mining and metals.

“DEVELOPING APPROACHES TO THE ENVIRONMENTAL AND HEALTH ASSESSMENT OF OUR METAL PRODUCTS IS A CHALLENGE THAT THE INDUSTRY HAS BEEN RESPONDING TO FOR OVER TWO DECADES.”



SAICM objective	Risk reduction	Governance	Capacity-building and technical assistance	Knowledge and information
ICMM MMM2020 Action Plan element	Taking a systems perspective	Building new and strengthening existing relationships	Optimising the production and application of minerals and metals	Contributing to a robust, accessible base of information to support decision making
Actions and status Activities completed or well advanced (note some of these are enduring) Begun but significant development still to be undertaken Yet to be commenced 2012 2015 Progress since 2012	1. Develop and implement hazard and risk assessment tools addressing the specific properties of metals, metal compounds, alloys and other inorganic substances and any related effects on health and the environment	7. Promote integration of specific assessment tools into broader risk characterisation systems and government policy frameworks at the national, regional and international level	12. Develop guidance on chemicals management in the mining and metals sector	18. Make available high quality hazard and risk assessment information on specific metals and metal compounds
	2. Encourage the development of guidance on a harmonised approach to the setting of occupational exposure limits	8. Convene workshops with commodity associations to exchange experiences and information on chemicals management	13. Encourage the prevention and minimisation of hazardous waste generation within ICMM member operations	19. Publish and disseminate fact sheets on new and revised hazard and risk assessment tools intended to address the specific properties of metals, metal compounds, alloys and other naturally occurring inorganic substances
	3. Establish guidance for identification, assessment and control of occupational health risks	9. Provide guidance for member companies on terms of reference for engagement with local communities and host governments on chemicals management, particularly in developing countries	14. Promote and exchange information on successful experiences and projects related to environmental site management and occupational health and safety	20. Convene training workshops for companies and organisations within the mining sector on key chemicals management topics such as the UN GHS and risk characterisation
	4. Provide scientific input to the development of protocols for characterisation of ecotoxicological and human health impacts in life cycle assessment	10. Encourage metal commodity associations to include chemicals management information and resources in their materials stewardship programs	15. Provide guidance on implementation of the UN Globally Harmonised System of Classification and Labelling	21. Develop a web-portal to provide common access to life cycle inventories for specific metals and metal compounds
	5. Promote eco-efficiency indicators to encourage efficient and effective use of materials and energy from a life cycle perspective	11. Develop a dialogue with the World Bank Group on chemicals management and poverty alleviation	16. Develop and implement mercury stewardship activities	22. Develop a sector specific framework for monitoring and public disclosure of emission levels of substances to air and water from ICMM member companies consistent with the Global Reporting Initiative guidelines
	6. Develop guidance on socio-economic assessment in risk management decision making for metals		17. Promote dissemination of existing guidance and address gaps relating to the safe handling of metals throughout the supply chain and specific metal containing products during recovery and recycling	23. Develop and publish a database of regulatory occupational exposure limits for substances linked to the production of minerals and metals

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Bruce McKean of Sustainability Matters is thanked for his work in compiling this review. Bruce McKean has extensive operational and communications experience in sustainability and stewardship issues associated with the life cycle of minerals and metals and the products derived from them. He has worked in government, industry and not-for-profit organisations and has lived and/or worked in more than 30 countries. (www.sustainabilitymatters.info)

Members of the ICMM Chemicals Management Working Group are thanked for their input and review to the report as well as their on-going efforts in implementation of the MMM2020 action plan. Particular thanks to Dr William Adams (Rio Tinto), Dr Katrien Delbeke (European Copper Institute) and Dr Violaine Verougstraete for the supply of case studies.

The ICMM team included John Atherton, Ben Davies and Devika Tampi.

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Chamber of Mines of the Philippines
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International Lead Association
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International Wrought Copper Council
International Zinc Association
ITRI
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The International Council on Mining and Metals is an organisation of leading mining and metals companies that collaborate to promote responsible mining, with a shared commitment to respect people and the environment.

ICMM is governed by the CEOs of the following companies:

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AngloGold Ashanti
Anglo American
Antofagasta Minerals
Areva
Barrick
BHP Billiton
Codelco
Freeport-McMoRan
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