

SESHA 31st Annual International High Technology ESH Symposium & Exposition

Where ESH and Technologies Converge

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Symposium attendees are eligible to receive certification
 maintenance points from both BCSP and ABIH.
 Certificates are available at the Registration Desk.

Registration Hours:

Ballroom Foyer

Tuesday, May 19	3:00-6:00 PM
Wednesday, May 20	8:00 AM-3:00 PM
Thursday, May 21	8:30 AM-1:00 PM
Friday, May 22	8:30-11:30 AM

Exhibit Hall Hours:

Salons I/II/III

Monday, May 18	11 AM-6 PM
Complimentary Lunch and Raffle	11:00 AM-1 PM
Soda Break	2:30-3 PM
Welcome Reception	4:30-6 PM
Tuesday, May 19	9:30 AM-3 PM
Coffee Break	10:00-10:30 AM
Exhibitor Sponsored Lunch.....	11:30 AM-1 PM
Soda & Snack Break and Raffle	2:30-3 PM

SESHA 31st Annual International High Technology ESH Symposium & Exhibition

Week Schedule

Monday, May 18

LEED Workshop 8:00 am-4:30 pm	Salon 2	Exhibitor Meeting 7:30 am	Salons I/II/III
Board of Directors 6:00-9:30 pm	Executive Board Room	Academic Committee Meeting 7:30 am	Sunset

Tuesday, May 19

PDC 1 - Boot Camp - CANCELLED		Keynote 3 8:30 am	Sonora A/B/C
PDC 2 - Silane & Chlorosilane Safety (Full Day) 8:00 am-5:00 pm	Sonora C	Break - Exhibit Hall 9:30-10:00 am	Exhibit Hall
PDC 3 - Sustainability - CANCELLED		Concurrent Sessions 10:00-11:30 am	Sonora A/B/C
PDC 4 - POU Abatement (Half Day) 1:00-5:00 pm	Sonora D1/D2	Lunch 11:30 am-1:00 pm	Sonora A/B/C

Wednesday, May 20

Morning Training Run for 5K Race 6:30 am	Meet in Lobby	Concurrent Sessions 1:00-2:30 pm	Sonora A/B/C
Opening Remarks 8:00 am	Sonora A/B/C	Break 2:30-3:00 pm	Salons I/II/III
Keynote 1 8:30 am	Sonora A/B/C	Concurrent Sessions 3:00-5:15 pm	Sonora A/B/C
Keynote 2 9:30 am	Sonora A/B/C	Local Chapter Recognition Event 6:30 pm	Sonora D

Friday, May 22

Awards Ceremony 10:30 am	Sonora A/B/C	5k Race 6:30 am	Meet in Lobby
Exhibits 11:30 am-6:00 pm	Salons	Fellows Forum Sponsored Breakfast 7:30 am	Sonora D1/D2
Lunch - Exhibit Hall 11:30 am	Salons I/II/III	Keynote 4 8:30 am	Sonora A/B/C
Concurrent Sessions 1-2:30 pm	Sonora A/B/C	Break 9:30 am	Sonora A/B/C Foyer
Break 2:30-3:00 pm	Salons I/II/III	Concurrent Sessions 10:00-11:30 am	Sonora A/B/C
Concurrent Sessions 3:00-4:30 pm	Sonora A/B/C	Closing Ceremony - SESH Business Update - Awards 11:30 am	Sonora A
Opening Reception 4:30 pm	Salons I/II/III		

Thursday, May 21

Morning Training Run for 5K Race 6:30 am	Meet in Lobby
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Professional Development Courses

Tuesday, May 19

Full Day, 8:00 am-5:00 pm

PDC 2 - Silane and Chlorosilane Safety & ER PDC.

E. Ngai, J.-R. Chen, S. Creighton

Room: Sonora D-3

A variety of Silanes and Chlorosilanes have been used for many years by the semiconductor IC industry. The most commonly used are silane, dichlorosilane and trichlorosilane. Despite this long history of use, these compounds have unique characteristics which must be considered for system design, operation, maintenance and effective incident mitigation. Despite 40 years of use, silane continues to cause serious incidents at user sites. The use of silane is expected to double or even triple as the Photovoltaic and LCD industries continue their dramatic growth. A number of companies are installing silane manufacturing facilities which use trichlorosilane as a raw material

In this PDC, Professor Jason Chen, Kaohsiung First University and Eugene Ngai, Chemically Speaking LLC will present results of their Silane release testing program. This program began in early 2006 immediately after the 2005 incident in Taiwan to better understand silane release behavior and why it doesn't always ignite immediately. To date hundreds of tests have been conducted under a variety of release conditions. While silane has been studied for almost 40 years by many researchers, the ignition behavior during a release remains a mystery. An extension of the testing program in 2008 was the spill testing of trichlorosilane and extinguishment of fires using a variety of foams. CGA G13 and ANSI standard is rapidly becoming a worldwide standard for silane systems. Since it was first published as CGA P32 in 1996 silane packaging, use and systems have changed. Setback distances which were based on the 1996 release studies may no longer be applicable.

The issues with silanes and chlorosilanes extend to the exhaust of deposition equipment, namely explosions and chemical exposure potentials to personnel. Susan Creighton of S. Creighton Consulting will discuss reaction mechanisms and control measures for the exhaust of silane and chlorosilane processing equipment. Susan Creighton an industry EHS specialist will also present on silicon deposition issues and incidents

1. Silane Safety and ER (E. Ngai)
2. Silane Release Testing (Prof Chen)
3. CGA G13 Background and Basis for Setback

Distances (E. Ngai)

4. Chlorosilane Safety and ER (E. Ngai)
5. Trichlorosilane Foam Testing (Prof Chen)
6. Silicon Deposition Incidents (S. Creighton)

This PDC is intended to give new and old users a detailed overview of silanes and chlorosilanes by industry experts.

Half Day, 1:00-5:00 pm

PDC 4 - Semiconductor Industry Exhaust Management, POU Abatement Device, and Centralized Abatement Equipment

M. Sherer

This PDC will provide detailed information on exhaust management, point-of-use abatement devices, and centralized abatement equipment in a semiconductor fab or similar operations. The determination of how to develop a process exhaust management strategy will be presented. The segregation and abatement of ammonia and abatement of fluorine are major exhaust management challenges that will be discussed. The design and operation of centralized wet scrubbers will be reviewed. The types of volatile organic compound (VOC) equipment will be explained. This PDC will be instructed with opportunities for the attendees to ask their specific questions. Handouts and ample opportunity to ask questions, discuss concerns and interact with instructors and classmates.

Symposium Planning Team

Symposium Planning Committee:

Co-Chairs: Steve Trammell and Laurie Beu

Safety/IH Session:

Co-Chairs: Faith Seal and Hilary Matthews

Environmental Practices Session

Co-Chairs: Michelle Lan and John Bucciarelli

Sustainability/CSR Session

Chair: Pat Tierney

Resource Conservation Session

Chair: Jennifer Chittick

Codes/Regulations Session

Chair: Roy Dojahn

ESH Data Management Session

Chair: Tiffany Giles

Chemical Regulations / Management Session

Chair: Scott Stewart

Nanomaterials ESH Session

Chair: Christine Pomerence

ESH in PV/Solar Session

Chair: Brett Davis

REACH Roundtable

Chair: Sanjay Baliga

Emergency Response Roundtable and Professional Development Courses

Chair: Sue Creighton

Board of Directors

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Doug Thornton, Fairchild Semiconductor Corp.

John Visty, Earth Tech- AECOM

Mary Majors, Air Products & Chemicals Inc

Final Program

Wednesday, May 20

8:30 – 11:30 am

Room: Sonora Ballroom

8:30 am **Opening Remarks**

Keynote 1

9:30 am **U.S. Climate Change Regulations and the PFC Voluntary Agreement: Looking Forward**
Kruger, Dina; US Environmental Protection Agency

Keynote 2

10:30 am **Industry Economic Forecast**
McClean, Bruce; IC Insights

11:30 am **Complimentary Lunch**

1:00-2:30 pm

Room: Sonora A

Safety/IH

Co-Chairs: Faith Seal, Hilary Matthews

1:00 pm **The Role of Process Hazard Assessment in Semiconductor Process Development**
Alain, Pardon; IMEC

Process Hazard Assessment (PHA) is developed by IMEC as a tool used to predict the ESH-impact of new semiconductor processes that are being investigated. The PHA is based upon a “process window” which is detailed in a Process Definition Sheet (PDS). The PDS gives maximum and estimated process flows as well as the physical conditions (temperature, pressure) of the process. The first step of the PHA is a Multi Criteria Hazard Assessment aiming to evaluate the physical hazards, toxicological effects as well as an evaluation of standards and regulations that apply to the use of the aimed precursors. The process recipe and stoichiometry allows us to investigate the chemical reactivity or physical effects of by-products. Effects of exothermal or endothermal reactions, built-up of solids, or release of explosive reaction products are assessed during this second stage of the PHA. If the reaction mechanisms are unknown the effects are investigated in an experimental way by monitoring the physical effects and by chemical analysis such as GCMS, FTIR,... while ramping-up the process from diluted chemicals and starting from benign process conditions. The outcome of the PHA allows one to select the technical and organizational measures to further develop or demonstrate the process

under safe conditions. Segregation of drains and exhausts, installation of on-board fire extinguishing systems on tools, use of process diluents, adequate effluent abatement or the change of process precursors can be the result of a PHA. Also, the advantage of running a PHA in a systematical way lies in educating scientists in the ESH-effects of the products and process conditions that they select for process development, hence in safe and sustainable processes that can be transferred to the semiconductor manufacturers.

1:45 pm **Dangers Created in Epitaxial Exhaust Lines by Partially Reacted Process Gases**
Vickery, Earl; Applied Technology Specialists, Inc.

Epitaxial depositions involving materials such as Silane and Phosphine are thermally cracked to produce Silicon or Phosphorus atoms and ions as part of the deposition process. Most of the gases injected into reactors during these operations remain unused and are expelled in the reactor exhaust lines. Cracked and partially cracked fractions, as well as partially reformed compounds, can be deposited on the exhaust line inner walls and are stable only under certain conditions and can unexpectedly react violently when these conditions change. These materials are often referred to as meta stable compounds and have been the cause of hundreds of millions of dollars in property and product losses. This paper will review one or more cases where these compounds have been the source of property loss and to present several solutions to minimize or eliminate the dangers they produce.

