The background of the entire page is a photograph of an industrial facility at night. Several large, cylindrical storage tanks are illuminated from within, creating a warm orange glow. A tall, dark vertical structure stands in the foreground. In the lower part of the image, there are pipes, railings, and some trees, all under a dark blue night sky.

IMOA Annual Review 2013/2014



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IMOA Annual Review

Overview from the Secretary-General

Welcome to IMOA's Annual Review for 2013–2014. This has been a busy year during which we have put together our new strategic plan. Members were polled on a range of issues prior to a two-day workshop in London where the Executive Committee discussed priorities for the Association over the next five years. A summary of the plan is available in the members' section of the website and as a printed copy.

Health, Safety and Environment

The award of Mutual Acceptance of Data (MAD) status for IMOA's molybdenum toxicological effects dataset is an outstanding achievement. Awarded by the OECD's Cooperative Chemicals Assessment Programme, the dataset is now the key reference point for the development or review of any environmental or human health legislation concerning molybdenum in some 40 countries around the world. IMOA is the first metal commodity association to secure MAD status for its REACH submitted dataset.



Tim Outteridge
Secretary-General

The Health and Safety Committee remains active in a wide range of other product stewardship and responsible care activities to support the continued use of molybdenum. The completion of an early life-stages fish study has successfully closed a U.S. data gap in IMO's marine dataset, enhancing the use of the latter for risk assessment and environmental quality standard-setting purposes. IMO research continues to be published in peer-reviewed journals. It also forms the basis for dialogue – this year with authorities in the Netherlands, Germany, Slovenia and the U.S. – in support of appropriate regulation for molybdenum. Life cycle data has also been a key focus, as we participated in a multi-metal project to harmonize Life Cycle Assessment methodologies and to develop consistent life cycle messaging within the industry.

IMO's Molybdenum Consortium (MoCon) is scaling down its activities but continues work in a number of REACH-related areas. Twelve Lead Registrant technical dossiers have been updated and the Secretariat continues to help members with registration, compliance checks, and ensuring that identified uses of substances are accurately recorded.

Market Development

In Market Development, we engage in projects and activities with the objective of raising the profile of molybdenum across a range of applications. In carbon steel, an ongoing program of engagement generated over 30 visits, events and follow-up meetings with steel producers. Trials with multiphase and press-hardening steels continued at a number of European and Asian steel mills, resulting in the adoption of some new production methods based on molybdenum alloying.

An industry-wide effort initiated by IMO culminated in the publication of a



design guide for structural stainless steel by the American Institute of Steel Construction (AISC). This much needed guidance will encourage the selection and greater use of stainless steel in structural applications. We have been actively involved with the dissemination of the design guide since publication, sponsoring workshops, presentations and webinars.

Alongside these activities, we continued our program of engagement in the Architecture, Building and Construction (ABC) sector, delivering workshops and webinars, and providing technical support to some of the world's most influential architectural design and engineering firms, mass transit authorities and other large project decision makers.

China is an important focus for market development. Three presentations on molybdenum applications were given at national conferences along with sector-specific seminars and workshops. IMO, in partnership with other metal associations, founded the China Stainless Cooperation and Promotion Group and is leading the Group's first project to

popularize stainless steel as the 'greenest' metal for architectural applications.

IMO has continued research efforts to discover and develop new or expanded uses and applications for molybdenum. A project to improve gear steels concluded earlier this year and successfully demonstrated that increasing molybdenum content to 0.55% greatly enhanced fatigue resistance, without increasing cost.

Several long-term projects are ongoing. The initial findings of a project examining stainless steel rebar corrosion in concrete confirm that molybdenum has a protective effect at higher temperatures and chloride concentrations. A second project is investigating the corrosion resistance synergies between molybdenum and nitrogen in stainless steels, so far demonstrating positive results.

A further project is studying the effect of molybdenum on the toughness and hardness of welded, extra-low carbon steel for pipelines. Early results suggest that molybdenum is not detrimental to weldability, as is often claimed.

Two other projects are aiming to optimize the design of long span structures with high-strength steel and the design of biogas tanks with stainless steel. Results will be available at the end of the three-year projects.

Finally, the stainless steel atmospheric corrosion testing project that we embarked on with the Kuwait Institute of Scientific Research (KISR) in early 2013 is progressing. The first set of samples has been retrieved and is being analyzed. We expect intermediate results later this year.

Communications

The unique properties of molybdenum were publicized in a number of target publications, including a paper on stainless steel façades, published in the premier global publication for the designers of tall buildings. Our ongoing media activity and engagement program generated 14 news releases over the year, raising the profile of molybdenum and reinforcing IMO A's reputation as the voice of the industry. In addition, a contact program designed to build stronger relationships with targeted publications has successfully placed articles focusing on the sustainability benefits of molybdenum.

The duplex stainless steel brochure is now available in Portuguese in addition to the existing seven languages and continues to be one of our most popular brochures, with nearly 160,000 copies downloaded since the second edition. Downloads of the molybdenum metal brochure have tripled since a completely revised and updated edition was published in September 2013.

Sustainability

IMO A's sustainability program continues to promote molybdenum's contribution to sustainable development and is now

embedded in our overall communications strategy. Four new case studies were published over the last year, highlighting molybdenum's contribution to sustainable development in subject areas ranging from fossil fuel power stations and automotive engineering design to desalination plants and micronutrients in agriculture. A total of seven case studies are now available to download from the sustainability section of the website. We have further studies in development and have completed, in association with PE International, a Life Cycle Assessment evaluating the environmental benefits of lightweighting automotive components with molybdenum-alloyed high-strength steel. The study is available on the IMO A website. A presentation entitled 'Sustainable Industries and Molybdenum



Applications' was given at the 29th International Ferro-alloys Conference in Barcelona in November 2013, the latest in a series of opportunities to highlight molybdenum's contribution to sustainable development.

