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Supply Network Conference

Mastering the Three A's of Supply Network Excellence: Agility, Adaptability, and Alignment

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Pb-Free Electronics: Drivers, R&D, and Transition

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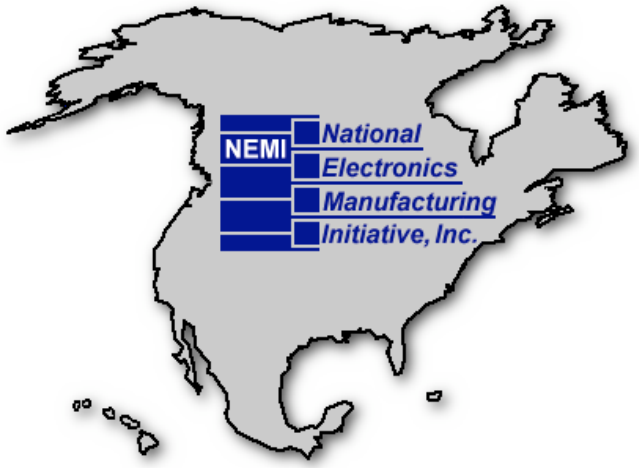
NEMI



Outline

Drivers of Change

Overview of R&D

Status of Implementation

Drivers for Elimination of Pb

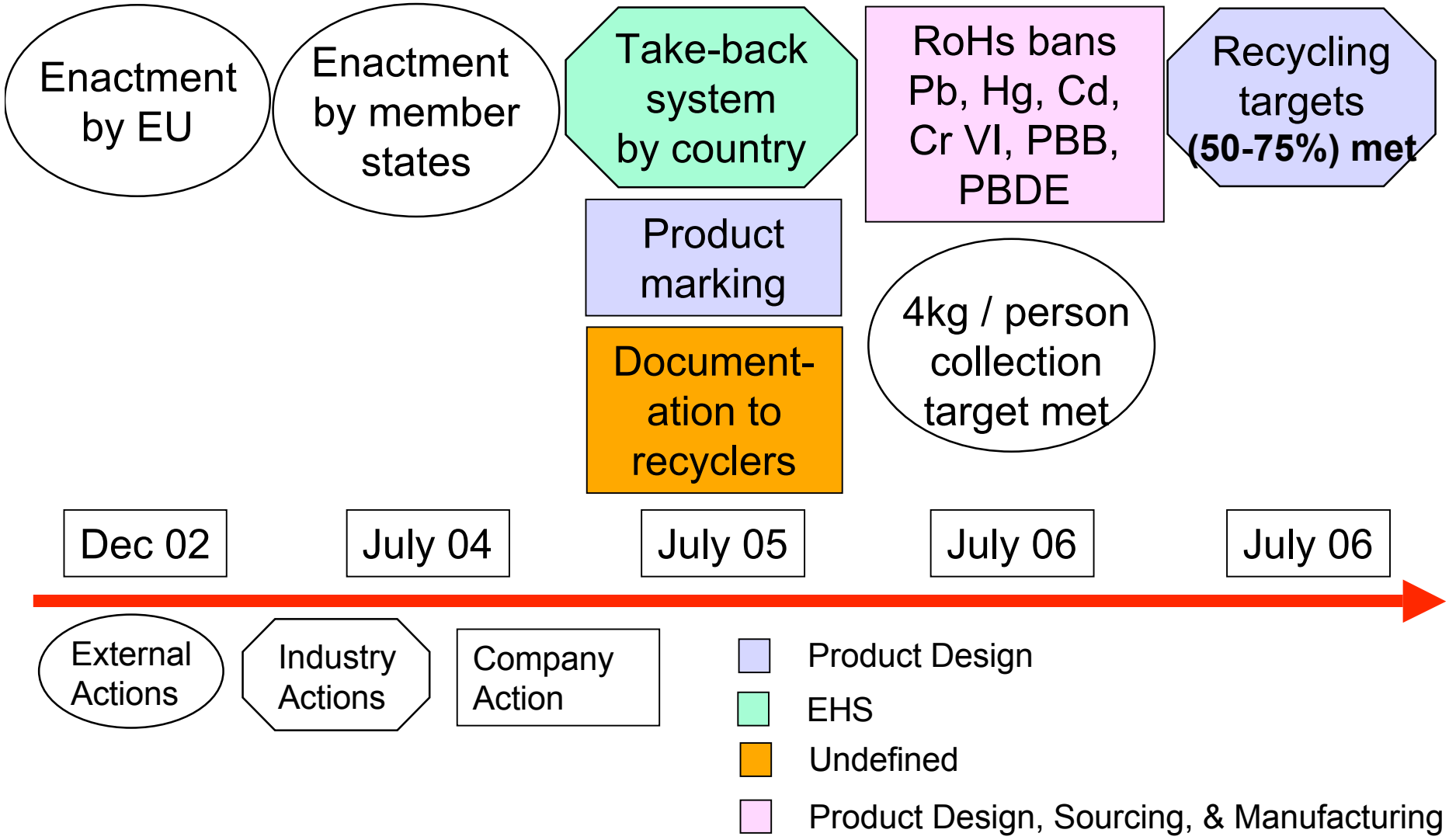
Increasing Environmental Legislative Activity

