North American Environmental Compliance Attitudes Towards Electronics

Krista Botsford
5-Trees LLC
Burlington, MA
John Messina
Semiconductor Division
National Institute of Standards and Technology (NIST)
Gaithersburg, MD
Eric Simmon
Semiconductor Division
National Institute of Standards and Technology (NIST)
Gaithersburg, MD

Abstract
More and more countries are beginning eco-compliance legislation for electronics products. Where does the USA stand? The rest of North America? This paper will discuss the following areas and attitudes towards environmental compliance in the USA: levels of legislation, who is (or should be) responsible, industry association involvement, and industry standards development.

Keywords: RoHS, WEEE, sustainability, recycling, material declaration

Introduction

The high-tech industry is global in its operations and sourcing, as well as in its manufacturing locations. With more and more countries introducing and adopting "greening" directives and regulations for electronics products, eco-compliance attitudes (both industrial and legislative) in North America are slow to come around. In fact, within North America, there has been no national legislation passed within the United States, Canada, or Mexico similar in nature to the environmental directives being adopted within the European Union (EU).

Within the United States and Canada, the movement to "green" electronics is beginning more at a state and local level, rather than at a national level as in the European Union. The movement is also being worked on by several industry groups and its supporting companies (many being international in nature). This paper will look at some of the environmental activity occurring within the North American area including industry group activities, US government activities (both federal and state), and standards development activities.

US Government Activities

Federal Level

The US Congress is the legislative branch of the US government that has the ability to establish governing laws. While Congress has enacted many laws over the years designed to protect workers health and the environment, there has been little motion on enacting environmental law for electronics products similar to the European Union's (EU) Restriction of Hazardous Substances (RoHS) directive and its Waste Electrical and Electronic Equipment (WEEE) directive[i]. (RoHS restricts the use of six hazardous materials in the manufacturing of various types of electronics and electrical equipment, while WEEE sets recycling and recovery targets for electrical equipment). This has continued despite a growing awareness of the topic by various congressional members who have brought forward similar measures. However, none of the proposed laws have advanced far enough to be addressed by both houses of Congress. This has often been attributed to a lack of a unified call by industry to enact such legislation. The end result is that there is no US federal law that bans the use of the six restricted RoHS substances within electronics.

However, there is the possibility that The Congress' position is likely to change for two main reasons. First there is a change in leadership for the 110th US Congress. The Democratic Party took the majority of the both the House of Representatives and the Senate in the last US federal elections. This has also resulted in a change of leadership in certain key congressional committees including the Senate Committee on Environment and Public Works[ii] and the House Energy & Commerce Subcommittee on Environment and Hazardous Materials[iii]. Based on how the congressional committee system works, any environmental legislation must be brought before one of these committees before it can be brought to a vote before the full House or the Senate. With new leadership come new priorities and the possibility of restricted substance legislation being addressed in one or both of these key committees.

Second and perhaps more importantly, with no formal direction coming from Congress, multiple states have started contemplating their own versions of RoHS. Among those states, California is clearly the leader having already passed legislation called the Electronic Waste Recycling Act[iv] (known as California RoHS). While good intentioned, there is always the possibility that differences between the state laws can result in confusion for the electronics industry. There is the very real fear that disjoint legislation will result in industry having to comply with multiple different laws (based on the states in which they are selling their products). Too many different requirements could raise the burden of compliance to the point where it is no longer possible to be cost effective. One remedy for this potential problem is the passage of federal legislation. A federal RoHS law would supersede all the individual States' legislation and provide a level playing field for industry by establishing a single law with which industry would have to comply.

Still, while there has been no federal legislation enacted, there are several federal agencies that are actively involved in environmental policy and industry support including the Environmental Protection Agency (EPA) and the Department of Commerce (DOC).

Federal Level: Environmental Protection Agency (EPA)
The EPA's mission is to protect human health and the environment[v]. It does this through several activities including enforcement of environmental regulations, research on environmental issues, sponsoring partnership programs, and educational effort. The EPA works to develop and enforce regulations that implement environmental laws that are passed by Congress. However, with no federal laws and no enforcement policies, support for RoHS like activities has instead focused on education and partnership programs.

