

BROADCASTER

INTERNATIONAL OXYGEN MANUFACTURERS ASSOCIATION

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Harmonization in Focus

Contributions of Harmonized Documents in Semiconductor Gas Handling and Future Activity for IHC work items by Taiyo Nippon Sanso

SATOSHI HASAKA and ICHIRO NAKAYAMA, TAIYO NIPPON SANSO CO.

THE RISKS OF GAS HANDLING IN THE JAPANESE SEMICONDUCTOR INDUSTRY

In the 1980's, the semiconductor business in Japan emerged and entered the global market. There were several fatal accidents that involved metal hydride gases like Silane. When the Japanese media reported the Miyazaki OKI Silane fire accident at Kyushu island in October, 1982, it was the first time Japanese citizens were made aware of hazardous materials used in semiconductor manufacturing.

Similar accidents with other gases also occurred. A Germane cylinder explosion at our Kawasaki facility in Kanagawa Prefecture near Tokyo occurred in 1984. While in October 1991, there were two fatalities at Osaka University when a Silane cylinder exploded as a result of a malfunction of the semiconductor gas supply system.

The Japanese national regulation of the High Pressure Gas Act has imposed severe restrictions for the use of specialty gases such as Silane, Disilane, Arsine, Phosphine, Diborane, Germane, and Hydrogen Selenide regardless of the storage volume of these gases. Japanese chip makers and gas manufacturers have also experienced many accidents and as a result, gained knowledge for the safe use and handling of electronic specialty gases.

During the 1990's, there was a concern about the potential for adverse effects to people or the environment. As a result the harmful effect of all chemicals was investigated. Many semiconductor gases were assigned the hazard classification of mutagen and carcinogen. In the 2000's, the Global Harmonized System had defined classifications for the hazards of flammable, toxicity, environmental effect, etc. In addition, REACH and RoHS regulations from the EU were also applicable. The Threshold Limit Value—which is the time weighted average value of a chemical for repeated exposure without producing adverse health effects, was recommended to be lowered for Arsine, from 50ppbv to 5ppbv by ACGIH (American Conference of Governmental Industrial Hygienists).

HARMONIZED DOCUMENTS FOR SEMICONDUCTOR GAS HANDLING

In accordance with such social issues and concerns, the projects of developing guidelines for Arsine and Phosphine were proposed in 2006. The harmonized documents were developed through the joint lead of JIMGA and AIGA in 2007 with Mr. HASAKA the leader of these projects with task force team members from JIMGA and AIGA based in Japan, USA, Taiwan and Singapore. A Taiwan summer meeting and Japan

Continued on page 4

IOMA 2016 73RD ANNUAL MEETING in Del Mar Approaching!

IOMA's 73rd Annual Meeting is scheduled for Sunday, October 23 to Thursday, October 27, 2016 at the Fairmont Grand Del Mar. We look forward to welcoming our member company representatives and their spouses/companions to sunny Southern California.

The Annual Meeting Program Committee, led by Vice President Clas Palmberg (Oy Woikoski Ab), has assembled an excellent program entitled *The Environment and Sustainability—Our Vital Role: Policy, Economics and Developing Opportunities*. The theme focuses on major challenges of our time—as governments grapple with energy and environmental policy, industry executives must strike a balance between managing shareholder expectations with “doing the right thing” over the long term for the environment and future generations. In addition to the business sessions we have several social events that provide plenty of networking opportunities.

FEATURED PRESENTATIONS



The Cultural & Economic Impacts of Living on an Ocean Planet

Dr. John Delaney

Professor of Oceanography, School of Oceanography and College of the Environment, University of Washington



The Global Economy and Some Trends Impacting Corporate Sustainability

Dr. John Rutledge

Chief Investment Officer and Member of the Investment Committee
Safanad



Shifting Investors Attitudes About Business Sustainability

Dr. Gregory Unruh

Arison Chair of Values Leadership and Associate Professor
George Mason University

INDUSTRY PANEL

The Program Committee also has assembled a panel of gas industry speakers, who will focus their presentations on topics related to the environment and sustainability. Executives from American Air Liquide Holdings, SIAD SpA, and Air Products and Chemicals will provide examples of how their companies are making sustainability a part of their culture, how their initiatives are contributing to a cleaner environment, and how companies can take a greater role in promoting industry sustainability. These presentations will be followed by a panel discussion including Dr. Unruh and moderated by Phillip Barlag with World 50.

PANEL MODERATOR



Phillip Barlag
Executive Director, World 50

PANELISTS



Michael Graff
Chairman & CEO
American Air Liquide Holdings &
Senior VP, Air Liquide Group



Bernardo Sestini
Managing Director
SIAD S.p.A.