1:00-2:30 pm

Room: Sonora B

Environmental Practices

Co-Chairs: Michelle Lan, John Bucciarelli

1:00 pm **PFC Abatement in the Semiconductor Industry, 2009**
Van Gompel, Joe; Austin, TX

Semiconductor manufacturing uses fluorine-based chemistries for both etch processes as well as for many deposition steps because the resulting inorganic fluorides are volatile and readily removed under vacuum. Perfluorinated gases (PFCs; CF₄, C₂F₆, SF₆, etc.), decomposed in a plasma, are routinely used as sources of fluorine atoms because they are relatively nontoxic and are available in sufficient purity and bulk at reasonable

prices. Consumption of these gases in the process is poor – as low as 15% for CF₄ – so much of the gas going into the chamber is exhausted. PFCs are very potent global warming gases and, as they are chemically stable, persist in the atmosphere for thousands of years. This is of great concern for their effects on climate change. The semiconductor industry has long acknowledged this concern, and technologies for abating PFCs have been developed. This is increasingly important as various governmental regulatory agencies are developing legislation to require reporting of PFC usage or even PFC emissions control in some cases. This paper will include a brief overview of PFC usage in semiconductor manufacturing processes, followed by a tour of scrubber technologies that are capable of abating PFC gases. These include fuel-fired combustion, plasma destruction, and PFC-specific catalytic destruction. Attention will also be given to the appropriateness of these technologies for the various semiconductor manufacturing processes.

1:45 pm Conducting a Greenhouse Gas Emissions Inventory: A Primer Cotter
Capaccio, David; Environmental Engineering, Inc.

Concern over the effects of global warming and the movement by international, federal, and state agencies to implement rules designed to track, curtail, and control emissions of green house gases (GHG) has produced a groundswell of action at corporate levels. Additionally, the semiconductor industry is seeing increased pressure from customers and investors to disclose emissions and actions pertaining to global warming, including the Global Reporting Initiative (GRI), the Carbon Disclosure Project (CDP), and the Electronic Industry Citizenship Coalition (EICC). This concern has brought forth a need for the semiconductor industry to better understand how their actions, operations, and tools may contribute to global warming, particular as they relate to the generation of GHG emissions. This paper discusses the drivers behind this movement and the protocols available for corporations to design and implement GHG inventories and reporting strategies. Specific guidance is provided outlining how semiconductor manufacturers and related industries can identify sources of GHG emissions for estimation and tracking, identifying some of the tools and approaches that can be used to accomplish this, and discussing the types of metrics that can be used to track and report progress towards established GHG reduction targets. The general protocol, “A Corporate Accounting and Reporting

Standard”, jointly published by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) [WRI, 2004] is part of a series of high level protocols designed to guide corporations in doing emission inventories, establishing reduction targets and strategies, and initiating programs to track and report progress towards those targets. This general protocol has spawned sector-specific guidance documents for the semiconductor industry, such as the World Semiconductor Council (WSC) protocols, which are presented with a focus on case-study application examples.

1:00-2:30 pm

Room: Sonora C

Resource Conservation

Chair: Jennifer Chittick

1:00 pm Reclamation of Water and Hazardous Materials in Silicon Processing

Krygier, Vivien, Berndt, Rolf; Pall Corporation

The semiconductor and PV industries not only consume an ever-increasing amount of water, solvents and other resources but, as a consequence, they also end up discharging large volumes of wastewater and potentially hazardous waste. In many places, expansion of production is restricted due to limited supply of water and by legal and local restraints. Among the processes requiring large quantities of water and producing significant amounts of wastewater or other contaminated fluids as well as silicon/silica fines are: • Pre-shaping (cutting, squaring, chamfering, surface grinding) of silicon ingots • Wafering (slicing of ingots) • Wafer cleaning • Chemical/Mechanical Polishing (CMP) • Silicon Backgrinding and Dicing Silicon/silica fines also appear in the exhaust gas of Czochralski pullers for mc-Si crystal growing. Despite some special features, these processes have a great deal in common. The particles (silicon, silica, silicon carbide) are typically generated or degraded by processes on the surface of workpieces. The majority of these particles are typically less than one micron in size, complicating separation by conventional methods (settling, centrifugation, cake filtration). Chemically enhanced coagulation or flocculation would result in additional contamination of water and adds cost to the reclamation process. A better way is to completely remove the solid particles by means of membranes or other filter media with pore sizes below the particle size. Special dynamic process modes – e.g.

crossflow, backflushing/ blowback and air scrubbing – help to maintain the filtrate flow on a reasonable, stable level. The selection of filter media, filter elements, process mode and process parameters and the design of the entire separation system closely depend on the properties and behavior of the dispersion to be purified. Moreover, the architecture of the reclaim process is – aside from the feed specifications – strongly influenced by the technical and economic targets. The particle concentrate generated by the dynamic membrane filtration, for instance, may be further dewatered by cake filtration or centrifugation, sometimes followed by thermal drying, resulting in a powder ready for disposal or reuse. The clear filtrate of a membrane filtration may be used for raw water replacement in DI water plants, for direct reuse with/without polishing or for easier application, e.g. scrubbers. The paper analyses the influence of waste specifications (solids content, particle size, viscosity, temperature etc.) on the selection of technologies, gives a survey on applications, and illustrates details of process design and sizing on the basis of case studies in PV and semiconductor manufacturing.

1:45 pm Applying the LCA Methodology to Semiconductor Devices

Laurin, Lise; Earthshift LLC

Life Cycle Assessment is a useful tool for understanding the environmental impacts of a product from raw material extraction through disposal. Using ISO 14040 and 14044 as a basis, users of LCA find that it is a scientifically-based, fair way to evaluate how “green” a product is. In addition to aiding process engineers in finding better ways to make their products, LCA can be used for marketing and wise policy-making. Using LCA before regulations go into place can prevent costly policy that provides little if any environmental improvement.

Developments in LCA data and tools have made it easier to model semiconductor devices. Macro data on semiconductors provides a benchmark and a starting point for basic data. More and more chemicals and gases are available in the databases, improving the quality and usefulness of results. Users have the ability to create modules with variable parameters for wafer starts, downtime, and film thickness for example, that can be used and reused for different layers and different devices. This enables more rapid modeling, assessment, and interpretation.

3:00-4:30 pm

Room: Sonora A

Safety/IH

Co-Chairs: Faith Seal, Hilary Matthews

3:00 pm Toxic Gas Monitoring System Best Practices – Thinking Beyond Simple Compliance

Belanger, Jim, Cox, John, Rivera, Nelson; BDM, President ATS

Toxic gas monitoring systems in the semiconductor industry and related high technology industries are required by local, state, and national Building and Fire Codes, as well as Corporate and insurance specifications. The interpretation of the codes and the application of corporate and insurance guidelines vary greatly from region to region. Many companies have installed toxic gas monitoring systems to meet code requirements or to satisfy their basic corporate guidelines. Not all companies follow the same protocols for design, installation, testing, and maintenance of a toxic gas monitoring system. The gases being monitored differ from company to company and even within the same companies sometimes differ from site to site. Details on where to monitor and the best locations to mount sampling points are often overlooked by the installer of a new system. New requirements arise during the course of doing business that may require your system to be flexible to meet the ever changing needs of industry and/or government regulations. Gas monitoring technologies are also constantly being improved, enhanced, or changed completely to improve the system response, accuracy, or to meet lower maximum allowable threshold concentrations. Multiple sampling and analytical technologies may be required to meet the needs of an entire facility. A single-technology approach may not always be the most optimal approach for a toxic gas monitoring system. What happens when your TGMS goes into an alarm condition? What is the most effective way to ensure personnel safety and maintain facility uptime? Emergency response protocols are as important as the hardware and software to detect hazardous chemical leaks in semiconductor manufacturing facilities. Protocols include employee training, assigned emergency response teams (ERT), evacuations and hazardous equipment and processes shut down. Safety personnel must develop an ERT protocol that is most efficient and effective for their facility. A best practices approach to a toxic gas monitoring system beyond simple compliance will be discussed including gases to be monitored, proper sample point locations,

multiple-technology approach, and alarm protocols to enhance the effectiveness of current and future toxic gas monitoring and control systems.

3:45 pm Risk Management: Unique EHS Strategies for R&D Equipment

Fessler, Mark; Tokyo Electron US Holdings, Inc.

SEMI S2 adequately defines product safety requirements for semiconductor production systems. The product safety requirements of R&D tools (concept/feasibility, alpha tools, beta tools), however, are usually left up to the company's "internal" tolerability of risk. As you all know, it is not reasonable to require R&D equipment to be fully SEMI S2 compliant, so the risk assessment approach lends itself very well to prioritize how to attack an audit of R&D equipment. Unlike full production equipment's larger Engineering and Manufacturing Departments, our R&D groups are much smaller, and while they have great expertise in Process Engineering, they do not necessarily understand the infrastructure required for adequate checks/balances for equipment safety during the rapid design / process changes of R&D. Remember that proof of concept is important, before going and designing for full safety compliance. Sometimes 1st Order failure to "danger" is possible on R&D tools. Heavy administrative controls are sometimes the only justification to protect until hazard can be engineered out of the design, or new safety interlocks and protective barriers can be designed in. The presentation describes one possible solution to help manage R&D equipment safety by ensuring that you are addressing and communicating the most severe risks. We have attempted to streamline the sometimes cumbersome engineering change control process, but it still ensures a strong emphasis "residual risk" communication. Such concepts are further elaborated in the latest Machinery Directive (2006/42/EC) which requires full implementation across the EU on December 29th, 2009. We recognized that R&D equipment sometimes exposes our Process engineers to chemical and electrical and mechanical hazards which may be MEDIUM, HIGH, or VERY HIGH risks. Our internal R&D risk assessment process can be considered similar to the old Mobile Army Surgical Hospitals (MASH unit) or a modern day triage units which provides rapid response/care to the most severe injuries (High Risk), but allows lower risk issue to be addressed later, when more time can be devoted. The presentation will introduce a proposed flowchart for decision making and describe how the Residual Risk Register (RRR) Program

was created to specifically capture and communicate potentially high risks in a controlled way.

