



# **IMOA Annual Review 2012/2013**



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# IMOA Annual Review

## Overview from the Secretary-General

Welcome to IMOA's Annual Review in the year of the 25<sup>th</sup> Annual General Meeting of the International Molybdenum Association. This report highlights the progress we have made against our strategic priorities and how we have worked in support of our members and the industry over the past year.

### Health, Safety and Environment

IMOA's Molybdenum Consortium (MoCon) continues work in a number of areas since the successful registration of chemically-produced molybdenum disulfide for REACH in July 2012. This marked the completion of MoCon's intense program to develop and submit risk assessment dossiers

on 12 molybdenum substances to the European Chemicals Agency (ECHA), initiated in 2006.

MoCon's Technical Working Group (TWG) continues to meet twice a year to update the technical dossiers and the Secretariat has supported members with technical assistance to ensure successful co-registrations under REACH. MoCon contributes to better hazard identification and classification through a range of activities using the portfolio of 12 substances, encouraging accurate and harmonized profiles based on sound reference data. MoCon is also pursuing a program to publish its research in peer-reviewed scientific journals.



Tim Outteridge  
Secretary-General



In addition to REACH-related activity, IMOA's HSE Committee continues with a wide range of activities to support the safe production and use of molybdenum around the world. This includes a program of research, dialogue with regulators to support appropriate legislation, and communication activities to encourage the use of recent scientific developments to enhance risk assessment accuracy.

## Market Development

IMOA's Market Development team works to raise the profile of molybdenum across a range of applications. A key event this year was the 2<sup>nd</sup> International Symposium on Mo and Nb Alloying in High Performance Steels. High-strength steel for truck frames and multi-phase steels for the automotive industry have also been areas of focus.

In stainless steel, the team has worked with industry to develop a design guide in association with the American Institute of Steel Construction, removing a significant barrier to the use of stainless steels in heavy structures. The use of molybdenum-containing stainless steel has been promoted via a number of other activities including conferences, seminars and a workshop program which has attracted over 900 delegates in the past year.

As China has looked increasingly to its domestic economy for growth, we have appointed a locally based consultant to help us become more active in this dynamic and developing marketplace. We continue to sponsor research to evaluate the beneficial effects of molybdenum in grades and applications where it has more potential or is presently not used. Recently concluded projects successfully demonstrated molybdenum's role in steels for pipelines and gears, and in protecting against atmospheric corrosion. Another project verified the effects of molybdenum in ultra high-strength hot-rolled steels.

Active research projects include the development of abrasion resistant molybdenum-bearing steels in applications for mining, high-strength steel in long span structures, the weldability of extra-low carbon line pipe steel, stainless steel in biogas tanks and rebar and the corrosion resistance synergies of molybdenum and nitrogen.

## Communications

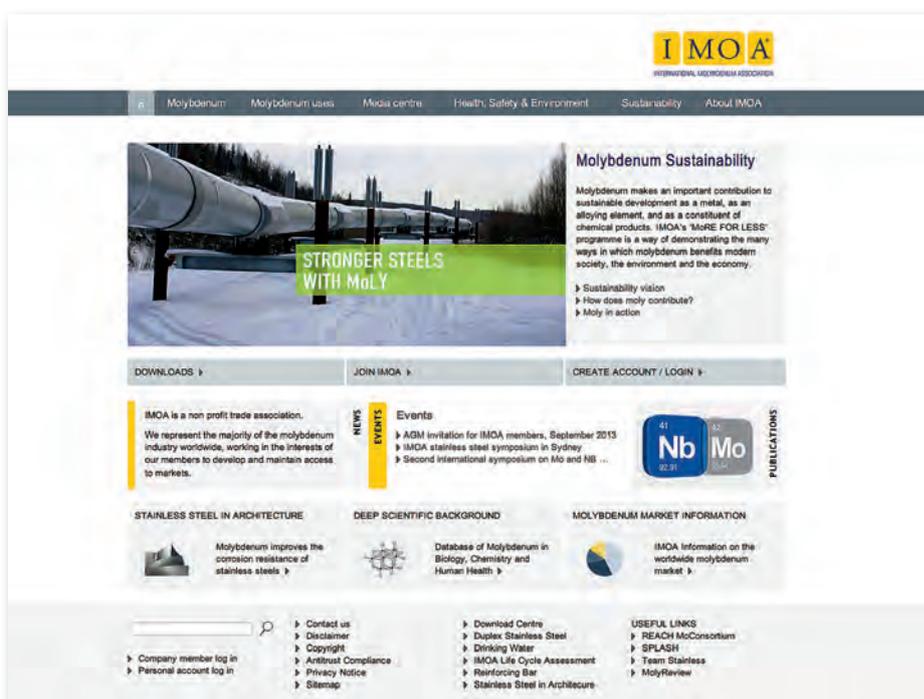
IMOA's website has undergone extensive review during the year. The site, last overhauled several years ago, has since amassed a large amount of additional content. An online survey of users, undertaken as part of the review, generated a very encouraging response, with the vast majority recording that they understood IMOA's role well and that overall the utility and content of the site met expectations. Therefore, with the benefit of this insight, we have refreshed the website with a modern design which improves the ease of navigation and access to content while leaving the

richness of the underlying information largely unchanged.

We continued with a proactive media plan which generated 13 news releases over the year, many linked to industry-specific themes and key market development events designed to further raise the profile of molybdenum and its applications. We extended the reach of MolyReview into our target media audiences and a contact program designed to build stronger one-to-one relationships with the top twenty industry media publications is underway.