Statistics

IMO A publishes annual and quarterly statistics of global molybdenum production and use, which are released to members and the media and serve to reinforce IMO A's reputation as the most reliable source of information about molybdenum.

Membership

We are a non-profit trade association, working to maintain and increase access to markets for our members. Over the period of this report, we have developed a new five-year strategic plan which aims to guide our Executive Committee, Secretariat and membership as we build on our strengths as a global community. In the next five-year period from 2014 to 2018, the Association will prioritize activities based on feedback from our members, gathered as part of the strategic planning process earlier this year.

We look forward to working with new and existing members, many of whom serve on our various committees and give their time selflessly, as we work to implement the actions from our new strategic plan.

Health, Safety and Environment (HSE)



Sandra Carey
IMOA HSE Executive



“We have achieved a number of significant goals over the year. The award of Mutual Acceptance of Data (MAD) status for our molybdate effects dataset means that it will play a key role in the regulation of molybdenum in over 40 countries. IMO’s marine dataset is now fully compliant with U.S. environmental quality standard-setting criteria, thanks to the completion of a key study in the U.S. and the first updates of technical dossiers required under REACH have been completed by IMO’s Molybdenum Consortium (MoCon).”

Health, Safety and Environment

Key activities and achievements in 2013/2014

IMOA HSE Committee

Research data

The most outstanding achievement by the HSE Committee over the last year has been to secure OECD Mutual Acceptance of Data (MAD) status for IMOA's molybdate effects data. This substantially enhances the global relevance of our molybdate hazard dataset, originally generated for compliance with EU REACH.

component – are as yet unevaluated by the EU regulatory authorities. The core of the OECD dataset is generated from studies using sodium molybdate dihydrate. We used this as the test substance for all our REACH research and as the basis for read-across to other molybdate compounds. Being the most readily soluble molybdenum compound (and therefore the 'worst-case' test scenario), it provides the most precautionary results, preferred by regulatory authorities.

A key benefit to industry is that MAD status means that the molybdate dataset is now the key reference point for any legislation involving molybdenum relating to environmental impact or human health in each of the 34 OECD industrialized member countries. Comprehensive hazard data enables accurate substance/mixture risk assessment by industry and national regulatory bodies. Other countries such as Brazil and India, although outside the OECD, adhere to CoCAM MAD status



MAD status is a data quality endorsement, awarded by the OECD's Cooperative Chemicals Assessment Programme (CoCAM). Scientific representatives from OECD member countries worked together to assess the technical robustness of the data and conclusions. IMOA's dataset was reviewed by scientists from Australia, Canada, Japan, the Netherlands, the U.S., the UK and the CoCAM Secretariat.

The CoCAM process is effectively an independent scientific audit and its successful completion is particularly valuable as our EU REACH technical dossiers – where the dataset is the central



IMOA's HSE representatives after the Washington OECD meeting.
From left: Rodger Battersby, Sandra Carey, Kevin Klipsch and Dagobert Heijerick

outcomes, bringing the international reach of this process to some 40 countries around the world. Furthermore, other countries automatically accept OECD MAD datasets into their chemicals management legislation – for example Korea, which is currently developing KOREA REACH/K-REACH.

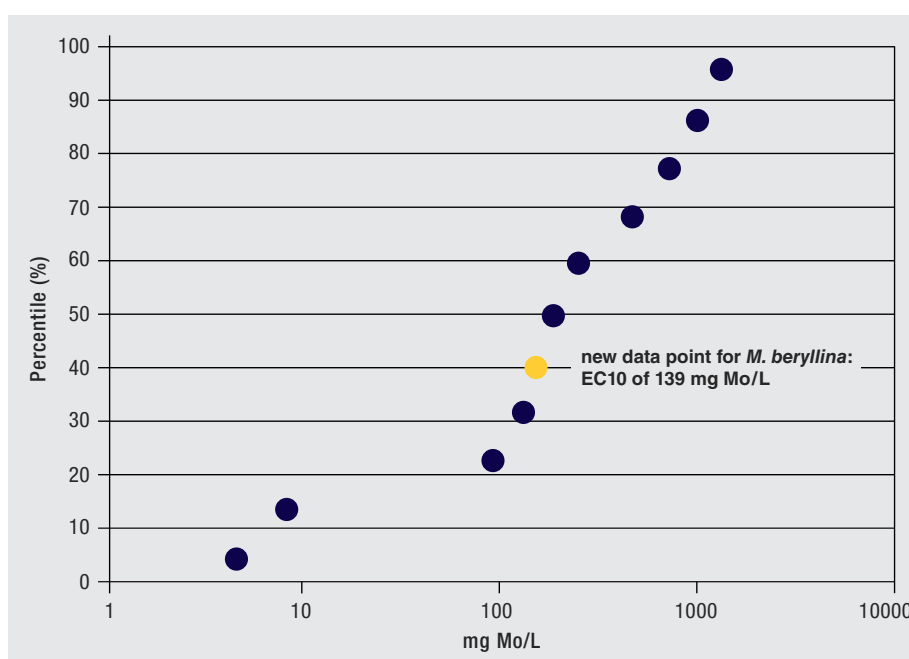
Further applications for this data include regulatory compliance, environmental quality standards, and mine development impact assessments. IMO A has also shared its CoCAM journey and lessons learned with other metals associations, which are now following the same path for their substances.