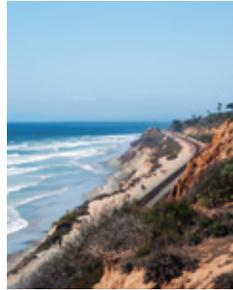


Joe Peitrantonio
Vice President EHSQ & Corporate
Chief Engineer
Air Products & Chemicals, Inc.



Dr. Gregory Unruh
Arison Chair of Values Leadership
and Associate Professor
George Mason University

SPECIAL EVENTS IN DEL MAR



In addition to our prestigious lineup of business speakers, our social program offers several events to help you explore the beauty of the Del Mar and La Jolla area. We have planned several group activities as described below.

The Annual Meeting kicks off on Sunday, October 23 with our traditional evening Welcome Dinner at the resort, allowing you to catch up and network with your colleagues.

On Monday IOMA is offering several optional activities. Attendees can participate in either the IOMA Golf Tournament at the Grand Del Mar; a tour of the USS Midway Aircraft Carrier; a tour of the San Diego Zoo Safari Park; or an excursion to La Jolla including the Museum of Contemporary Art and a group lunch.

On Monday evening the U.S. member companies of IOMA are generously hosting a reception and dinner at Scripps Seaside Forum, part of the Scripps Institution of Oceanography. The Forum is located right on the beach in La Jolla Bay with the Pacific Ocean as a backdrop. This casual event is an ideal opportunity for you to relax and visit with your IOMA colleagues.

On Tuesday following the first General Session, IOMA again is offering several optional tours. Attendees have the option to participate in either a Tour and Tasting at Stone Brewery & Malahat Spirits Distillery, Sea Kayaking in La Jolla Bay Ecological Reserve or a Shopping Excursion to La Jolla.

Tuesday evening is IOMA's traditional President's Banquet at the Fairmont Grand Del Mar. This reception and dinner will include awards presentations and dancing in the resort's ballroom. The dress code is business attire.

On Wednesday afternoon following the second General Session, attendees have the option to participate in a Tour of the USS Midway Aircraft Carrier or Sea Kayaking in La Jolla Bay Ecological Reserve.

On Wednesday evening we will conclude the meeting with our traditional Closing Reception at the Fairmont Grand Del Mar. For many, this is the last opportunity during the conference to meet with your fellow IOMA members. We encourage everyone to stop by the reception to meet your friends before going to your respective Dine-Out dinner or to say goodbye to others. ■



IOMA[®] 2016

ANNUAL MEETING PROGRAM AT-A-GLANCE

Sunday, October 23

All Day.....Major Arrivals
6:00 pm–9:00 pmWelcome Dinner

Monday, October 24

7:00 am–10:00 amBreakfast

OPTIONAL ACTIVITIES

8:00 am–1:00 pmSan Diego Zoo Safari Park
9:00 am–1:00 pmGolf Tournament at The Grand Golf Club
(on property)
9:30 am–1:30 pmTour Aboard the USS Midway
Aircraft Carrier
10:30 am–4:00 pmExcursion to La Jolla, including the Museum
of Contemporary Art, Group Lunch
and Shopping
6:30 pm–10:30 pmReception & Dinner at the
Scripps Seaside Forum
(co-hosted by IOMA's member
companies from the U.S.)

Tuesday, October 25

6:30 am–8:30 am.....Breakfast
8:30 am–12:00 pmFirst General Session
1:00 pm–3:00 pmBoard of Directors Meeting

OPTIONAL ACTIVITIES

12:30 pm–4:30 pmTours & Tastings at Stone Brewery &
Malahat Spirits Distillery
1:00 pm–4:00 pmShopping Excursion to La Jolla
(transportation only)
1:00 pm–4:30 pmSea Kayaking in La Jolla Bay
Ecological Reserve
6:30 pm–12:00 pmPresident's Banquet

Wednesday, October 26

6:30 am–9:00 am.....Breakfast
8:30 am–12:00 pmSecond General Session

OPTIONAL ACTIVITIES

1:00 pm–4:45pm.....Tour Aboard the USS Midway
Aircraft Carrier
1:00 pm–4:45 pmSea Kayaking in La Jolla Bay
Ecological Reserve
6:30 pm–8:00 pmClosing Reception
8:00 pm–untilDine-Out Night

