Final Report

"The Economic & Operational Impact of Environmental Regulations and New International Standards On Your Business"

A Focus Group Meeting

For the Marine Science & Technology Industry

Held on March 22, 2006 at the UMASS Advanced Technology Manufacturing Center, Fall River, MA

December 2006

Office of Technical Assistance and Technology

EXECUTIVE OFFICE of ENVIRONMENTAL AFFAIRS

Executive Summary

The Marine Science and Technology (MS&T) industry is an important cluster of the Commonwealth of Massachusetts with an above average growth rate. It is a diverse industry that includes: instrumentation, services, research, shipbuilding, materials and supplies. To help the industry realize its potential contribution to economic development in Massachusetts, the Executive Office of Environmental Affairs (EOEA) Office of Technical Assistance and Technology (OTA) launched a study in June 2005 of the potential environmental barriers that might impede the growth of the industry in Massachusetts. OTA contracted the services of the Marine & Oceanographic Technology Network (MOTN), a regional industry trade association to conduct a survey of the MS&T industry and develop an Issues Paper to highlight environmental regulatory barriers that the industry faces.

The Issues Paper suggests that the MS&T industry faces a number of barriers to growth. The largest number of MS&T establishments are small facilities that manufacture electronic products. A survey of federal and state databases for MS&T facilities listed among six selected environmental regulatory programs suggested that while (1) facilities making electronic products are more likely to be listed or participate in these programs, (2) smaller facilities are less likely to be listed or participate in these programs[1]. Challenges facing this subsector include uneven participation in current environmental regulatory programs and new domestic and international restrictions on products containing toxic materials such as lead.

In effort to examine and verify these conclusions, a focus group meeting of representatives from the MS&T community was held on March 22, 2006. This meeting included discussion of topics raised in the Issues Paper that was prepared for the OTA by MOTN. The participants list was drawn from a study of marine electronics manufacturers in Massachusetts by the University of Massachusetts Donahue Institute study released in May of 2005 ("the Donahue Institute Study") and the meeting included twelve (12) senior managers, from ten (10) marine electronics manufacturers.

The objectives of the focus group meeting included:

1) Identification of specific environmental challenges and opportunities associated with the design, manufacture, and sale of MS&T products and services
2) Evaluation of the impact of pending implementation of WEEE and RoHS directives
3) Discussion of opportunities for EOEA and OTA to assist in resolving any growth barriers that may be caused by regulatory compliance requirements
4) Identification of the types of services that OTA can provide to assist in reducing the use of toxic chemicals in the MS&T industry

Through this interchange with industry participants, OTA gained a sense that these small companies have well educated staff with a fundamental understanding and interest in environmental compliance. However they either lack the knowledge, capabilities, or time

[1] Found in the "Rate of Environmental Reporting" section at the end of Appendix A.

to understand how the intricacies of the regulations apply to their operations. As a result of the focus group discussions, OTA might best assist the industry by providing assistance that would:

1) Build core regulatory capacity (working knowledge) with the leaders and peers within this group and where needed, offer compliance assistance
2) Provide RoHS and WEEE guidance to ensure the industry continues to export unhindered to Europe and to similarly regulated parts of the United States

Background

Over the past two years, state governments in New England have increasingly recognized the existence of the Marine Science & Technology (MS&T) Industry as an emerging economic sector. Generally these governments wish to promote growing sectors to maintain their economies while at the same time performing their duty to conserve their natural resources. The Commonwealth of Massachusetts' Executive Office of Envrionmental Affairs (EOEA) seeks to make the regulatory process more predictable to foster the more dynamic elements of the private sector while maintaining or improving the level of protection of the environment through its Lean and Green agenda. OTA as a part of EOEA brings a technical and industry perspective to support EOEA's policy initiatives, particularly as it applies to emerging technologies and industries.

In a recent economic impact study conducted by the University of Massachusetts Donahue Institute [2], ("The Donahue Institute Study"), the emerging MS&T industry consists of nearly 500 companies, employs over 55,000 people and contributes nearly $8 billion annually to the New England economy. The study further characterized the industry by the following categories:

- Developers and manufacturers of:
  - Oceanographic and geophysical measuring instruments
  - Acoustics for underwater remote sensing, imaging and positioning
  - Electronics marine instruments and platforms operating in extreme underwater conditions
  - Electronics for shipboard navigation and communication systems
- Providers of marine services such as commercial marine research, marine engineering, software and systems design and lease vessel operations
- Providers of marine materials and supplies such as paints, engines, riggings, machinery, composites and coatings, mooring systems
- Shipbuilders and ship designers

The Office of Technical Assistance and Technology (OTA) and Marine & Oceanographic Technology Network (MOTN) selected developers and manufacturers because they are the dominant subsector within the Massachusetts MS&T industry. They are also most likely to participate in or be subject to current environmental regulations. Finally, Marine Instumentation & Equipment products are likely to contain lead and

[2] *The Marine Science and Technology Industry in New England,* Clyde Barrow, Rebecca Loveland, David Terkla, University of Massachusetts Donahue Institute, 2005

other toxic materials as restrictions phase in under European RoHS and WEEE directives and similar regulations in California and other parts of the United States.

While the Marine Services industry is a close second in importance to the Massachusetts economy, this subsector is much less likely to use reportable quantities of toxic substances. In Massachusetts, the last two subsectors of marine materials & supplies and shipbuilding are small and nonexistent, respectively.

The Massachusetts MS&T industry was further characterized by the Donahue Institute study The Donahue Institute Study also reported that the Massachusetts MS&T industry has a significant number of small businesses (<25 employees) and companies that depend heavily on the export of their products and services to the international market in order to remain viable. These small businesses may need to comply with the same domestic and international regulations that larger companies do.

The Marine & Oceanographic Technology Network (MOTN), was contracted by OTA to organize and conduct an industry Focus Group Meeting with the following objectives:

- Identify the specific environmental challenges and opportunities associated with the design, manufacture and sale of the MS&T products and services
- Evaluate the impact of the implementation of European WEEE and RoHS directives on the MA MS&T industry
- Discuss the opportunities for EOEA and OTA to assist in resolving any growth barriers that may be being caused by regulatory compliance requirements
- Identify the types of services that OTA can provide to assist in reducing the use of toxic chemicals in the MS&T industry

In preparation for this Focus Group Meeting, MOTN prepared and issued a document titled, *Background and Issues Paper for Marine Science and Technology Group Meeting* (See Appendix A). The agenda for the meeting was based upon this report and focused on the following topics:

- Solicitation of comments and suggestions from marine manufacturers and suppliers as to how OTA can assist in the environmental compliance process
- The industry awareness of available techniques and technologies to control volatile organic compound (VOC) emissions and spent organic compounds
- The industry awareness and impact of the new European Union RoHS directives restricting the use of lead-based solder – and the availability of alternatives
- The industry awareness and impact of new EU WEEE directives requiring that manufacturers arrange and pay for the collection, treatment, recycling, recovery and disposal of electronic scrap
- Environmental issues specific to marine equipment manufacturers involved in providing hardware to the US Department of Defense (DoD) and how they compare to issues of concern to EOEA and OTA

Focus Group Meeting Overview

MOTN and OTA identified the primary SIC Codes[3] represented by the Massachusetts MS&T industry and then selected and invited sixty-five (65) Massachusetts marine equipment manufacturers and material suppliers to attend the Focus Group Meeting (See Appendix B – *List of Invited Companies*).

The Focus Group Meeting was held on March 22, 2006 at the UMASS Advanced Technology Manufacturing Center (ATMC) in Fall River, MA. Twelve (12) senior managers representing ten (10) manufacturing organizations participated along with several members of EOEA, OTA and MOTN. The final attendee list can be found in Appendix C - *Final Attendee List*). The focus group agenda and speaker list is located in Appendix G.

Mr. Hugh Murphy, MOTN President, served as the overall coordinator and facilitator for the meeting. Copies of his Power Point presentations to introduce the main topics and to guide the discussion throughout the meeting are found in Appendices D & E.

Mr. Paul Richard, OTA Director, opened the meeting with a brief introduction to OTA as a non-regulatory technical service provider. As part of their mission, OTA has been identifying environmental regulatory barriers might be slowing the growth particular industry sectors, such as the MS&T industry. He invited the participants to share any thoughts or issues that they may have in this regard in order to help OTA to better understand the specific needs of the MS&T industry.

To add emphasis to Mr. Richard's remarks, presentations were made by other representatives of EOEA and OTA that further described the many responsibilities and assistance capabilities of their organization. OTA's mission of reducing toxics use (TUR) in the workplace as was explained as preferable to the capture & control of toxic emissions. The framework for the day's presentations and discussions was based upon the two messages of OTA's use of TUR to minimize regulated activities and identification policies or regulations that could merit streamlining.

Mr. David Lutes, Undersecretary for Policy for EOEA, keyed in on the State's industry-friendly environmental agenda to assist the growth of the Massachusetts business by working with the various industries to streamline the regulatory reporting process wherever possible.

Mr. James Cain, a Project Manager for OTA, discussed the 3,000+ site visits that have been performed by OTA since 1995 and the significant positive results that have been realized – including a reduction of over 200 million pounds of toxics.

Mr. Rick Reibstein, a Senior Analyst with OTA, provided an overview of the legal aspects of regulatory compliance and cited recent court cases involving Massachusetts

[3] A summary of major and/or core SIC Codes for identified MA MS&T companies is included as Appendices 1 & 2 of the *Background and Issues Paper for Marine Science & Technology Meeting* which is included herein as Appendix A

companies that were cited for non-compliance. He urged companies to make a concerted, good-faith effort to comply, which is looked upon with favor by the courts.

Ms. Pam Civie, an Industry Researcher for the Toxics Use Reduction Institute (TURI), provided a detailed regulatory and economic overview on the new European Union WEEE and RoHS directives and the impact that they will likely have on the ability of US suppliers to continue to be competitive in providing marine electronics to EU countries. These topics created a significant level of interest and discussion from participants. Ms. Civie informed the group that assistance is available to help them comply with these new directives. One resource is the TURI Lead-Free Electronics Consortium, a UMASS Lowell-based collaborative support group established to assist industry to achieve zero-defect lead-free soldering, while ensuring a level of reliability comparable to that of leaded solder joints. Her Power Point presentation is included in Appendix F.