The dataset is published under the auspices of the United Nations and is publicly available on the OECD website at <http://bit.ly/1pvtHpb>. The OECD download, a SIDS Initial Assessment Profile, is a 15-page overview document containing the key data and hazard conclusions in the molybdate effects dataset.

Aquatic data

We have also completed an early-life stages study on the marine fish *menidia beryllina*, closing a data gap and adding further value to the existing IMO A marine dataset. The completion of this study means that it can now be used in the U.S. for deriving Final Chronic Values (FCVs) – safe concentrations for molybdate in the marine environment, similar to Predicted No Effect Concentration (PNEC) levels in the EU.

The graph above shows the study result situated mid-way between other marine toxicity datapoints, enabling a U.S. FCV of 1.29 mg Mo/L to be derived. Likewise, it lifted the EU PNEC marine value from 1.91 mg Mo/L to 2.28 mg Mo/L, reflecting the relatively low toxicity of molybdate to the marine environment.



Species Sensitivity Distribution (SSD) data

Life cycle inventory data

IMO A participated in a shared project with several other metal trade associations (aluminium, cobalt, copper, manganese, nickel, lead, zinc and steel) to harmonize Life Cycle Assessment (LCA) methodologies. The goal was to give guidance on how to align LCA methodologies and to facilitate a more consistent approach to life cycle inventory and assessment methodologies across the industry.

The project facilitates comparison across different studies and helps to establish credibility for LCA databases across the industry, encouraging consistent messaging. The guidance document and its accompanying Q&A are intended to act as a 'common voice' for the metals and minerals industry on LCA methodologies when engaging with various stakeholders including regulators, life cycle database

providers, LCA practitioners, and industry groups related to the metals and minerals sector. The top four issues included in the guidance document are system boundaries; dealing with co-products; end-of-life recycling; and Life Cycle Impact Assessment (LCIA) category choices.

IMO A was an early adopter of LCA disciplines, generating its first metallurgical LCI back in 1998, in response to a data request from the EU stainless steel industry. More information about IMO A's three LCIs over the past 15 years (two for metallurgical products and one for a host of molybdenum chemicals) are available from the LCI section of our website – recently enhanced with a new page about the methodologies guidance and Q&A documents.

It is important for IMOA to remain active in this area because LCA data is an increasing imperative for government and industry sustainability initiatives. For example, the European Commission released the Product Environmental Footprint (PEF) guide in April 2013, along with the Organisational Environmental Footprint (OEF) guide, under the 'Single Market for Green Products Initiative'. The objective is to support a single metric for a single market, thus enhancing transparency and fair competition. The ultimate aim is to provide incentives to report and reduce environmental impacts.

Environmental footprinting is gaining in public profile and becoming a more mainstream activity for products (PEFs) and organizations (OEFs), along with green building codes, Environmental Production Declarations (EPDs), Eco-labels and Health Product Declarations (HPDs) to name but a few. Inaccurate, absent or proxy data for molybdenum can translate into negative perceptions about molybdenum's sustainability credentials. IMOA keeps working to ensure accurate information is available

under the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). The aim is to assess whether specific characteristics of concentrates could be a predictor of corrosion potential, and then share that information with the membership.

Regulatory activity

The HSE Committee maintains a technical dialogue with the global regulatory community, sharing robust data and supporting appropriate legislation and regulation. We have engaged with regulators in the Netherlands, Germany, Slovenia and the U.S. (EPA Office of Water, Colorado, Wisconsin and Texas) on molybdenum-specific issues in the last year.

A current hot topic is the proposed 0.03% EU Specific Concentration Limit for reproductive toxicity for lead metal and the Commission's intention to seek an EU-wide harmonized classification. Such a limit may have repercussions for some molybdenite and roasted molybdenite concentrates. IMOA is

discuss regulatory-driven HSE issues and data gaps relating to molybdenum that are likely to require focused research in the next few years. Six issues were identified and submitted for consideration by the Executive Committee.

Publications and workshops

We continue to pursue our policy of publishing research in peer-reviewed technical journals to maximize dissemination and the application of data and its conclusions by regulatory authorities. The current list of published research is now available on the IMOA website at <http://www.imoa.info/HSE/IMOAHSE-research-publication.php>. We continue to issue 'Moly News – HSE Alerts' on topics of broad interest to the membership, and to disseminate the Americas and Asia Reviews to our members, informing them about HSE regulatory developments on those continents.

This year, IMOA is a co-sponsor of a second workshop on soil criteria as a follow-up to an initial event in September 2012. A primary aim of this workshop, to be held in Chicago with regulatory participation, is to encourage the move from ecological soil screening values to the development of soil clean-up criteria for metals that include enhanced consideration of bioavailability. In 2012, a case study used molybdenum data in a soil calculator under development by industry to underline the importance of bioavailability. The calculator demonstrated the large effect that bioavailability corrections have on final values, and the much smaller effect choice has on protection level. Building further on this initiative, IMOA is now participating in a multi-metal project that seeks to assess and validate whether existing EU soils toxicity data is sufficiently representative of North American and Canadian soils, or whether there are data gaps to address.

Publishing research in peer-reviewed journals maximizes dissemination and encourages application of the data and its conclusions by regulatory authorities.

for these data-hungry and perception-critical sustainability initiatives – ultimately helping to maintain access to markets.