Further coverage of specific ABC projects featuring molybdenum was successfully achieved in a number of target publications in the U.S., Europe, China and India, reaching more than 120,000 decision makers, through the work of the market development team.

The review of IMOA's communications collateral recommended a more consistent visual style which is now





being applied to all new publications. A revised and updated member prospectus has been produced, highlighting the work of IMOA in support of its membership, and is due to be published in September 2013.

Additional activity centred around commemorating the 25<sup>th</sup> Annual General Meeting to take place in Salt Lake City, Utah, in September.

## Sustainability

Sustainability considerations form an increasingly important part of every organisation's overall communications. The unique properties of molybdenum are integral to many sustainable applications. We continued to develop the 'MoRE FOR LESS' section of the website, highlighting how a small amount of molybdenum in a product or application can make a significant contribution to sustainable development.

The first three in a series of case studies illustrating the depth and breadth of molybdenum's contribution to sustainable development were published during the year. Two studies examine the role of molybdenum in sustainable buildings and the third evaluates molybdenum's contribution to solar energy through its application in thin-film photovoltaic panels.

'sustainability' presentations have been given at conferences and symposia, further raising awareness of molybdenum's sustainability credentials.

## Statistics

IMO A publishes annual and quarterly statistics of global molybdenum

## Molybdenum's unique properties are harnessed in products and applications which contribute to sustainable development, saving energy and resources ...

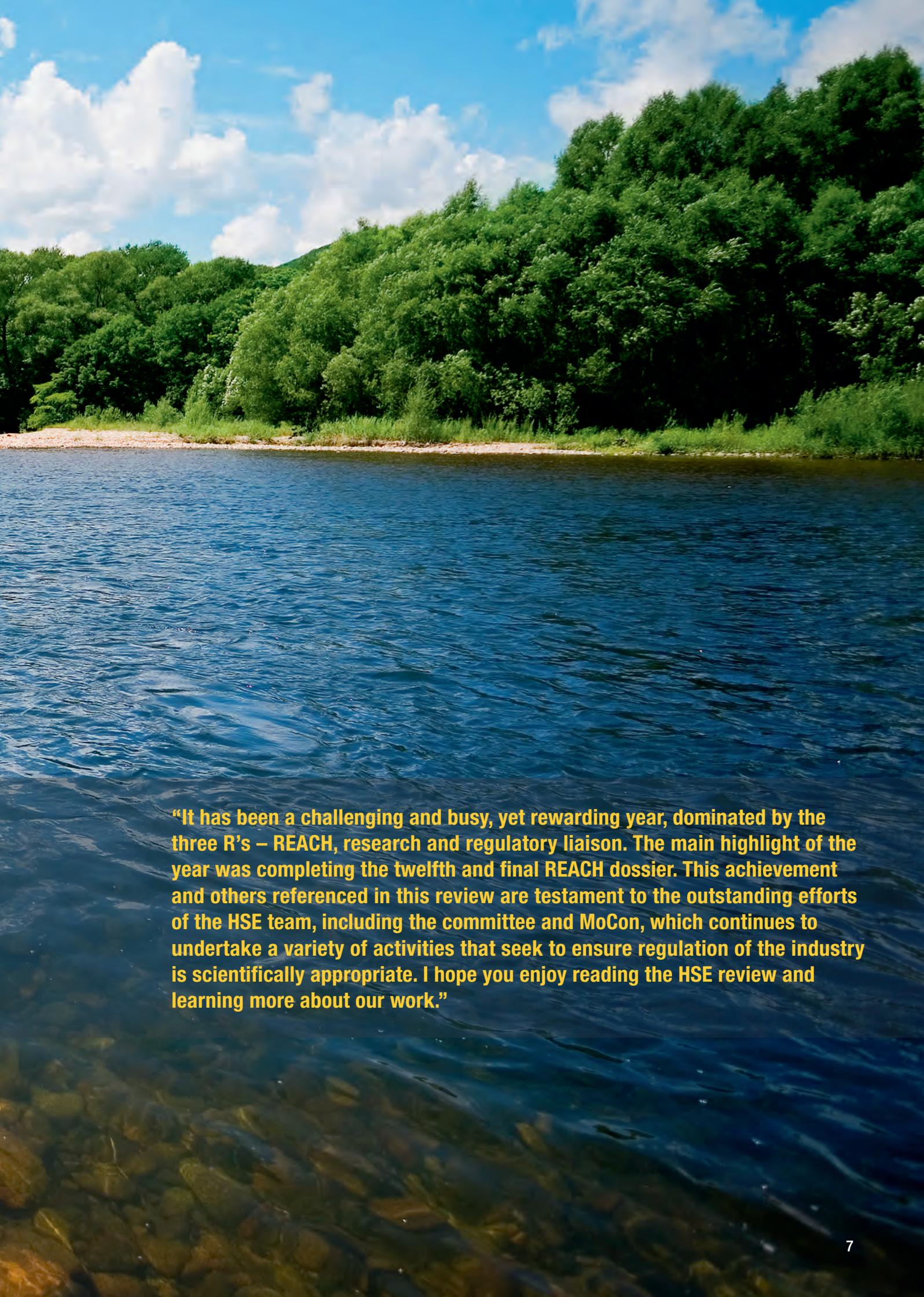
The Sustainable Development Working Group meets twice yearly to direct and consider sustainability initiatives. During the year, the SDWG invited and considered a range of proposals to develop in-depth, sector-specific metrics relating to molybdenum's contribution to sustainable development for use in future communications. A number of

production and use, including year-on-year comparisons which are released to the media. These serve to reinforce IMO A's reputation as the single most accurate source of information on molybdenum. A more detailed report of historical molybdenum market data is available to members through a portal on the IMO A website.