3:00-4:30 pm

Room: Sonora B

Emergency Response Roundtable

Chair: Sue Creighton

3:00 pm Disaster Control Planning for a Semiconductor Facility

Pompa, Dominic, Pardon, Alain, Finley, P.; Northrop Grumman-Electronic Systems

Knowing how to prepare for both natural and man-made disasters is particularly challenging for the semiconductor industry. This paper proposes a management systems approach to providing worker safety, environmental stewardship, and business continuity planning. Learn how every component of disaster planning is dependent on the fab's ability to adapt during a time of crisis. Author: Dominic N. Pompa Fellow Engineer Northrop Grumman Electronic Systems Linthicum, Maryland

3:00-4:30 pm

Room: Sonora C

Sustainability/CSR

Chair: Pat Tierney

3:00 pm Sustainability: Opportunities and Challenges for the EHS Professional

Mohin, Tim; EORM

Perhaps the most overused "buzz" word in recent times is sustainability. While the definition may be elusive, the implication of the sustainability movement offers tremendous promise and growth opportunities. At the heart of the concept are challenging and extremely important technical considerations for the EHS professional. As engineers and technically oriented people, EHS professionals prefer precise definitions and certifications for each element of our practice. The practice of sustainability is still evolving and the expertise required for competence in this area is, as yet, undefined. The key to success in managing a successful sustainability program is to develop a sound strategy that adds value to your business, is operationally achievable, and defines how EHS professionals and key business partners can contribute to the program. This paper will discuss the development of a sustainability strategy, how the practice of EHS aligns with core sustainability

principles, how EHS professionals can champion the effort, and how sustainability can expand the scope and stretch the capabilities of a typical EHS department. The paper will focus on EHS management of the supply chain as an example of these issues. Finally, the paper will provide first-hand perspectives on the opportunities and challenges ahead for the EHS professionals who decide to accept the journey.

3:45 pm Developing an Overall CO2 Footprint for Semiconductor Products

Yao, Marissa, Cullen, Michael, Stewart, Scott; Intel

Understanding the total life cycle CO2 impacts of different types of products and operations has been a subject of significant interest recently. Total life cycle impacts include not just the CO2 generated from the manufacture of a product, but also from the product's use and from the manufacture of all the inputs that go into creating the product. In theory, understanding this total impact can help manufacturers identify means of reducing the impact and could give consumers information that can be used as a consideration in purchase decisions. Unfortunately, there are to date no broadly accepted and consistent methods for calculating this impact. Determining the boundaries that define which inputs should be included in the assessment is a significant challenge. In addition, supply chains for manufactured products can be highly complicated, involving hundreds or thousands of individual suppliers, all of which have a large number of end customers. Few if any of these suppliers have the ability to collect energy use and CO2 impact data in a way that breaks the impact down by product or customer. This is especially true with complex products like semiconductors, making it very difficult to allocate the CO2 from the supply chain in a way that a customer such as Intel can estimate its portion of the impact from the manufacture of a material that is used by many other customers as well. This paper will present the results of a recent Intel study aimed at defining the boundaries for a life cycle CO2 assessment of its products and operations, and will present the results of the impact of the various stages that were studied.

Thursday, May 21

8:30-9:30 am

Room: Sonora Ballroom

Keynote 3

Chair:

8:30 am Photovoltaics and Semiconductors - Parallel paths to Sustainability

Fthenakis, Vasilis; Brookhaven National Laboratory and Columbia University

9:30 am Break

10:00-11:30 am

Room: Sonora A

ESH in PV/Solar

Chair: Brett Davis

10:00 am Leveraging EHS Knowledge to Solve Complex PV Challenges

Goss, Dale, Nicholson, Tim; EORM, AKT

Environmental, Health, and Safety (EHS) professionals are faced with a myriad of complex challenges compounded by the tremendous pace from the growth of the global photovoltaic (PV) industry. Regulatory requirements; environmental protection; worker safety & health; process tool installation and maintenance; facilities; and risk management are just a few examples of the issues faced by today's EHS professional. Over the last five years this market area has catalyzed the birth of new companies, manufacturing facilities, and attracted a range of employees from various industries to support this new industry in a variety of geographical locations. As a result, EHS professionals entering this industry area must quickly ramp up their knowledge of the chemical and physical hazards and identify ways to address current and upcoming regulatory requirements drawing from related industry experience and best management practices. As an example, the PV industry EHS profession can leverage the experiences from the integrated circuit and flat panel display industries over the last two decades. This presentation will discuss the multiple pressures facing EHS professionals, address lessons learned from similar industries, and highlight best management practices that the EHS professional can use immediately to reduce risk, optimize EHS performance, and reduce cost. The presentation will also highlight current cooperative efforts from global organizations, and how the EHS professional can be involved in not only the fostering and develop-

ment of proven EHS standards but a company's overall business strategy.

10:45 am Managing the Hazards and Environmental Challenges of Epi Deposition Processes in Solar and Semiconductor Manufacturing

Johnsgard, Mark, Johnsgard, Kris; Ebara Technologies Inc.

Epitaxial deposition has long been an essential process in the manufacture of many semiconductor devices, including microprocessors, memory, and power devices. With the added applications in the solar industry, many new and larger deposition systems along with a new generation of designers, engineers and technicians will be challenged with safely handling the many potential hazards of Epi deposition. This paper will outline the many hazards of the Epi process, focusing on the safe and effective treatment of the exhaust gas stream, and the challenges of the upcoming high capacity tools currently under development for the solar industry. Wet scrubbing can be an effective abatement strategy for Epi process but must offer high efficiency gas removal and long times between maintenance. The high efficiencies minimize the impact to facility systems and the environment. The extended maintenance intervals lead to minimized human interface and exposure to contaminants within the abatement internals, and greatly reduce the incidence of human error during servicing.

10:00-11:30 am

Room: Sonora B

Environmental Practices

Co-Chairs: Michelle Lan, John Bucciarelli

10:00 am How To Survive A Corporate Environmental, Safety, Health, and Fire Protection Audit

Pompa, Dominic; Northrop Grumman

With more and more emphasis being placed on environmental stewardship and corporate responsibility many semiconductor companies have instituted corporate audits as a way to insure regulatory compliance. While these audits are admirable, they also are very expensive, time consuming and stressful not only for the environmental/safety professional(s), but also for the entire site. See how one company has prepared for these audits through a positive and proactive program of preparation. You will learn how to set realistic objectives, meet significant milestones, develop a "Green

Philosophy", and generate employee accountability while increasing employee pride.

10:45 am Implement a Beneficial Reuse Program to Lower Your Generator Status

Lacheta, Darrin; Tosoh SMD, Inc.

Prior to 2006 Tosoh SMD (Tosoh), a supplier of sputtering targets and thin film materials, had been classified as a large quantity generator of hazardous waste. Tosoh regularly generates corrosive and flammable hazardous waste streams from manufacturing and laboratory operations. Tosoh, with the aid of an outside vendor, implemented a beneficial reuse program and lowered its generator status to "Small Quantity". The outside vendor matched Tosoh's hazardous waste streams with companies that needed similar materials as inputs. These beneficially reused materials no longer count against Tosoh's hazardous waste generator status. The costs associated with Tosoh's beneficial reuse program are similar to hazardous waste disposal costs, but Tosoh benefits from a lower burden in areas such as completing annual reports, conducting facility inspections and employee training. The receiving companies benefit from purchasing substitute materials at lower cost than virgin materials. The planet benefits because a smaller amount of hazardous materials are used to accomplish multiple tasks. The beneficial reuse program has been much more effective than Tosoh's previous participation in Waste Exchange Programs, which tend to focus on bulk shipments. Tosoh's successful beneficial reuse program has extended into solid waste streams allowing Tosoh to reach corporate recycling/reuse goals.

10:00-11:30 am

Room: Sonora C

GHG Roundtable

Chair: B. Davis

Speakers: Beu, Laurie, Trammell, Steve; SEMI, SIA

1:00-2:30 pm

Room: Sonora A

ESH in PV/Solars

Chair: Brett Davis

1:00 pm SEMI's PV EHS Initiative - Engaging EHS and Facilities Professionals

Zude, Aaron; SEMI

The PV industry has experienced tremendous growth over the past five years, placing enormous pressures on EHS needs and practices in the industry. Operating in dozens of countries, hundreds of new production facilities have recently come on line and thousands of new workers are interfacing with complex and potentially dangerous production processes. Unlike semiconductor fabs, which have experienced EHS staffs and robust EHS hazard controls in place, many PV facilities are currently in the learning mode. One of the challenges to ensuring that effective hazard controls are in place at PV manufacturing facilities, wherever they may be located, is that the PV industry has not yet developed an effective means for sharing knowledge on an industry-wide scale. Many of the process hazards in PV manufacturing are similar to those encountered and already solved by the semiconductor industry as the result of decades of cooperative effort and information sharing. There is a critical need to transfer the lessons learned and hazard controls developed by the semiconductor industry to the PV industry. This can occur in the form of education and training at EHS workshops, and through the application of safety and facility standards. This presentation will discuss SEMI's PV standards development and EHS initiatives. Attendees will be provided an overview of SEMI's current PV activities, including information on opportunities to participate. SEMI's PV EHS initiatives are a first step towards satisfying the need for developing experienced PV EHS professionals and for fostering development of proven EHS procedures and practices within the PV industry.

1:45 pm Overview of Hazards in a Renewable Energy Research Facility

Manno, Doug, Nelson, Brent; National Renewable Energy Laboratory

The National Renewable Energy Laboratory (NREL) is the nation's primary laboratory for renewable energy and energy efficiency research and development (R&D). NREL's mission and strategy are focused on advancing the U.S. Department of Energy's and our nation's energy goals. The laboratory's scientists and researchers support critical market objectives to accelerate research from scientific innovations to market-viable alternative energy solutions. At the core of this strategic direction are NREL's research and technology development areas. These areas span from understanding renewable resources for energy, to the conversion of these resources to renewable electricity and fuels, and ultimately to the use of renewable elec-

tricity and fuels in homes, commercial buildings, and vehicles. The laboratory thereby directly contributes to our nation's goal for finding new renewable ways to power our homes, businesses, and cars. The diversity of hazards associated with this research is vast. It ranges from the movement of extremely large and unwieldy wind turbine blades to the toxic, highly toxic and pyrophoric gases used in photovoltaic device production. These hazards are presented in an ever changing and dynamic environment. Standards, regulations and industry best management practices often either do not apply to the work or do not exist. This presentation will provide an overview to the main renewable energy technologies and the principal hazards of each. This will include a discussion of the relationship between the Environment, Health and Safety Office staff and research personnel and the approach used to mitigate risk challenges in a collaborative and creative manner.