Facilitated Group Discussion

The facilitated group discussion was led by MOTN President, Mr. Hugh Murphy was structured to coincide with the principle issues set forth in the *"Background and Issues Paper for Marine Science & Technology Group Meeting"* that was used as the guiding document for the meeting.

Organic Solvents and Volatile Organic Compounds (VOCs)

Meeting participants were confident that their companies were complying with both state and federal regulations on the proper handling, storage, use and disposal of VOC-containing materials at their workplaces. While there was no feedback on control devices, many of the companies at the meeting are not large enough sources to need control devices. Some of the participants indicated that they would be verifying VOC use and procedures with their company's designated environmental compliance person.

Electronic Scrap, Hazardous Waste, and Hazardous Materials

Participants indicated that their companies had procedures in place and actively participated in regularly scheduled collection and proper disposal of electronic scrap and hazardous waste. It was mentioned, however, that companies were sometimes blindsided by the discovery of new chemicals, compounds and substances that were added to the list of controlled hazardous materials to be monitored. The group expressed the need for earlier notices of changes and more direct communication about regulations. Perhaps an e-mail notification or newsletter on topics such as HAZMAT listings, MACT standards, and other regulatory changes could alert companies to these periodic events.

EPCRA and Pollution Prevention

There are currently 320 toxic chemicals that are listed by the US EPA. Industry participants indicated that they were satisfied that their respective companies were aware of and took the necessary precautions regarding the prevention of pollution. Again, the group stated the need for the transmission of periodic notices or newsletter for changes or updates to new environmental regulations.

Department of Defense (DoD) Perspective

A gradual phase-in of lead-free requirements might affect companies that are (or are planning to be) qualified electronic equipment vendors to the Department of Defense (DoD). Contractors to the DoD may have already adapted to the regulation banning the use of chromates used for corrosion protection and anti-fouling properties in coatings. Several attendees currently sell products to the DoD and were somewhat knowledgeable about the efforts of the aerospace industry to find a suitable replacement for lead-based solder. On the other hand, very few were familiar with the regulation banning the use of chromates. Several attendees were interested in the availability of a "drop-in" replacement for chromium in coatings that was discovered by scientists at the Naval Undersea Warfare Center (NUWC) Division in Newport. The process has been patented and the coating is available for use through licensing from NUWC. Contact information was provided to the audience for those wishing to followup with NUWC directly.

EU's RoHS and WEEE Directives

The next discussion centered on the new requirements for disposal of electronic scrap and identifying and implementing the necessary process changes to replace lead-based solder with a satisfactory alternative in the manufacture of electronic PC boards and assemblies. This topic elicited the most comments and generated significant discussion.

Questions & comments included:

1) How can the EU enact regulations for which there are no known substitutes for lead-based solder that work universally?
2) Dell has found a lead-free solder substitute that they are using in their products that are sold in the EU, however most PC's are not subjected to the environmental extremes of many MS&T products (e.g., on the deck of a ship in the hot sun to cold temperatures experienced at deeper ocean depths).
3) The EU is currently granting exceptions for military and navy equipment as well as for some scientific equipment used in the ocean environment
4) What is the timing of compliance to these regulations since it appears it varies from country to country?
5) How can small MS&T companies be kept aware of the development of lead-free solders, as they are too small to embark on investing R&D dollars to find substitutes?
6) How can the industry be sure that lead-free solders will endure in long lived marine electronic equipment, which may perform a critical function over many years and could cause a catastrophic event if it suddenly failed due to some type of failure which comes only with time?

Conclusion

OTA concluded from these discussions that the lack of regulatory knowledge is in part due to the industry being mostly comprised of small businesses that do not have dedicated Environmental, Health, and Safety staff. In some cases, this individual primarily functions as the company's quality assurance, engineering or manufacturing manager.

In general, small MS&T companies appear to have a fundamental understanding of environmental regulations and an interest in complying with them, but may be totally

unaware when they might be technically in violation of one or more of these regulations. As a result, these companies need to have one or more of their staff educated with a broad view of important local, state, federal and international environmental regulations that could affect the manufacture and sale of their products, permissible emissions and worker health and safety.

Another key finding was that most of these companies export products to Europe and are very concerned with how the new RoHS directive will play out when the ban on distribution of products containing lead, mercury, cadmium and other toxics takes effect. Will there be confusion or mistakes made on both ends of the supply chain when attempting to provide components and sub-assemblies specified to contain lead for one application and to be lead-free for another?

Companies in this industry are also concerned that individually they are too small to influence the supply chain. In addition, they are concerned about the reliability of new lead-free components in their equipment which must operate in harsh ocean environments.

Next Steps

As a result of the Focus Group Meeting, several "next step" initiatives are discussed below under two major themes:

- training for environmental compliance
- technical progress & regulatory updates for the European initiatives

OTA, with MOTN's support, must find ways to improve the environmental regulatory awareness of the many smaller Marine Science & Technology companies and help them stay current on environmental regulations and reporting obligations. To accomplish this OTA may work with MOTN to offer a series of training sessions to improve regulatory competencies and understanding. In addition, opportunities may exist for OTA to help the industry improve reporting and record-keeping practices as well as to help MS&T businesses learn to use self-audits to identify and prioritize environmental liabilities within their facilities. MOTN could assist OTA by helping to motivate the industry toward these objectives and support OTA sponsored training sessions as well as distribute the necessary application forms and guidance documents to their members. Both MOTN and OTA may coordinate a follow-up meeting to assure that the companies understand the process, apply the knowledge learned from the training sessions, and periodically follow up to assess if competency and practices have improved.

Since it was also learned that many of these companies will be impacted by the new European RoHS and WEEE regulations, a valuable next step will be to provide the industry with up-to-date information on issues such as the results of accelerated testing of lead-solder alternatives and the introduction of newly developed DfE manufacturing processes. In this regard, another next step effort would be for OTA and MOTN to work together with the Toxic Use Reduction Institute (TURI) of UMass Lowell to establish an industry outreach initiative, such as a quarterly newsletter or email notification for the Massachusetts MS&T community. This would not only serve to inform the MS&T

community on these important issues, but would also begin to establish OTA as a "go to" organization that these companies can turn to for advice and assistance in environmental compliance and regulatory issues in the future.

While this Focus Group Meeting was extremely valuable, it is only a first step that will require further efforts and dedicated resources on the part of OTA to continue the dialogue, develop and deliver training events. This continuing dialogue will provide OTA the opportunity to learn more about the unique aspects of the industry with respect to their technological and materials requirements and to identify further ways to assure that as these manufacturers grow, they will meet regulatory obligations and minimize their environmental footprint. Massachusetts must not inhibit future growth by undue restrictions or overly-complex regulatory practices.

Appendix A

Background and Issues Paper

Background and Issues Paper for Marine Science and Technology Group Meeting

The Commonwealth of Massachusetts | *Office of Technical Assistance* | *Executive Office of Environmental Affairs*

Executive Summary

1. Introduction
   - MS&T Industry
   - Environmental issues
   - OTA, MOTN and ATMC

2. Purpose
   - Identify Environmental Challenges
   - Evaluate Impact of WEEE and RoHS Directives
   - Facilitate Regulatory Streamlining and Compliance
   - Identify Service Opportunities with OTA

3. The Marine Science and Technology Industry in MA

4. General Characterization: SIC Identification
   - SIC 36 & Electronic Assemblies
   - SIC 38 Measuring, Analyzing and Controlling Equipment

5. Environmental Issues of MS&T Industry and Supply Chains
   A. Lead and Lead-Containing Solders
   B. Lead-Free Alternatives
   C. VOC and Organic Solvents
   D. Electronic Scrap
   E. U.S. Regulations and Compliance
   F. Pollution Prevention
   G. European WEEE and RoHS Directives
   H. Defense Industry Perspective

Conclusions

Appendix 1 SIC Industry Codes
Appendix 2 Rate of Environmental Reporting by MS&T Companies

Executive Summary

There are 300 establishments that participate in the Marine Science and Technology (MS&T) industry in Massachusetts. With sales of $3.3 billion and 18,000 workers this has grown into a robust industry sector in recent years. In 2005, The Office of Technical Assistance began a project to determine if it is possible to reduce regulatory barriers for companies in this growing industry. The project has three phases. The first was to identify and characterize establishments in the sector. The second was to survey state and federal databases for participation by these establishments in several common environmental programs. The third and final phase will be to convene a focus group representative of the industry to discuss needs of the industry in this area and get feedback on several possible ways these needs could be met.

Of the five subsectors identified in a previous study of the New England MS&T industry, two are dominant in the Massachusetts MS&T industry – marine services and marine instrumentation & equipment (MIE). MIE employs half of the MS&T workers in Massachusetts and is more likely to use lead and other toxic materials. For these reasons, OTA is interested in learning more about this subsector.

Additionally, establishments have been classified by whether or not a majority of their business is in the MS&T industrial sector. About 40% of the establishments identified have marine science & technology as their "core" business. To some extent this group may contain more of the smaller the "start-ups". The other 60% of establishments are "partially" involved in the MS&T industry. They have multiple products/markets and tend to be larger, perhaps more mature entities. A focus group could help to determine how the needs "core" establishments differ from the "partial" establishments.

OTA surveyed several databases to determine which establishments participate in any or several of five regulatory programs – TURA, TRI, Tier II, Hazardous Waste, and Air Emissions. (Wastewater was excluded because these records tend to be kept at the localities.) Most of the program participation is from establishments in the manufacturing SICs, particularly electrical and electronic equipment (36 and 38). Ten establishments were found to use Lead and/or Lead Compounds above the regulatory thresholds for reporting. About ¼ of the MS&T establishments are in these two SICs. There are several reasons for convening a focus group, one of which would be to learn if the lower level of regulatory participation by the "core" group of establishments is due to educational needs or if their environmental footprint is not yet sufficiently large to participate in these programs. It is also expected that the establishments with electrical components in their products want to and need to learn more about how best to adapt to the new international restrictions and regulations on products that now contain Lead and other toxics.

1. Introduction

MS&T Industry - The Marine Science and Technology (MS&T) has grown into a robust industry sector in the New England area within recent years. The sector employed over 55,000 thousand people in this region and generated nearly 8 billion dollars of sales in 2004. Massachusetts is home to almost two-thirds of the region's nearly 500 firms and has been ranked consistently among the top ten states nationwide in terms of business, employment and sales[1].