Thursday, October 27

6:30 am–10:00 am.....Continental Breakfast
All Day.....Major Departures

2016 OFFICERS & DIRECTORS

Chairman of the Board

Stefan Messer, *Messer Group GmbH, Bad Soden, Germany*

President

Tom Thoman, *Airgas, Inc., Radnor, PA, USA*

Vice President

Clas Palmberg, *Oy Voikoski Ab, Voikoski, Finland*

Treasurer

Michael Graff, *American Air Liquide Holdings, Houston, TX, USA*

Secretary

Alex Buendia, *Strandmollen Industrigas A/S, Klampenborg, Denmark*

Directors

Gabriel Bitton, *Oxygen & Argon Works Ltd., Caesarea, Israel*

Ara Hacet, *Carbide Industries, Louisville, KY, USA*

Amer Huneidi, *Gulf Cryo Holdings, Safat, Kuwait*

Yujiro Ichihara, *Taiyo Nippon Sanso Corp., Japan*

Corning Painter, *Air Products & Chemicals, Inc., Allentown, PA, USA*

Scott Telesz, *Praxair, Inc., Danbury, CT, USA*

Giorgio Trevisi, *OXICAR, Valencia, Venezuela*

Executive Director

David A. Saunders, *Washington, DC, USA*

Director of Member Services

Erika Freundel, *Washington, DC, USA*

Legal Counsel

Charlie Haag, *Jones Day, Washington, DC, USA*

INTERNATIONAL OXYGEN MANUFACTURERS ASSOCIATION

1000 Potomac Street, NW

+1 202 452 8100

Suite 108

Fax: +1 202 833 3636

Washington, DC 20007

Email: info@iomaweb.org

USA

www.iomaweb.org

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Photo 1. "Water—¹⁸O" 3rd Plant

winter meeting held in 2007 resulted in the development of the "Code of Practice Arsine AIGA 050/08//JIMGA—T-S/36/08/E" and "Code of Practice Phosphine AIGA 051/08//JIMGA—T-S/37/08/E". Both documents were then shared with EIGA and CGA in May 2008.

AIGA had issued both documents of Arsine and Phosphine. JIMGA had issued both documents on November 2009 and again later on April 2010, to align with Japanese regulation and to maintain the meanings of the original draft. CGA and EIGA published

versions of the harmonized document in 2010 as CGA publications G-16 and G-17 and EIGA Documents 162 and 163. Currently, revision of the documents has been in progress since 2014 with planned completion in 2017 2Q.

Electronic specialty gases are applied as a doping gas for silicon-based solid state electronic devices into a furnace or ion implantation process. They are also used as a primary source in compound semiconductors such as light emitting diode and power device like Gallium and Indium compounds. Many specialty gases are flammable and extremely toxic. They are shipped as compressed gas or liquefied compressed gas with container pressures of 1Mpa or more.

The issue of the safe handling is very important and a relevant topic to the compressed gas industry as well as the user community of specialty gases. These harmonized documents are intended for the supplier, distributor and users of Arsine and Phosphine and related handling equipment. The documents include guidance for design of equipment, cylinders and valve usage, handling controls and safety as well as fire protection, gas detection, ventilation and related safeguards.

In addition to the documents for Arsine and Phosphine, a document entitled "Safe Handling of Electronic Specialty Gases of AIGA 018/15" was also developed with the joint lead of AIGA and JIMGA in 2008. Mr. NAKAYAMA and AIGA deliberated the draft among task team members delegated from AIGA and JIMGA. Last year 2015 Q4, the document was completed as a harmonized document (AIGA 018, CGA P-46, EIGA Doc199 and JIMGA IHC-Doc/29). This document covers many electronic gases given their worldwide proliferation and the inherent danger and risk associated with their use.

Electronics specialty gases encompass gases and mixture that are primarily used in the semiconductor and photovoltaic industry. The document is intended to recommend best practices, which will enhance safety in the workplace where these gases and mixtures are prepared, during transport from the production site to the user and, where they are stored and used. Since these gases are usually packaged at high pressure and can be reactive, flammable, toxic or corrosive, great care should be taken in their use even if mixtures containing lesser concentrations of these gases are classified as inert.

The IHC gap analysis program started in 2013 to identify potential harmonization projects from a safety hazard point of view. The goal is to determine whether appropriate standards are in place relative to the hazards identified. Working together, CGA and EIGA successfully completed both the ASU and Acetylene gap analysis programs. Currently, the Electronic Specialty Gases (ESG) gap analysis program is being jointly



Photo 2. Hydro Shuttle for Mobile

led by AIGA and JIMGA. Silane as a flammable gas with a pyrophoric property was chosen first due to the severe accidents reported worldwide. Mr. NAKAYAMA is playing a role as ESG program coordinator and cooperatively working with the experts of JIMGA, AIGA, CGA and EIGA to complete the Silane and flammable gases gap analysis by early 2017.