# Health, Safety and Environment



Sandra Carey  
IMOA HSE Executive



**“It has been a challenging and busy, yet rewarding year, dominated by the three R’s – REACH, research and regulatory liaison. The main highlight of the year was completing the twelfth and final REACH dossier. This achievement and others referenced in this review are testament to the outstanding efforts of the HSE team, including the committee and MoCon, which continues to undertake a variety of activities that seek to ensure regulation of the industry is scientifically appropriate. I hope you enjoy reading the HSE review and learning more about our work.”**

# Health, Safety and Environment

## Key activities and achievements in 2012/2013

### REACH Molybdenum Consortium

July 2012 marked the successful REACH registration of chemically-produced molybdenum disulfide (CAS No. 12612-50-9/EC 235-721-1) and the completion of the daunting task, initiated in 2006 by our REACH Molybdenum Consortium (MoCon), to develop and submit risk assessment dossiers on 12 molybdenum substances to the European Chemicals

manufacturers and importers to register their chemical substances (including metals) with ECHA. (More background information is available in IMO's Annual Reviews 2010–2011 & 2011–2012, and at [www.molybdenumconsortium.org](http://www.molybdenumconsortium.org)).

Statistics released by ECHA following the 31 May 2013 deadline for substance registrations in the 100 – 1000 tonnes tonnage band show total substance registrations at just under nine thousand so far. The top ten most frequently co-registered substances include iron, aluminium and aluminium oxide and leading countries in terms of co-registrant volumes are Germany, the United Kingdom, the Netherlands, France and Belgium. We continue with the task of supporting MoCon members

with technical assistance to ensure success in submitting their REACH co-registrations, whether directly or via Only Representatives (in the case of non-EU manufacturers), and to service Letter of Access applications from non-members. Business was brisk in the run up to the May 2013 deadline!

#### Technical activities

The work of the MoCon Technical Working Group (TWG) continues with twice-yearly meetings to meet the needs of ECHA which requires the technical dossiers to be 'living documents', for periodic update when significant new data becomes available. TWG has embarked upon its first update of dossiers, where the key enhancements are as shown below.



Agency (ECHA). The dossiers are the technical cornerstone of industry compliance with the EU REACH Regulation No. 1907/2006 that seeks to achieve safer handling and use of chemicals by industry, professionals and consumers. It also requires EU

Update	Data available in
End-of-life waste data	CSR Section 2.2, no entry in IUCLID
Oral sub-chronic repeated dose toxicity	CSR Section 5.6.1, and IUCLID 7.5.1
Prenatal developmental toxicity	CSR Section 5.9.2, and IUCLID 7.8.2
Recalculation of oral DNEL for general public	CSR Section 5.11 and DNEL report annexed to CSR
Aquatic bio-accumulation study	CSR Section 7.1.2, and IUCLID 5.3.1
Revised soil PNECs and regional assessment	CSR Section 7.2, and IUCLID 6.3
CSR: REACH Chemical Safety Report DNEL: Derived No Effect Level	IUCLID: International Uniform Chemical Information Database PNEC: Predicted No Effect Concentration

Technical Tool	Users
<p><b>EU PNEC soil calculator:</b> Uses REACH data to predict safe concentrations of molybdenum in soils with differing physico-chemical characteristics. Download free at: <a href="http://www.arche-consulting.be/metal-csa-toolbox/soil-pnec-calculator/">http://www.arche-consulting.be/metal-csa-toolbox/soil-pnec-calculator/</a></p>	<p>Molybdenum processing plants, downstream users of molybdenum (such as steelworks), and national/local environmental authorities.</p>
<p><b>Scaling Tool:</b> Checks compliance with Exposure Scenarios for hazardous substances. Download free at: <a href="http://www.arche-consulting.be/metal-csa-toolbox/du-scaling-tool/">http://www.arche-consulting.be/metal-csa-toolbox/du-scaling-tool/</a></p>	<p>EU downstream users of metals/compounds generate to-scale data that demonstrates compliance for their specific plant with REACH eSDS risk management measures.</p>
<p><b>Multi-metal Database:</b> Summarizes endpoint data, hazard conclusions and methodological calculations.</p>	<p>Eurometaux REACH Forum Consortia members that contributed data, for use as a multi-metal screening tool for the classification of UVCBs and mixtures.</p>

eSDS = Extended Safety Data Sheet    UVCB = Unknown or Variable Composition, Complex Reaction Products or Biological Material

The TWG activity also seeks to add value to the REACH dataset that MoCon created by incorporating aspects of it into REACH-related technical tools that have been specifically designed and developed by REACH metals consortia initiatives. Examples are shown above.

### Hazard classification

Hazard identification and classification is a key component of REACH. Ongoing MoCon activity in this area includes:

- The EU Hazard Classification Inventory Discussion Forum, instigated by ECHA at the request of industry, where we participate in dialogue between companies reporting different substance hazard profiles to the REACH MoCon Substance Information Exchange Forum (SIEF)-agreed entries for the 12 substances in the MoCon portfolio.
- Ad-hoc discussions with companies whose eSDS contain different hazard profiles to those of MoCon, to identify the reference data giving rise to the hazard conclusion. In the event the data is not scientifically reliable or relevant, we invite them to align their hazard profile with the MoCon REACH SIEF-agreed profile.