To support the continual growth and to reduce the environmental barriers and liabilities impeding the growth, it is the intent of the Massachusetts Executive Office of Environmental Affairs - Office of Technical Assistance (**OTA**) to hold a focus group meeting with manufacturers and suppliers of marine science and technology in this region. Although not yet in effect, the European Union's RoHS (Restriction on Use of Certain Hazardous Substances) and WEEE (Waste from Electrical and Electronic Equipment) directives are already having a dramatic impact. RoHS bans the use of cadmium, mercury, hexavalent chromium, polybrominated diphenyls, polybrominated diphenyl ethers, and lead. Of the substances, lead is the most pervasively targeted substance and has received the most attention. The metal plays a critical role in the assembly of electronics and is the most challenging of substances to be removed from the production lines.

The Marine & Oceanographic Technology Network (**MOTN**) and the Advanced Technology & Manufacturing Center at the University of Massachusetts - Dartmouth (**ATMC**) are engaged to assist OTA with this project. The goal of this project is to identify the environmental challenges and regulations that the MS&T industry faces as well as services that OTA can provide to enhance the competitiveness of the Massachusetts MS&T industry globally.

OTA - The Massachusetts Office of Technical Assistance is a non-regulatory branch of the Executive Office of Environmental Affairs (EOEA). OTA has a staff of nearly 20 including engineers and chemists to help manufacturers and industrial facilities find ways to reduce or eliminate their use of toxics and generation of hazardous byproducts.

OTA promotes pollution prevention and environmental compliance through comprehensive on site assistance and a range of outreach and education services. The office also partners with industry, universities, government agencies and others to identify, evaluate and promote innovative pollution prevention technologies and practices.

MOTN - Since 1995, the mission of Marine & Oceanographic Technology Network (MOTN) has been to employ a collaborative strategy to foster the economic & technological success of its member companies. MOTN member organizations are primarily engaged in the advancement of marine science & technology for undersea

defense, ocean research and commercial oil & gas exploration and trans-oceanic telecommunications applications.

Over the past 10 years, MOTN has established itself as a successful and unique industry collaborative, geared toward improving both the economic and technological positions of its New England regional members. MOTN's diverse membership, consisting of over 75 academic, government and industrial organizations, provides the network with a very diverse and broad-based menu of options relating to economic expansion and technological development. MOTN continues to grow and its members continue to benefit from this broad-based perspective, through a variety of shared organizational initiatives and sponsored events.

ATMC - The Advanced Technology & Manufacturing Center at the University of Massachusetts - Dartmouth is a 60,000 sq.-ft. facility with three major functions. First , the ATMC hosts and supports small, start-up venture companies. In that role, the ATMC provides space, technical expertise, support services specialized labs, and interns to help new high-tech business prosper. Second, the ATMC engages in research related to military and industrial projects. In that role, the ATMC has specialized laboratories, support staff, science and engineering faculty, and graduate and undergraduate students to work on these products and process design and engineering projects. Third and finally, the ATMC provides cost effective meeting and conferencing space to local businesses for meetings and presentations that range from four people to two hundred people. Among the eight specialized labs, the environmental chemistry lab will actively participate in this project.

2. Purpose

The goal of the focus group meeting is to initiate a discussion of key environmental issues faced by marine science and technology providers for the purpose of assisting OTA in:

1) Identifying the environmental challenges and opportunities associated with the design, manufacture and sale of the marine science and technology products and services;
2) Evaluating the impact of the implementation of WEEE and RoHS directives on U.S. marine science and technology industry;
3) Discussing the opportunities to streamline regulatory compliance in the U.S. and MA;
4) Identifying the types of services that OTA can provide to reduce the use of toxic chemicals in the marine science and technology industry.

3. The Marine Science & Technology Industry in MA

The marine science & technology sector in Massachusetts consists of a diverse range of industries and technologies, employing people from across the New England region who produce items as basic but essential as communications antennas and chain and rope for

commercial fishing and as advanced and critical as undersea robotics and stabilized sensor systems for military and other uses.

Recently, a comprehensive study of the marine science & technology industry was accomplished by researchers at the University of Massachusetts Donahue Institute[1]. The study was the first time that the industry was formally quantified, classified and analyzed as a true technology cluster.

From an economic standpoint, the study found that Massachusetts is home to 298 establishments involved to some degree in marine science & technology. These establishments employ over 18,000 workers and realize annual sales of ~$3.3 billions.

Because sectors of the marine science and technology industry do not have their own exclusive SIC or NAICS codes the Donahue research team also identified five primary sub sectors or categories of the MA marine science and technology cluster. These include:

A. Marine Instrumentation and Equipment (MIE):

This category contains firms producing cutting-edge marine equipment, such as transducers, various meters, remote sensing equipment, fiber optic and GPS systems, a variety of sensors and underwater power sources and generating equipment.

- Oceanographic and geophysical measuring instruments, such as magnetometers and current meters;
- Acoustics for underwater remote sensing, imaging and positioning;
- Electronics for marine instruments and platforms, which enable sensing, imaging, positioning and other instruments to function in extreme underwater conditions;
- Electronics for marine navigation and communications, which enable onboard, under and above water navigation and communication, including GPS systems and fiber optic systems to allow Internet-based communications relays.

B. Marine Services (MS)

This category contains a wide variety of marine engineering and consulting firms, marine monitoring systems, floating research facilities and marine security and/or defense firms.

[1] *The Marine Science and Technology Industry in New England,* Clyde Barrow, Rebecca Loveland, David Terkla, University of Massachusetts Donahue Institute, 2005

- Commercial marine research and consulting, which covers marine-related technical services, including applied research; design and engineering; testing and evaluation; GIS and other mapping services.
- Software and systems design for marine monitoring and operations

C. Marine Research, Education and Technology Transfer (MRE)

This category consists mainly of higher education institutions and a variety of research institutes and consulting groups, working in areas such as:

- Marine research and consulting, including applied ocean physics and engineering, marine chemistry and geochemistry and physical oceanography;
- Marine education;
- Industry and technology transfer groups.

D. Marine Materials and Supplies (MMS)

This includes much of the material input for marine activities, such as paints, engines, riggings, machinery, composites and coatings, mooring systems and packing and crating.

E. Shipbuilding and Design (SBD)

This category includes major defense-related shipbuilding operations.

4. General Characterization: SIC Identification

Of the 298 Massachusetts establishments that were identified as having some involvement in the marine science and technology industry, only 135 were shown to be involved in the industry in a core capacity. Of these 135 establishments, 129 were successfully classified by SIC 4-digit SIC codes. A summary of the number of companies involved in each of the 59 individual SIC's represented is contained in Appendix 1. Based on the research, the majority of Massachusetts' MS&T firms are in the Electronic Equipment (SIC 36) and electronic assembly, and Measuring, Analyzing, and Controlling Instrument (SIC 38) sectors.

5. Environmental Issues of MS&T Industry and Supply Chains

Manufacturers in the SIC 36 and SIC 38 sectors are involved in activities such as crystal preparation, wafer fabrication, cleaning, assembly, electroplating, electro-less plating, imaging, soldering, masking, and coating. Background information along with the environmental issues and challenges relevant to these processes will be presented to the focus group meeting to foster the discussion among the participants.

A. **Lead and lead-containing solders** – Traditionally, tin-lead solder coating is added to printed circuit board (PCB) and component leads before assembly. The solder coating involves dipping the panel into molten solder or electroplating solution. After the PCBs are manufactured, the electrical components are attached during assembly. Adhesives are applied to the boards, and then the components are attached and soldered to the board. The solder usually consists of 63% tin and 37% lead. With the increasing pressure from European Union to ban the use of lead and other toxic substances, US manufacturers should be prepared to find alternatives to the tin-lead solders and master the technologies to use them.

B. **Lead-free alternatives** – Alternative technologies to tin-lead solders are categorized into two main groups: non-lead solders and electrically conductive adhesives. One of the biggest challenges with those non-lead solders is the reflow temperature. The high reflow temperatures of high tin groups can compromise the integrity of the components during assembly. On the other hand, lower reflow temperatures of indium and bismuth alloys can result in unwanted reflow during service in high temperature applications. Since the majority of the conductive adhesives are epoxies, they are attractive from a durability point of view. However, these materials have a reputation of unstable conductivity at the interconnection junctions.

Questions Massachusetts-based manufacturers need to ask themselves about electronic assembly using lead-based solder

1. *Is your company aware of the new EU regulations prohibiting the import of electronic equipment manufactured with tin-lead solder?*
2. *What lead-free alternatives are available in the marketplace and how are they different from current manufacturing processes?*
3. *How mature and reliable are those alternative technologies? What is the economic impact of compliance to new alternative soldering processes?*
4. *Can alternatives be treated as "drop-ins" to the process or will they require modifications to equipment and component specifications?*
5. *Is progress being made toward improving the performance of the conductive adhesives?*
6. *What is the international definition of lead-free and how do I certify my products and my suppliers to be lead-free?*

C. **Organic solvents and VOCs** – Organic solvents have been used extensively in photolithography, cleaning, and drying. Many have toxicity and flammability issues and contribute to changes in atmospheric ozone. The emissions and controls for these chemicals have been stated in great detail in major environmental regulations for air, water, and waste.

Questions Massachusetts-based manufacturers need to ask themselves about organic solvents and VOCs

1. *What are available techniques and technologies to control VOC (volatile organic compounds) emissions?*
2. *What halogenated solvents are used in manufacturing marine technology equipment?*
3. *What is the common practice for electronic manufacturers to handle spent organic solvents?*

D. **Electronic scrap** – WEEE (Waste Electronic and Electrical Equipment) Directive mandates that companies selling electrical and electronic equipment to the European Union (EU) arrange and pay for the collection, treatment, recycling, recovery and disposal of electronic scrap starting as early as August 2005.