1:00-2:30 pm

Room: Sonora B

REACH Roundtable

Chair: Sanjay Baliga

1:00 pm Device Maker Perspective

Speranza, Dawn; Intel

Provide a device makers perspective on the new EU REACH regulation. This talk will cover how we are getting our supply chain ready to meet all of the legal obligations imposed by REACH and how we are working within the supply chain to ensure our products meet all of the substances in articles requirements.

1:00-2:30 pm

Room: Sonora C

Chemical Regs/Management

Chair: Scott Stewart

1:00 pm Characterization of Trichlorosilane Release and Combustion Hazards

Chen, Jenq-Renn, Tsai, Hsiao-Yun, Ngai, Eugene Y. National Kaohsiung First University of Science & Tech., Taiwan

Trichlorosilane (TCS) is one of the key raw materials in manufacturing of PV grade polysilicon and silane gas. It is also been used directly in the semiconductor process as an alternative silicon source gas. TCS has a boiling point of 31.85 degree C and a flash point of -27.3 degree C with flammability limits of 1.2%~90.5%, rendering TCS a flammable liquid. The

major hazard of TCS is however not lies on its flammability but rather on its water reactivity and combustion by-product hydrogen chloride (HCl). Burning of TCS in air does not create a noticeable flame but instead, a very thick white smoke. Pure TCS vapor in the air will also react with moisture and form light smoke. The white smoke contains silicon dioxide and HCl which could cause significant impact on the environment and nearby community. To date, there exist very little information on how to assess the impact from TCS release and combustion. In this work, we will attempt to address these issues by performing direct field tests of TCS release and combustion. Three sizes of square test pans, 0.3m²0.3m, 0.5m²0.5m, and 1m²1m, with height of 0.1 m are used for TCS release and combustion tests. Five thermocouples are attached to the bottom of the pans to measure the liquid temperature. A fixed amount of TCS is filled into the test pan that is placed on a digital balance to measure the vaporization rate. For combustion tests, the TCS is ignited by a torch and the burning rates are measured. An open-path FTIR is used to identify the pollutant in the downwind ambient air. Pollutants identified were silicon dioxide and HCl for TCS combustion, and TCS and HCl for TCS release. Direct reading gas detectors were used to monitoring hydrogen chloride concentration in downwind locations. A dense gas dispersion model is used to verify the source model from burning rate and the measured downwind HCl concentration. The results will be useful in the emergency planning and risk assessment for TCS release.

1:45 pm Newly Identified Hazards Associated with Silicon Wafer Thinning Operations

Rubin, Jamie; Avago Technologies, Fort Collins, CO

An unexpected exothermic reaction in a sealed 55-gallon drum, followed by an “explosive” event, initiated an industrial hygiene case study and frustrating investigation to determine the cause of this reaction. Within semiconductor manufacturing, one process involves thinning the back side of a silicon wafer after the circuitry has been completed on the front side. The wafer thinning operation involves a basic water-wet process and diamond grit. The ground silicon contained in the waste water is removed using polypropylene filters. These filters become loaded and must be replaced. One day it was noted the filters were generating an exothermic reaction when removed. As a precaution, the filters were placed into a steel 55-gallon drum and

taken outside. Unfortunately, the lid was sealed on the drum. After conferring with several experts about what exothermic reaction might be occurring, a decision was made to don appropriate protective gear and loosen the drum lid. The lid forcefully (6-8 feet in the air) came off the drum either due to over-pressurization or a deflagration event. An industrial hygiene graduate student and the company CIH were tasked to determine the cause of this event. To date, the exothermic reaction continues to occur with the “explosion” hazard being controlled by not sealing the filters in a drum. Literature searches, numerous air sampling tests with direct reading instruments, standard IH sampling methods, grab-bag sampling with GC-MS analysis have been conducted. Though no individual results conclusively identified the compounds, each result provided a puzzle piece to assist in completing the picture. Some compounds have successfully been identified while others remain elusive. The IH graduate student presented the preliminary data at the SSHA conference in 2007 and received best student presentation award but was not able to present this at the closing session. Since that presentation, the investigation has continued and a NIOSH Health Hazard Evaluation was requested and is on-going. Though e results indicate a significant safety (flammable gas/gases) and health hazard (toxic gases) exists with the byproducts associated with this operation.

3:00-5:30 pm

Room: Sonora A

ESH Data Management/PV

Chair: Tiffany Giles

3:00 pm Applying What We Learned from Semiconductor to the PV Industry

DeGiorgio, Vinnie; FM Global

The PV Industry in many ways minors the semiconductor industry during the 1980’s and 1990’s with respect to rapid growth and evolving new processes. We learned many EH&S lessons regarding that period. Those lessons included fire and explosion risks, worker exposure, changing codes, new processes and chemicals, exhaust treatment, etc. This presentation will review what we have learned and how these lessons can be applied to the growing PV industry.

3:45 pm Managing Hazards in a Photovoltaic Research Facility

Nelson, Brent, Manno, Doug; National Renewable Energy Laboratory

Photovoltaic (PV) devices, also known as solar cells, directly convert sunlight into electricity. Even though it was known since 1839 that shining light on an electrolytic cell increases electricity generation, it took until the early 1950's before scientists at Bell Labs made the first PV devices that were capable of powering actual electronic devices. These early PV devices were made from crystalline silicon. The attractiveness of PV is the ability to generate electricity with a free "fuel" source—sunlight—that will be available on cosmological time scales and operationally produce no emissions. However, until recently, cost, reliability, and performance of PV devices have kept them from being competitive with traditional methods of electricity generation. The world production volume of PV manufacturing has more than doubled every two years for the past decade. Silicon continues to be the dominant material in PV manufacturing and the PV industry now processes more high purity silicon than the microelectronics industry. In the ever-continuing effort to make PV more competitive in the market place, many new material systems have been tried. To date, successful material systems include those based on gallium arsenide, amorphous silicon, copper-indium-gallium-selenide, cadmium telluride, organic, and dye-sensitized materials. The National Center for Photovoltaics (NCPV) at the National Renewable Energy Laboratory (NREL) maintains research programs supporting PV applications in all these areas, as well as crystalline silicon. The environmental, health, and safety (EHS) hazards presented by these activities are very similar to those of the semiconductor industry, and codes applying to semiconductor facilities also apply to PV facilities. Flammable, pyrophoric, toxic and highly toxic, corrosive, nanoscale, and cryogenic materials are used in PV processes. A given PV manufacturing facility focuses on large volume production of a given technology and therefore may deal with a subset of these materials. As a research facility supporting all these technologies, NREL has to be able to manage the risks associated with all the PV technologies, albeit in much smaller quantities. The NREL EHS Office works proactively with researchers and management in the NCPV to ensure hazardous production materials are stored, dispensed, processed, and abated according to applicable codes, policies, and procedures. In this presentation we

will present the framework for managing these hazards in a research environment where operations need to be flexible and adapt to new research areas. We will also illustrate differences between the types of engineering and administrative controls in a research facility to those in PV and semiconductor manufacturing.

4:30 pm Supplier Management IT solutions for ESH

Sharma, Balu, SupplierSoft, CA

As outsourcing increases, SEMI manufacturers are ever more dependent on their suppliers to ensure customer success. As a result, ESH professionals must increasingly collaborate with the suppliers to ensure that products comply with increasingly stringent regulations such as RoHS/REACH. Increasingly, companies are adopting CSR principles that tackle issues such as sustainability, GHG emissions and packaging of products. The Wal-mart Sustainability 360 is a prime example of such initiatives. Despite these changes, ESH professionals still use manual processes such as paper, e-mail, spreadsheets and word documents to collaborate with suppliers. As per a recent Aberdeen survey, 75% of supplier interaction still happens manually. Frequently, ESH requires multiple departments working with suppliers. As a result, companies have no central visibility into the ESH efforts that involve suppliers. The business impact includes operational inefficiencies leading to higher costs, along with increased supplier risks associated with quality, compliance and time-to-market. Over the last few years, comprehensive Supplier Management Platforms (SMP) have evolved that enable companies to flexibly manage all aspects of their supplier collaboration. These platforms can help companies provide a 360 degree view of supplier interaction across various functional departments such as ESH, Quality, Procurement and Engineering. These platforms are flexible enough to enable companies to automate any interaction that currently involves use desk top tools. Specifically for ESH professionals, these platforms can help automate following sample processes: • Collect Supplier Certifications such as ISO 9001/14001 and OSHAS 18001. • Survey suppliers through on-line ESH questionnaires • Track ESH supplier contacts • Collect part and chemical level compliance (RoHS/REACH) information. • Manage supplier ESH audits • Manage supplier corrective action • Ensure information stays accurate through expiration driven reminders • Manage ESH projects that involve tens and hundreds of suppliers • Enforce ESH business

processes • Provide real time visibility through dashboards and reports. Besides improving productivity, these platforms help companies reduce ESH compliance risk, improve supplier quality and help companies market ESH as a differentiator. Some SMP vendors offer Software as a Service (SaaS) model where the software is accessed through the web-browser over internet (similar to Google). This eliminates the need for installing the software inside the company and eliminates IT resource requirements. SaaS solutions frequently offer free trails. Subscription models vary from monthly to annual contracts and are usually based upon the number of users accessing the application. As a result, these applications can reduce your upfront investment and the risk of failure.

3:00-5:30 pm

Room: Sonora B

Sustainability/CSR

Chair: Pat Tierney

3:00 pm Sustainability Standards and Metrics

Redick, Thomas, Crane, Lauren, Fessler, Mark; GEEClaw, Applied Materials, Tokyo Electron America

Sustainability has arrived for semiconductor suppliers, but to define it and measure it will be challenging. Energy conservation, water, worker health and social obligations all need metrics, and this session will survey metrics issues and standard-setting activity for the sustainable “life cycle”, emphasizing the role played by ANSI and ISO standards. SEMI Global Care, S23 Energy and various Corporate Social Responsibility (“CSR”) organizations will offer self-assessment and quantitative measurement as SEMI members can lead the way in making metrics using statistical analysis and innovative metrology tools. Current ANSI, NIST and ASTM sustainability initiatives will be profiled along with Japanese carbon footprint labels and the JIG approach to ROHS. Competing demands for information and the practical limitations of component part or bulk suppliers will be raised. Sustainability metrics will provide a common language for explaining the “why” of sustainability, while innovators struggle to come up with the “How” to achieve it.

