Semiconductor Equipment Industry Framework for Safety Guidelines & Environmental Standards

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Outline

• Role of Trade Associations in Standards
  – SEMI Standards in the Semiconductor Industry
  – SEMI’s Global Care Program

• Why Voluntary Industry EHS initiatives?
  – Potential benefits to companies, industry & society

• What is Global Care?
  – How it provides a framework for addressing EHS issues affecting our industry

• Steps taken by member companies demonstrating the principles of Global Care
The Electronics & Semiconductor Industry Ecosystem

SEMI® membership

SEMI = Semiconductor Equipment & Materials International
Role of Trade Organizations

Who has been most active in negotiating and influencing standards & environmental initiatives?

• Governments
• Large International Corporations
• Industry Trade Organizations such as
  - TechAmerica (formerly AeA)
  - IPC
  - SEMI & SIA
Trade Organization Highlights

What are some specific contributions?

• AeA
  - Extensive involvement with interpretation of EU Directives and Standards over the last 20 years.

• IPC
  - Standards & tools used in Electronics industry

• SEMI
  - Industry Standards, Education, and Advocacy
  - RoHS2 & WEEE industrial tool protections
  - Global Care voluntary program, semiconductor industry
Examples of Industry Initiatives

<table>
<thead>
<tr>
<th>Industry</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>UN Global Compacts</td>
</tr>
<tr>
<td><strong>Semiconductors</strong></td>
<td>Global Care</td>
</tr>
<tr>
<td>Electronics</td>
<td>Electronic Industry Code of Conduct</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Responsible Care®</td>
</tr>
<tr>
<td>Fine chemicals</td>
<td>ChemStewards® SM</td>
</tr>
<tr>
<td>Forestry &amp; Paper</td>
<td>Sustainable Forestry Initiative®</td>
</tr>
<tr>
<td>Fisheries</td>
<td>Marine Stewardship Council</td>
</tr>
<tr>
<td>Coffee</td>
<td>Common Code for Coffee Community</td>
</tr>
</tbody>
</table>
The SEMI standards activity started in 1973 when the industry faced a silicon shortage and there were over 2,000 different user specifications for silicon wafers.

Benefits:
• Encourage innovation
• Reduce costs
• Align technology roadmaps
• Ensure product connectivity & compatibility
• Enable positive growth and economic benefit

Present portfolio: 860 Standards (25 Safety)
92 inactive or withdrawn
SEMI Safety Guidelines

- Safety Guideline for Equipment Safety Labels
- Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment
- Safety Guideline for Process Liquid Heating Systems
- Safety Guideline for the Separation of Chemical Cylinders Contained in Dispensing Cabinets
- Safety Guideline for Sizing and Identifying Flow Limiting Devices for Gas Cylinder Valves
- EHS Guideline for Exhaust Ventilation of Semiconductor Manufacturing Equipment
- Safety Guideline for Evaluating Personnel and Evaluating Company Qualifications
- Safety Guidelines for Ergonomics Engineering of Semiconductor Manufacturing Equipment
- Safety Guideline for Risk Assessment and Risk Evaluation Process
- Environmental, Health and Safety Guideline for Manufacturing Equipment Decontamination
- Environmental, Health and Safety Guideline for Documents Provided to the Equipment User for Use With Semico Equipment
- Safety Guidelines for Fire Risk Assessment and Mitigation for Semiconductor Manufacturing Equipment
- Guide for Semiconductor Manufacturing Equipment Design for Reduction of Environmental Impact at End of Life
- Safety Guideline for Unmanned Transport Vehicle (UTV) Systems
- Environmental, Health, and Safety Guideline for Silane Flammable Silicon Compounds
- Safety Guideline for Training of Manufacturing Equipment Installation, Maintenance and Service Personnel
- Safety Guideline for Worker Protection
- Safety Guideline for the Electrical Design of Semiconductor Manufacturing Equipment
- Safety Guideline for Multi-Employer Work Areas
- Safety Guideline for Hydrogen Peroxide Storage & Handling Systems
- Environmental, Health, and Safety Guideline for FPD Manufacturing System
- Safety Guideline for the Contents of Environmental, Safety, and Health (ESH) Evaluation Reports
- Safety Guideline for Robots and Load Ports Intended for Use in Semiconductor Manufacturing Equipment
- Guide for Fluorinated Greenhouse Gas (F-GHG) Emission Characterization and Reduction
SEMI S2 – The Main Document