FUTURE CONTRIBUTION FOR IHC ACTIVITY FROM TAIYO NIPPON SANSO

The United Nations projected a population of 9 billion people in the world by 2050. When this occurs, the various social issues for future politics, economic or ideologue systems will be different. Industrial gas companies will inevitably have to face this social phenomenon: water, food, energy, and material will be lacking as well as an aging society and urbanization.

Taiyo Nippon Sanso is dedicated to accelerate the distribution of medical gases such as respiratory oxygen and isotopic enriched "Water—¹⁸O" used in the diagnosis of cancer. We have already installed three (3) air separation plants to expand "Water—¹⁸O" capability to 600 kg per year. Photo 1 shows the newly established third production plant of "Water—¹⁸O" on February 2016.

For energy consumption, mobile hydrogen stations for hydrogen fuel cell vehicles will be distributed to all Japanese regions and other countries. A low cost and compact mobile hydrogen station was introduced to the consumer market in August, 2013 as shown in Photo 2.

In addition to the above, with the introduction of IoT, AI and Cloud Database, the working schemes that use automation will be dramatically changed and will help eliminate the accidents for our gas business and make for an effective business performance.

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SATOSHI HASAKA joined Nippon Sanso, current Taiyo Nippon Sanso in 1984, and is responsible for GM of Technical Standardization Department of Technical Affairs Division. He had dedicated for R&D of Semiconductor gases for 23 years. He also worked for Tohoku University for 1989–1992, and Matheson Gas Products for 1995–1997, and IBM for 2010–2012 in US. His task is a chairman of IHC-WG in JIMGA and an observer of IOMA GC as well.



ICHIRO NAKAYAMA joined Nippon Sanso, current Taiyo Nippon Sanso in 1983. He has worked for various departments such as R&D, Medical gas and harmonization activity. He is working as secretariat of International Council of JIMGA and, IHC-WG and Deregulation WG under International Council since 2013.

IOMA MEMBER NEWS



Air Liquide Completes Divestiture of U.S. Assets to Matheson

Air Liquide S.A. (Paris, France) completed the divestiture of certain U.S. assets to Matheson Tri-Gas, Inc. (Basking Ridge, NJ, USA), announced on June 24, 2016, and cleared by the U.S. Federal Trade Commission (“FTC”) in a decision published on September 1, 2016. This divestiture represents the majority of the asset sales required by the FTC in connection with Air Liquide’s acquisition of Airgas. The transaction includes the sale of 18 air separation units in 16 locations; two nitrous oxide production facilities; four liquid carbon dioxide production facilities in four states, including two dry ice production facilities; and three Airgas retail packaged welding gas stores in Alaska. Under the terms of the purchase agreement, Matheson has acquired production facilities, equipment, inventory, distribution assets, and customer contracts, and has also hired employees related to the divested assets.

Air Products Opens Specialty Gases and Helium Transfill Facility in South Korea

Air Products and Chemicals, Inc. (Allentown, PA, USA) recently announced the opening of its new state-of-the-art non-electronics specialty gases and helium transfill facility in Ochang, North Chungcheong, South Korea, to meet the growing demand driven by the automotive, electronics, analytical, bio-healthcare, petrochemical, refining and other industries. Located geographically at the center of South Korea, Ochang has been developed as an industrial complex for high-tech industries, including fine chemical, pharmaceutical, and electronic material manufacturing. The new plant will enable Air Products to deliver its non-electronics ultra-high purity specialty gases (99.995% and above)—including rare gases and mixtures, as well as packaged helium—to these markets more efficiently and reliably.

Specialty gases represent rare or ultra-high purity gases, and their unique properties can help industries improve yields, optimize performance and lower costs. The specialty gases produced by Air Products’ Ochang plant are supplied in 10 liter 150 bar cylinders, 47 liter 150 bar cylinders and cylinder packs, as well as 50 liter 180 bar cylinders, and will be supplied in 50 liter 200 bar high-pressure and large-volume cylinders.

Linde Malaysia Establishes JV with PETRONAS Gas Berhad

The Linde Group (Munich, Germany) announced that its subsidiary, Linde Malaysia Sdn Bhd, has established a joint venture company with PETRONAS Gas Berhad (PGB) to build a state-of-the-art industrial air gas facility that will produce gaseous oxygen and nitrogen to supply the needs of PETRONAS’ world-scale Refinery and Petrochemicals Integrated Complex (RAPID), within the Pengerang Integrated Petroleum Complex (PIPC) in southern Malaysia. Linde and PETRONAS’ joint venture company, Pengerang Gas Solution Sdn Bhd (PGS), has also secured long-term agreements for the supply of oxygen and nitrogen to the world-scale refinery and petrochemical complex, which includes an ethylene oxide/ethylene glycol plant. PGS will build two large air separation units and associated gas facilities resulting.