3:45 pm Moving Toward Sustainability in Advanced Technology Facilities

Chasey, Allan; Arizona State University

Sustainability and Sustainable Development are buzz words in today’s society. Since its introduction

with the Bruntland Commission Report in 1987, the philosophy of Sustainability and Sustainable Development has made significant progress, moving from the traditional ideas of economy and environmentalism to discussions and actions in corporate board rooms. As the Global Reporting Initiative of the UN Environment Program has indicted, business responsibility extends beyond the shareholders to people and places both near and distant from a company’s physical facilities. For corporations today, adherence to sustainability norms has now turned into a matter of survival and competitive abilities which also carry monetary rewards. The needs/requirements for both energy and resource conservation and facility cost reduction have not gone unnoticed in the International Technology Roadmap for Semiconductors (ITRS), a fifteen year look ahead for the semiconductor industry. The Environmental Safety and Health (ESH) chapter indicates that the most difficult challenges relate to the facility’s energy usage, water reduction/optimization and sustainability. These deal with the need to develop methodologies, processes, and/or systems that will provide a comprehensive understanding of the way that facilities, process equipment, and resources affect the sustainable performance in the ESH arena, yet meet manufacturing needs. At the same time, the Factory Integration (FI) chapter is responding to the continued pressure to reduce facility costs even in the face of ever increasing complexity, and provide cost effective, operating facilities. These two positions can be diametrically opposite. ESH needs must be integral in the planning, design, construction and operations of a semiconductor fabrication facility. A current measure that is gathering publicity and notoriety is the program of the US Green Building Council (USGBC) commonly called LEED (Leadership in Environmental and Energy Design). LEED for New Construction (LEED NC) has been used to assess performance of resource intensive facilities, but modifications and improvements to the current LEED rating system are needed to help better define and construct high performing resource intensive facilities. This presentation will look at current sustainability programs, for example LEED from the USGBC and the US EPA Labs21 Environmental Performance Criteria (EPC), and how they relate or do not relate to advanced technology facilities. The presentation will outline a foundation for defining parameters to help develop resource efficient facilities. This includes understanding the resource requirements of the semiconductors manufacturing facilities and how they differ from other facilities

in terms of water and energy requirements. It identifies potential areas that need to be addressed when developing criteria to determine the sustainability resource intensive facilities.

4:30 pm Prevention through Design (PtD)

Jamali, Jay; Enviro Safetech

This presentation will give an overview of Prevention through Design (PtD). Several studies have shown that the risk of occupational injury and illness as well as environmental impact can be reduced by integrating decisions affecting Environmental Health and Safety (EHS) in all stages of the design process. The Prevention through Design (PtD) approach is based on the concept that one of the best ways to prevent and control occupational injuries, illnesses and fatalities is to design out or minimize hazards and risk early in the design process. An ounce of prevention is worth a pound of cure. Proper PtD during the design and re-design process will prevent or minimize work-related hazards and risks associated with the construction, manufacture, use, maintenance and disposal of facilities, materials, equipment and processes. In addition it will eliminate or reduce the cost of retrofits. However PtD requires: Forethought Experience Management support Information in a timely manner PtD will result in less OSHA inspections and fines due to less accidents, injuries and illnesses, which usually trigger an OSHA inspection. OSHA fines range from hundreds of dollars to millions depending on circumstances. PtD and DFS usually reduce the cost of overhead. Although the costs associated with worker injuries are limited under workers compensation, third party liability (contractors and public) is not limited. The phases during which safety can be designed into the process are: Conceptual design Detailed engineering Procurement Construction Startup Demolition PtD will be beneficial during three major timeframes in the practice of safety: Preoperational, in the design process, where the opportunities are greatest and the costs are lower for hazard and risk avoidance, elimination or control Operational mode, where hazards are to be eliminated controlled and risks reduced before their potentials are realized and hazards-related incidents or exposures occur; Post-incident, as hazards-related incidents and exposures are investigated to determine causal factors and necessary risk-reduction measures. PtD is used to avoid bringing hazards and risks into the workplace when new facilities, equipment, materials and processes are considered, and to ensure that hazards and risks are properly addressed when existing operations are altered. To

implement PtD management may: Designate qualified in-house personnel to identify and analyze hazards, and assess the risks deriving from them for operations in place; Employ independent consultants with hazard identification/analysis and risk assessment capabilities to assist with respect to operations in place and in the acquisition of new facilities, equipment, materials or processes; Enter into arrangements with suppliers of newly acquired facilities, equipment, materials or processes to fulfill these responsibilities.

3:00-4:30 pm

Room: Sonora C

Chemical Regs/Management

Chair: Scott Stewart

3:00 pm Out with the Old, in with the New: OSHA and EPA under the Obama Administration

Rallison, Todd, Fava, Andrea; Intel, Chandler, AZ, Washington, DC

With arrival of the Obama Administration we are likely to see an increase in OSHA and EPA rulemaking and enforcement activity. This will be driven by new legislation pushed by the Obama Administration and adopted by Congress. During the recent campaign, President Obama pledged to strengthen occupational health and safety by increasing funding for OSHA inspections and training, issuing more standards and supporting the enactment of the Protecting America's Workers Act, which would increase OSHA civil and criminal penalties, expand coverage to public employees and enhance protections for whistleblowers. Similarly, President Obama has indicated that EPA will receive increased budget and funding to manage its increased role in the fight against climate change. In addition, EPA will be at the forefront of efforts to address toxic chemicals, revamp the Superfund program, and tighten air and water regulations. Of course, all these changes may be slowed by the economic crisis, which will force the Obama administration to set priorities, most likely focusing on areas where there is an intersection between jobs and the environment.

3:45 pm Avoiding a trainwreck between chemical policy and technology requirements

Jewett, Jim; Harland, John; Harper, Steve; Intel Corporation

Public/regulatory policy demands that chemicals identified for potential hazards should be prohibited from use in commerce and products in the consumer market. At the same time the future for semiconductor manufacturing requires the use of novel and unique chemicals that have a high probability of exhibiting those same potential hazards of concern. This presentation will discuss both sides of the argument on precautionary policy and hazard elimination with respect to semiconductor technology needs of the future.

4:30 pm Semiconductor Nanomaterials: Toxicology, Exposure Assessment, Controls & Control Banding

Kincaid, Linda, Rohm, Timothy; Industrial Hygiene Services

Toxicology: Nanoparticles (NP) present a greater health risk than do their bulk counterparts. NP can lead to tissue inflammation, which can be a precursor of cancer. Carbon nanotubes can induce granulomas, similar to those caused by asbestos. Many NP contain metal catalysts with little relevant toxicological data. Available data are primarily based on in vitro or animal studies, with very little human toxicology. Current research indicates that total surface area or total particle count may be better exposure indices than mass concentration, the usual industrial hygiene metric. **Exposure Assessment:** Standard exposure assessment methodologies are inadequate for NP. Industrial hygiene methods typically measure mass concentration, which does not correlate well with NP toxicity. Commercially available instruments can measure total surface area and total particle number, but these instruments include larger particles in their measurements as well as NP. Particle counters can also be prohibitively expensive, and most are cumbersome for field measurements. **Engineering Controls & PPE:** Standard containment and controls are effective for NP. Laboratory hoods, glove boxes, and local exhaust ventilation effectively capture NP. HEPA filters are adequate to remove NP from an airstream. Respirators with HEPA cartridges provide effective personal protection. Latex gloves provide only moderate protection. **Control Banding:** Given the lack of traditional industrial hygiene methods for NP exposure assessment, control banding is a plausible interim alternative. Samuel Paik, et.al. of Law-

rence Livermore National Laboratories have produced a Control Banding Nanotool that is user friendly and provides recommendations on engineering controls and PPE for various NP use scenarios. The Nanotool is based on Microsoft Excel, and it is readily customized for specific situations. Implementation of the 4 by 4 matrix is similar to the COSHH Essentials, used in Great Britain. Severity determination evaluates surface chemistry, particle shape, particle diameter, solubility, carcinogenicity, and other attributes of the NP in question. Probability determination estimates amount of materials used in a task, dustiness/mistiness, number of employees exposed, frequency of operation, and duration of operation. Each factor is entered into the Excel spreadsheet, which returns a Risk Level (RL) and recommended controls for the task in question. The CB Nanotool is presented with permission of the authors.

Friday, May 22

8:30-9:30 am

Room: Sonora Ballroom

Keynote 4

Chair:

8:30 am Keeping the focus on EHS in a down economy

Scarpace, Lew; Intel Corporation

9:30 am Break

10:00-11:30 am

Room: Sonora A

Codes/Regulations

Chair: Roy Dojahn

10:00 am Agency Inspection Readiness – The Path to Success

Schiller, Dina; Applied Materials

It is every company's goal to create a safe workplace, protect the environment and comply with regulatory requirements while ensuring business continuity operations. It is common practice to use the number of non-compliances as a measure of effectiveness against this target. This paper focuses on the ongoing efforts of Applied Materials Environmental Operations Group to ensure inspection readiness and environmental compliance at ALL times through the use of better leading indicators for performance. Some of these key proactive efforts include the environmental management system, a management of change program for process and facilities, an environmental self-audit program which empowers suppliers and stakeholders to close out any findings, an EHS action database, and an environmental compliance calendar system.

10:45 am Implementing an Energized Electrical Work Program

Davis, Brett; Zephyr Environmental Corporation

Both the Occupational Safety and Health Administration (OSHA) and the National Fire Protection Association (NFPA) have established regulations and standards with allowances for some electrical work being performed on energized circuits. To ensure conformance to these requirements it is important for companies to develop company specific energized electrical work programs that detail the procedures to be followed for authorizing, permitting, performing and documenting energized electrical work tasks. This pre-

sentation provides details about making determinations of whether or not energized electrical work can be authorized or "justified" per NFPA 70E and discusses the relevance of OSHA's separate rules for "maintenance" and "construction", in 29 CFR 1910 and 29 CFR 1926, respectively. The presentation offers a decision tree that can be used to determine when energized work can be allowed and details corresponding best practices for work permits, personal protective equipment, training and documentation.

10:00-11:30 am

Room: Sonora B

Resource Conservation

Chair: Jennifer Chittick

10:00 am Conducting an Environmental Audit

Sherer, Mike; Sherer Consulting Services, Inc.

Environmental audits can be useful and valuable to a company. It is crucial that the auditor assist the business with ideas to reduce costs and streamline compliance activities. This presentation will detail important items for the audit and during the audit. Some common environmental program opportunities for improvement will be presented that were found during actual environmental audits.