SEMI S2-0712a
ENVIRONMENTAL, HEALTH, AND SAFETY GUIDELINE FOR SEMICONDUCTOR MANUFACTURING EQUIPMENT

1. Purpose
2. Scope
3. Limitations
4. Referenced Standards and Documents
5. Terminology
6. Safety Philosophy
8. Evaluation Process
9. Documents Provided to User
10. Hazard Alert Labels
11. Safety Interlock Systems
12. Emergency Shutdown
13. Electrical Design
14. Fire Protection
15. Process Liquid Heating Systems
16. Ergonomics and Human Factors
17. Hazardous Energy Isolation
18. Mechanical Design
19. Seismic Protection
20. Automated Material Handlers
21. Environmental Considerations
22. Exhaust Ventilation
23. Chemicals
24. Ionizing Radiation
25. Non-Ionizing Radiation and Fields
26. Lasers
27. Sound Pressure Level
Voluntary Industry Initiatives: Tools to Integrate EHS and Business Goals

• EHS improvements in the provision of goods & services are increasingly expected by society worldwide, with Europeans and Japanese cultures leading the way.

• Industries, including exempt manufacturers and those who sell business to business & are usually invisible to ultimate consumers, are influenced to meet these societal concerns while cost-effectively delivering needed goods & services. Goals & profit are the yardsticks for how well we accomplish this.

• Global Care, a voluntary EHS initiative of the semiconductor equipment and materials industry, is a tool for our industry and our individual companies.
Voluntary Industry Initiatives & Programs

Why Should Companies Support & Comply?

- Industry-developed programs contain requirements that are typically acceptable to the industry participants.
- These programs represent a consensus of industry experts usually with a sound technical basis.
- Voluntary programs that precede regulation will set minimum requirements often reflected in regulation.
- The cost of adhering to voluntary programs will be equivalent to justifying why not, or catching up later.
- Voluntary programs represent defensible “good practices” or “industry best practices”.
- Alignment of voices and interests is more effective.
Benefits of Voluntary Industry Initiatives

• Help grow overall industry and market size.
• Enhance positive public image & reputation for industry.
• Provide a trusted, unified voice to speak to outside stakeholders.
  – Better to negotiate for science-based regulations subject to cost-benefit analysis.
• Visible indication of leadership & company commitment.
• Guide companies toward appropriate unique goals.
• Allow an industry to be viewed as a whole, rather than on the basis of an individual company.
• Allow collaborative tool and benchmark development.
• Better support the small & medium enterprises that have limited internal resources.
• Limit the advantage of non-participants.
Global Care: The Semiconductor Industry’s Commitment to Environment, Health & Safety

• A set of five voluntary principles and supporting practices:
  – Workplace Health & Safety
  – Resource Conservation
  – Product Stewardship
  – Community Service
  – Excellence

• A collaborative, industry-wide, voluntary initiative.
  – Coordinated by SEMI, an industry trade association.

• Encourages members to lead by example and collaborate for continued improvement.

• Sets expectations of corporate EHS responsibility.

• It is NOT a ready-made set of templates & tools.

• It is NOT dependent on altruism.
Global Care as a Framework

A successful approach is to use Global Care as a internal framework for EHS issues.

- Identify & prioritize known initiatives
- Track and analyze new requirements
- Communicate with management
- Set plans, goals, targets for success
- Report & justify effort & resources
Basic Global Care commitment

- A CEO “Letter of Commitment”.
- Implementation of the five Global Care principles.
- Demonstration of a high-level corporate commitment and a systematic approach to fulfilling the principles.
  - Within six months of the initial commitment, each company is expected to return to SEMI a brief description of their Global Care implementation plan including a summary of any ongoing EHS efforts.
- Reporting on tangible results of practices and progress under each principle by completing a brief Annual Survey.
- Appointment of a Global Care liaison to support commitments, and work with other Global Care members to strengthen the initiative.