The aim of these activities is continuous improvement by encouraging harmonized and accurate hazard profile messaging in the eSDS of different players in the supply chain, through the progressive ‘weeding out’ of scientifically unsound data.

Another important initiative is the MeClas (Metals Classification) tool. It incorporates REACH-registered hazard profile data to enable users to generate hazard classifications for mixtures and

UVCB substances. The Excel-based tool includes a facility for refining hazard classification calculations in the case where mineralogical composition is known and bio-availability data is incorporated. The tool is freely available from [http://www.arche-consulting.be/metal-csa-toolbox/metals-classification-tool-\(meclas\)/](http://www.arche-consulting.be/metal-csa-toolbox/metals-classification-tool-(meclas)/) to encourage its wider use for Globally Harmonized System (GHS) classification purposes in the mining and metals industries.

The screenshot shows the ARCHE website with the following elements:

- Logo:** ARCHE ASSESSING RISKS OF CHEMICALS
- Navigation:** HOME → NEWS → THE ARCHE TEAM → SERVICES → METAL CSA TOOLBOX → ORGANICS TOOLBOX → CONTACT
- Hero Image:** A landscape with a natural rock archway under a blue sky.
- Text:** PROVIDING HIGH QUALITY SERVICES IN THE FIELD OF RISK ASSESSMENT
- Section 1: DU SCALING TOOL**
  - Under REACH, the Downstream User (DU) is obliged to check compliance with the Exposure Scenario (ES) forwarded by the Registrant. The information on Operational Conditions (OCs) and Risk Management Measures (RMMs) given in the ES should be compared with the actual OCs and RMMs of the DU. OCs/RMMs may not always be completely identical with the OCs/RMMs specified in the ES, and may actually deviate from them. When one or more of the actual OC and RMM differ from those of the ES, it is not immediately apparent whether the use is still in compliance with the ES. In all cases, the DU should still be able to ascertain that he is in compliance with the ES.
- Section 2: RELEVANT DOCUMENT**
  - Excel 2007 MetalUsesCalculator V1.15
- Section 3: Keep track of our LATEST NEWS**
  - ARCHE LAUNCHES ITS RESCUE PROGRAM
  - ARCHE developed a one-to-one assistance program to help downstream users demonstrate compliance with



## Publications and workshops

We pursue a program to publish our research in peer-reviewed technical journals so that the data can be considered by the regulatory community, who are generally unable to use unpublished studies for legislative purposes. Within the last twelve months, three papers about MoCon research into the fresh water and marine environments and their contingent PNEC derivations, as well as a fish bio-accumulation study, have been published in 'Science of the Total Environment'. This brings the current total number of MoCon research related published papers to eleven.

In February 2013, at the invitation of ECHA, scientific presentations were given on the read across approach for developing multiple dossiers for molybdenum substances at two workshops in Helsinki by Dr Philip Mitchell and Sandra Carey of IMO's HSE Secretariat and Dr Sylvia Jacobi, a MoCon member company representative.



## REACH evaluation

ECHA continues to expand its list of substances for evaluation by EU member state authorities. Evaluation is an in-depth assessment of the contents and quality of a REACH technical dossier. The first CoRAP (Community Rolling Action Plan) list contained 90 substances and the second list, published in March 2013 has increased that number to 116. The fact that none of the MoCon substances are on the CoRAP lists is a pleasing note on which to conclude this section.

## IMO A HSE Committee

Research, regulatory activity and communications are the three interrelated areas in which IMO's HSE Committee is actively engaged.

## Research and testing

We continue to enhance our knowledge and understanding about the toxicology and toxicokinetics of molybdenum through focused research programs. This is to both to ensure the appropriate protection of human health and to provide the regulatory community with scientifically robust data on which to base legislative developments. Recent and ongoing research projects include:

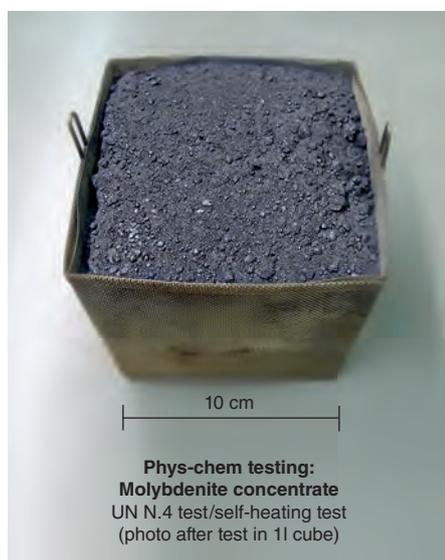
## Aquatic data generation

Data generation for two aquatic species (one fresh water and one marine), will significantly add value to our existing aquatic effects database by rendering it fully proficient for the derivation of Final Chronic Values according to U.S. risk assessment methodology. This differs slightly from the EU methodology for which the database was originally generated. The marine test is ongoing in the USA, and the fresh water species test is foreseen for the coming months.



### Self-heating test for molybdenite concentrates

To comply with data provision for this GHS hazard evaluation endpoint, we commissioned the UN N4 test on a worst-case (high oil content) sample of concentrates. Test results determined that hazard classification for this endpoint is not required.