Questions Massachusetts-based manufacturers need to ask themselves about electronic scrap

1. *With perhaps a third of sales by the Massachusetts MS&T industry to foreign markets, does the directive pose a problem to the Massachusetts MS&T industry? As producers of components or sub-assemblies? As producers of finished products? For distribution channels used for the EU or other markets?*
2. *How do I dispose of electronic scrap and does my disposal method comply with EPA State of Massachusetts and local environmental regulations?*
3. *What are my company's plans for compliance with new EU and pending state and federal electronic scrap disposal regulations?*

E. **Federal Environmental Statutes and Regulations** – Under the Clean Air Act (CAA), the National Ambient Air Quality Standards (NAAQS) have been established for six pollutants. The standard for ozone is the only one that impacts the electronics industry. While the electronics industry is not a major source of ozone, it is a significant source of regulated VOCs that contribute to the formation of ozone.

Under Clean Water Act (CWA), the National Pollution Discharge Elimination System (NPDES) permit program regulates the discharge of pollutants to the waters of the US. The electronic manufacturing facilities may need to test for any of 126 priority pollutants listed in 40 CFR 122, Appendix D. The priority pollutants likely to be discharged by facilities in the electronics industry include copper, lead, lead compounds, silver, chromium, and trichloroethylene. Massachusetts strictly regulates discharges to ground and local wastewater authorities regulate discharges to sewer.

Another federal law that affects the practice of electronic industry is the Resource Conservation and Recovery Act (RCRA). Many wastes generated by the

electronics industry are considered RCRA toxicity characteristic hazardous waste due to constituents such as silver, trichloroethylene and lead.

Questions Massachusetts-based manufacturers need to ask themselves about compliance with Federal statutes and regulations

1. *Is there technical assistance available from the Commonwealth of Massachusetts to assist my company in complying with environment regulations?*
2. *Does my company have suggestions to streamline the compliance procedure or to reduce the cost of doing business in Massachusetts?*

F. **Pollution Prevention** – Several federal laws and regulations affect decisions regarding pollution prevention, with the most influential being Pollution Prevention Act of 1990, Emergency Planning and Community Right-to-Know Act (EPCRA, also known as SARA Title III), the Resource Conservation and Recovery Act, and the Clean Water Act. A major component of EPCRA is the requirement for an annual report of all routine releases of any of some 320 toxic chemicals into the air, water, or soil. These data are compiled by the community and the state and published annually as the Toxic Release Inventory (TRI). Lead, chrome, plastisizers, flame retardents, and halogenated solvents are listed TRI materials[2].

Massachusetts is one of the states that have passed laws to incorporate aspects of pollution prevention into RCRA and EPCRA reporting requirements. Generally, these laws require industrial facilities that use or generate materials listed in either EPCRA or CERCLA to develop a source reduction and waste minimization plan, including an implementation schedule, and to track and report reduction progress.

G. **WEEE and RoHS Directives** (Substances, Product Categories, Schedules)
The European Union is leading the campaign to ban the use of a list of toxic substances, including cadmium, mercury, hexavalent chromium, polybrominated diphenyls, polybrominated diphenyl ethers, and lead, in electronics and other related industries by passing the WEEE and RoHS directives. The directives were agreed on February 13th, 2003. By October 2004, a draft of the regulations and a non-statutory guidance were published. A timetable is set to achieve the goal in three and a half years. By the end of the summer in 2005, regulations for WEEE and RoHS to be made final. By January 2006, producer responsibility for financing commences alongside retailer take-back. RoHS substance ban commences July 1st, 2006, and by December 31st collection and recycling targets are to be achieved.

[2] http://www.epa.gov/tri/

The precedent of WEEE and RoHS have triggered legislative activities in all major industrial regions to address management, reporting or elimination of hazardous substances and electronics waste collection and treatment. **Industry experts estimate that U.S. could lose approximately $240 billion over three years if the U.S. does not respond to these initiatives quickly and completely by identifying viable alternative solders that perform well and pose fewer environmental risks.**

Questions Massachusetts-based manufacturers need to ask themselves about WEEE and RoHS directives

1. *Are there RoHS equivalent legislative initiatives in MA or the U.S.?*
2. *How does the implementation of WEEE and RoHS affecting the Massachusetts MS&T industry?*
3. *Is the Massachusetts MS&T industry ready for the challenge?*

H. **Defense Industry Perspective** – As more commercial suppliers adapt "green" technologies, chances of lead-free materials technologies finding their way into defense equipment will increase significantly. There will be questions as to the functionality and reliability of alternative interconnection technologies under harsh service and storage conditions. The literature contains an abundant amount of data on the reliability of tin-lead solder. However, relatively little data exists for any of the alternative non-lead materials.

The U.S. Department of Defense has banned the use of chromate-based coatings used for anti-corrosion and anti-fouling of metal surfaces in order to reduce the release of chromium into sea water. The Defense Industry has scrambled to find suitable non-polluting substitutes and until very recently was using compounds with chrome -3 as the chromium substitute. Additionally, titanium is used frequently in deepwater, pressure-resistant equipment housings and is often bonded to other metals or carbon-fiber materials. Bonding requires the surface of the titanium to be etched using chromate compounds, which creates toxic waste.

In both cases above, scientists at the US Navy's Naval Undersea Warfare Center (NUWC) in neighboring Rhode Island have discovered "drop-in" substitute compounds which eliminate most of, if not all, the environmental problems associated with chromium and chromates. NUWC has transferred these technologies to industry through patent licenses. These "drop-in" chemical compounds are available to DoD marine equipment manufacturers for anti-corrosion coatings and titanium bonding applications.

Suppliers of US Navy equipment have to comply with the requirements of the Shipboard Environmental Protection Program, which includes such Solid Waste Management, Ozone Depleting Substances, Pollution Prevention Afloat, Oil Pollution Abatement, Uniform National Discharge Standards, Hazardous Material Minimization Centers, Non-Oily Wastewater, Ballast Water, Environmental

Information Management, Medical Waste Management and Hazardous Material Control and Management.

The US Navy also maintains an online Authorized Users List (AUL) for the Navy's mission-critical Ozone Depleting Substances (ODS), which includes the status of conversion of fleet air-conditioning and refrigeration plants from Class I ODS to HFC-134a and HFC-236fa. The Navy continuously analyzes proposed EPA and international ODS regulations for potential adverse impact to Navy operations. The Navy's ODS reserve database includes Chlorofluorocarbons (CFCs) 11, 12 113, 114, 502, and Halons 1211 and 1301 and ODS Fleet equipment includes USN ship refrigeration and air-conditioning plants and fire suppression systems.

Questions Massachusetts-based manufacturers need to ask themselves about supplying the DoD electronic equipment for use in the ocean or on-board USN ships.

1. *How do lead-free alternatives affect qualified electronic equipment vendors to the DOD?*
2. *Does my company use chromates or chromium-based compounds for anti-corrosion or anti-fouling coatings?*
3. *Does my company bond titanium?*
4. *Is my company aware of "drop-in" substitutes for chromates for anti-corrosion and anti-fouling coatings and for titanium etching?*
5. *Are we aware and comply with US Navy environmental regulations for shipboard equipment from the USN Shipboard Environmental Protection Program?*

6. Massachusetts MS&T Companies and Regulation Compliance

In general, there are a few large companies such as Raytheon, Lockheed-Martin and L-3 Communications with divisions or subsidiaries in Massachusetts, who produce MS&T equipment but the Massachusetts MS&T Industry is comprised mostly of small-sized manufacturers producing electronic systems, sensors, navigational equipment for use in the ocean or on-board marine vessels. Appendix 3 provides the results of survey and analysis made of the number of Massachusetts marine science and technology companies, which have filed for permits in compliance with regulations such as: Toxics Use Reduction Act (TURA), Toxic Release Inventory (TRI), Resource Conservation and Recovery Act (RCRA), Tier 2 and Clean Air and Water Quality Act. In almost all of these cases, SIC 36 and SIC 38 were in the top three for greatest number of companies, employees, and revenue, leading the study to focus on their impact in MS&T most heavily. In addition, these two SIC codes reported to TURA, TRI, and RCRA most often

as well as hold the majority of air and water permits in the MS&T industry. However, reporting rates were low.

Conclusions

Several databases were surveyed to determine the establishments on record as participating in any of six regulatory programs – TURA, TRI, Tier II, Hazardous Waste, Air Emissions, and Wastewater. Data quality of TURA and TRI is good. Data for wastewater programs was scant and not easily searchable with the available databases. Data for the other three programs is acceptable quality for this level of analysis.

If all 263 establishments participated in all 5 regulatory areas (discounting wastewater) there would have been potentially 1315 (263 X 5) "program participations". The survey number was found to be 92 (e.g., 42 X 2) or 7% of the potential maximum. There is a lower participation rate by the smaller "Core" establishments. Forty percent of MS&T establishments are "Core", but they account for only 1/4 of the program participations. Overall, the highest participation rates were in the TURA, TRI and RCRA programs. As would be expected, consulting and educational SICs normally don't have a high rate of participation in these regulatory programs. There are ten establishments filing for Lead or Lead Compounds under TURA. The biggest difference between "Core" and "Partial" MS&T establishments was in the Tier II program with one and twelve participants respectively.

Most participation in these programs is from establishments in the manufacturing SICs, particularly electrical and electronic equipment (36 and 38). About ¼ of the MS&T establishments are in these two SICs. Nearly half of program participations were also from this group.

In 2006, OTA will convene a focus group. There are several reasons for convening a focus group from the industry. There are ten known users of Lead and probably several others that don't exceed the quantity or employee thresholds for reporting. These companies could benefit from learning more about technical alternatives and the developing domestic and international restrictions on Lead in products. There is also significant participation in hazardous waste programs and it would be important to learn the most pressing concerns for recycling and disposing of electronic wastes and byproducts. There is a lower level of participation in programs for air emissions, however, in recent years DEP has been inspecting and registering even the smallest painting and printing operations. Since it was difficult to obtain data on wastewater programs which are often regulated at the local level, it would be useful to learn more clearly how water is used in this unique industry and if there are common concerns that could be addressed through education or regulatory streamlining.