Two such examples of the EPA's activities are the Energy Star Program[vi] and the Product Stewardship[vii] effort. The Energy Star Program is a joint venture between the US Department of Energy (DOE) and the EPA. The program is designed to promote energy efficient consumer products. Starting as a voluntary labeling program designed to help identify and promote energy efficient products; it has resulted in the US saving over $12 billion dollars in energy costs in 2005 alone. The Product Stewardship is a product centered approach to environmental protection. Also known as Extended Product Responsibility, it seeks to encourage all the players in a product's lifecycle (manufacturer, suppliers, users, etc) to share in the responsibility of reducing the environmental impact of any given product. This educational effort by the EPA hopes to encourage companies and manufacturers to choose sustainable manufacturing and production.

Federal Level: Department of Commerce (DOC)
The US DOC[viii] is a Cabinet department of the US federal government. Its mission is to foster, serve, and promote the US's economic development and technological advancement. The DOC is composed of several Commerce Bureaus tasked with multiple responsibilities including the gathering of economic and demographic data, issuing of patents and trademarks, and helping to set industrial standards. One agency, the National Institute of Standards and Technology (NIST)[ix], has been actively engaged in supporting industry in complying with environmental legislation.

NIST is a non-regulatory federal agency within the US Commerce Department's Technology Administration. NIST's mission is to promote US innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. Within NIST are several organizations that are working to support US compliance with various environmental legislation including: Electronics and Electrical Engineering Laboratory (EEEL)[x], Chemical Science and Technology Laboratory (CSTL)[xi], Material Science and Engineering Laboratory (MSEL)[xii], and the Hollings Manufacturing Extension Partnership (MEP)[xiii]. EEEL has been supporting the development of standards to support the exchange of electronic information within the electronics industry. The Infrastructure for Integrated Electronic and Design Manufacturing (IIEDM)[xiv] project within EEEL helped develop the IPC standard 1752 that supports the exchange of material declaration information. CSTL has been focusing on the scientific aspect of the new environmental legislation by developing testing methods for determining the presence of restricted substances. MSEL's metallurgy division has been working on lead-free solder alternatives. MEP has been providing education to US companies on how to comply with EU's RoHS and WEEE directives. As part of its activities, MEP maintains several centers around the US that offer RoHS and WEEE training to US companies.

State Level: WEEE
State legislation directed at limiting the environmental impact of electronics manufacturing and end products was spurred by the European Union's RoHS and WEEE directives. U.S. efforts began in California and proliferated from there.

In California, the Electronic Waste Recycling Act of 2003 went into effect in 2005. The scope of "Covered Electronic Devices" (CEDs) was Cathode Ray Tubes (CRT), Liquid Crystal Displays (LCDs), and televisions containing CRTs and LCDs. It was amended to further specify CEDs to contain (1) a screen measured diagonally and not to be (2) "contained within, or a part of a piece of industrial, commercials, or medical equipment, including monitoring and control equipment."

At the publication of this paper, (May 2007) over 25 states had proposed or pending legislation based on electronic waste (e-waste).

There is a movement towards regional initiatives, which should help disseminate information and lower implementation and research costs. Two such coalitions are Northeast Regional Electronics Management Project[xv] (NREMP) and Midwest E-waste Policy Development Initiative (MEPDI) or Midwest Regional Electronics Waste Recycling Policy Initiative[xvi] (MREWRPI). NREMP is actually an international coalition consisting of several states in the US and a province in Canada. Member entities include: CT, DE, ME, MA, NH, NJ, NY, PA, RI, VT, Quebec, and the US Virgin Islands. In July 2006, model legislation was published by the NREMP[xvii].

MEPDI, consisting of several Midwestern state agencies including MN, MI, IL, WI, and IA, focuses on the development of a consistent and unified approach for managing waste electronics. This effort is similar to the NREMP, and builds on model legislation developed through their efforts and input from stakeholders.[xviii] The MEPDI endorses an efficient and effective mechanism for the collection and recycling of waste electronics. It is consistent with the key principles of product stewardship, with manufacturers assuming responsibility for the collection and recycling of waste electronics. The policy statement also supports several important attributes of an effective e-waste program, including convenience for residents, clear performance goals, ease of administration for state government, environmentally sound management standards, and opportunities for interstate collaboration[xix].

In February 2005, the Council of State Governments/Eastern Regional Conference (CSG/ERC) and the Northeast Recycling Council, Inc. (NERC) launched a collaborative project to develop a coordinated legislative approach to end-of-life electronics management in the Northeast. As part of the project, CSG/ERC and NERC facilitated an effort among state legislators, legislative and environmental agency staff from ten states, the U.S. Virgin Islands, Puerto Rico and Quebec to craft model legislation.

During the course of this effort, participants solicited input from nearly 100 stakeholders, including electronics manufacturers, retailers, recyclers, leasing companies, reuse organizations, environmental groups, and local government representatives. Following an intensive 14-month-long process, the group has released "An Act Providing for the Recovery and Recycling of Used Electronic Devices"[xx].