Data for GHS endpoints

IMOA commissioned the UN N4 self-heating substance test for molybdenite concentrates in 2013. The results confirm that hazard classification for this endpoint is not required. IMOA is currently testing a range of concentrates for corrosivity to metals, another endpoint

therefore actively supporting Eurometaux in its outreach activities to highlight the disproportionately negative downstream consequences for industry.

Focusing on future scientific research

In anticipation of the next five-year IMOA Strategic Plan (2014–2018), members of the HSE Committee and invited scientific experts met in London in December 2013 for an HSE research brainstorming meeting. The aim was to identify and



Participation in other metals associations and industry groups

Trade Association/Grouping	IMOA represented in
ETAP (Environmental Toxicology Advisory Panel)	Sponsor Group and panel technical discussions
Eurometaux (European Association of Metals)	Environment, Health and Safety Group Risk Assessment and Classification Group (RAC) HSE Sustainable Operations Group (SOG) Product Policy Group (PPG) REACH Forum Exposure Scenario Task Force
ICMM (International Council on Mining and Metals)	Associations Coordination Group Chemicals Management Task Force Product Stewardship Group and roundtables
NAMC (North American Metals Council)	Steering Committee Technical Issues Group

Where pertinent, IMOA chooses to participate in multi-metal projects such as the LCI and soil projects as the most cost-effective and knowledge-enriching way to achieve project goals. To maximize benefit for IMOA's members, we share knowledge and collaborate closely with our colleagues in other metal trade associations via our active participation in technical committees such as Eurometaux, ICMM, NAMC and ETAP, as shown in the table above.

REACH Molybdenum Consortium (MoCon)

In 2010, MoCon completed its initial mission to develop and submit technical dossiers on hazard identification and risk assessment for 12 molybdenum substances. The European Chemicals Agency (ECHA) requires the technical dossiers to be 'living documents', meaning that periodic updates are required when significant new science becomes available. This has indeed been the case for molybdenum, with two significant studies published in peer-reviewed technical journals: a 90-day repeated dose

toxicity study and a prenatal developmental toxicity study.

During the second half of 2013, the MoCon Technical Working Group (TWG) forged ahead with updating all 12 Lead

Registrant (LR) technical dossiers. All but one of these First Updates was submitted to ECHA by early 2014. The remaining dossier, for calcium molybdate, will be submitted shortly.

MoCon REACH Substance Portfolio

Substance	Lead Registrant	EINECS No.
Roasted Molybdenite Concentrate (tech oxide)	Sadaci NV	289-178-0
Molybdenum Trioxide (pure)	Climax Molybdenum BV	215-204-7
Molybdenum Metal	Plansee Metall GmbH	231-107-2
Sodium Molybdate	Climax Molybdenum BV	231-551-7
Ammonium Dimolybdate	Climax Molybdenum BV	248-517-2
Ammonium Heptamolybdate	Climax Molybdenum BV	234-722-4 & 234-320-9
Ammonium Octamolybdate	Climax Molybdenum BV	235-650-6
Ferromolybdenum Slags	Sadaci NV	282-217-2
Molybdenum Dioxide	Chemiemetall AG	242-637-9
Calcium Molybdate	5NPlus Belgium	232-192-9
Iron Molybdate	Clariant Prodotti Italia srl	237-389-3
Chemically-produced Molybdenum Disulfide	Grace GmbH	235-721-1

All the Lead Registrants in this table were nominated and elected by each respective Substance Information Exchange Forum (SIEF). Ferromolybdenum is covered under REACH by separate registrations for Mo and Fe.

The ECHA registration deadline in the 100–1000 tonnes band was 31 May 2013. The MoCon Secretariat helped a number of MoCon members and ‘Letter of Access’ purchasers to successfully submit their co-registrant dossiers for MoCon substances. It was a very busy period with some submitting registrations on the very last day.

Compliance check

Although the REACH evaluation process is the primary mechanism for assessing dossier contents, ECHA is increasingly using IT tools to conduct compliance checks. This means all LRs and co-registrants need to constantly check for any compliance communications in their REACH-IT inbox. Substance identity data is a key area of interest and a compliance check for Ferromolybdenum Slags was received by Sadaci NV as Lead Registrant in November 2013. There is a 30-day window in which to dialogue with ECHA if necessary, and to fulfill the data request to their satisfaction. Sadaci and the MoCon Secretariat duly complied with the deadline for the submission of further information about substance identity and the manufacturing process.

An important lesson learned was that the compliance check is not only on the Lead Registrant, but also on co-registrants. This can vastly extend the task if it is a substance with numerous co-registrants, but thankfully this was not the case for Ferromolybdenum Slags.

REACH evaluation

We remain vigilant in checking the annual ECHA CoRAP (Community Rolling Action Plan) list featuring all substances selected for evaluation by EU member state authorities. Happily, no MoCon substances have appeared on the list, now in its third year and with a total of 201 entries.

Review of Identified Uses

In preparation for its Second Update of the technical dossiers, MoCon's TWG is currently concluding a consultation exercise to ensure that all Substance Information Exchange Fora members have the opportunity to check that their identified uses of substances are accurately recorded with the correct use descriptor codes. This due diligence exercise became necessary when

MoCon is aiming to ramp down its activities and conserve funds through the remaining period until after the last co-registrations for less than 100 tonne substances in May 2018. However, the Technical Working Group remains on task each year to fulfill ECHA requirements and the Steering Committee continues its overall supervisory role of ensuring the financial, technical and administrative health of the IMO A REACH Molybdenum Consortium.