### RCS

Respiratory crystalline silica (RCS) has become a hot topic as the EU discusses whether to regulate it via the Carcinogens at Work Directive or the Chemical Agents Directive. It was hazard-classified during the REACH process as a Specific Target Organ Toxicant, Repeated Exposure (STOT RE2) for RCS content of 1 to 10%. The current threshold trigger value below which no RCS classification is legally required is 1% in the EU. Crystalline silica is classified as a human carcinogen in the U.S. A reliable method for quantifying the percentage content of RCS in substances and mixtures is needed, so we are working to develop an appropriate methodology for determining RCS in molybdenite ores, concentrates and roasted molybdenite concentrate.

### Regulatory activity

An important part of the HSE Committee's responsibility is to engage regulators in technical dialogue where developing legislation could impose an unjustified burden upon members. Over the past year, we have actively engaged with regulatory authorities around the world:

#### The Netherlands

The Dutch Expert Committee on Occupational Safety (DECOS) is considering available data to determine whether to move ahead with its proposal to firstly classify sodium molybdate (and all molybdates) as a reproductive toxicant, and secondly to introduce an Occupational Exposure Limit for molybdenum trioxide and for sodium molybdate. IMOIA submitted recent data that does not support such a classification. Likewise, we contended that any OEL setting should take particle size correction into consideration.

#### Germany

The authorities continue their deliberations about whether to introduce a maximum permissible limit value for molybdenum in groundwater of 25 µg Mo/l, and have extended the scope of the proposal to also include soils and secondary materials. We have made a technical submission

prompted us to work together with Eurometaux to seek, in particular, for the definition of the tonnage threshold trigger for a UVCB substance to be the tonnage of the classified constituent within the UVCB substance, and not the total tonnage of the UVCB substance itself. This would ensure proportionate application of the Seveso rules and would not disproportionately penalize plants using and generating materials containing minor quantities of hazard classified constituents. The EU Commission did not adopt the proposed definition. It also introduced certain chronic endpoints into the scope of environment hazards.

#### USA

The State of Pennsylvania proposed setting an environmental quality standard for molybdenum in surface waters at 25 µg Mo/l. IMOIA responded with a technical submission during the public consultation period detailing its scientific rationale for not supporting such a standard. In June 2013, the final rule-making package excluded regulation of molybdenum.

#### OECD Cooperative Chemical Assessment Programme (CoCAM)

In April 2013, IMOIA's Executive Committee endorsed the HSE Committee proposal

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**An important part of the HSE work is to engage regulators in technical dialogue where developing legislation could impose an unjustified burden upon members.**

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arguing against such a low limit value, and continue to input new scientific data into the debate as it arises.

#### European Union

Revision III of the Seveso Directive, relating to the prevention of major chemicals accidents involving dangerous substances was reviewed in 2012. This

to submit the IMOIA molybdenum (molybdate) effects dataset to CoCAM for quality evaluation. A successful outcome would mean the dataset would be awarded Mutual Acceptance of Data (MAD) status, which is an endorsement for its use in the 34 OECD member countries. This will be a key project for IMOIA's HSE Committee during 2013–2014.



## Dissemination and education

We take part in initiatives to communicate and encourage the use of recent scientific developments and methodologies that enhance risk assessment accuracy. The U.S. Soils Workshop in September 2012, co-sponsored by IMOA, was one such opportunity to encourage the regulatory community to take bioavailability considerations into greater account when conducting screening level risk assessment for soil remediation purposes. The two-day workshop included a presentation about soil risk assessment for molybdenum and used the molybdenum dataset in a pilot soils risk assessment calculator tool which is currently under development (with enhanced functionality

compared to the existing EU Soils PNEC calculator).

We also respond to data call-ins from national risk assessment programs such as the Australian National Industrial Chemicals Notification and Assessment Scheme (NICNACS) initiative. In 2012, we took part in a poster presentation event by the Society of Environmental Toxicology and Chemistry on hazard evaluation of molybdenite concentrates using bioavailability data generated by the Transformation Dissolution Protocol. Bioavailability data is important because it determines what fraction of a substance is available for uptake by humans and/or the environment. Bound fractions are unavailable to potentially cause toxicity.

We continue to inform our members about regulatory developments in the Americas and also in Asia through quarterly regulatory reviews. In addition, we continue to issue periodic 'Moly News – HSE Alerts' on topics of broad interest to the IMOA membership. January 2013 saw the inclusion of an HSE Committee article for the first time in IMOA's MolyReview.

All our HSE activities are managed and driven forward by the corporate representative members of the IMOA HSE Committee, the HSE Executive staff member and its consultants, to whom we express our sincere gratitude for their dedication and professionalism.

# Market Development



Dr. Nicole Kinsman  
IMOA Technical Director



**“It has been a year of real progress in market development, bringing some long-term plans to fruition and completing a number of important projects. Particular highlights include the completion of the AISC stainless steel design guide and the appointment of a consultant in China. These and the other activities detailed in this review highlight our work in promoting the benefits of using molybdenum. I hope you enjoy reading about our year in market development in more detail and I look forward to hearing your thoughts.”**

# Market Development

## Key activities and achievements in 2012/2013

### Alloy steels

IMOA continues to engage heavily with the carbon steel industry, with 34 visits, events and follow-up meetings conducted over the last year at conferences, workshops and directly with steel mills and foundries.

High-strength steel for truck frames continues to evolve as an important market, particularly in eastern Asia. Two Chinese mills have adopted 600 MPa (0.1% molybdenum) and 700 MPa (0.2% molybdenum) strength steel and IMOA is working with an Indian multinational on a 960 MPa grade. We are developing a similar product portfolio with two Korean manufacturers with target strengths

ranging from 550 to 980 MPa. Other variants are in the pipeline, all with the addition of 0.2–0.3% molybdenum.