10:45 am New Metrology for Process Optimization and Water and Energy Savings during Surface Preparation of Patterned Wafers

Dhane, Kedar, Han, Jeongnam, Yan, Jun, Shadman, Farhang, Vermeire, Bert; University of Arizona, Tucson

Surface preparation of patterned wafers by batch processing becomes a major challenge as semiconductor fabrication moves deeper in submicron technology nodes. Many fabs already employ single-wafer immersion and single wafer spinning tools. The main drawback of single-wafer tools is their lower throughput. This disadvantage is eased by introduction of multi chamber tools. To reduce cycle time and resource utilization during rinse and dry processes without sacrificing surface cleanliness and throughput, in-situ metrology is desirable. Electrochemical Residue Sensor (ECRS), metrology was used to compare typical single wafer spinning tools with immersion tools for rinsing of the patterned wafers. This novel metrology technology combines hardware for an in-situ measurement with software for process data analysis. Successful incorporation of this metrology improves visibility of

what is happening inside micro-features during surface preparation and will reduce dependency on external analyzing techniques such as ICPMS, SEM, and TEM and will lead to fast response time. In this study the ECRS was incorporated into a lab scale single-wafer spinning and a single-wafer immersion tool. A special contact pad was designed and fabricated for the single wafer spinning tool. It was mounted below the chuck to electronically connect the ECRS to the LCR meter. This modified single-wafer spinning clean/rinse/dry tool setup can provide real-time data on the amount of contaminant or water left inside micro- and nano-structures during rinsing and drying. The ECRS was used to monitor the dynamics of rinsing after various cleans such as SC-1, SC-2 and Piranha. It was observed that different cleaning chemicals impact the subsequent rinse not only through adsorption and desorption of the cleaning chemical but also through surface charge. The surface charge depends on the concentration and the temperature of the cleaning chemicals. The results are analyzed by using the comprehensive process model which takes into account various transport mechanisms such as adsorption, desorption, diffusion, convection and surface charge. This allows the concentration of contaminant on the surface to be extracted from the measurements. By using this in-situ and real time metrology it is possible to optimize any rinsing or drying process that will lead to savings of water and energy usage. This novel metrology can be used at very low impurity concentration with very high accuracy.

10:00-11:30 am

Room: Sonora C

Nanomaterials ESH

Chair: Christine Pomeroy

10:00 am Nanotechnology: Environment, Health, and Safety

Miller, Clark; Arizona State University, Tempe

This presentation will provide a brief overview of the field of nanotechnology and environment, health, and safety issues surrounding its application. Discussion will focus on highlights of research on the safety of nanoparticles, current safety guidelines from the National Institute of Occupational Safety and Health, and sources of further information about risk and safety issues surrounding nanotechnology.

10:45 am Risk Management and Nanoscale Materials; Adopting a Stewardship Standard

Ewert, Donal; AIHA Nanotechnology Working Group

Accepting risk is a prioritization process, one in which risks with the greatest potential for loss are put aside in favor of those that pose only a minimal chance of defeat. The skilled risk manager constantly monitors this and adjusts the campaign to balance risks against effort and benefit. If innovation involves concepts that have already realized success, familiarity can be utilized to advance marketability. If it is for something unknown, the approach must overcome a human tendency to avoid jeopardy. With nanotechnology advancement, these barriers can be slightly less formidable. This is primarily due to our acceptance of chemical development as an integral part of technology. Thus, we have come to routinely anticipate change. To accommodate our risk-averse nature, the public carefully balances change with a portfolio of protections, all designed to guard human health and the environment in which we live. These safeguards include a host of regulations that now govern the actions of all producers and chemical end users. Companies no longer have the freedom to introduce new products without first tempering their process through a myriad of health and safety considerations. By establishing tough regulatory oversight, we control the processing, marketing, transportation and disposal of nearly every chemical in existence. It is now incomprehensible to imagine that a company would develop and manufacture a new chemical, whether nanoscale or not, without first offering careful consideration to the toxicological impact and legal implications that may occur. While creation of nanoscale

materials is a novel process, the risk management tools used to control outcomes is not. Like all advances in chemistry, risk is managed throughout the product life cycle. At the design phase, process safety considerations including control banding and chemical hygiene are applied to provide protection for the workforce. Once the processes are initiated; skilled organizations add education, exposure assessment, and monitoring to their arsenal of tools. Thereafter, we rely on product stewardship and corporate sustainability to move the process forward and assure public safety. Finally, a new tool has become available that allows us to conduct full-cycle risk analysis using analytical methods. This latter protocol, entitled Risk-MaPP, lays out a detailed description of each process and accounts for the risks associated with individual levels of exposure.

11:30 am

Room: Sonora A

**Closing Ceremony
SESHA Business Update
Awards**

Speaker Biographies

Jim Belanger

Mr. Belanger has over 14 years of experience in the semiconductor industry as an environmental health and safety professional. He earned a B.S. in Occupational Safety from Keene State College and an M.B.A. from Daniel Webster College. He served as a Safety Engineer at Digital Equipment Corporation and National Semiconductor Corporation, both 200mm semiconductor manufacturing facilities. In his years as a safety engineer, he assisted in the development and management of various EH&S programs and equipment installation processes. His responsibilities also included the design, installation, and maintenance of state-of-the-art toxic gas monitoring systems. In 2005, Mr. Belanger transitioned to Honeywell Analytics as a Regional Sales Manager serving the eastern region of the United States. Mr. Belanger currently serves as the Business Development Manager for the high technology line of business. In this role, he is able to assist customers with his technical background while also helping Honeywell Analytics bring new technologies to market that will better serve the high technology sector.

Allan Chasey

Dr. Chasey is an Associate Professor in the Del E. Webb School of Construction at Arizona State University. He received a Ph.D. from Virginia Tech, a Master of Science in Engineering Management from the Air Force Institute of Technology, and a BS in Civil Engineering from Arizona State University. He is Director of CREATE, Construction Research and Education for Advanced Technology Environments, a research consortium of 30 companies representing the Advanced Technology design and construction industry. He is a registered Professional Civil Engineer in Arizona and a member of American Society of Civil Engineers (ASCE), the International Society of Pharmaceutical Engineers (ISPE), and the Institute of Environmental Sciences and Technology (IEST), and SESH.A.

Jenq-Renn Chen

Jenq-Renn Chen is the Professor of the Department of Safety, Health and Environmental Engineering, National Kaohsiung First University of Science and Technology, Taiwan. He is also in charge of the Taiwan EPA Southern Emergency Response Team which provided emergency response service to southern Taiwan. He received MSc and PhD from Imperial College, London, UK, both in Chemical Engineering. He has authored more than 50 papers in international journals and con-

ferences, all in the broad range of process safety. He also participated in more than 70 chemical emergency responses and incident investigation in Taiwan. His current research interests are gas explosion, bubble explosion, and fundamental aspects of chemical releases.

Taipau Chia

Taipau Chia was born in Taiwan in 1962. I obtained a PhD degree from the Department of Materials Science and Engineering of the University of Florida in USA in 1993 and worked as an associate researcher from 1993 to 1998 in the Institute of Occupational Safety and Health in Taiwan. After qualified in a national examination for safety professional in Taiwan[CSP], I worked as an associate professor in the Department of Safety, Health and Environmental Engineering of Hungkuang University since 1998. Major research interests include occupational safety management, planning of safety program and work safety in confined space. Recent Projects I conducted include 'Project of Chemical Hazards Prevention and Integrated Emergency Response Program' (2007), 'Project of Self-Management of Occupational Safety and Health in High Technology Industry', both were funded by the Bureau of Central Taiwan Science Park in Taiwan(2008).

David M. Cotter

Mr. Cotter is a senior environmental engineer at Capaccio Environmental Engineering, Inc located in Marlborough, Massachusetts. He holds a Bachelors Degree in Mechanical Engineering from Wentworth Institute of Technology and has worked as an air quality specialist for over twenty years. His experience includes: ambient monitoring, source testing, indoor air quality, air pollution control specification, transportation air modeling, air emissions inventory/auditing, compliance resolution, and air permitting.

John D. Cox

Mr. John D. Cox has a B.S. in Chemical Engineering and a M.S. in Environmental Health Engineering from the University of Notre Dame. He has more than 25 years of experience managing industrial environmental health and safety programs. He is experienced in the development of EH&S management systems and has considerable success in implementing proactive, prevention-based programs, accomplishing significant reductions in operating costs. Mr. Cox has been an EH&S Manager for Digital Equipment Corporation, EH&S Director for Shipley Company and Vice Presi-

dent of Worldwide Environmental Health and Safety Affairs for Siliconix, Inc. Mr. Cox is a Professional Engineer in both Chemical and Environmental Engineering and an accomplished C.I.H. At Advanced Technology Solutions, Mr. Cox specializes in the development of value-added EH&S management systems, industrial hygiene studies, prevention-based health and safety programs and facilitating product/process/equipment safety reviews. John has specified, conceptually designed and commissioned a number of toxic/flammable/corrosive/pyrophoric gas detection and control systems for semiconductor fabrication facilities for industrial clients and academic institutions over the past 30 years.

Lauren Crane

Lauren Crane (Univ. Houston, B.S. Elec. Eng, Univ. Texas), started out as programmer/systems engineer for ion implanters. Since 1995, as Product Regulatory Analyst in Applied Materials (AMAT) EHS, Lauren has handled regulatory compliance with European directives and SEMI Standards. He assists with AMAT's energy efficiency program and helped write S23. As co-leader of SEMI's International S23 Task Force with Mr. Shigehito Ibuka (Tokyo Electron), he participated in SEMI Technical Education Programs and the ISMI Manufacturing Symposia, the ISMI Total Equipment Energy analysis tool and new North American revision proposals for SEMI S23.

Brett Davis

Brett Davis is currently a Project Engineer for Zephyr Environmental Corporation in Austin. Before entering the consulting profession, Brett was on the Corporate Environmental, Health and Safety (ESH) Staff for Motorola's Semiconductor Products Sector, where he provided consulting support and managed special projects for site operations worldwide. Brett's current professional interests include process risk management, air permitting, climate change, resource conservation and electrical safety. Brett served as chair of the Travis County Local Emergency Planning Committee (LEPC) for nine years. He served on the Central Texas Clean Air Force Executive Committee for four years and is currently the Chair of the organization's Technical Committee. Brett has a B.S. in Chemical Engineering from the University of Texas at Austin and an M.S. in Hazardous Waste Management from National Technological University of Fort Collins, CO. He has been a registered professional engineer in Texas since 1991.