- **Pb-Bans in Products**
  - **All electronics-RoHS in Europe (July 2006)**
  - **Cables (100 PPM) Proposition 65, California (2002)**
- **End-of-Life Disposal Legislation**
  - Electric Home Appliances Recycling Law in Japan (1998)
  - **WEEE in Europe (July 2005)**
  - Automotive legislation in Europe
  - EOL legislation pending in 20 states

Commercial Customer Requirements

- **Multiple motivations at work**
  - Corporate stewardship/image
  - Product marketing advantage

RoHS and WEEE Timeline



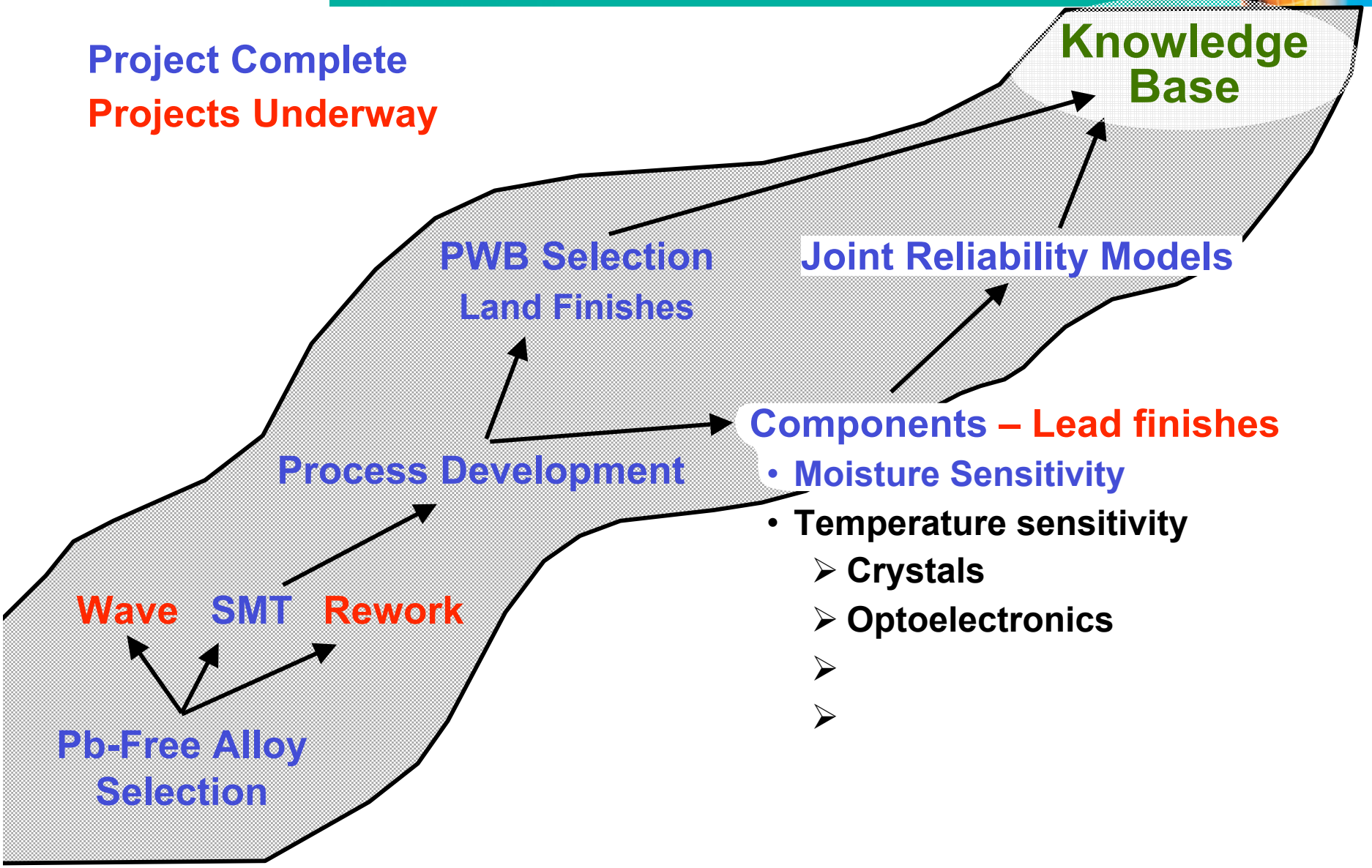
Situation Analysis: Technology

NCMS Pb-free Program 1994 To 1998

NEMI Pb-free Projects 1999 To Present

- **Lead-Free Assembly Project**
  - Alloy, Process, Components, Reliability
- **Lead-Free Assembly and Rework Project**
  - Assembly Process Development, Components & Materials, Rework Process Development, Reliability
- **Tin Whisker Modeling Project**
- **Tin Whisker Accelerated Test Project**
- **Tin Whisker Users Group**

Summary of NEMI Pb-Free Projects



Pb-Free Project Results

Solder Alloy

- Recommended Sn-3.9Ag-0.6Cu for reflow and Sn-0.7Cu for wave

Components

- 240C max achievable for large ICs, 250C max for small ICs on boards □ 0.92” thick
- JEDEC revised J-STD-020B standard 250°C –5/+0

Process

- Manufactured with existing assembly process equipment
- Performance of Pb-free pastes and fluxes are adequate

Reliability

- Demonstrated Pb-free joints are more reliable than tin-lead

On-Going Technology Development

Work still needed to implement/understand SnAgCu solders. Projects underway on:

- **Board laminates & ability to withstand higher temp**
- **Board finishes for SnAgCu soldering**
- **Component lead finishes**
  - Tin whisker accelerated stress testing
  - Fundamental understanding of tin whisker formation
- **Component replacement & rework**
  - Thin (0.060”) and thick (0.130”) boards
- **Wave solder for pin-in-hole components**

Situation Analysis: Implementation

- Widespread introduction of Pb-free solders in Japan
- Limited introduction of Pb-free solders in North America and Europe
- The most pressing implementation issue for Pb-free solder is the availability of components specified to meet higher soldering temperatures
- Pb-free components are becoming available; however, lead finishes are still under debate for high reliability applications
- Need effort on eliminating Pb in cables
- NEMI evaluating how to facilitate the conversion of the supply chain

Key Action Item

OEMs and EMS firms must work with their supply chain to develop a coordinated transition plan