Source: Global Care booklet
Global Care Member Companies

- Air Products
- Amkor Technology
- ANELVA
- Applied Materials
- ASML
- Asyst Technologies
- ATMI
- AZ Electronic Mtls.
- Axcelis Technology
- BOC Edwards
- Brewer Science
- Calitech Co.
- CIC Photonics
- Compugraphics Intl.
- Credence Systems
- Cymer
- Dainippon Screen Mfg. Co.
- DISCO
- Dow Chemical Co.
- DuPont Electronic & Com. Tech.
- E4 Technologies
- EKC Technology
- Entegris
- Ferrotec Corp.
- FSI International
- GSI Lumonics
- Hakuto Co.
- Hermes-Epitek
- Hitachi Chemical Co.
- Hitachi Chemical Co. America
- Hitachi Kokusai Electric
- Horiba
- HORIBA STEC
- INFICON
- Innovative Robotics
- KLA-Tencor
- Lam Research
- Lasertec Corp.
- LTX Corp.
- M+W Zander
- Matheson Tri-Gas
- MEMC Electronic Materials
- Metron Technology
- MKS Instruments
- Nikon
- Nisene Tech. Group
- Novellus Systems
- Photronics
- Rushbrook
- SCP Global Technologies
- SEH America
- SEMI
- Solvay H₂O₂
- SUMCO Phoenix
- Tegal Corp.
- Teledyne Hastings
- Teradyne
- Therma-Wave
- Tokyo Electron
- Trebor Intnl.
- Ultratech
- Wadsworth-Pacific Mfg.
Global Care highlights its members and their EHS successes

Join the EHS Honor Roll—Join Global Care!


The leading technology companies are also the leaders in environment, health and safety. Join Global Care and support our industry’s commitment to EHS.

web.org/globalcare

Putting Tools to Sleep Saves Energy: Canon Anelva Demonstrates the Global Care Spirit

The following GLOBAL CARE "success story" is one in a series of real-world examples of how Global Care companies are putting environmental, health and safety best practices into use. Global Care is the semiconductor industry’s EHS initiative, managed by SEMI. For more information, visit www.semi.org/globalcare.

With the growing cost and increased demand for energy resources, many companies face the challenge of finding new ways to conserve energy, particularly when these companies must share these resources with a growing population.

Canon Anelva recently faced this situation at its Fukushima, Japan facility, which serves as a product demonstration and R&D center. As a user of equipment to fabricate silicon wafers, Canon Anelva found itself facing a situation where it operates continuously and that full or partial shutdowns were practical. Even for frequency-sensitive equipment which could not be fully shut down due to the length of start-up, the team decided that component and/or subsystems could be shut down or turned off and restarted quickly enough to save energy while not adversely affecting the work schedule.

Canon Anelva engineers modified equipment to use variable-frequency controllers in equipment meters. This modification enabled the equipment to be turned on and off as needed to achieve energy savings. As a result, the equipment was turned on and off an average of five times a day to save energy. As a result, the equipment was turned on and off an average of five times a day to save energy.
Tokyo Electron improves safety and enhances its brand

• Emphasizing EHS excellence helped global sales expansion
• Implemented ISO 14000 EMS in factories
• Improved safety training of field engineers
• Overcame language barriers to better practices
• Provided community services such as blood donation programs
• Akira Inoue honored by award in his name

EHS Success Stories

Global Expansion Required An Emphasis on EHS Excellence

To successfully expand its global semiconductor equipment business, this company improves its EHS performance to satisfy many stakeholders—overseas customers, employees, local communities, and regulators.

Challenge

Tokyo Electron Ltd. (TEL) underwent a remarkable transformation from its inception in 1963 to now—from a small electronics trader to the second largest equipment supplier to the global semiconductor manufacturing industry.

TEL’s improvement of its environmental, health and safety (EHS) practices accelerated after it focused on the semiconductor sector, partly in response to government pressure. During the late 1980s and early 1990s, the Japanese government imposed stricter safety rules on semiconductor-related companies after a series of fatal accidents in the industry involving hazardous gases.

After TEL quickly brought its operations into compliance with Japanese EHS laws, it faced stricter US and European requirements. These became an acute challenge as TEL developed customers in Europe and North America in the late 1990s.

“Even if we had a great advantage in equipment performance, such as throughput, quality or process management, we could not expand our business in the US and Europe if we didn’t have an EHS management system,” said Shigehito Ibuka of TEL.

Once the equipment manufactured by TEL complied with various global EHS requirements, it remained to increase field engineer safety training and awareness. “We already complied with SEMI S2. However, our work safety practices needed to be improved,” Ibuka said.

Response

The top management of the company decided to make a strong commitment to EHS Principles. First, Akira Inoue, until his death in April 1999, then Tetsumi Higashi led the company to adopt a high standard of environmental awareness and concern for EHS issues.