Compliance with legislation within the US at this time is scattered, with California seen as leading the way. For compliance activities, many companies are following California's lead but are keeping abreast of local jurisdictional and federal activities as well. At the federal level, as mentioned, e-waste legislation was introduced in January 2007.

State Level: RoHS

Legislation restricting substances similar to EU's RoHS directive are less prevalent in the US, at the publication of this paper. California's current RoHS legislation restricts four heavy metals (Pb, Hg, Cd, Cr_6) from the CEDs in the related e-waste legislation. The main difference between the EU and California implementation is California based their restriction on the date of manufacture; the restriction went into effect on 1 January 2007. Similar to the EU's RoHS/WEEE directives, products manufactured within California for sale outside California are excluded from the legislation[xxi].

California currently has a proposal for incorporating all ten categories of CEDs in the EU's RoHS directive. The proposal passed from the state government's Committee of Natural Resources as of April 2007. The basics of the California version are to include the same categories and exemptions, but use the date of manufacture as an enforcement date (date to be determined). The working draft was stated to not be more restrictive than the EU version[xxii]. For questions on interpretation or enforcement, the legislation is expected to follow the lead of the Department of Trade and Industry in the United Kingdom.

Industry Associations

AeA

AeA (formerly the American Electronics Association), founded in 1943, is a nationwide non-profit trade association that represents multiple segments of the technology industry.[xxiii] The AeA International Environment committee works closely with the US EPA, the US DOC and the Office of the United States Trade Representative. The committee meets twice a year, bringing in various guest speakers. The subcommittees also provide updates on their work during these meetings. On a daily basis, committee members are kept abreast of international environment issues via emails covering new articles, new regulations, and hearings on Capitol Hill.[xxiv]

The objectives of the AeA International Environment Committee are to:

- Provide timely information and analysis to industry on international environment issues;

- Develop and effectively communicate globally strategic, consensus driven positions on international environment issues of concern to AeA membership; and

- Provide an interface between industry and the relevant government regulatory agencies regarding full range of international environment and related issues.[xxv]

The AeA International Environment Committee has working group subcommittees. These subcommittees develop position papers, develop comment letters, coordinate education events, and work closely with government agencies as representatives from the high tech industry on international environment matters[xxvi].

- China RoHS[xxvii]
- International Electronics Recycling (EU WEEE and China WEEE)[xxviii]
- Product Lifecycle and Design/Energy Efficiency[xxix]
- International Chemical Regulations (REACH[xxx], SAICM)
- Global Substance Restrictions - EU[xxxi], China[xxxii], Japan[xxxiii], Korea[xxxiv] and the US[xxxv]

Harmonization of common hazardous substance restriction requirements is essential to facilitate global access of RoHS compliant materials, components, and electronic and electrical products with the high level of confidence of meeting regulatory objectives at minimum cost to the supply chain. AeA and its member companies have been working on the "AeA RoHS Harmonization Principles[xxxvi]" draft. Industry efforts in this area are an important element to have existing or planned hazardous substance restriction regulations harmonized.

IEC

The International Electrotechnical Commission (IEC) founded in 1906, is a global organization that produces international standards for electrical, electronic and related technologies. Their goal is to produce internationally accepted standards that can be used in support of international commerce. In 1935 the IEC adopted the Giorgi measurement system which was expanded in 1960 and became the International System of Units used today. IEC also produces dual logo standards in cooperation with other standards bodies such as ISO and IEEE. With increased global concern over the effects of electronics manufacturing on the environment, the IEC has created a technical committee to address these issues. Presently over 130 countries participate as either member countries or affiliate countries (including North American countries), and there is strong participation from US industry.

IEEE

The Institute of Electrical and Electronics Engineers (IEEE) is a professional association dedicated to the advancement of electrical technology. Formed in 1963 through the merger of the American Institute of Electrical Engineers (AIEE) and the Institute of Radio Engineers (IRE), the IEEE today has over 370,000 members in over 160 countries. One of its main activities is the development of international standards that form the basis for many computing, telecommunication, information, and power generation technologies. This includes developing standards that support industry's efforts to comply with environmental legislation.

Using an open development process, the IEEE builds standards through consensus based on input from all interested parties. Currently the IEEE library contains over 1300 standards that have been completed or are in development.