Appendix A-1
MA Marine Science & Technology Industry SIC Summary

SIC	Industry Description	No. Establishments
28	**Chemicals & Allied Products**	
2819	Industrial Inorganic Chemicals	1
2851	Paints and Allied Products	3
30	**Rubber & Miscellaneous Plastic Products**	
3053	Gaskets; Packing and Sealing Devices	1
3089	Plastic Products	2
32	**Stone, Clay, Glass and Concrete Products**	
3271	Concrete Block and Brick	1
3296	Mineral Wool	1
33	**Primary Metal Industries**	
3316	Cold Finishing of Steel Shapes	1
3357	Non-Ferrous Wiredrawing and Insulating	2
34	**Fabricated Metal Products Except Machinery and Transportation Equipment**	
3429	Hardware	1
3469	Metal Stamping	1
35	**Industrial & Commercial Machinery and Computer Equipment**	
3511	Turbines and Turbine Generator Sets	1
3519	Internal Combustion Engines	1
3531	Construction Machinery	2
3545	Machine Tool Accessories	1
3559	Special Industry Machinery	1
3568	Power Transmission Equipment	1
3571	Electronic Computers	1
3572	Computer Storage Devices	1
3577	Computer Peripheral Equipment	1
3599	Industrial Machinery	1
36	**Electronic & Other Electrical Equipment & Components, Except Computer Equipment**	
3625	Relays and Industrial Controls	1
3651	Household Audio and Video Equipment	1
3663	Radio and TV Communications Equipment	3
3669	Communications Equipment	2
3674	Semiconductors and Related Devices	2
3679	Electronic Components	8
3699	Electrical Equipment and Supplies	3
37	**Transportation Equipment**	
3731	Shipbuilding and Repairing	2
3732	Boat-building and Repairing	1

Appendix A-1
(continued)
MA Marine Science & Technology Industry SIC Summary

SIC	Industry Description	No. Establishments
38	**Measuring, Analyzing & Controlling Instruments; Photographic, Medical and Optical Goods, Watches and Clocks**	
3812	Search and Navigation Equipment	21
3821	Laboratory Apparatus and Furniture	2
3823	Process Control Instruments	2
3825	Instruments to Measure Electricity	4
3826	Analytical Instruments	1
3827	Optical Instruments and Lenses	1
3829	Measuring and Controlling Devices	5
3841	Surgical and Medical Instruments	2
3842	Surgical Appliances and Supplies	1
3845	Electro-medical Equipment	1
3861	Photographic Equipment and Supplies	1
50	**Wholesale Trade – Durable Goods**	
5023	Home Furnishings	1
5043	Photographic Equipment and Supplies	1
5049	Professional Equipment	2
5063	Electrical Apparatus and Equipment	1
5065	Electronic Parts and Equipment	3
5072	Hardware	1
5084	Industrial Machinery and Equipment	2
5085	Industrial Supplies	1
51	**Wholesale Trade – Non-Durable Goods**	
5162	Plastic Materials and Basic Shapes	1
5169	Chemicals and Allied Products	1
55	**Automotive Dealers & Gasoline Service Stations**	
5551	Boat Dealers	1
5731	Radio, Television and Electronic Stores	1
87	**Engineering, Accounting, Research, Management & Related Services**	
8711	Engineering Services	5
8731	Commercial Physical Research	11
8732	Commercial Non-Physical Research	2
8733	Non-Commercial Research Organizations	2
8734	Testing Laboratories	1
8742	Management Consulting Services	1
8748	Business Consulting	2

Appendix A-2
Rate of Environmental Reporting by Massachusetts MS&T Companies

1. Summary and Results

The MS&T industry is separated into two groups, a collection of core companies and a collection of partial companies. (Both of these designations have been described previously). The top three SIC code groups within the core sector that have the largest number of inclusive companies and employ the highest number of people are SIC 87, SIC 38, and SIC 36 although SIC 38 employs slightly more people than SIC 87. The three largest revenue generators in the core sector are SIC 38, SIC 44, and SIC 36. In the partial sector, the top three SIC codes with the greatest number of companies and with the largest revenue are SIC 87, SIC 38, and SIC 73. SIC 36 follows close behind. SIC 38, SIC 87, and SIC 36, have the highest number of employees. All of the above SIC codes were given in decreasing order. To better illustrate:

Rank	# Core	# Core Emps.	$ Core	# Partial	# Partial Emps.	$ Partial
1	SIC 87	SIC 38	SIC 38	SIC 87	SIC 38	SIC 87
2	SIC 38	SIC 87	SIC 44	SIC 38	SIC 87	SIC 38
3	SIC 36	SIC 36	SIC 36	SIC 73	SIC 36	SIC 73
Close behind				SIC 36		SIC 36

In almost all of these cases, SIC 36 and SIC 38 were in the top three for greatest number of companies, employees, and revenue, leading the study to focus on their impact in MS&T most heavily. In addition, these two SIC codes reported to TURA, TRI, and RCRA most often as well as hold the majority of air and water permits in the MS&T industry. However, reporting rates were low.

	SIC 36	SIC 38
Core	25% - 37.5 %	5.8% - 11.7%
Partial	13.3% - 20%	4.7% - 19%

Appendix A-2 (continued)
Rate of Environmental Reporting by Massachusetts MS&T Companies

SIC	Description	"App. 1" # Est	Core # Est	Core # Emps	Core Sales $ mm	Partial # Est
17	Contractors					2
28	Chemicals & Allied Products	4	1	23	3.7	3
30	Rubber & Misc Plastic Products	3				3
32	Stone,Clay,Glass,Concrete Prds	2				1
33	Primary Metals Industries	3				3
34	Fabricated Metal Products	2				3
35	Indus&Comm.Mach,Computers	11	4	105	22.2	9
36	Electronic & Electrical Equipment	20	8	285	34.8	15
37	Transportation Equipment	3	2	35	3.9	1
38	Measure, Analyze, Control Equip.	41	17	699	61.8	21
39	Miscellaneous Manufacturing		1	4	0.2	1
44	Water Transportation		2	152	56.0	1
48	Communications					1
50	Wholesale Trade - Durables	12	9	109	20.5	6
51	Wholesale Trade - Non-Durables	2				1
52	Building Materials					1
55	Automotive Dealers & Service Stations	1				1
57	Home Furnishings, & Equipment	1				1
63	Insurance					1
67	Holding & Other Investment Offices		1	70	0.1	
73	Business Services		2	6	0.5	17
76	Miscellaneous Repair Services		1	5	0.3	
82	Educational Services		8	85		
86	Membership Organizations		1	54		
87	Engineering,Acct,Research,Mgt	24	24	633	15.3	57
89	Miscellaneous Services					3
	Totals	129	81	2265	219	152
	Master List Totals		107	2620	331	156
3812	Search & Navigational Instruments	21	12	449	57.3	7

Appendix A-2
(continued)
Rate of Environmental Reporting by Massachusetts MS&T Companies

SIC		Core # Est TURA	Core # Est TRI	Core # Est Tier 2	Core # Est RCRA	Core # Est Air	Core # Est Water	Partial # Est TURA	Partial # Est TRI
17	Contractors								
28	Chemicals & Allied Products	1	1	1	1	1		1	1
30	Rubber & Misc Plastic Products							1	1
32	Stone,Clay,Glass,Concrete Prds							1	1
33	Primary Metals Industries							3	3
34	Fabricated Metal Products								
35	Indus&Comm.Mach,Computers					1		1	1
36	Electronic & Electrical Equipment	2	2		3	2		2	2
37	Transportation Equipment							1	1
38	Measure, Analyze, Control Equip.	1	2		1	2		4	4
39	Miscellaneous Manufacturing								
44	Water Transportation								
48	Communications								
50	Wholesale Trade - Durables								
51	Wholesale Trade - Non-Durables							1	1
52	Building Materials								
55	Automotive Dealers & Service Stations							1	1
57	Home Furnishings, & Equipment								
63	Insurance								
67	Holding & Other Investment Offices								
73	Business Services								
76	Miscellaneous Repair Services								
82	Educational Services		1						
86	Membership Organizations								
87	Engineering,Acct,Research,Mgt							1	1
89	Miscellaneous Services								
	Totals	4	6	1	5	6	0	17	17
3812	Search & Navigational Instruments	1	1		1	2		2	2

Appendix A-2
(continued)
Environmental Compliance Survey of Massachusetts MS&T Companies

2. Clarification of Appendix 3 Column Headings Above

"**App 1 Est**." is the data from the original report by the contractor MOTN which breaks down each SIC code industry
"**Core/Partial # Est**." is the number of core/partial establishments within each SIC code
"**Core/Partial # Emps**." is the number of employees within the core/partial sector for each SIC code
"**Core/Partial sales $mm"** is the amount of revenue (in millions of dollars) produced in the core/partial sector for each SIC code
"**Core/Partial # Est. TURA**" is the number of core/partial companies within each SIC code that are TURA (Toxics Use Reduction Act) filers
"**Core/Partial # Est. TRI**" is the number of core/partial companies within each SIC code that are TRI (Toxics Release Inventory) filers
"**Core/Partial # Est. Tier 2**" is the # of core/partial companies within each SIC code that are Tier 2 filers (storage of reportable quanties of listed toxics on site
"**Core/Partial # Est. RCRA**" is the number of core/partial companies within each SIC code that are RCRA (Resource Conservation and Recovery Act) filers
"**Core/Partial # Est. Air**" is the number of core/partial companies within each SIC code that are air permit holders
"**Core/Partial # Est. Water**" is the number of core/partial companies within each SIC code that are water permit holders

2. Sources of Information

The appendix was compiled using information from several different databases. The EPA website (http://www.epa.gov/enviro/html/multisystem_query_java.html) was used to access information regarding TRI and RCRA filers. TURA filers were accessed using the Massachusetts Toxics Use Reduction Act website (http://www.turi.org/turadata). Air and Water permit holders were found in the Massachusetts Department of Environmental Protection FMF database (http://dep-app-bos-007.dep.govt.state.ma.us/dephtml/epics.html).