In September 1998 the company unveiled in Credo on Environmental Preservation, followed in November that year with a Credo on Safety and Health. A Safety First Declaration was published in June 1999.

To comply with US and European EHS rules, TEL translated copies of the U.S. Occupational Safety and Health Administration regulations into
Axcelis reduces waste disposal costs and saves water

• Recirculating cooling water saves both water and money
• Sixteen-month payback period for capital invested
• Replaced once-through system with recirculation system
Cymer improves workplace safety and attracts world-class talent

- Top management support enables first-rate safety program
- Improvement in employee retention rate
- Lives saved by in-house emergency response team
- 30 percent reduction in strain/sprain injury rate by ergonomic injury reduction program

EHS Success Stories

Safe, Secure Workplace Helps Retain World Class Talent

Company management sees direct link between focus on environment, health and safety, and employee productivity.

Challenge

When Cymer, Inc. moved from the R&D phase to mass production of its light source products in the late 1990s, it began adding employees rapidly. In January of 1996 Cymer had 130 employees and by December 1997, head count skyrocketed to over 800. A professional safety expert was then hired as part of the employee team up to help insure the health and safety of all Cymer employees.

While Cymer has achieved a considerable measure of business success, it operates in a highly competitive, technology-driven market. To survive it must focus on maintaining a technology lead over its competitors. The company works hard to recruit world-class experts, and recognizes that providing a safe, secure workplace is a key factor in retaining them. It also recognizes that its leading customers value an environmentally “green” supplier.

Response

In 1997, Cymer began building a highly professional environmental, health and safety (EHS) team. The initiative received backing from senior management, and the team was given the necessary resources to get the job done.

The small professional EHS staff has augmented its strength by training 25 safety coordinators and over 60 emergency evacuation monitors. The EHS team also:

- Gives safety training to employees
- Conducts regular inspections and reviews
- Works closely with medical providers, HR, and workers’ compensation carriers to reduce the severity of injuries and illnesses and time away from work
- Ensures compliance with environmental regulations and works to reduce waste
- Operates a fire risk management program and an emergency response program
Global Care Employee Awareness

Keep It Clean

Global Care

For more information on Global Care visit www.sem.org/global-care

RECYCLING FACTS & TRENDS

General Facts

Metal Products Facts

Paper & Wood Products Facts

Glass & Plastic Products Facts

Batteries, Computer & Cell Phone Products Facts

Product Safety Engineering Society

Insist on CYMER

semi
Thank you for your attention

www.semi.org/globalcare
Acronyms

- SEMI = Semiconductor Equipment & Materials International
- AeA = American Electronics Association
- IPC = Institute of Interconnecting & Packaging Electronic Circuits
- SIA = Semiconductor Industry Association
- EHS = Environmental, Health, and Safety
- EMS = Environmental Management Systems
- WEEE = Waste Electrical and Electronic Equipment Directive
- RoHS = Restriction of the use of certain hazardous substances in electrical and electronic equipment
- EUP/ErP = Eco-design of Energy-using Products Directive
- TLA = Three Letter Acronym
Author Biographies

Mark S. Frankfurth is a graduate of Virginia Polytechnic Institute and State University (VPI & SU "Virginia Tech") in Blacksburg, Virginia, receiving a bachelor’s degree in Electrical Engineering in 1988. Presently holding an engineering management position at Cymer Inc. overseeing Product Safety & Regulatory Compliance Engineering, Mark assists in the development of high-power industrial laser systems for the semiconductor industry. Background expertise in product safety, electromagnetic compatibility (EMC), quality engineering, and environmental topics resulted from 5 years as a Senior EMC Engineer at AST Research Inc. of Irvine, California, where Mark contributed to the development of personal computer systems from an EMC, safety, and reliability engineering perspective. Prior to this Mark participated in the development and installation of optical fire detection systems detecting UV and IR signatures. Mark is a Certified Laser Safety Officer (CLSO) by the Laser Institute of America (LIA) Board of Laser Safety, a NARTE certified EMC Engineer, and formerly an ASQ Certified Quality Engineer. Organizations where Mark serves in leadership roles or as an active member include IEEE, SESHA, ASSE, NFPA, SEMI, LIA, and NARTE. Contact Info – email: mfrankfurth@cymer.com phone: 858-385-6558