IPC

IPC, founded in 1957 as the Institute for Printed Circuits, is a US based (but now worldwide) trade organization supporting the electronics industry. IPC covers many aspects of electronics manufacturing. Over 75% of the members are US companies, and the IPC Printed Circuits Expo/APEX is the largest electronics assembly exhibition in North America. IPC standards committees have produced standards that cover board assembly, PCBs, quality control, data exchange, and more. As a part of its efforts, IPC has developed standards to support its member companies' efforts to comply with RoHS. A complete list of standards may be found on the IPC website: www.ipc.org. IPC often partners with iNEMI (the INternational Electronics Manufacturers Initiative), an organization dedicated to identifying and closing technology gaps within the electronics industry.

Jisso International Council & Jisso North American Council
The Jisso International Council (JIC) was founded in 2000, holding its first meeting in Chicago, IL, USA. Its objectives are to promote a strategic partnership among global organizations interested in the total solution for interconnecting, assembling, packaging, mounting, and integrating system design. To accomplish these objectives, members cooperatively work to support and encourage standards development at a national or international level, to encourage the development of technology roadmaps, to address environmental issues, and to monitor market trends.

Jisso is a term that reflects the total packaging solution for electronic products. The characteristics of the Jisso concepts consider the bare die, its packaging as an off-the-shelf product, or in a module combined with other parts, and mounting and interconnecting on a product substrate and integrated in the entire system design. There are over 11 industry associations which have overlapping representation in the JIC.

JIC is currently comprised of three regional councils: Jisso European Council (JEC), Jisso Japan Council (JJC), and Jisso North American Council (JNAC). Most recently, the three councils planned the first annual Jisso International Forum (JIF). This year's theme (2007) for the annual forum is *Electronics and the Environment*.

JNAC is a non-profit organization, governed by a chairman and a secretary. Its mission is to monitor and foster development of standards using existing standards organizations interested in the total solution for interconnecting, assembling, packaging, mounting, and integrating system design standardization. The JNAC and its members are committed to fostering open competition in the development of products and services based upon industry needs.[xxxvii]

SMTA – Surface Mount Technology Association
The SMTA membership is an international network of professionals who build skills, share practical experience, and develop solutions in electronic assembly technologies, including microsystems, emerging technologies, and related business operations.[xxxviii] SMTA hosts events at the local, national, and international level that focus on environmental compliance and lead-free technology, or that have a significant portion dedicated to the topic.[xxxix] Recently, SMTA has hosted several web seminars on the EU's RoHS, China RoHS, and other world-wide eco-compliance directives.[xl]

One such activity is the Successful Lead-Free/RoHS Strategies Conference in Boxborough, MA, being held on June 19, 20, and 21, 2007.[xli] This event will provide relevant information and best practices for use in the reliable and effective transition to lead-free and RoHS assembly. This event is being co-located with the SMTA Boston Academy and Tabletop Exhibition.

Standards Development
IEC TC111
In 2005 the IEC technical committee, TC111 on Environmental Standardization for Electrical and Electronic Products and Systems, met for the first time to begin creating international standards to support environmental aspects of electronics manufacturing.

There are presently four working groups within TC111: WG 1: Material Declaration for Electrical and Electronic Equipment, WG 2: Environmentally Conscious Design for Electrical and Electronic Products and Systems, WG 3: Test Methods of Hazardous Substances, and WG HWG4: Recycling, Reuse and Recovery.

WG1 is working on standardizing material declaration for electronics manufacturing. This includes a data exchange format and structure (similar to IPC 1752, this will be XML based) and a list of declarable substances (similar to the Joint Industry Guide substance lists). Additionally WG1 is trying to incorporate material declaration for Environmentally Conscious Design (ECD) within the standard. This has proven to be difficult due to the lack of a clear definition for ECD. Because the WG1 scope overlaps with the IPC data exchange standards and the Joint Industry Guide, hopefully these efforts can be combined to prevent redundancy. WG2 is covering all aspects of ECD. WG3, covering test methods, is facing a particularly difficult task since measuring certain substances within homogeneous materials is quite challenging. Despite this difficulty, WG3 has produced a Committee Draft for Vote (CDV) that is presently being revised. WG HWG4 was formed at the last meeting in Tokyo, Japan, and will focus on a possible IEC standard on recycling and reuse. Again, due to the large impact on US electronics industry, US technical experts on both data exchange (WG1) and chemical metrology (WG3) are active participants in TC111.