Molybdenum containing multi-phase steels for automotive applications are also in development, with trials at German and Chinese manufacturers focusing on dual phase (DP) DP780 and 980 grades as well as complex phase 800 MPa steels. Trials are underway using molybdenum in press hardening steel which is rapidly gaining market share and is predicted to make up to 40% of the car bodies of the future. Early results suggest that molybdenum enhances resistance against fracture, meaning higher energy absorption in a collision.



A paper with the title ‘Reverse metallurgical engineering towards sustainable manufacturing using Nb and Mo alloyed high performance steels’ detailing how molybdenum contributes to sustainable solutions in vehicle manufacturing, was published in the ‘Journal of Advances in Manufacturing’.

### **2<sup>nd</sup> International Symposium on Mo and Nb Alloying in High Performance Steel**

*Organized by IMOA and Companhia Brasileira de Metalurgia e Mineração (CBMM) and hosted by the Korean Institute of Metals and Materials (KIM), Posco and Hyundai Steel, the event was held at Jeju Island, South Korea in May 2013. The symposium featured 23 of the world’s leading alloy steel authorities as speakers. A number of papers detailed the metallurgical effects of both alloying elements in a wide range of steels covering automotive, structural, pipeline, machinery and mining applications. The audience comprised 90 delegates from 16 countries representing 60 companies and research institutes. The results of several IMOA projects were presented and generated great interest in further investigating the potential of molybdenum as an alloying element.*

### **Architecture, Building & Construction (ABC)**

IMOA uses various market development strategies to boost awareness in the ABC sector. In the last year, more than 900 delegates attended workshops in the U.S. and South Africa. In the U.S., in-house workshops and project meetings, jointly sponsored by IMOA and the Nickel Institute, targeted influential architecture firms, engineering companies, transit and port authorities, public works departments and education authorities.



Workshops were held with a total of 28 firms and 634 delegates. An additional 280 attended events in South Africa, organized by the Southern African Stainless Steel Development Association (SASSDA) and co-sponsored by IMOA.

Articles jointly written by IMOA and the Nickel Institute on sunscreens were published in 'The Construction Specifier' (U.S.) and 'Architect+Design' (China) and an article on San Diego's new harbor bridge appeared in MolyReview in July 2012. Existing IMOA-sponsored articles were revised for the Nickel Institute to create a special issue of 'Architecture+Design' (India).

These articles reached a total of 122,500 decision makers. IMOA also gave a keynote presentation on 'Molybdenum-Containing Stainless Steel for Sustainable Architectural Design' at BAC 2013 in Shanghai.

### **AISC Design Guide for Stainless Steel**

*In our work in North America, we found that the lack of a design standard for heavier stainless steel structural sections was a significant barrier to use in applications such as canopies, structural beams and pedestrian bridges. A structural engineer had to design stainless steel components without any official guidance and request a Code exception for every project using larger sections. The use of stainless steel was therefore very limited and faced great obstacles.*

*To solve this problem, IMOA initiated an industry-wide effort to create a design guide, bringing together stainless steel producers and industry associations. Five years later, the American Institute of Steel Construction (AISC) 'Design Guide 27: Structural Stainless Steel' is complete and due to be published on September 1, 2013. The guide, drafted with the help of the Steel Construction Institute in the UK, is already generating significant interest in the use of structural sections in new designs. Two U.S. state transportation departments are now considering stainless steel vehicular bridges. After the successful introduction of the guide, our next target is to see it converted into an AISC specification.*

An article on the FDR Four Freedoms Memorial in New York City was run in the July 2013 issue of MolyReview and one on advances in stainless steel weather screens has been submitted for the 'Council on Tall Buildings and Urban Habitat Journal' (International).

We also cooperate with and provide support for stainless steel development associations, fabricators, surface finish suppliers and others involved in market development.