Linde’s first joint venture with PGB, Industrial Gases Solutions Sdn Bhd (IGS), is an air gases trading company. Linde, through IGS, also supplies

gases to PETRONAS’ subsidiaries in Malaysia, including to its Kerteh and Gebeng Petrochemical Complexes. Linde’s Engineering Division, which will design and construct PGS’ air separation units (ASUs), also concluded the engineering, procurement, construction and commissioning (EPCC) contract with PGS.

Messer Commissions Third ASU in Vietnam

Messer Group GmbH (Bad Soden, Germany) has commissioned its third air separation plant in Vietnam. The plant was built to supply gases to the family partner of the Messer family concern of many years, steel manufacturer Hoa Phat Steel, thereby increasing their daily capacity by 240,000 standard cubic meters of oxygen and 480,000 standard cubic meters of nitrogen. In 2011 Messer in Vietnam and the Hoa Phat Group signed the company’s first 25-year supply contract.

The new air separation unit (ASU) is the largest industrial gases plant in North Vietnam. It supplies the steelworks itself as well as produces gases in liquid form for the local market. Following a construction period lasting 15 months, the plant is now in stable operation and producing air gases, such as oxygen, nitrogen and argon. Together with the previously existing ASUs, the Hoa Phat Steel steelworks is now being supplied with 22,000 cubic meters of gaseous oxygen and 30,000 cubic meters of gaseous nitrogen via pipeline every hour. Messer plans to supply other plants besides Hoa Phat Steel with gases in both liquid and gaseous form, particularly those in the North Vietnamese industrial corridor from Hanoi to Hai Phong.

Air Products to Supply Glass Wool Manufacturer in South Korea

Air Products and Chemicals, Inc. (Allentown, PA, USA) was recently awarded a long-term contract by KCC Corporation, a leading glass producer and the largest construction material manufacturer in South Korea, to supply oxygen to the new glass wool production line at its Gimcheon facility. The new production line is scheduled to come on-stream in 2017. Air Products will install a PRISM® vacuum swing adsorption (VSA) oxygen generator at KCC Corporation’s Gimcheon site to supply on-site gaseous oxygen to the furnace for full oxy-fuel combustion, an advanced technology proven to make glass manufacturing cleaner.

KCC Corporation, established in 1958, is the largest building material maker in South Korea focusing on developing high value-added products based on high energy efficiency and environmentally friendly technology. With operations throughout the country and overseas, the company has an extensive business portfolio with a leadership position in the domestic float glass, glass wool and industrial paint markets.

Praxair Completes Yara Acquisition

Praxair, Inc. (Danbury, CT, USA) officially completed its purchase of Yara International ASA’s European carbon dioxide (CO₂) business. Praxair finalized its acquisition of Yara’s remaining 34 percent stake in the Yara Praxair Holdings AS industrial joint venture.



RELATED ASSOCIATION NEWS

EIGA Documents

The European Industrial Gases Association (EIGA) (Brussels, Belgium) has the following publications available:

- “Medical Oxygen Systems for Homecare Supply”—Doc 89/16 (revision of Doc 89/11)
- “Security Guarding Guidance for EIGA Members”—Doc 925/16
- “Gas Compatibility with Aluminium Alloy Cylinders”—Doc 161/16 (revision of Doc 161/10)
- “Typical Post-Marketing Pharmacovigilance Cases in the Medical Gases Industry”—Doc 203/16
- Training Package TP 09/16 “Slips, Trips and Falls” (Revision of TP 09/04)
- “EIGA Template for DGSA Annual Report”—Doc 156/16 (revision of Doc 156/09)

You can view or download many other publications at the following address:
www.eiga.eu.



IOMA & INDUSTRY EVENTS CALENDAR

2016

OCTOBER 23–27

IOMA 73rd Annual Meeting
 The Grand Del Mar
 San Diego, CA, USA



2017



JANUARY 25–26

EIGA Winter Seminar:
 Human Factors
 Brussels, Belgium

APRIL 23–27

CGA Annual Meeting
 Coral Gables, Florida, USA

NOVEMBER 11–15

IOMA’s 74th Annual Meeting
 The Ritz-Carlton Dubai at
 Jumeirah Beach
 Dubai, UAE

2018

SEPTEMBER 29–OCTOBER 3

IOMA’s 75th Annual Meeting
 Grand Hotel Wien
 Vienna, Austria