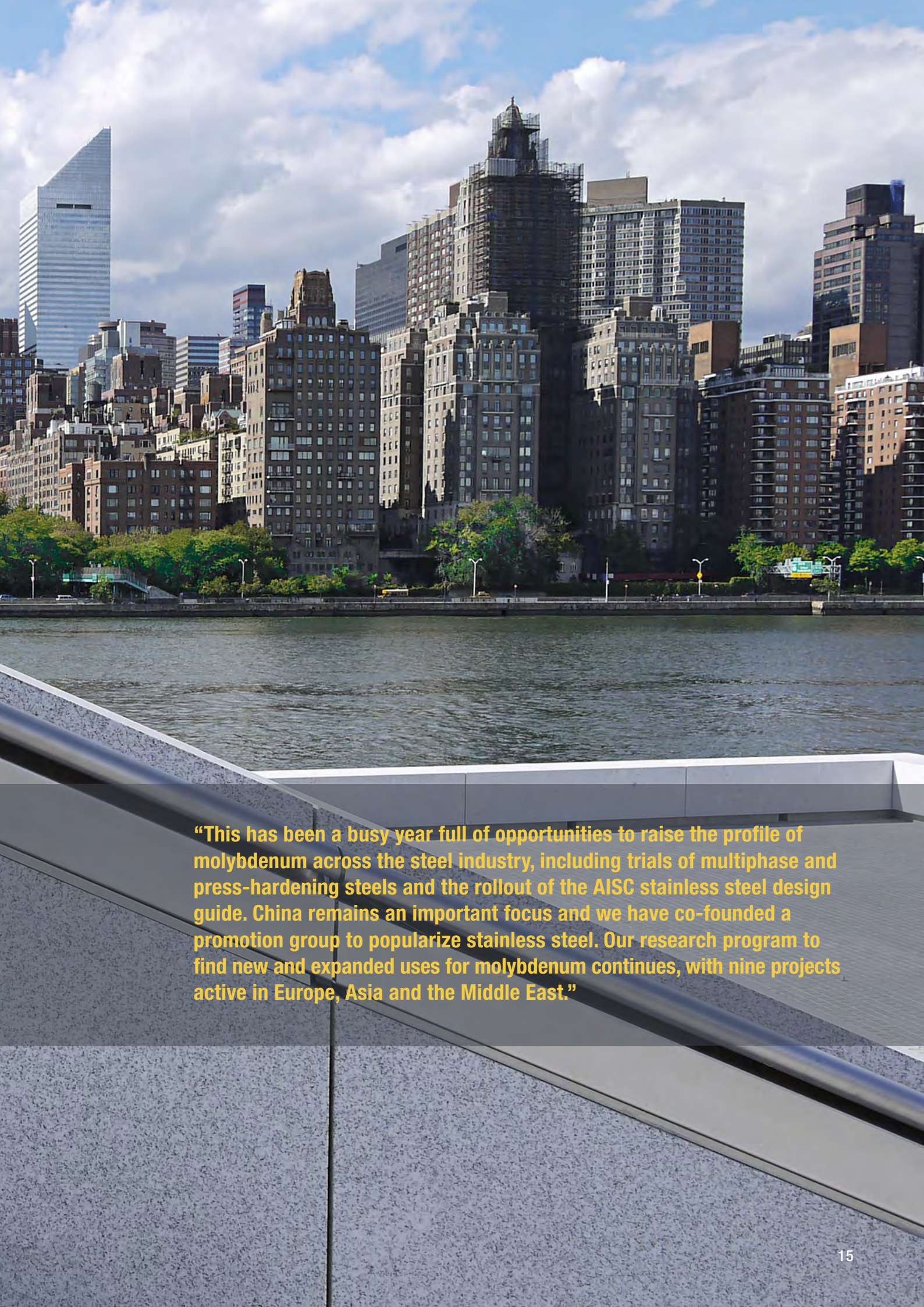
ECHA expanded the data requirements after the original 2010 LR dossier. Submissions now need to reference manufacture and formulation as well as industrial, professional and consumer uses. As a result, data additions have been made to eight of the 12 MoCon substances.

All IMO A HSE and MoCon technical activities are managed and driven forward by the corporate members of the respective HSE Committee and MoCon Technical Working Group, the HSE Executive staff member and our consultants. We express our sincere gratitude to all of them for their dedication and professionalism.

Market Development



Dr. Nicole Kinsman
IMOA Technical Director



“This has been a busy year full of opportunities to raise the profile of molybdenum across the steel industry, including trials of multiphase and press-hardening steels and the rollout of the AISC stainless steel design guide. China remains an important focus and we have co-founded a promotion group to popularize stainless steel. Our research program to find new and expanded uses for molybdenum continues, with nine projects active in Europe, Asia and the Middle East.”

Market Development

Key activities and achievements in 2013/2014

Carbon steels

We continued our program of engagement with the carbon steel industry. IMOA's consultant in this area supported steel mills and foundries with expert metallurgical advice on molybdenum-containing alloy steel with over 30 visits, events and follow-up meetings conducted during the year.

As well as direct support, we have helped to increase the overall awareness of the value of molybdenum alloying by contributing to published papers and academic texts. We wrote a paper in cooperation with National Taiwan University and China Steel Corporation, which examines the effects of adding molybdenum to high-strength hot-rolled steels. The result, 'Secondary hardened bainite', has been accepted for publication in 'Materials Science and Technology', and details the microstructure effects of adding 0.1–0.3% molybdenum.

At the invitation of the editors, we also contributed two chapters to 'Green and Sustainable Manufacturing of Advanced Materials', a book being published this fall. The chapters demonstrate how a small amount of molybdenum can make a big difference to the sustainability of power generation and transport.