## Activity in China

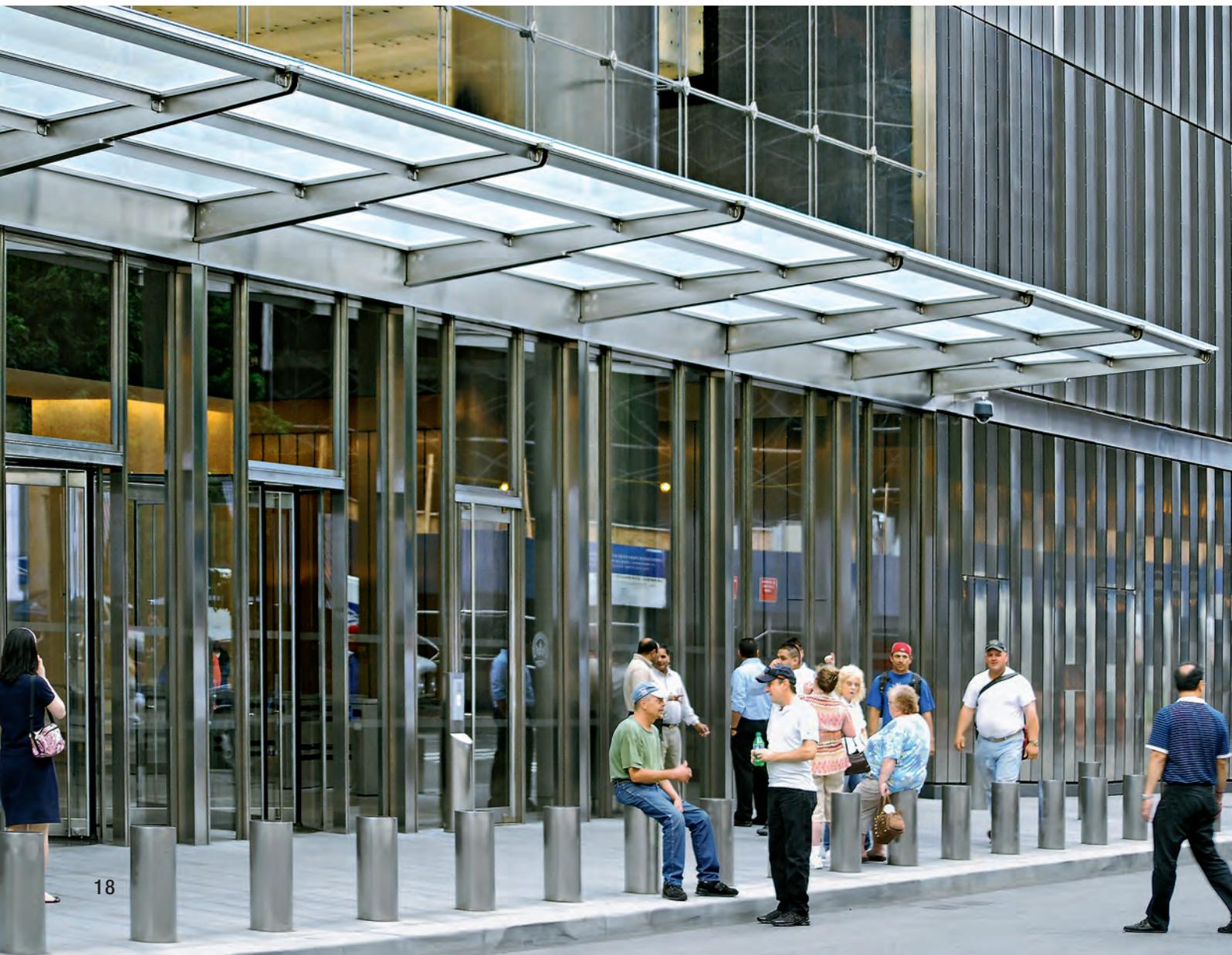
The Chinese economy is moving from the export of manufactured goods to more internal consumption. In order to be closer to this transition and to secure efficient follow-up of the emerging opportunities, IMOA appointed a new consultant in China in Autumn 2012, based in Shanghai.

### Promotion of stainless steel in ABC

The speed and scale of China's urban development is unprecedented, with

more than half of China's total population living in cities and plans to move a further 250 million rural residents to cities by 2025. China's ABC sector is therefore worthy of specific attention.

Stainless steel façades and roofing applications are still relatively rare in China, so we are planning a series of workshops to familiarize architects with their advantages. We will also work with fabricators and installers to help develop this market.



### Solar water heaters

Solar water heaters are at the forefront of a renewable energy drive in China, with 16 million units sold in 2012, using some 200,000 tons of stainless steel. However, unlike similar units in Japan, Korea and Brazil, the typical Chinese water heater uses stainless steel without any molybdenum. We are conducting a survey of solar water heater producers to better understand their requirements and will also participate in a workshop to promote molybdenum-containing stainless steels held at the annual conference of the China Household Appliances Association.



### Other efforts

IMOA provided support at seminars on ferritic stainless steels in Taiwan and at the China Stainless Steel Council (CSSC) Duplex Conference in Beijing in 2012, and at the CSSC Annual General

We co-organized a symposium at the NACE Corrosion 2013 conference in Orlando, USA in March 2013, with 19 papers on recent experiences with

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**We appointed a Shanghai-based consultant to promote stainless steels and provide technical support to Chinese fabricators, architects and engineers.**

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Meeting in Jiayuguan, Gansu Province in June 2013. Supporting such events promotes stainless steel use and strengthens our relationships with the organizing associations, key to effective market development with limited resources.

### Duplex stainless steel

The duplex brochure is now available in English, Chinese, German, Japanese, French, Italian and Spanish. Downloads increased from nearly 40,000 last year to over 55,000. More than 110,000 copies have been downloaded from our website since the beginning of the second edition at the end of 2009.

corrosion-resistant materials and continued to chair the NACE TEG 114X technical exchange group on duplex and ferritic stainless steels at the conference. These activities raise greater awareness of the benefits of working with stainless steels and encourage greater specification in the future.

### Research

We sponsor research to discover and develop new or expanded uses and applications for molybdenum.

### Completed projects

Three alloy steel research projects have now concluded and their results are

being published. A project with Salzgitter-Mannesmann proved that the addition of 0.1% molybdenum to standard X80 pipe plate yielded better toughness and strength so that it is suitable for arctic applications.

A second project with the German Federal Institute for Materials Research and Testing (BAM) indicated that an alloy containing 0.8% molybdenum could substitute existing materials in bearings and gears. It offered identical load carrying capacity and slip-rolling resistance with lower friction, which could improve fuel efficiency in vehicles. A third project with the China Iron & Steel Research Institute (CISRI) demonstrated the specific metallurgical effects of molybdenum on the precipitation of titanium in low carbon steels, important for the development of ultra high-strength hot-rolled steels.