IPC 175x[xlii]
In 2004, iNEMI identified the inability to exchange product composition data needed to meet the EU directives as a major issue for the electronics industry and any US electronics companies selling products in the EU (or selling products that eventually end up in the EU). To respond to this need, IPC created the IPC 2-18 Declaration Process Management Subcommittee to establish a declaration process between customers and their suppliers for the exchange of product material

data. The committee was faced with a serious challenge as they had little time to write and implement a standard that needed to support many stakeholders with diverse business approaches. Because of the critical nature of this challenge for US industry, US government technical experts from NIST participated on the committee and were instrumental in its development. By March 2006 not only had the data structure been designed, but a PDF based implementation had also been developed. The PDF solutions allow small businesses, often with little or no IT budget, to easily exchange data with larger customers using integrated data management solutions.

The IPC 175x series of standards is meant to be flexible and allow for declaration of any type of data needed in the manufacturing process. The first version of the standard includes the base information necessary for the transaction, such as company and contact information (IPC 1751) and the information necessary for a material declaration (IPC 1752). Version 1.0 of 1752 uses a XML schema to define the data structure and data types for a 1752 material declaration.

Recently, IPC has begun revising the 175x series. This revision is being driven by the need to support more regulations and the desire to support different types of declarations. As other countries around the world follow the EU lead in restricting substances used in electronics, there is a need to capture new data to meet these regulations. To support this, IPC 1752 v2.0 will have a more general regulation section. In fact the entire series will become more modular, with the manufacturing information section being moved to it's own section (IPC 1756). Additionally, several other features are being added. These include better support for multiple parts and better multi-level reporting. Finally, version 2.0 will not include any implementation, instead focusing on the XML schema and allowing the solution providers to focus on the implementation. This will be very effective as it allows IPC to distribute resources much more efficiently.

IPC RoHS Certification[xliii]

Implementation of RoHS lead-free requirements has become a major concern for the entire supply chain, especially original equipment manufacturers (OEMs) and electronics manufacturing services (EMS) companies. The electronics assembly industry is now beginning to understand that the implementation process requires more than substituting tin-lead with lead-free solder. The requirements impact the entire electronics assembly process from materials management to process engineering to test and inspection. To aid the electronics assembly industry in its drive to lead-free implementation, IPC created "IPC Certification for RoHS Lead Free Electronics Assembly Process Capability[xliv]".

The goal of the IPC certification audit program is to provide an audit of an electronics assembly facility – at the OEM or EMS level – and determine if the company's facility has processes and procedures in place to demonstrate that it is capable of producing products to meet the lead-free requirements of the RoHS Directive. The audit is not designed to ensure that the company will produce RoHS lead-free compliant products. Certification will expire two years from the date it is issued. The certification can be used as a step in demonstrating due diligence method of complying with the RoHS directive.

There are two phases to the audit: a pre-audit questionnaire and an on-site audit. Phase One is the pre-audit questionnaire; it consists of 301 items broken into 15 sections corresponding to different areas of the electronics assembly operations. The pre-audit questions are rated Level 3, 2, or 1, with Level 3 being the most critical[xlv].

Phase Two is a single or multi-day on-site audit. The audit will review the actual lead-free processing area, supporting documentation for the process; clarify any questions from the pre-audit questionnaire; and address any corrective actions found during the audit. The topics to be covered during the process are as follows:

- General
- Training
- Surface Mount Assembly
- Wave Soldering
- Rework and Repair
- Assembly Materials
- Components
- Design and Engineering
- Test and Inspection
- Materials Assembly Database
- Materials Procurement
- Materials Warehouse
- Materials Field Return
- Quality
- Materials Declaration

Because it involves inspection of procedures and processes in place at the time of the audit, certification cannot ensure or be used to represent that the facility's products will be RoHS lead-free compliant. The certification audit is designed to validate a RoHS lead-free electronics assembly processes' capabilities to customers and suppliers.

Going Forward

US attitudes and activities on environmental compliance are far from uniform. Indeed, the only real common characteristic is that it is important to stay informed because attitudes and legislative activities are constantly changing.

While there has been no national legislation passed within the United States, Canada, or Mexico similar to RoHS and WEEE, various US Federal organizations (NIST, EPA) have been providing and will continue to provide support for industry to comply with and better understand environmental legislation. Most of the RoHS-type legislation is being led by the state of California. From the California base, it will expand in the USA. While this will be slow to happen, the US government on all levels is becoming environmentally aware. Indeed, with the growing number of individual states seeking to pass their own environmental legislation, it is almost inevitable that the US federal government will get involved at some point.