Vinnie DeGiorgio

Vinnie DeGiorgio is the semiconductor Principal Engineer for FM Global and provides company-wide technical leadership. He has nearly 30 years of property loss control and business impact risk assessment experience associated with the semiconductor and related high technology industries. Vinnie has a BS Degree in Engineering and a MS Degree in Fire Protection Engineering. He maintains memberships in the NFPA, SFPE, board member of SESH and is the secretary of the NFPA 318 Technical Committee on Cleanrooms. Vinnie has traveled to Asia numerous times and is very knowledgeable of the Asian semiconductor industry.

Kedar Dhane

I am a graduate student at ChEE Dept, University of Arizona, Tucson. I have been working on this project for last 4 years as a dissertation topic. I am very close to my graduation. I have done an internship for 3 months at Freescale Semiconductor, Tempe in summer of 2008. I have worked on several projects in my undergraduate years and have maintained a good GPA. I have received several awards for my academic achievements. I have about 5 years of clean room (class 10 and 100) work experience and familiar with various deposition, dry and wet etch, lithography and metrology tools. Apart from academia, I have worked on several committees on university level during my undergraduate and graduate years.

Donald Ewert

The year 2009 marks Don's 32nd year as a practicing Industrial Hygienist with a career start as Radiation Safety Officer for North Dakota's largest radioisotope user. During his tenure with North Dakota State University, Don completed his Bachelor's degree in Chemistry and worked towards a Masters degree in Business Administration along with a PhD in Biochemistry. In 1985, Don founded HTI Laboratories and Industrial Consultants, an environmental engineering and consulting firm. This start-up venture gained national recognition and in 1990, the company boasted more than 100 EHS professionals working from 5 offices nationwide. As a leading field & laboratory services organization, HTI served some of our country's largest corporations as well as a Who's Who of institutional, industrial, and governmental cliental. Through HTI, Don oversaw environmental sampling of the World Trade Center's Twin Towers, remediation of medical facilities at Guantanamo Bay Cuba, creation of the first EPA-NIST Certified Mobile Laboratory,

and development of three major environmental laws. Following years as an expert witness in the area of forensic toxicology, Don accepted a position as Research Scholar in the Center for Environmental Toxicology & Technology at Colorado State University and furthered his graduate work in Environmental Health and Toxicology. Upon leaving CSU, Don began work with the Fort Peck Tribes of Northeastern Montana. There, he led the tribal nation toward satisfaction of a major consent decree. At the conclusion of this work, Don returned to Colorado where he served as the Environmental, Health, & Safety Manager for NanoProducts Corporation, a venture capitalized metal oxide powders manufacturer. In this position, he provided guidance to an anxious health community concerned about the potentially toxic effects of nanoscale materials. More recently, Don joined Oso BioPharmaceuticals, formerly Catalent Pharma Solutions, in their New Mexico based corporate operations. With OsoBio, Don provides global EH&S oversight for FDA-cGMP Risk Management Programs and utilizes his vast industrial hygiene and environmental experience to create leading edge exposure control practices involving a wide range of potent pharmaceutical compounds. Don is also Vice-Chairman of the American Industrial Hygiene Association's Nanotechnology Working Group where his leadership skills are being used to benefit the professionals and public served by this important organization.

Mark Fessler

Mark Fessler (B.S./M.A. in Mech. Engineering) has over 15 years in the semiconductor industry and is one of a few SEMI members that have championed the investigation for more accurate / efficient ways to analyze existing safety and environmental data. In his 13 years at Tokyo Electron U.S. Holdings, Inc. (TEH) he acted as engineering manager (Reliability and Product Safety), mainly design and testing including existing TEL equipment. He actively supports SEMI Standards Programs (Equipment E-Standards and Safety S-Guidelines). As TEH's Product Safety Program Manager for both Japan and US, he oversees new R&D equipment programs involving surface treatments. He introduced new statistical analyses to TEH's safety programs.

Mark Fessler

Mark received his Bachelor's and Master's degree in Mechanical Engineering and has worked for over 15 years as an Engineering Manager in the semiconductor industry. Mark's background started in the area of Reliability Engineering as the semiconductor industry

expanded in the 1990's to also include Product Safety Engineering. Both of these fields (Reliability and Product Safety Engineering) are very similar in that they are both primarily concerned with failure modes, and the resulting severity and likelihood of such occurrences. Mark used well proven reliability methodologies (Risk Assessments', Life Testing, FMEA and HAZOP's) and readily incorporated them into the semiconductor's Product Safety Engineering field. Mark's >12 year tenure at Tokyo Electron U.S. Holdings, Inc. (TEH) he has held engineering management positions both Reliability and Product Safety, focused in design and testing of various TEL production lines. Mark's current role as TEH's Product Safety Program Manager has focused in supporting both TEL's Japanese and US factories in product safety issues, especially with new R&D equipment programs. He has championed the investigation for more accurate / efficient ways to design and audit R&D equipment. The introduction of new TEH risk management process was a natural progression in the advancement of TEL safety programs in the both the US and in Japan.

Dale Goss

Biography not available at the time of printing.

Tim Higgs

Tim Higgs is an environmental engineer with Intel's corporate environmental organization. He received his B.S. degree in chemical engineering from Michigan State University in 1983 and is a registered professional engineer (chemical) in the State of Arizona. Tim has been with Intel for 25 years in a variety of environmental positions at the site and worldwide levels, and has extensive experience in matters related to air permitting, air emissions control, energy efficiency and climate change. He has worked with state and local regulatory agencies across the U.S. as well as in other nations on air pollution control programs, and has frequently consulted with U.S. EPA on air program matters of importance to the semiconductor industry.

Jay Jamali

Mr. Jamali EHS Director of Enviro Safetech has over 25 years of experience in the EHS field. He is a CSP, CHMM, CHCM with a bachelors degree ins safety engineering and a minor in industrial hygiene. He is on the faculty of University of California and has presented at EHS conferences locally and internationally.

Jim Jewett

Biography not available at time of printing.

Mark Johnsgard

Mark and Kris Johnsgard attended SJSU studying Physics in the 70s while working full time at Epitaxy Inc., the first Epi service company in Silicon Valley. They have over 60 years of combined experience in epitaxial and silicon wafer processing, equipment and process development and facilities and maintenance at companies such as Gemini Research, Moore Technologies and Mattson Technology. In 1988 they founded Airgard Inc. a point of use gas abatement manufacturer, initially targeting abatement solutions for the Epi industry. Between them they have over 15 patents granted and applied for.

Linda Kincaid

Linda Kincaid has a Master of Public Health from U.C. Berkeley, and she is a Certified Industrial Hygienist. She has been associated with Dr. Timothy Rohm and Industrial Hygiene Services since 1990. Her area of expertise is exposure assessment, and she is qualified to address complex exposure scenarios. Since 2003, Ms. Kincaid has focused on EHS issues related to nanotechnology, and she has actively followed developments in the field. She attended the Second International Symposium on Nanotechnology and Occupational Health and the AIHA-NCS 2008 Technical Symposium: "Occupational Health Aspects of Nanomaterials". She is a member of the AIHA Nanotechnology Working Group. She participated in the 2008 Nano Risk Analyses workshop hosted by the Society for Risk Analysis, where she had the opportunity to discuss the subject in depth with Dr. Andrew Maynard and other leaders in the field. Ms. Kincaid is conversant with current EHS methodologies to measure nanoparticles and minimize occupational exposures. Timothy Rohm is a Ph.D. in Chemistry and a Certified Industrial Hygienist (retired). He is the founder of Industrial Hygiene Services, an EHS consulting company in Silicon Valley. Dr. Rohm was instrumental in developing the Santa Clara County Toxic Gas Ordinance, now the model ordinance for the semiconductor industry. He has specialized in monitoring toxic gases and has developed numerous monitoring protocols for high tech clients. Dr. Rohm is a recognized authority on industrial hygiene and occupational exposure issue. He teaches industrial hygiene for the U.C. Santa Cruz Extension.

Vivien Krygier

Vivien Krygier is currently Senior Vice President of Microelectronics Marketing at Pall Corporation. She received her Ph.D. from McGill University, Montreal,

Canada, in biochemistry. Before joining Pall Corporation, she worked at the Max Planck Institute for Biochemistry in Germany and the Albert Einstein College of Medicine in New York. For over 29 years, she has been involved with the semiconductor industry in various roles at Pall Corporation, including new product development and customer support. She has published several articles in the field. She is currently supporting Pall's efforts in the photovoltaic arena.

Darrin Lacheta

Darrin Lacheta has been the Environmental, Health & Safety Engineer at Tosoh SMD, Inc. for over five years. Prior to joining Tosoh Mr. Lacheta operated his own EHS consulting company. Mr. Lacheta has worked in the field of EHS for over 17 years focusing on areas such as hazardous waste management and minimization, industrial wastewater treatment, hazard communication, RoHS and REACH. Mr. Lacheta is a Professional Engineer registered in the State of Ohio, a CHMM, an Ohio EPA Class III Wastewater Operator and a Certified Electroplater/Surface Finisher (CEF). Mr. Lacheta earned a B.S. in Chemical Engineering from The Ohio State University and an MBA from the Fisher College of Business, The Ohio State University. Mr. Lacheta lives in Dublin, Ohio with his wife and three children.

Lise Laurin

Lise Laurin, began her career at Intel and spent 20 years in the semiconductor industry before founding EarthShift in 2000 to help businesses understand their environmental impacts.

Doug Manno

Mr. Manno is a graduate of Illinois State University with two B.S. degrees in Occupational Safety and Industrial Technologies. He has been working in the safety field for 14 years. 10 of those years have been at the National Renewable Energy Laboratory in Golden, Colorado. He is a CSP and a darn nice guy.

Clark Miller

Professor Miller is Associate Director of the Center for Nanotechnology in Society and the Consortium for Science, Policy & Outcomes at Arizona State University. He is also the Chair of the PhD Program in Human and Social Dimensions of Science and Technology. He holds a PhD in Electrical Engineering (Cornell, 1996) and a BS in Electrical Engineering (Illinois, 1990).

Tim Mohin

Tim Mohin is a Principal Consultant for Environmental and Occupational Risk Management [EORM] in San Jose. Mr. Mohin is the team leader for EORM's growing sustainability and corporate social responsibility practice. Prior to EORM, Mr. Mohin was Apple's senior manager for supplier responsibility - leading Apple's efforts in developing a world-class program for achieving social and environmental responsibility in Apple's supply chain. Mr. Mohin also formerly worked for Intel Corporation from 1995 to 2006 where he held several positions including Corporate Environmental Manager and Director of Sustainable Development. Before joining Intel, Mr. Mohin worked in the Federal Government with both US Senate and US EPA. He led the development of environmental technology legislation and was the EPA lead for the Air Toxics provisions of the Clean Air Act Amendments of 1990. Mr. Mohin has a BS from the State University of New York and a Masters degree from Duke University.