The proceedings of the IMOA-sponsored high performance steel symposium held in Taiwan in 2011 have been published.

'Fundamentals and Applications of Mo and Nb Alloying in High Performance Steels – Volume 1' has been printed and distributed to interested companies and metallurgical experts, and is available from IMOA as hard copy and PDF.



Trials with multiphase steels continued at a number of European and Asian steel mills. Other ongoing trials have shown that a new, molybdenum-containing alloy concept for dual phase DP800 steel can solve the cracking problems that occurred during forming of the original grade. They are expected to result in the further deployment of molybdenum alloying where it was not previously used.

We continue to support projects and research on press-hardening steel (PHS) with strengths between 1500 and 2000 MPa. This material represents an important growth market as it is expected to comprise up to 30% of the structural weight of a car body in future. Two different projects have assessed 1900 MPa PHS grade steel in laboratory trials and both found that 0.15 wt% molybdenum alloying had the positive effect of obstructing intergranular cracking along grain boundaries, often observed in such high-strength steels. This potentially opens up further opportunities for commercial applications.

The same effect is relevant to direct quench (DQ) steels that are being optimized in an IMOA-sponsored project with a European steelmaker. Other alloying elements which improve hardenability appear to promote intergranular cracking, so molybdenum may become the first choice for use in these steels.

Another IMOA-sponsored project to develop better carburizing steels for gears, conducted with the German Institute for Machine Elements (FZG) in Munich and Buderus concluded earlier this year. One of the investigated alloys (20MnCr5 mod. with 0.55% molybdenum) clearly outperformed all common gear steels, in two DIN standard benchmark tests, without adding to the cost. It is likely that

gears of this new material could support either higher torque, or for equivalent loads, could be built smaller and lighter.

The conclusions of an earlier research project on high-strength line pipe steel, in association with Salzgitter Mannesmann Forschung, have been independently confirmed by a large Chinese steelmaker who has developed a plate alloy design for heavy gauge X80 grade steel. All specified properties of X80 were safely met with this alloy design for plates up to 34 mm gauge. The general conclusion is that the addition of 0.1% molybdenum allows more flexible processing and stabilizes mechanical properties.

We are already planning for the 'International symposium of Nb and Mo alloyed iron and steel materials for the mining and minerals processing industry', to be held in May 2015 in Sao Paulo, Brazil. In view of the event, several research activities, most of them in China, have been initiated to investigate the effect of molybdenum in plate, sheet and cast materials for use in the mining industry.

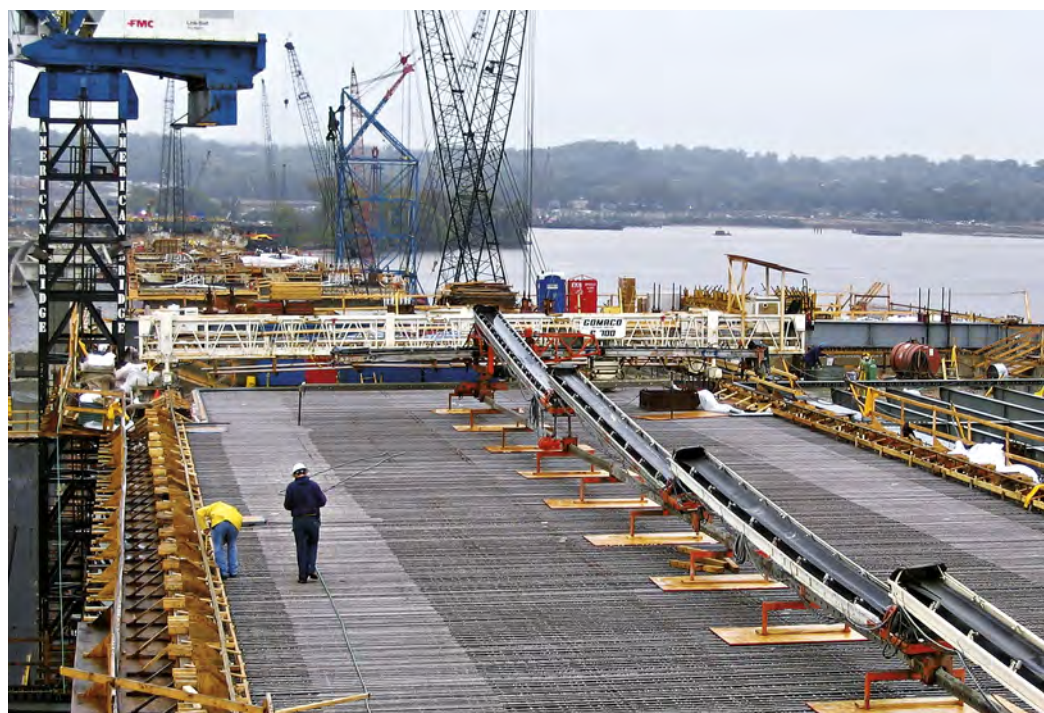
Architecture, Building and Construction (ABC)

Stainless steel: Structural

AISC Design Guide 27

The American Institute of Steel Construction (AISC) Steel Design Guide 27 – Structural Stainless Steel (DG 27) was published in September 2013. An industry-wide effort taking several years, production of the guide was initiated by IMOA and involved several stainless steel producers and industry associations who jointly funded it. AISC members can download a free PDF of the guide.