Until federal legislation is passed, it is likely that federal agencies will work with standards organizations in order to create voluntary programs that seek to provide better environmental protection. Two such programs are the development of IEEE 1680 "Standard for Environmental Assessment of Personal Computer Products"[xlvi] and Electronic Product Environmental Assessment Tool (EPEAT)[xlvii]. IEEE 1680™ is a standard developed jointly by the IEEE and the EPA, and it is the first US standard to establish environmental purchasing guidelines for computers. IEEE 1680™ seeks to assist companies striving to reduce the environmental impact of these purchases. EPEAT, operated by the Green Electronics Council (GEC), is a procurement tool designed to assist large institutional purchasers of computer equipment. The EPEAT system is built around product registration. Manufacturers register their products with GEC and declare their products' performance based on the criteria within IEEE 1680™.

North American industries have been working on developing their own standards to comply with environmental legislation around the world with various degrees of success. For example, while North American industries have worked on standardizing the reporting format for materials declaration (IPC 175x), many companies had already begun using their own formats. Fortunately, many of these companies are remaining involved with the standardization efforts by the various industry groups. It is important for industry groups, leading technology companies, and all levels of the government to work on harmonizing standards as much as possible.

Finally, it is apparent that, as attitudes around the world has begun accepting and moving towards manufacturing "RoHS" compliant electronics, the US electronics industry is now beginning its struggle with understanding of the concept of "green manufacturing". Currently, as there is no one definition of a "green" component, there has yet to be an accepted definition of "green manufacturing". One of the troubles with trying to define "green manufacturing" is the level at which you start the definition. How are "green" materials defined? What information is necessary to define a manufacturing process as "green"? These questions will need to be answered as US companies find their way forward towards a more responsible type of manufacturing. But that is a topic for another paper… or, quite possibly, a book.

Endnotes

---

[i] European Commission website information on RoHS and WEEE;
http://ec.europa.eu/environment/waste/weee_index.htm; accessed 25 Apr 2007
[ii] U.S. Senate Committee on Environment and Public Works;
http://epw.senate.gov/public/; accessed 25 Apr 2007
[iii] The House Committee on Energy and Commerce;
http://energycommerce.house.gov/Subcommittees/ehm.shtml; accessed 25 Apr 2007
[iv] California Department of Toxic Substance Control: Electronic Hazardous Waste;
http://www.dtsc.ca.gov/HazardousWaste/EWaste/index.cfm; accessed 25 Apr 2007
[v] U.S. Environmental Protection Agency website; http://www.epa.gov/; accessed 25 Apr 2007
[vi] Energy Star website; http://www.energystar.gov/; accessed 25 Apr 2007
[vii] Product Stewardship Program website; http://www.epa.gov/epr/; accessed 25 Apr 2007
[viii] U.S. Department of Commerce Website; http://www.doc.gov/; accessed 25 Apr 2007
[ix] The National Institute of Standards and Technology website;
http://www.nist.gov/; accessed 1 Feb 2007
[x] Electronics and Electrical Engineering Laboratory website;
http://www.eeel.nist.gov/; accessed 25 Apr 2007
[xi] Chemical Science and Technology Laboratory website;
http://www.cstl.nist.gov; accessed 25 Apr 2007
[xii] Material Science and Engineering Laboratory website;
http://www.msel.nist.gov/
[xiii] Hollings Manufacturing Extension Partnership website;
http://www.mep.nist.gov; accessed 25 Apr 2007
[xiv] Infrastructure for Integrated Electronic Design and Manufacturing Project website
http://www.eeel.nist.gov/812/IIEDM/index.html
[xv] http://www.csgeast.org/enrgwaste.asp; accessed 1 May 2007
[xvi] http://www.pca.state.mn.us/oea/stewardship/electronicsmidwest.cfm; accessed 1 May 2007
[xvii] Model Electronic Recycling Legislation - An Act Providing for the Recovery and Recycling of Used Electronic Devices; *The Council of State Governments/Eastern Regional Conference · The Northeast Recycling Council, Inc.* Revised July 2006; accessed 1 May 2007
[xviii] http://www.pca.state.mn.us/oea/stewardship/electronicsmidwest.cfm; accessed 1 May 2007
[xix] http://www.pca.state.mn.us/oea/stewardship/electronicsmidwest.cfm; accessed 1 May 2007
[xx] http://www.csgeast.org/pdfs/RegionalDraft7-06_revised.pdf; accessed 1 May 2007
[xxi] http://www.aeanet.org/billtracking (members only access); accessed 1 May 2007
[xxii] American Electronics Association E-Waste Road Show; 23-27 Apr 2007
Presentation discussion by Ms. Felise Cooper, Allen & Overy LLP
[xxiii] http://www.aeanet.org/aboutaea/aboutstart.asp; accessed 1 May 2007
[xxiv] http://www.aeanet.org/governmentaffairs/gabl_enviro_commitee_page0905.asp; accessed 1 May 2007
[xxv] http://www.aeanet.org/governmentaffairs/gabl_enviro_commitee_page0905.asp; accessed 1 May 2007
[xxvi] http://www.aeanet.org/governmentaffairs/gabl_enviro_commitee_page0905.asp; accessed 1 May 2007
[xxvii] http://www.aeanet.org/governmentaffairs/gabl_ChinaRoHSpage0905.asp; accessed 1 May 2007
[xxviii] http://www.aeanet.org/governmentaffairs/gabl_WEEEpage0905.asp; accessed 1 May 2007
[xxix] http://www.aeanet.org/governmentaffairs/gabl_energyefficiencypage0905.asp; accessed 1 May 2007
[xxx] http://www.aeanet.org/Forums/A_O_REACH_fact_sheet_January07.asp; accessed 1 May 2007
[xxxi] http://www.aeanet.org/governmentaffairs/gajl_EuropeOverview.asp; accessed 1 May 2007
[xxxii] http://www.aeanet.org/GovernmentAffairs/gabl_ChinaRoHSpage0905.asp; accessed 1 May 2007
[xxxiii] http://www.aeanet.org/governmentaffairs/gamb_JapanOverview.asp; accessed 1 May 2007
[xxxiv] http://www.aeanet.org/governmentaffairs/gabl_Korea_Draft_WEEE.asp; accessed 1 May 2007
[xxxv] http://www.aeanet.org/GovernmentAffairs/gajl_stateenvironment0206.asp; accessed 1 May 2007
[xxxvi] http://www.aeanet.org/governmentaffairs/gabl_RoHSHarmonizationPrinciples.asp;
accessed 1 May 2007
[xxxvii] http://jisso.ipc.org/jnac_p1.htm; accessed 1 May 2007
[xxxviii] SMTA web site; http://www.smta.org; accessed 3 May 2007
[xxxix] SMTA Environmental Compliance; http://www.smta.org/#environmental_compliance;
accessed 3 May 2007
[xl] SMTA Calendar of Events; http://www.smta.org/news/smta_calendar/calendar.cfm; accessed 3May 2007
[xli] SMTA Symposia Page; http://www.smta.org/education/symposia/symposia.cfm; accessed 3 May 2007
[xlii] IPC Website 175x; http://members.ipc.org/committee/drafts/2-18_d_MaterialsDeclarationRequest.asp;