Appendix B

Invited Companies

No.	Company / Contact E-mail Address	MA Location	Product / Service	MOTN Co. (Y/N)
1	**Advanced Electronic Design, Inc.** Mr. Dave Swithers (President) dswithers@ieee.org	300 Miles Standish Boulevard, Taunton, MA 02780 (508) 977-0761	Prototype & fabricate custom computers, microprocessors and micro-controllers.	Yes
2	**Teledyne-Benthos, Inc.** Mr. Francois Leroy (VP) fleroy@benthos.com	49 Edgerton Drive North Falmouth, MA 02556 (508) 563-1000	Underwater sensors and towed systems	Yes
3	**Coastal Leasing** Dr. Don Grossman (President) dg@coastal-usa.com	179 Sidney Street Cambridge, MA 02139-4328 (617) 497-1122	Manufactures integrated hardware & software systems for ocean research	Yes
4	**EPC Labs** Mr. John Curley (Director) johnc@epclabs.com	42A Cherry Hill Drive Danvers, MA 01923 (978) 777-1996	Manufactures recording devices for marine applications	Yes
5	**Endeco/YSI** Mr. Kevin McClurg (VP/GM) kmcclurg@ysi.com	13 Atlantis Drive Marion, MA 02738-1448 (508) 748-0366	Manufacturer of coastal monitoring systems	Yes
6	**Falmouth Scientific Inc. (FSI)** Mr. John Baker (President) jbaker@falmouth.com	1400 Route 28A Cataumet, MA 02534-0315 (508) 564-7640	Manufactures oceanographic instruments for measuring temperature, pressure, salinity, currents, etc.	Yes
7	**Hydroid, Inc.** Mr. Kevin McCarthy (VP) kmccarthy@hydroidinc.com	6 Benjamin Nye Circle Pocasset, MA 02559 (508) 563-6565	Manufactures autonomous underwater vehicles (AUV's)	Yes
8	**McLane Research Laboratories Inc.** Mr. Michael Matthewson (VP/GM) mclane@mclanelabs.com	121 Bernard Saint Jean Drive East Falmouth, MA 02536 (508) 495-4000	Manufactures ocean sampling systems	Yes
9	**Materials Systems, Inc. (MSI)** Dr. Les Bowen (President) lbowen@matsysinc.com	543 Great Road Littleton, MA 01460 (978) 486-0404	Manufactures piezocomposite materials used in acoustic (sonar) transducers	Yes
10	**Mooring Systems Inc.** Mr. James Capellini (President) james@mooringsystems.com	1227 Route 28A Cataumet, MA 02534 (508) 564-4770	Manufactures oceanographic moorings & instrumentation deployment platforms	Yes

No.	Company / Contact E-mail Address	MA Location / Telephone	Product / Service	MOTN Co. (Y/N)
11	**NOBSKA** Dr. Todd Morisson (VP) Mr. Paul Dugas (Dir, Manufacturing) atmorisson@nobska.net	28 Pilot Way Falmouth, MA 02536 (508) 360-2393 (508) 292-2548	Manufactures current meters, wave meters and tide gauges	Yes
12	**Sea Sciences, Inc**. Mr. Dirk Casagrande (VP) dirk@star.net	40 Massachusetts Avenue Arlington, MA 02474 (781) 643-1600	Manufactures undulating towed vehicles	Yes
13	**Lockheed-Martin Sippican, Inc.** Mr. Bill Walsh (President) bill.walsh@lmco.com	7 Barnabas Road Marion, MA 02738 (508) 748-1160	Manufactures expendable sensors and probes, underwater vehicles and ASW systems	Yes
14	**Webb Research Corp.** Mr. Dan Webb (President) dwebb@webbresearch.com	82 Technology Park Drive East Falmouth, MA 02536-4441 (504) 548-2077	Manufactures variable buoyancy sensor platforms, floats and gliders	Yes
15	**Woods Hole Group** Mr. Bob Hamilton (VP) bhamilton@whgrp.com	81 Technology Park Drive East Falmouth, MA 02536 (508) 540-8080	Manufactures floating ocean observation systems (buoys)	Yes
16	**Harris Acoustics, Inc.** Mr. Bill Murphy (President) sales@harrisacoustics.com	141 Washington Street East Walpole, MA 02032 (508) 660-6000	Manufactures underwater acoustic transducers	No
17	**MASSA Products, Inc.** Mr. Donald Massa (President) info@massa.com	280 Lincoln Street Hingham, MA 02043 (781) 749-4000	Manufactures underwater acoustic transducers	No
18	**Bluefin Robotics, Inc.** Mr. Frank van Mierlo (President) info@bluefinrobotics.com	237 Putnam Avenue Cambridge, MA 02139 (617) 498-0028	Manufactures automated underwater vehicles (remotely operated & autonomous)	No
19	**Aanderaa Instruments, Inc.** Mr. Richard Butler Jr. (VP/GM) Richard.Butler@aanderaa.no	182 East Street, Suite B Attleboro, MA 02703-4209 (508) 226-9300	Manufacturer of oceanographic data collection instruments	No

No.	Company / Contact E-mail Address	MA Location / Telephone	Product / Service	MOTN Co. (Y/N)
20	**Aerodyne Research, Inc.** Dr. Charles E. Kolb (President) info@aerodyne.com	45 Manning Road Billerica, MA 01821-3976 (978) 663-4918	Manufacturer of laser trace gas detectors	No
21	**Ultra Electric Ocean Systems** Mr. Rick Kielmeyer (President) Rick.Kielmeyer@ultra-os.com	115 Bay State Drive Braintree, MA 02184 (781) 848-3400	Manufactures expendable underwater systems and sensors for ASW purposes	No
22	**BIW Cable Systems** sales@drakausa.com	22 Joseph E. Warner Boulevard North Dighton, MA 02764 (508) 822-5444	Manufacturers underwater cables & connectors	No
23	**Clearwater Instrumentation, Inc.** Dr. Gary Williams (President) sales@clearwater-inst.com	304 Pleasant Street Watertown, MA 02472 (617) 924-2708	Manufacturer of drifter and marker buoys	No
24	**Cuming Corp.** Dr. William Cuming (President) cumingcorp@aol.com	230 Bodwell Street Avon, MA 02322-1119 (508) 580-2660	Manufacturer of syntactic foam floatation systems	No
25	**Deep Sea Systems, International** Mr. Chris Nicholson (President) dssiinc@aol.com	PO Box 622 Falmouth, MA 02541-0622 (508) 540-6732	Manufactures remotely operated vehicles and associated components	No
26	**EdgeTech, Inc.** Mr. Rick Jablonski (President) info@edgetech.com	4 Little Brook Road West Wareham, MA 02576 (508) 291-0057	Manufactures underwater towed vehicles, acoustic tracking systems, acoustic releases and sensors	No
27	**J.W. Fishers Manufacturing Inc.** Mr. Jack Fisher (President) jwfishers@aol.com	1953 County Street East Taunton, MA 02718 (508) 822-7330	Manufactures underwater detection systems for recreational applications	No
28	**L.L. Rowe Company** Jerrold R. Starr (Executive VP) jstarr@llrowe.com	66 Holton Street Woburn, MA 01801 (781) 729-7860	Manufactures marine electrical components, connectors, lights & switches	No

No.	Company / Contact E-mail Address	MA Location / Telephone	Product / Service	MOTN Co. (Y/N)
30	**Megapulse, Inc.** megapuls@megapulse.com	101 Billerica Avenue North Billerica, MA 01862 (978) 670-9960	Manufacturer of marine navigation systems and radio beacons	No
31	**Northstar Technologies** Mr. David Ritblatt (General Manager) sales@northstarnav.com	30 Sudbury Road Acton, MA 01720 (978) 897-6600	Manufacturer of auto-pilots, plotters, fish-finders and marine communications gear	No
32	**Phoenix Science & Technology Inc.** Dr. Raymond B. Schaefer (Principal) info@phoenixsandt.com	27 Industrial Avenue Chelmsford, MA 01824 (978) 367-0232	Manufacturer of acoustic sources (sparkers) and pulsed light sources for UV water treatment	No
33	**UMASS Dartmouth ATMC** Dr. Tom Curry (Director) tcurry@umassd.edu	151 Martine Street Fall River, MA 02723 (508) 910-9830	Small business incubator facility	Yes
34	**Brooke Ocean Technology USA** Mr. Roger Race (General Manager) rrace@bot-usa.com	1213 Purchase Street (3rd Floor) New Bedford, MA 02740 (508) 990-4575	Manufacture deployment & retrieval systems for underwater vehicles	Yes
35	**True North Technologies, Inc.** Mr. David E. Pheifer (President) dpheifer@tntc.com	2 Clock Tower Place, Suite 335 Maynard, MA 01745 (978) 897-5400	Manufacturer of electronic compasses and inclinometers	No
36	**Triton Systems, Inc.** Mr. George Kachen (VP) gkachen@tritonsys.com	200 Turnpike Road Chelmsford, MA 01824 (978) 250-4200	Manufacturer of advanced composite materials for harsh environments	No
37	**Textron Systems**	201 Lowell Street Wilmington, MA 01887-2941 (978) 657-2100	Manufacturer of military weaponry and surveillance systems	No
38	**Surmet Corporation** Mr. Tim Davis (President) tdavis@surmet.com	20 B Street Burlington, MA 01803 (781) 272-3969	Manufacturers of advanced materials and coatings	No
39	**Signatron Technology Corp.** Dr. Steen A. Parl (President) info@signatron.com	29 Domino Drive Concord, MA 01742-2845 (978) 371-0550	Manufacturer of microwave equipment used for tracking cargo	No

No.	Company / Contact E-mail Address	MA Location / Telephone	Product / Service	MOTN Co. (Y/N)
40	**Si2 Technologies** Dr. Joseph M. Kunze (President) jkunze@si2technologies.com	200 Turnpike Road Chelmsford, MA 01824-4000 (978) 606-2601 (Ext. 135)	Manufacturer of multifunctional electronic systems and components for high performance applications	No
41	**Setra Systems Inc.** Dr. Y. T. Li (President) info@setra.com	159 Swanson Road Boxboro, MA 01719-1304 (978) 263-1400	Manufacturer of high accuracy transducers and pressure gauges	No
42	**SeaScan Inc.** Mr. Pierre Tillier (President) seascan@cape.com	346 Gifford Street Falmouth, MA 02540 (508) 540-3340	Manufacturer of float-based oceanographic equipment	No
43	**Schaefer Corp.**	321 Billerica Road Chelmsford, MA 01824-4191 (978) 256-2070	Manufacturer of high-grade power supplies	No
44	**Rolls Royce Naval Marine, Inc.**	110 Norfolk Street Walpole, MA 02081 (508) 668-9610	Manufacture ship power plant and steering components	No
45	**Radiation Monitoring Devices, Inc.** Dr. Gerald Entine (President) gentine@rmdinc.com	44 Hunt Street Watertown, MA 02472 (617) 926-1167	Manufacturer of personal and area radiation detectors	No
46	**Piezo Systems, Inc.** info@piezo.com	186 Massachusetts Avenue Cambridge, MA 02139 (617) 547-1777	OEM manufacturer of piezo elements for a variety of applications	No
47	**Radant Technologies, Inc.** Mr. John Maciel (VP Engineering) radant@ultrnet.com	255 Hudson Road Stow, MA 01775 (978) 562-3866	Manufacturer of radomes, antennas and structural components	No
48	**Physical Sciences Inc.** Mr. George E. Caledonia (President) Mr. Jim Glynn (VP Marine) caledonia@psicorp.com glynn@psicorp.com	20 New England Business Center Andover, MA 01810 (978) 698-0003	Low level manufacturing of lasers and optical systems transitioning from R&D to production	No

