



International Electronics Manufacturing Initiative

## **iNEMI Proactive Approach**



*Bob Pfahl, iNEMI*

## **Evolution of Pb-Free Projects to meet pending legislation**

- **Original Need for Pb-Free Solders identified in 1998 Roadmap**
- **Succeeding Roadmaps identified additional gaps**
- **A series of projects conducted from 1998-2006 to close the gaps**

## Environmentally Conscious Electronics Projects

**Pb-Free Assembly**  
Chair: Edwin Bradley, PhD Motorola  
Co-Chair: Rick Charbonneau

Complete

**Pb-Free Assembly & Rework**  
Chairs: Jerry Gleason, HP  
Charlie Reynolds, IBM  
Team Leaders: Jasbir Bath, Solectron  
Quyen Chu, Jabil Circuit  
Mathew Kelly, Celestica  
Ken Lyjak, IBM  
Patrick Roubaud, HP

Complete

**RoHS Transition Task Group**  
Chair: Dave McCarron, Dell  
Projects:  
Component Supply Chain Readiness  
Component and Board Marking  
Assembly Process Specifications  
Materials Declarations

Complete

**Mat. Declaration Data Exchange**  
Chair: Richard Kubin, E2open  
Co-chair: Marissa Yao, Intel

Complete

**Tin Whisker Accel. Tests**  
Chair: Heidi Reynolds, Sun Microsystems  
Co-Chairs: Jack McCullen, Intel  
Mark Kwoka, Intersil

**Tin Whisker Users Group**  
Chairs: Joe Smetana, Alcatel  
Richard Coyle, Lucent

**Tin Whisker Modeling**  
Chair: George Galyon, IBM  
Co-Chair: Maureen Williams, NIST

**Pb-free BGAs in SnPb Assy.**  
Chair: Robert Kinyanjui, Sanmina-SCI

**Pb-free Wave Soldering**  
Chair: Denis Barbini, Vitronics Soltec  
Co-chair: Paul Wang, Microsoft

**Pb-free Substrate Finishes**  
Chair: Keith Newman, Sun Microsystems  
Co-chair: Charan, Gurumurthy, Intel

## **Evolution of Pb-Free Projects to meet pending legislation**

- **Continuing to identify evolving gaps to close:**
  - **High-Reliability RoHS Task Force**
  - **Six New Gaps Identified at the Intel/IPC Workshop**
  - **Gaps identified at this Forum**

## **Establish Proactive Programs**

**„Industry should take a proactive approach, work with stakeholders, and direct our activities where there is technical/ecological evidence we could and should be doing a better job to protect the environment. We should involve stakeholders in the process of evaluating alternative technologies to determine trade-offs between product functionality, environmental impact, reliability, safety, and cost.“ (Pfahl-Johnson)**



International Electronics Manufacturing Initiative

## **iNEMI / EPA Bromine-Free Substrate Projects**



- **Participants:**
  - **US EPA**
  - **Electronics industry through iNEMI**
  - **Other Stakeholders including NGOs**
- **Environmental Objective**
  - **Evaluate environmental risk of brominated and alternative flame retardants in PWB substrates**
- **Unique Characteristics**
  - **Industry lead proactive study to evaluate:**
    - **The technology risks of alternatives**
  - **EPA lead partnership to evaluate:**
    - **The environmental risks**

## **Project Objectives:**

- **Build on industry knowledge and capability,**
- **Consider unique market segment requirements,**
- **Identify technology readiness and gaps,**
- **Stimulate supply capability, and**
- **Recommend standards development opportunities**

- 1. Define electrical requirements based on market segment application**
- 2. Validate electrical and mechanical properties**
  - Loss tangent and Dk modeling over required range of signal speed
  - Mechanical performance validation for lead free assembly
- 3. Validate material supplier and PWB manufacturer infrastructure capability**
- 4. Estimate costs – volume market leader for new material may not achieve cost parity with best-in-class FR4**

<b>This Project IS</b>	<b>This Project Is NOT</b>
<b>Technical evaluation of key electrical and mechanical properties</b>	<b>EHS assessment</b>
<b>Focused on those attributes which are of most value to supply chain.</b>	<b>Biased towards specific laminate suppliers, geographies, or market segments.</b>
<b>Build on learning from prior investigations</b>	<b>Repeat of prior work</b>
<b>Recommendations for standards development or further investigation</b>	<b>Standard Development</b>
<b>Focused on circuit board</b>	<b>Electronic components, Cables</b>

**Goal:** *Review prior work and make recommendations for testing needed. Investigation should take into account the needs of electronic product sectors represented by iNEMI membership.*

- **Identify market segment requirements**
- **Identify candidate materials (synch with EPA)**
- **Identify key performance characteristics and test criteria**
- **Design test vehicle(s) and test methodologies, leverage standards where possible**

***Goal: Develop, manage, and execute performance testing.***

- **Develop evaluation schedule**
- **Procure parts and test vehicles**
- **Assign teams to carry out completion of the testing in a standardized fashion**
- **Perform mechanical and reliability testing on test vehicles.**

**Goal:** *Compile results, assess significance, make recommendations, and publish report.*

- **Assess performance relative to market segment requirements.**
- **Assess technology readiness / identify gaps**
- **Assess manufacturing capability and supply capacity**
- **Publish results**

## US EPA Design for Environment Program: Alternatives Assessment of Flame Retardants for the Electronics Industry

- **Goal:** To identify and evaluate commercially available flame retardants and their environmental, human health and safety and environmental fate aspects in FR-4 printed circuit boards.
- **Scope:** The partnership will incorporate life-cycle thinking into the project as it explores the potential hazards associated with flame retardants and potential exposures throughout the life cycle of flame retardants as used in FR-4 printed circuit boards. As appropriate, the scope will include aspects of the life cycle where public and occupational exposures could occur. For example, consideration of exposures from incineration or burning at the end of life will be included, as will exposures from manufacturing and use.

This Project IS	This Project Is NOT
An EHS assessment of both halogenated and halogen-free materials	Technical evaluation of key electrical and mechanical properties of halogenated and halogen-free materials (iNEMI project)
Assessment of environmental and human health endpoints (environmental endpoints include ecotoxicity, fate and transport)	Comprehensive environmental or human health risk assessment
Based on sound science	
Voluntary	Regulatory
Multi-Stakeholder Partnership	

**EPA will encourage the participation of individuals from different disciplines and interests to contribute on the range of tasks outlined in the project plan.**

- **Participants to date include:**
  - **OEMs (environmental & product safety representation) and trade associations**
  - **Component and board manufacturers**
  - **Chemical companies (raw material suppliers, flame retardant suppliers, etc) and trade associations**
  - **NGOs – environmental groups, worker unions**
  - **Standards organizations**
  - **Universities**
  - **Governments – US EPA and Sweden Keml**
- **Other participants could include:**
  - **Federal governments**
  - **State governments**
  - **Local governments**
  - **Other national governments**
  - **Electronics recyclers**
  - **Public interest groups**

# **iNEMI** Summary of Proactive Approach

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- **Search for Environmentally Benign Alternatives Should be Based on Good Science and Technology**
- **Technology and business risks and the impacts of original process/materials and alternatives should be evaluated prior to legislative action.**
- **Voluntary programs have been effective in the electronics industry.**
- **Stakeholders should be involved in the process from the beginning (Both within the firm and within the community)**

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