DG 27 was authored by the UK-based Steel Construction Institute (SCI) and provides much needed design guidance for structural sections over 3 mm in



thickness. As an AISC publication, its guidance should be accepted by building code officials, facilitating selection of stainless steels for structural applications. The funding organizations are hopeful that it will be the precursor to a final specification recognized by the International Building Code (IBC).

Since its release, IMOA has helped to disseminate the guide by co-sponsoring a one-day roll-out workshop in New York, a two-part AISC live webinar which drew over 1,000 participants, and a presentation and booth at AISC's Annual Convention in Toronto earlier in 2014. A presentation was given at the NACE Conference in San Antonio, U.S. and in-house workshops were run at six structural engineering firms.

Eurocode 3: Part 1.4

Eurocode 3: Part 1.4 is the European design standard for structural stainless steel. Since the standard was published

in 2006, a huge amount of research into the structural performance of stainless steel has been carried out. With funding from Euro Inox, IMOA and the Nickel Institute (NI), significant amendments to the code were written to better reflect current usage and enable more economic design. Unlike other parts of the Eurocode, which will not be updated for several years, these amendments will be published in early 2015.

Reinforcing bar

The United States Federal Highway Administration (FHWA) sponsors one-day workshops on corrosion resistant materials at the transportation departments of different U.S. states. IMOA's 30-minute rebar presentation was revised this year and presented to about 250 decision makers in five states at the U.S. FHWA's request. Molybdenum-containing Type 316LN and duplex stainless steels 2304 and 2205 make up a significant share of this market.



Stainless steel: Architecture and building

We ran four workshops for architects and fabricators and held meetings in association with the NI in September 2013, attracting 155 participants.

Architect workshops were given in Beijing, Shenyang, Shenzhen and Shanghai.

A separate meeting with a prominent Beijing architect explored possible stainless steel industry involvement in China's 'Three Star' green building rating system.

Knowledgeable stainless steel fabricators are important for market expansion.

A workshop was held with the prominent curtain wall contractor Shenyang Yuanda Company. Technical meetings were also held with key design groups at the roofing company Beijing Kaiser.

In-house workshops, webinars and project meetings were held with 32 firms and organizations in New York, Chicago and San Francisco – attracting some 540 attendees. Over the last year, we have also provided technical support for a range of high profile projects in planning around the globe. Most of these activities were jointly funded with the NI.

While individual interaction is critical, effective marketing requires dissemination of information on stainless steel design and sustainability to large numbers of decision makers. In September 2013, our paper on stainless steel secondary façades was published in the 'Council on Tall Buildings and Urban Habitat (CTBUH) Journal', the premier global publication for designers of tall buildings. We also provided significant editorial support to a Principal at Goettsch Partners' Chicago office in the development of a paper which will be given at the CTBUH annual conference in Shanghai in September 2014. Goettsch ranks among the largest global architecture firms designing tall buildings and 80% of their work is in Asia and the Middle East. The paper stresses

the need for corrosion resistant materials in severe environments, encourages use of molybdenum-containing stainless steels and primarily references IMO A and NI publications.

Our consultant also gave a joint presentation with Goettsch at the American Institute of Architects (AIA) annual convention in Chicago in June 2014. Both this presentation and the CTBUH annual conference paper cover all common architectural metals but conclude that high-alloyed stainless steels are the most cost-effective, long-term choice for locations with salt and pollution exposure.

Stainless steel: Decision maker education

We have developed an international database of ABC contacts and use it to disseminate monthly, topic-specific bulletins, providing answers to common stainless steel questions. The bulletin reaches a growing number of global decision makers and raises our profile in the technical community. We have added a sign-up button to the ABC pages of the IMO A website to enable new readers to easily subscribe.

A number of sector-specific seminars and workshops were also run in conjunction with the NI. In addition to the in-house workshops on ABC already mentioned, pharmaceutical industry seminars were held in Tianjin, Shangyu and Shanghai – attracting 380 participants from 50 key companies.

CSSC, NI, the International Chromium Development Association (ICDA), IMO A and CITIC Metal Co. Ltd jointly established the China Stainless Cooperative Promotion Group (CSCPG) to encourage the appropriate use of stainless steel in China. An industry round table meeting on green building and stainless steel solutions will be held in September 2014 and a dedicated symposium is planned for 2015. IMO A will also deliver a presentation on behalf of CSCPG at the Yangzi Valley Green Building Conference in Wuhan in October 2014.

In the area of curtain walls and façades (building envelopes), we are supporting a number of ongoing projects including the Ping An Finance Center and the Museum of Contemporary Art

IMO A is a co-founder of the China Stainless Cooperative Promotion Group (CSCPG), which encourages the greater use of stainless steel in China

Market development in China

China continues to be an important focus for market development, with a Shanghai-based consultant representing IMO A since 2012. Presentations were given at five events including the 'China Iron and Steel Association (CISA) International Stainless Congress' in September 2013 and the 'China Stainless Steel Council (CSSC) Annual Conference' in June 2013 and May 2014.

and Planning Exhibition (MOCAPE) in Shenzhen, Guangdong. Using these projects as models, we aim to encourage greater use of stainless steel façades.

We are also engaging with China's national preeminent iron and steel research institute, CISRI, to develop a performance atlas for stainless steel. This will be published in Chinese and will give tangible data to architects on the performance of existing stainless steel



installations in a variety of climates and environments within eight Chinese cities. The project is due to begin in September 2014.

Duplex stainless steel

The duplex stainless steel brochure continues to be the most popular document on the IMOA website, with some 40,000 copies downloaded over the year. In early 2014, we added a Portuguese version to the seven other languages available: English, Chinese, German, Japanese, French, Italian and Spanish. As well as English, the Japanese version is currently the most popular followed by the French version. Nearly 160,000 copies have been downloaded from our website since the second edition was published.