Brent Nelson

Brent spent most of his career studying second-generation photovoltaic (PV) devices; primarily hydrogenated amorphous silicon and its alloys at the National Renewable Energy Laboratory (NREL). He is well published in the scientific community and written numerous internal documents as well as coauthoring several papers in the EHS field. He is also a well known within the PV community for his expertise in safety practices in working with hazardous production materials (HPMs) and has chaired the HPM safety panel at NREL for over a decade. Currently Brent manages a laboratory designed to integrate as many of the PV technologies and material characterization techniques as possible.

Tim Nicholson

Biography not available at time of printing.

Alain Pardon

Alain Pardon is manager of the ESH-group at IMEC and leads the ESH-team. He has been involved in the safety of semiconductor process development for more than 20 years. IMEC is an international centre of excellence based in Belgium and housing 1600 scientists and technicians from more than 50 different nationalities. Its mission is to perform R&D, ahead of industrial needs by 3 to 10 years in microelectronics, nanotechnology, design methods and technology for

ICT systems. One of its core activities is to develop and demonstrate semiconductor manufacturing processes. IMEC has a turnover of more than 250 MEuro.

Dominic N. Pompa

Dominic N. Pompa has been involved in environmental, safety, health, and fire protection for over 35 years. First as a Compliance Officer with the Maryland Occupational Safety and Health Administration, then as a Safety Engineer with the Westinghouse Electric Corporation, and finally as a Fellow Engineer with Northrop Grumman's Advanced Technology Laboratories. Dominic received his B.S. in Education from Towson State College and subsequently received both a M.S. in Instructional Technology from Towson State University, and in Safety Science from Indiana University of Pennsylvania. Dominic has been a professional member of SESH since 1994.

Todd Rallison

Todd Rallison is CS Counsel with Intel Corporation with primary responsibility in the environmental, health and safety (EHS), real estate, construction, and product regulation areas. Prior to joining Intel in 2001, Todd was a shareholder in the Phoenix, Arizona law firm of Gallagher & Kennedy, P.C. and in-house counsel with Arizona Public Service Company and Motorola, Inc.

Thomas P. Redick

Tom Redick (BA/J.D. University of Michigan) has over 23 years of experience as an environmental and product safety attorney for clients in the high-technology (including Cymer, Inc. since 1998) and biotechnology industry sectors. He focuses on standard-setting and regulatory issues, including liability avoidance and compliance with industry standards addressing socio-economic and environmental impacts of multinational operations. His practice emphasizes compliance with supply chain demands for environmental information and transportation issues, including documentation for recycled industrial equipment with traces of toxics under the Basel Convention on Hazardous Waste. He was recently appointed to the ANSI SCS-002 Life Cycle Assessment (Type III Ecolabeling) Standards Committee. Web bio at www.geeclaw.com.

Nelson F. Rivera

Mr. Nelson F. Rivera has over 30 years of experience working as a supplier of gas detection solutions to the semiconductor industry. He earned a B.A. in Business and Marketing from DePaul University in Chicago.

go and M.B.A. in Global Business Management from UOP. He served as VP of Operations and Engineering for MST Technologies and President of MST Technologies. In his years as a VP of Engineering, he managed the development and integration of life safety systems which included toxic gas monitoring and control systems. In 2006, Mr. Rivera transitioned to Honeywell Analytics as a Sr. Marketing Manager for the High Tech / Government Line of Business serving the Americas. In this role, Mr. Rivera works with customers, R&D and engineering in the development of products that provide solutions to the high technology sector.

Jamie Rubin

CIH Certified Industrial Hygienist and CHMM Certified Hazardous Material Manager. Education: BS in Environmental Health from Colorado State University and MS in Environmental Health from University of Cincinnati. Seven years experience as OSHA Compliance Officer and OSHA supervisor. Twenty three years experience in high tech industry including Honeywell, Hewlett Packard, Agilent Technologies and Avago Technologies.

Dina C. Schiller

Dina currently works as a Senior Environmental Engineer in Applied Materials. She has more than 10 years of EH&S experience in semiconductor industry, government sector, consulting and academe. Dina holds a Bachelor of Science degree in Chemical Engineering (Cum Laude) and a Master of Science degree in Environmental Engineering from the Philippines. She is a licensed Professional Engineer (Chemical PE), a Board Certified Safety Professional (CSP), and a Registered Environmental Assessor (REA). She's also an active member of the Chemical PE Exam Committee of the National Council of Examiners for Engineering and Surveying (NCEES). Dina has successfully presented in the past three SSHA Conferences.

Balu Sharma

Balu Sharma is the CEO and founder of SupplierSoft. He has experience in enterprise software market with deep domain expertise in supply chain and ESH issues. He has vertical domain expertise in electronics supply chain chains, including SEMI equipment companies and semiconductor manufacturers. SupplierSoft customers include a large SEMI equipment manufacturer. He has an undergraduate degree from IIT Bombay in Electrical Engineering and a master's degree from USC, Los Angeles.

Mike Sherer

Mike Sherer, P.E. is the Principal of Sherer Consulting Services, Inc. Mike has 28 years of experience in environmental projects and programs. He has worked in the semiconductor industry for 17 years, and has conducted environmental audits in several semiconductor and high-tech facilities.

Dawn E. Speranza

Dawn E. Speranza has over 20 years of EHS experience ñ 10 with Intel/ 10 with DEC. She has held various positions in the EHS field and is currently the REACH program manager for the Intel Global Fab Materials EHS organization. She is located in New Mexico. Prior to this, Dawn was on assignment at International SEMATECH where she project managed various global chemical initiatives and the ESH assessments of new materials and processes for the advanced technologies. She also has managed Fab Construction Safety projects from the design phase & tool installation to de-install and demolition. She has a B.S. degree from Tulane University and a M.S. degree from the University of Massachusetts at Amherst. Dawn is a certified Industrial Hygienist and Safety Professional. Dawn currently holds the position of president on the Semiconductor Environmental Safety & Health Associations Board of Directors. Dawn is an active member of the SEMATECH REACH work group.

Joe Van Gompel

Joe Van Gompel is the President and Founder of Glade Consulting, LLC, focusing on subfab operations, safety training, and climate change in the semiconductor industry. Joe has a BS in Chemistry from Carroll College in Wisconsin and a Ph.D. in Chemistry from the University of Illinois. Previously, Joe spent 12 years as a point-of-use exhaust gas management specialist for (BOC) Edwards, where he was the primary technical specialist for Edwards' POU scrubbers in the US. While there, Joe had final approval of scrubbers on new processes, ensuring proper configurations based on safety while optimizing for uptime and cost of ownership. In addition, Joe wrote and presented technical papers and seminars at conferences and was the technical liaison between the fab and the company. Prior to Edwards, Joe spent 5 years as an applications chemist at Mattson Instruments, an FTIR supplier subsequently purchased by Thermo. Joe is active with SSHA and is a member of the American Chemical Society.

Earl Vickery

I spent 23 years as a process engineer and manager in the semiconductor industry. In 1989 while a Member of the Technical Staff at the Hewlett Packard Company, I developed the Guardian Gas Protection System that has been used through the world. I then founded On Demand Environmental Systems and Applied Technology Specialists to design and manufacture air and process gas abatement systems. I have also been a technical resource over the last ten years for several law firms working on cases involving abatement technology and equipment.

Aaron Zude

Aaron Zude is the Senior Director of the Environmental, Health & Safety (EHS) Division at SEMI. His role is to coordinate SEMI's global environmental health and safety activities by working in conjunction with regional offices to effectively deliver benefits to members related to EHS issue advocacy; committee management; program development; internal and external communication and integration of EHS activity with the member segments that SEMI serves. SEMI is the global industry association serving the manufacturing supply chains for the microelectronic, display and photovoltaic industries. SEMI maintains offices in Austin, Beijing, Brussels, Hsinchu, Moscow, San Jose, Seoul, Shanghai, Singapore, Tokyo, and Washington, D.C.

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Exhibitors

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Exhibit Hall Raffle:

We will be holding a raffle with some very nice prizes in the Exhibit Hall on Thursday. Starting Wednesday you will be able to get tickets at each exhibit booth in exchange for a business card. Drawings will take place at the end of the lunch and afternoon breaks on Thursday. You must be present to win.

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Free Wireless Internet Access is provided in the exhibit hall.

Exhibit Hall Schedule and Activities:

Wednesday:

- ◆ Complimentary Exhibitor Lunch, Begin Distribution of Raffle Tickets in the Exhibit Hall from 11:30 AM to 1:00 PM
- ◆ Afternoon break in the Exhibit Hall from 2:30 to 3:00 PM - Continue Distribution of Raffle Tickets
- ◆ Evening Welcome Reception in the Exhibit Hall from 4:30 to 6:00 PM - Continue Distribution of Raffle Tickets

Thursday: RAFFLE BEGINS!

- ◆ Morning break in the Exhibit Hall from 10:00 to 10:30 AM; Raffle Drawing #1 at 10:25 AM
- ◆ South of the Border Exhibitor Sponsored Lunch in the Exhibit Hall from 11:00 AM to 1:00 PM; Raffle Drawing #2 at 12:45 PM.
- ◆ Afternoon Soda Break in Exhibit Hall from 2:30 to 3:00 PM; Closing Raffle at 2:55 PM

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SEMI is the global industry association serving the manufacturing supply chains for the microelectronic, display and photovoltaic industries. SEMI supports its members through industry advocacy, safety guidelines, EHS committees and Working Groups (Energy Conservation, RoHS, Materials Declaration, PFOS, and REACH), the SEHS Grapevine online discussion group (www.semi.org/grapevine), and an annual industry workplace illness & injury survey. SEMI manages Global Care (www.semi.org/globalcare), a voluntary initiative promoting EHS excellence and sustainability. SEMI maintains offices in Austin, Beijing, Brussels, Hsinchu, Moscow, San Jose, Seoul, Shanghai, Singapore, Tokyo, and Washington, D.C. For more information, visit www.semi.org.

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Zephyr is an environmental, health and safety firm offering consulting, training, and data systems services to clients worldwide. Zephyr is 15 years old and has offices in Austin, Houston and Baltimore. We specialize in air & water quality, waste management & cleanup issues, incident management, and workplace & community safety.