IMOA's joint research program with CISRI on the effect of molybdenum on ferritic stainless steel in outdoor architectural applications was also completed at the end of 2012. It showed that even with higher chromium content, a minimum of 1.6% molybdenum is necessary for sufficient atmospheric corrosion resistance, which will be helpful for the promotion of moly-containing ferritic stainless steels for architectural applications.





### New and ongoing projects

A project on the improvement of gear steels with FZG and Buderus is still active. Results so far indicate that increasing molybdenum content in the alloy improves fatigue resistance without an increase in cost. We are working with INCUBA SA and the Universities of Chile and Sao Paolo on the development of better grinding balls and SAG mill liners using molybdenum steel. With SCI and others



### Atmospheric corrosion testing in Kuwait

Selecting the correct grade of stainless steel in the Middle East can be particularly challenging due to the humidity, high temperature and proximity to the Persian Gulf. Together with the Kuwait Institute of Scientific Research (KISR), we have therefore embarked upon a program of atmospheric corrosion testing.

Team Stainless has published a new sustainability brochure and developed an accompanying animation, which can be seen on its website at [www.teamstainless.org](http://www.teamstainless.org). We have also completely revised and updated the molybdenum metal brochure.

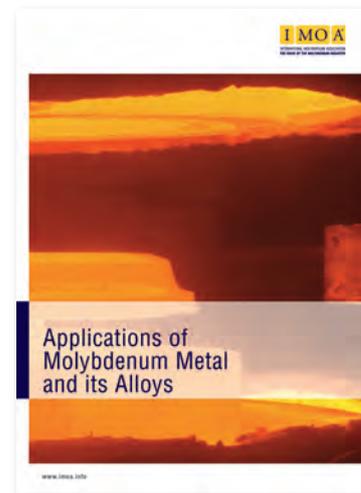
we are working on the Hilong project, looking at ways to optimize the use of high-strength steel in long span structures. We are also working with SCI and other partners to develop guidance on the design and fabrication of stainless steel biogas and other tanks. Both projects are part-EU funded.

With Voestalpine, we are studying the effect of molybdenum on the toughness and hardness of welded extra low carbon line pipe steel. A further project based on a PhD thesis with Ugitech and the French Institute of Science and Technology for Transport, Development and Network (IFSTTAR) is examining the corrosion of stainless steel rebar in concrete. Finally, in cooperation with Ugitech and the University of Grenoble, we are working on enhancing our understanding of the corrosion resistance synergies between molybdenum and nitrogen in stainless steels.

KISR installed some 270 samples of different grades and finishes at five sites in Kuwait in March 2013. Half will be inspected after one year, the other half after two years. Photographs will document how the different grades and surface finishes fare at these locations, with the higher molybdenum grades expected to perform better. The images will then help architects to select the appropriate stainless steel and surface finish.

### Other efforts and feedback

In November 2012, we co-sponsored the Stainless Steel Experts Seminar in Ascot, with other members of Team Stainless. The seminar encourages structural stainless steel researchers to exchange results, thereby avoiding duplication and improving global knowledge and cooperation. Many results will feed into specifications and design standards for structural engineers.



We work entirely in the interests of our members and it was very heartening when an engineer took the time last year to praise the IMO A team, describing the quality and organization of our technical literature as 'outstanding'. While it's always nice to receive praise, we want to hear all your feedback and suggestions for how we can continue to improve our service to you.

# Financial Report 2012

## Income and expenditure account

For the year ended 31 December 2012

### IMOA/Molybdenum Consortium

	2012 \$	2011 \$
<b>Turnover</b>	3,146,394	2,824,462
Operating and administrative expenses	3,022,961	3,008,738
<b>Operating surplus/(deficit)</b>	123,433	(184,276)
Other interest receivable and similar income	8,728	9,709
<b>Surplus/(deficit) on ordinary activities before taxation</b>	132,161	(174,567)
Tax on surplus/(deficit) on ordinary activities	1,309	1,456
<b>Surplus/(deficit) on ordinary activities after taxation</b>	130,852	(176,023)

## Balance sheet

For the year ended 31 December 2012

### IMO A/Molybdenum Consortium

	2012		2011
	\$	\$	\$
<b>Fixed assets</b>			
Tangible assets		22,370	29,849
<b>Current assets</b>			
Debtors	80,084		93,055
Cash at bank and in hand	5,277,955		5,221,144
	5,358,039		5,314,199
<b>Creditors – amounts falling due within one year</b>	(887,961)		(982,452)
<b>Net current assets</b>		4,470,078	4,331,747
<b>Total assets less current liabilities</b>		4,492,448	4,361,596
<b>Reserves</b>			
Profit and loss account		4,492,448	4,361,596
<b>Accumulated funds</b>		4,492,448	4,361,596

### Financial Commentary

The 2012 audited accounts presented here are consolidated figures for IMO A and the Molybdenum Consortium and are subject to approval at the 2013 AGM. Income from subscriptions and levies amounted to US\$3,146,394. After expenses of US\$3,022,961, a sum of US\$123,433 was carried forward bringing the combined accumulated funds to US\$4,492,448. Of this US\$3,132,879 is attributable to IMO A and US\$1,359,569 to the Consortium.

In the case of IMO A, the year-end balance was consistent with the Executive Committee's policy of maintaining a buffer approximately equal to one year's expenditure. This mitigates the effect of fluctuating income and ensures that the obligations of the Association can be met. The Molybdenum Consortium reserves will contribute to the funding of the Consortium until 2018.



INTERNATIONAL MOLYBDENUM ASSOCIATION  
THE VOICE OF THE MOLYBDENUM INDUSTRY



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