No.	Company / Contact E-mail Address	MA Location / Telephone	Product / Service	MOTN Co. (Y/N)
49	**Northern Airborne Technology Inc.** natinc@ma.ultranet.com	28 Lord Road, Suite 130 Marlborough, MA 01752 (508) 303-6762	Manufactures specialized aircraft and marine communications equipment	No
50	**Northrup-Grumman - Fibersense Technology Corp.** Mr. Michael S. Perlmutter (Exec. VP)	755 Dedham Street Canton, MA 02021-1402 (781) 830-9690	Manufacturer of Precision Fiber Optic Gyroscopes	No
51	**OPTRA Inc.** info@optra.com	461 Boston Street Topsfield, MA 01983-1290 (978) 887-6600	Manufactures Electro Optic Measurement Systems	No
52	**Persistor Instruments, Inc.** info@persistor.com	254-J Shore Road Bourne, MA 02532-4104 (508) 759-6434	Manufacturer of Miniature Computer Components and PC Boards	No
53	**Energen Inc.** Dr. Chad H. Joshi (President/CEO) energen@energeninc.com	650 Suffolk Street Lowell, MA 01854 (978) 259-0100	Manufactures actuators, controllers, linear motors and thin film materials	No
54	**Image Acoustics, Inc.** Dr. John Butler butler@imageacoustics.com	97 Elm Street Cohasset, MA 02025 (781) 383-2002	Manufactures loud-speakers	No
55	**Implant Sciences Corporation** Dr. Anthony J. Armini (Pres/CEO) info@implantsciences.com	107 Audubon Road, #5 Wakefield, MA 01880-1246 (781) 246-0700	Surface treatments for medical devices	No
56	**IMTRA Corporation** contact@imtra.com	30 Samuel Barnet Boulevard New Bedford, MA 02745 (508) 995-7000	Manufacturer of thrusters, marine lighting, anchoring systems, pumps and tanks	No
57	**INSTRON Corporation** Mr. Steve Martindale (Exec. VP/CEO) Mr. Rick Tattersfield (VP/Dir. QC) rick_tattersfield@instron.com	825 University Avenue Norwood, MA 02062-2643 (781) 828-2500	Manufactures materials testing machines	No

No.	Company / Contact E-mail Address	MA Location / Telephone	Product / Service	MOTN Co. (Y/N)
58	**International Light Technologies Inc**. Mr. Thomas Connolly (Pres./CEO) info@intl-light.com	10 Technology Drive Peabody, MA 01960 (978) 818-6180	Manufactures light measurement instrumentation	No
59	**L-3 Communications – Henschel Inc.** Mr. Bob Grochmal (VP) info.henschel@L-3com.com	9 Malcolm Hoyt Drive Newburyport, MA 01950 (978) 462-2400	Manufacturer of power control systems for US Navy and commercial marine applications	No
60	**Jentek Sensors Inc.** Dr. Neil Goldfine (President) jentek@shore.net	110-1 Clematis Avenue Waltham, MA 02453-7013 (781) 642-9666	Manufacturer of access control systems	No
61	**MESA Systems Company** info@mesasystemsco.com	6 West Mill Street, Unit 3 Medfield, MA 02052 (508) 359-5322	Manufacturer of specialty measurement systems, communications equipment and control devices	No

Appendix C

Final Attendee List

March 22, 2006 - Focus Group Final Attendee List

Name	Title	Company / Address	E-mail	Telephone
Tom Weik	Operations Manager	EdgeTech 4 Little Brook Road West Wareham, MA 02576	weik@edgetech.com	(508) 291-0057
Henry Brown	Purchasing Manager	EdgeTech 4 Little Brook Road West Wareham, MA 02576	brown@edgetech.com	(508) 356-9711
Mark Belcher	Senior Electrical Engineer	McLane Research Labs 121 Bernard St. Jean Drive East Falmouth, MA 02536	mbelcher@mclanelabs.com	(508) 495-4000
Matthew Sears	EHS Engineer	Lockheed Martin Sippican 7 Barnabas Road Marion, MA 02738	matthew.e.sears@lmco.com	(508) 748-1160
Karen Cerritelli	EHS Manager	Materials Systems Inc. (MSI) 543 Great Road Littleton, MA 01460	cerritelli@matsysinc.com	(978) 486-0404
Bill Powell	Director of Business Development	True North Technologies 2 Clock Tower Place Maynard, MA 01754	bpowell@tntc.com	(978) 897-5400
Robert Dluhy	Project Engineering Manager	UMASS ATMC 151 Martine Street Fall River, MA 02723	rdluhy@umassd.edu	(508) 999-9121
Dr. Tom Curry	Director, ATMC	UMASS ATMC 151 Martine Street Fall River, MA 02723	tcurry@umassd.edu	(508) 999-9121
Hugh Murphy	President (2005/2006)	Marine & Oceanographic Technology Network (MOTN) PO Box 1951 North Falmouth, MA 02556	hmurphy@purvis.com	(401) 845-8439
Cheryl Zimmerman	President 2006/2007	Marine & Oceanographic Technology Network (MOTN) PO Box 1951 North Falmouth, MA 02556	cheryl.zimmerman@farsounder.com	(401) 784-6700
Lorna Bandstra	Marketing Manager	Hydroid Inc. 6 Benjamin Nye Circle Pocasset, MA 02559	lbandstra@hydroidinc.com	(508) 563-6565
Rick Smith	Engineering Support Services Supervisor	Teledyne Benthos 49 Edgerton Drive North Falmouth, MA 02556	rsmith@benthos.com	(508) 563-1000
Bill Grafton	Sales Manager	Woods Hole Group 81 Technology Park Drive East Falmouth, MA 02536	wdgrafton@whgrp.com	(508) 495-6253
Archie Todd Morrison III	VP Engineering	NOBSKA 6 Quissett Circle Falmouth, MA 02540	atmorrison@nobska.net	(508) 360-2393

Appendix D

Facilitator's Introductory Slides

"The Economic & Operational Impact of Environmental Regulations and New International Standards on Your Business" Focus Group

March 22, 2006

ATMC UMASS/D

Fall River, MA

Environmental Focus Group

AGENDA

8:30 – 9:00 Registration

9:00 – 9:30 Welcome & Opening Comments

- Paul Richard, Director OTA
- Dave Lutes, Undersecretary For Policy, MA EOEA

9:30 – 10:00 Objectives & Issues

- Hugh Murphy, MOTN
- Jim Cain, OTA

Environmental Focus Group

AGENDA cont.

10:00 – 10:30 Regulatory Overview
- Rick Reibstein, Sr. Analyst, OTA

10:30 – 10:45 Break

10:45 – 11:15 Regs on Haz Sub (RoHS) and Waste from Electrical & Electronic Equip. (WEEE)
- Pam Civie, Industry Research, TURI

11:15 – 1:00 Facilitated Focus Group Discussion

1:00 – 1:30 Lunch

1:30 – 2:00 Overview of Office of Technical Assistance

2:00 Adjourn

Environmental Focus Group

Logistics

- Rest Rooms
- Coffee Break Scheduled at 10:30am
- Lunch Scheduled at 1:00pm
  - Provided by OTA
- Questions hold until Focus Group Discussion
- Administrative Assistance
  - Ms. Emily Alves, ATMC
- Facilitators:
  - Ms. Cheryl Zimmerman, MOTN
  - Mr. Hugh Murphy, MOTN

2

"The Economic & Operational Impact of Environmental Regulations and New International Standards on Your Business" Focus Group

March 22, 2006

ATMC UMASS/D

Fall River, MA

Environmental Focus Group

Background

- **Focal Point -------Issue Paper**
- **Office Of Technical Assistance part of MA Executive Ofc. Of Environmental Affairs**
- **Purpose --- to Assist MA companies in Understanding & Complying with MA Environmental Regulations**
- **OTA Held a Similar Focus Group Meeting for Medical Products Industry Sector**
- **OTA learned of Donahue Inst. Study of Marine Science & Technology Business Sector**

Environmental Focus Group

Background (cont.)

- **Marine Science & Technology (MS&T) Study**
  - Identified over 300 MA companies produce MS&T products or services in MA
  - Total Annual Sales > $3.3B
  - Employ > 18,000
- **Marine & Oceanographic Technology Network(MOTN)**
  - Founded in 1994
  - Non-Profit Business Professional Org.
  - Biannual Ocean Technology Workshop
  - Foster Collaborations between Member Companies, Academia, Federal Labs and Customer Community
  - 75 Member Companies in New England

Environmental Focus Group

Focus Group Issue Paper

- In collaboration with OTA, MOTN contacted MA member companies
- Identified issues and concerns
  - Lead and Lead-based Solder
  - Organic Solvents & VOC's
  - Electronic Scrap
  - Compliance with Fed & State Environmental Regs
  - Pollution Prevention
  - WEEE and RoHS Directives
  - DoD Industry Perspective

Environmental Focus Group

Focus Group Issue Paper

- Results in Issue Paper
  - Copies Available
- Serves As Basis For Focus Group
- Today's Goals and Objectives

Environmental Focus Group

Today's Goals and Objectives

1. **Discover Economic Barriers & Disincentives caused by Fed or MA Environmental Regs. & Permitting Rqmts.**
2. **Identify Common Problems in Environmental Regulation Compliance**
3. **Where Can OTA Provide Assistance?**
4. **Can MA Compliance Processes be Streamlined?**
5. **Raise Awareness of Future Restrictions & Regulations (e.g. European RoHS & WEEE)**

Appendix E

Facilitator's Discussion Slides

“The Economic & Operational Impact of Environmental Regulations and New International Standards on Your Business”
Focus Group

Focus Group Discussion

Environmental Focus Group

Issue #1

Organic Solvents & Volatile Organic Compounds (VOC's)

Environmental Focus Group

Organic Solvents & VOC's

- How many companies are using VOC's?
- Is your company still using VOC's?
- If yes, why?
- If not, what are you using instead?
- What are available to control VOC emissions?
- What halogenated solvents are used in manufacturing MS&T equipment?
- What are some common practices for handling spent organic compounds?