IMOA chaired the 'Recent experiences with austenitic and duplex stainless steels' symposium at the NACE Corrosion 2014 conference in San Antonio, USA in March 2014. A total of 18 papers were presented during this day-long event which proved highly popular amongst the 150 delegates. IMOA also continued to chair the well-attended meeting of the NACE 114X technical exchange group on duplex and ferritic stainless steels.

Research and Development

We sponsor research to discover and develop new or expanded uses and applications for molybdenum. The following long-term projects are active:

The corrosion of stainless steel rebar in concrete is being studied by Ugitech and the French Institute of Science and Technology for Transport, Development and Network (IFSTTAR) in Paris. Preliminary experiments in mortar show evidence that molybdenum has a protective effect at higher temperatures and chloride concentrations. IFSTTAR has started aging real concrete slabs contaminated with 8% chloride in climatic chambers. The eventual goal is to determine the critical chloride content for corrosion at 25° and 40°C for stainless steels and carbon steel.

A project with Ugitech and the University of Grenoble is designed to enhance our understanding of the corrosion resistance synergies between molybdenum and nitrogen in austenitic stainless steels. So far we have confirmed and quantified

a significant increase in the protective effects of molybdenum and nitrogen when added together compared to their individual effects when added alone over a wide range of pH.

We are also studying the effect of molybdenum and other alloying elements on welded extra-low carbon line pipe steel in a project in association with Voestalpine. Early results suggest that molybdenum does not have a role in the deteriorating toughness in heat affected weld zones, as it is often claimed, but that the amount of silicon may be much more important. We are working with SCI in the UK and others on the HILONG project, looking at ways to increase the utility of high-strength steel in long span structures, for example in stadia. We are also working with SCI and other partners to develop guidance on the design and fabrication of stainless steel biogas and other tanks in the BIOGASS project. Both three-year projects are majority-EU funded.

The stainless steel atmospheric corrosion testing project that we embarked on





in early 2013 with the Kuwait Institute of Scientific Research (KISR) continued during the year. Half of the samples of different grades and finishes have been retrieved after one year of exposure and are now being analyzed. The others will be checked after the second year.

Team Stainless

IMO A is a member of Team Stainless, formed from the trade associations of the stainless and alloying element industries to promote the benefits of stainless steel. The Team Stainless partners jointly sponsor carefully selected projects which are of mutual interest. The following projects have been completed or are under way in the current year:

SCI has created materials for two one-hour university lectures on structural stainless steel design, providing professors and lecturers with a ready-

made package to introduce stainless steel to their students, which would otherwise not be covered. SCI also completed model specifications based on Eurocode 3 to guide structural engineers to correctly specify stainless steel. The topics covered include procurement, specification, cutting, bending, welding, bolting and installation.

Team Stainless is supporting two research projects. The first, carried out by the Royal Institute of Technology (KTH) in Sweden, examines metal release of stainless steel in food contact. The second, undertaken by the Paris Institute of Technology for Life, Food and Environmental Sciences in France and Manchester Metropolitan University in the UK, looks at best practice in cleaning stainless steel surfaces for hygienic applications. Both projects underline the utility of stainless steel and support confidence in its selection for such applications.

Other efforts

Relaunched in August 2013, the brochure 'Applications of molybdenum metal and its alloys' has been widely disseminated and is currently one of the top three downloads from the IMO A website.

A short brochure was created for use at a water conference in Italy in 2013. 'Water – our most valuable resource' is a summary of previously published articles and is available to download from the IMO A website.

The market research company SMR carried out an in-depth study of the oil and gas market for molybdenum-containing alloy steels, stainless steels and nickel-based alloys in 2012. 'Corrosion resistant steels and alloys in the oil and gas industry', found that molybdenum use in this sector is greater than previously assumed.

Financial Report 2013

Income and expenditure account

For the year ended 31 December 2013

IMO/Molybdenum Consortium

	2013 \$	2012 \$
Turnover	3,481,542	3,146,394
Operating and administrative expenses	3,406,215	3,022,961
Operating surplus/(deficit)	75,327	(123,433)
Other interest receivable and similar income	4,014	8,728
Surplus/(deficit) on ordinary activities before taxation	79,341	(132,161)
Tax on surplus/(deficit) on ordinary activities	1,157	1,309
Surplus/(deficit) on ordinary activities after taxation	78,184	(130,852)

Balance sheet

For the year ended 31 December 2013

IMO A/Molybdenum Consortium

	2013 \$	\$	2012 \$	\$
Fixed assets				
Tangible assets		16,530		22,370
Current assets				
Debtors	340,699		80,084	
Cash at bank and in hand	5,089,412		5,277,955	
	5,430,111		5,358,039	
Creditors – amounts falling due within one year	(876,009)		(887,961)	
Net current assets		4,554,102		4,470,078
Total assets less current liabilities		4,570,632		4,492,448
Reserves				
Profit and loss account		4,570,632		4,492,448
Accumulated funds		4,570,632		4,492,448

Financial Commentary

The 2013 audited accounts presented here are consolidated figures for IMO A and the Molybdenum Consortium and are subject to approval at the 2014 AGM. Income from subscriptions and levies amounted to US\$3,481,542. After expenses of US\$3,406,215, a sum of US\$75,327 was carried forward bringing the combined accumulated funds to US\$4,570,632. Of this US\$3,153,517 is attributable to IMO A and US\$1,417,115 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
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