accessed 3 May 2007

[xliii] IPC Training and Certification Page; http://leadfree.ipc.org/files/lf_cert_bro_forms_LR.pdf; accessed 1 May 2007

[xliv] http://leadfree.ipc.org/RoHS_3-5.asp; accessed 1 May 2007

[xlv] http://leadfree.ipc.org/files/LFSampleChecklist.xls; accessed 1 May 2007

[xlvi] IEEE website; http://www.ieee.org; accessed 25 Apr 2007

[xlvii] EPEAT website; http://www.epeat.net/; accessed 25 Apr 2007

IPC Get Interconnected.™ MIDWEST CONFERENCE & EXHIBITION

North American Environmental Compliance Attitudes Towards Electronics

IPC Mid-West Conference

Krista Botsford (5-Trees)
John Messina (NIST)
Eric Simmon (NIST)

IPC ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES®

IPC Get Interconnected.™ MIDWEST CONFERENCE & EXHIBITION

Outline

- Government Activities
  - Federal
  - State
- Industry Associations & Standards Development
  - IPC 175x™
  - IPC RoHS Lead-Free Capabilities Certification
- Going Forward

IPC ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES®

Government Activities: Federal Level

- Congress
  - Senate Committee on Environment and Public Works
  - House Energy & Commerce Subcommittee on Environment and Hazardous Materials
  - Any environmental legislation must be brought before one of these committees before it can be brought to a vote before the full House or the Senate
- No formal direction coming from Congress means states are able to introduce their own versions of RoHS