Environmental Focus Group

Issue #2

Disposal of Electronic Scrap

And

Hazardous Materials

Environmental Focus Group

Disposal of Electronic Scrap & Hazardous Materials

- How does your company dispose of electronic scrap? (Lead, chromates, etching compounds, circuit boards, batteries, plating materials etc.)
- Does this method comply with EPA, MA and local regulations?
- EU WEEE Directive may affect 1/3 of MA MS&T Industry
- How does my company plan to comply with new EU and pending federal and state electronic scrap disposal?

Environmental Focus Group

Issue #3

EPCRA

And

Pollution Prevention

Environmental Focus Group

Pollution Prevention

- EPCRA (Emergency Planning & Community Right-to-Know Act)
- Resource Conservation & Recovery Act
- Clean Water Act
- EPCRA requires Annual Report for all routine releases of 320 toxic chemicals
- MA has incorporated aspects of prevention into EPCRA reporting requirements

Environmental Focus Group

Issue #4

Department of Defense Perspective

Environmental Focus Group

DoD Perspective

- DoD has banned Chromates from Anti-Corrosion and Anti-Fouling Coatings
- Similarly, DoD restricted use of Chromates from titanium etching for bonding
- Most substitute Coatings use Chromium-3
  - Long Term effects not known
- NUWC has developed “drop-in” substitutes for both cases
- POC: Dr. Theresa Baus, Head of Technology Transfer Office, Tel: (401) 832-8728

Environmental Focus Group

Issue #5

Effects of EU

Regulations on Hazardous Substances (RoHS)

And

Waste from Electrical and Electronic Equipment (WEEE)

Environmental Focus Group

EU RoHS and WEEE Directives

- EU WEEE Directive
  - Arrange for collection, treatment, recycling, recovery and disposal of electronic scrap
- 1/3 of MA MS&T Companies Export
  - Many of These Export to EU
- Lead-Based Solder banned from Electronics
- Lead-Free Solder Substitutes Melt at Higher Temperatures May Cause Component Failure

Appendix F

Slides Presented on RoHS and WEEE

Toxics Use Reduction Institute

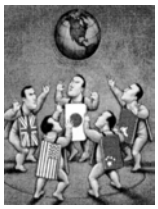
European Directives – An Overview of RoHS and WEEE

OTA Marine Science & Technology Forum
March 22, 2006

Pam Civie, Industry Research Program Manager
Toxics Use Reduction Institute
University of Massachusetts Lowell
978-934-3142
pcivie@turi.org

Why Should You Care?

- Global Economy
- OEM's moving toward greening product life cycles, closing materials loop, restricting hazardous substances
- EU WEEE and RoHS largest regulatory drivers for this type of change



What does that mean for Suppliers?

- Compliance with OEM's regulatory requirements critical to survival
- Compliance with OEM voluntary initiatives and goals differentiate suppliers

What does that mean for Suppliers?

- Requires:
  - Supply chain communication
  - Agile businesses: nimble design and manufacturing production
  - Integration of environmental, health and safety issues into product design process
  - Innovation: materials, supply chain relationships

European Union Directives

Objective: reduce solid waste, encourage re-use and recycling, make recycling and disposal safer

- Waste Electrical and Electronic Equipment Directive (WEEE)
- Restriction on Hazardous Substances Directive (RoHS)

WEEE

- *Objective: Divert WEEE from landfills and incinerators to environmentally sound re-use and recycling*
- Broad applicability to electronic products and electrical equipment, with list of exemptions
- All applicable products in the EU after **August 13, 2006** must pass WEEE compliance and carry the "wheelie bin" sticker.

Good source of information:
http://www.dti.gov.uk/sustainability/pdfs/finalweee.pdf

Relationship Between WEEE and RoHS

- WEEE aims to encourage the design of electronic products with environmentally-safe recycling and recovery in mind.
- RoHS dovetails with WEEE by reducing the amount of hazardous chemicals used in electronic manufacture, thereby reducing the hazards associated with recycling and recovering WEEE.

European RoHS Directive

- Substitution of certain heavy metals and brominated flame retardants where alternatives are available
- Phase out by **July 1, 2006**
- Covers "equipment" that is "put onto the market" after that date

www.newark.com

Good source of information:

http://www.dti.gov.uk/sustainability/pdfs/finalrohs.pdf

Who's Affected?

- Any business that sells electronic products, sub-assemblies or components directly to EU countries, or sells to resellers, distributors or integrators that in turn sell products to EU countries, is impacted if they utilize any of the restricted materials

Compliance with RoHS

- RoHS restricts the use of SIX substances:
  - Heavy Metals
    - Lead (Pb)
    - Mercury (Hg)
    - Hexavalent Chromium (Cr+6)
    - Cadmium (Cd)
  - Flame Retardants:
    - Polybrominated biphenyls (PBBs)
    - Polybrominated diphenyl ethers (PBDEs)
- But does not specify:
  - Maximum concentration limits
  - How manufacturers can comply
  - Requirements for market surveillance

Covered Product Categories

- Large household appliances:
  - e.g., refrigerators, washers, stoves, AC
- Small household appliances:
  - e.g., vacuum cleaners, hair dryers, coffee makers
- Computing & Communications Equipment
- Consumer Electronics:
  - e.g., TVs, DVD players, stereos, video cameras
- Lighting:
  - e.g., lamps, lighting fixtures, light bulbs
- Power Tools:
  - e.g., drills, saws, nail guns, lathes, sprayers
- Toys and Sports Equipment:
  - e.g., video games, electric trains, treadmills
- Automatic Dispensers:
  - e.g., vending machines, ATM machines

Exempt Products Categories

- Large stationary industrial tools
- Control and monitoring equipment
- National security use and Military equipment
- Medical devices
- Some light bulbs and some batteries
- Spare parts for electronic equipment in the market before July 1, 2006

Compliance Recommendations

1. Determine if products need to comply
   - Scope, exemptions, will supply chain force changes?
2. Self declaration
   - Obtain declarations
   - Maintain technical compliance file
3. As a last resort, analyze supplier parts
4. Part numbers may not change so need to segregate
5. Respond to customers requests for information
6. Develop RoHS compatible components and sub-assemblies and RoHS compliant products

Possible Exemptions for Marine Industry

- Current:
  - Military applications
  - Measurement and control instruments
- Requests:
  - Components intended for lifetime use
- ***Important note***: even though your product may be exempt, you may find yourself going green if you purchase high-volume RoHS-compliant parts, or move to more expensive mil-spec components

Conclusions

- US electronics companies – *and their supply chain* – must be prepared to comply with global restrictions on substances in order to maintain economic competitiveness
- The most critical deadline is *July 1, 2006*
- Assistance is available

TURI's Industry Research Program Initiatives

- Supply chain communication
  - Workshops, OEM and EU trends and requirements, TURI Greenlist Bulletin
- Innovation
  - Materials research and evaluation
  - Lead-Free Electronics Industry Research Consortium
  - Polymer systems: Nanomaterials, alternatives to lead stabilizers, safer flame retardant materials
- Surface Solutions Laboratory

TURI Workshops on WEEE and RoHS Compliance

- TURI has held 17 workshops since 2000 specifically for the electronics industry and its supply chain, including wire and cable coaters, to hear from experts on compliance
- Two electronics companies are opening their doors to demonstrate what they've done to become RoHS compliant as part of TURI's Demonstration Site Program
- Check our website for updates and scheduled events (www.turi.org)

Contact Us

Massachusetts
Toxics Use Reduction Institute

www.turi.org

Click on "Industry ⇒Research ⇒Supply Chain Program" for Wire and Cable or Lead-free Electronics supply chain work

Check out "New at TURI" for upcoming events and reports

Click on "Library" to subscribe to Greenlist Bulletin

978-934-3275
Liz Harriman: harriman@turi.org
Greg Morose: Gregory_Morose@uml.edu
Pam Civie: pcivie@turi.org

Appendix G

AGENDA

Focus Group Meeting
Agenda

March 22, 2006

8:30 – 9:00 am	**Registration & Continental Breakfast**
9:00 – 9:30 am	**Welcome & Opening Comments** **- Paul Richard – Director OTA** **- Dave Lutes – Undersecretary for Policy EOEA**
9:30 – 10:00 am	**Objectives and Issues – Hugh Murphy (President, MOTN)** **OTA Overview- Jim Cain (OTA)**
	a. Discovering economic barriers and disincentives that may be the result of MA environmental regulations or the permitting process **b. Detecting common problems in environmental regulation compliance** **c. Identifying areas where OTA can assist your company in understanding or complying with environmental regulations** **d. Pinpointing areas where streamlining of the compliance process is possible** **e. Determining the awareness of companies to the new European regulations on hazardous substances (ROHS) and waste from electrical or electronic equipment (WEEE)**
10:00 – 10:30 am	**Regulatory Overview – Rick Reibstein (OTA Senior Analyst)**
10:30 – 10:45 am	**- Coffee Break –**
10:45 – 11:15 am	**ROHS and WEEE – Pam Civie (Industry Researcher – TURI)**
11:15 am – 1:00 pm	**Facilitated Group Discussion – Hugh Murphy (MOTN)**
	a. Use of organic solvents and VOC's **b. Disposal of electronic scrap and hazardous materials** **c. Defense industry standards and related issues** • **WEEE** • **RoHS** • **Lead-based solder and substitutes**
1:00 – 1:30 pm	**- Lunch –**
1:30 – 2:00pm	**Office of Technical Assistance (OTA) – Paul Richard (OTA)** **- Services provided**
2:00 pm	**Adjourn**