Government Activities: Federal Level

- **Environmental Protection Agency (EPA)**
  - Mission: to protect human health and the environment
  - Activities:
    - Enforcement of environmental regulations passed by congress
    - Research on environmental issues
    - Sponsoring partnership programs
    - Education
  - Programs:
    - Energy Star Program
      - joint venture between the US Department of Energy (DOE) and the EPA
      - 2005 Savings: over $12 billion dollars
    - Product Stewardship Program
      - A product lifecycle based approach to environmental protection
      - AKA: Extended Product Responsibility
      - Seeks to encourage all the players in a product's lifecycle (manufacturer, suppliers, users, etc) to share in the responsibility of reducing the environmental impact of any given product. This educational effort by the EPA hopes to encourage companies and manufacturers to choose manufacturing and production that is sustainable

Government Activities: Federal Level

Department of Commerce (DOC)

- Mission: to foster, serve, and promote the US's economic development and technological advancement
- A Cabinet department of the US federal government
  - tasked with
    - gathering of economic and demographic data
    - issuing of patents and trademarks
    - helping to set industrial standards.

- National Institute of Standards and Technology (NIST)
  - A non-regulatory federal agency within the U.S. DOC's Technology Administration
  - Mission: to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life.

Legislative Activities: State Level WEEE

- Over 25 states have proposed or pending legislation based on e-waste
- California is leading the way
  - Electronic Waste Recycling Act of 2003 went into effect in 2005 for Covered Electronic Devices (CEDs): CRTs, LCDs, and televisions containing CRTs and LCDs.
    - screen >4" measured diagonally
    - not to be "contained within, or a part of a piece of industrial, commercials or medical equipment, including monitoring and control equipment.
- Regional initiatives
  - Northeast Regional Electronics Management Project (NREMP)
    - An international coalition: CT, DE, ME, MA, NH, NJ, NY, PA, RI, VT, Quebec, and the US Virgin Islands.
  - Midwest E-waste Policy Development Initiative (MEPDI)
    - Minnesota, Michigan, Illinois, Wisconsin, and Iowa
  - Midwest Regional Electronics Waste Recycling Policy Initiative (MREWRPI)

Legislative Activities: State Level RoHS

- Less prevalent in the US
- California's currently only state with RoHS legislation
  - Effective date: 1 January 2007
  - Focused on four heavy metals (Pb, Hg, Cd, Cr6) from the CEDs in the related e-waste legislation
  - Difference from EU: implementation is based on the date of manufacture
- California currently working on incorporating all ten EU categories
  - proposal passed from committee as of April 2007

IPC 175x

- Originally designed to be a flexible form and allow for declaration of any type of data needed in the manufacturing process
- Original version includes basic information
  - company and contact information (IPC 1751)
  - material declaration (IPC 1752)
- Version 1.0 of 1752 uses a XML schema to define the data structure and data types for a 1752 material declaration.

- Currently working on revision
  - Driven by:
    - the need to support more regulations
    - the desire to support different types of declarations
  - Version 2.0
    - More general in the regulation section
    - More modular
      - manufacturing information section (IPC 1756)
      - multiple parts
      - multi-level reporting
      - will not include any implementation, instead focusing on the XML schema
    - Also moving away from form due to support needed to maintain form format

IPC Get Interconnected.™ MIDWEST CONFERENCE & EXHIBITION

IPC RoHS Lead-Free Capabilities Certification Program

- Two phased certification
  - Pre-audit questionnaire
    - 301 items broken into 15 sections corresponding to different areas of the electronics assembly operations
  - On-site audit
    - A single or multi-day on-site audit
    - Review the actual lead-free processing area, supporting documentation for the process; clarify any questions from the pre-audit questionnaire; address any corrective actions found during the audit.
- Certification can only cover the procedures and processes in place at the time of the audit
- Certification cannot ensure or be used to represent that the facility's products will be RoHS lead free compliant.
  - Certification is designed to validate a RoHS lead free electronics assembly processes' capabilities to customers and suppliers.

IPC ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES®

IPC Get Interconnected.™ MIDWEST CONFERENCE & EXHIBITION

Going Forward

- US attitudes and activities on environmental compliance are far from uniform
- California will likely be the leader; other states will follow and expand from California's lead
- Standardization of the reporting format for materials declaration will assist industry significantly
  - Such as version 2 of IPC 175x
- Next step: "green manufacturing"
  - understanding of the concept of and defining green manufacturing and procurement

IPC Get Interconnected.™ MIDWEST CONFERENCE & EXHIBITION

Contact Information

- Krista Botsford, 5-Trees LLC
  - Phone: (781) 552-9585
  - E-mail: kbots@5-trees.com
- John Messina
  - Phone: (301) 975-4284
  - E-mail: john.messina@nist.gov
- Eric Simmon
  - Phone: (301) 975-3956
  - E-mail: eric.simmon@nist.gov

Thank you!

IPC ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES®