Halogen-Free Electronics

An Overview

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Agenda

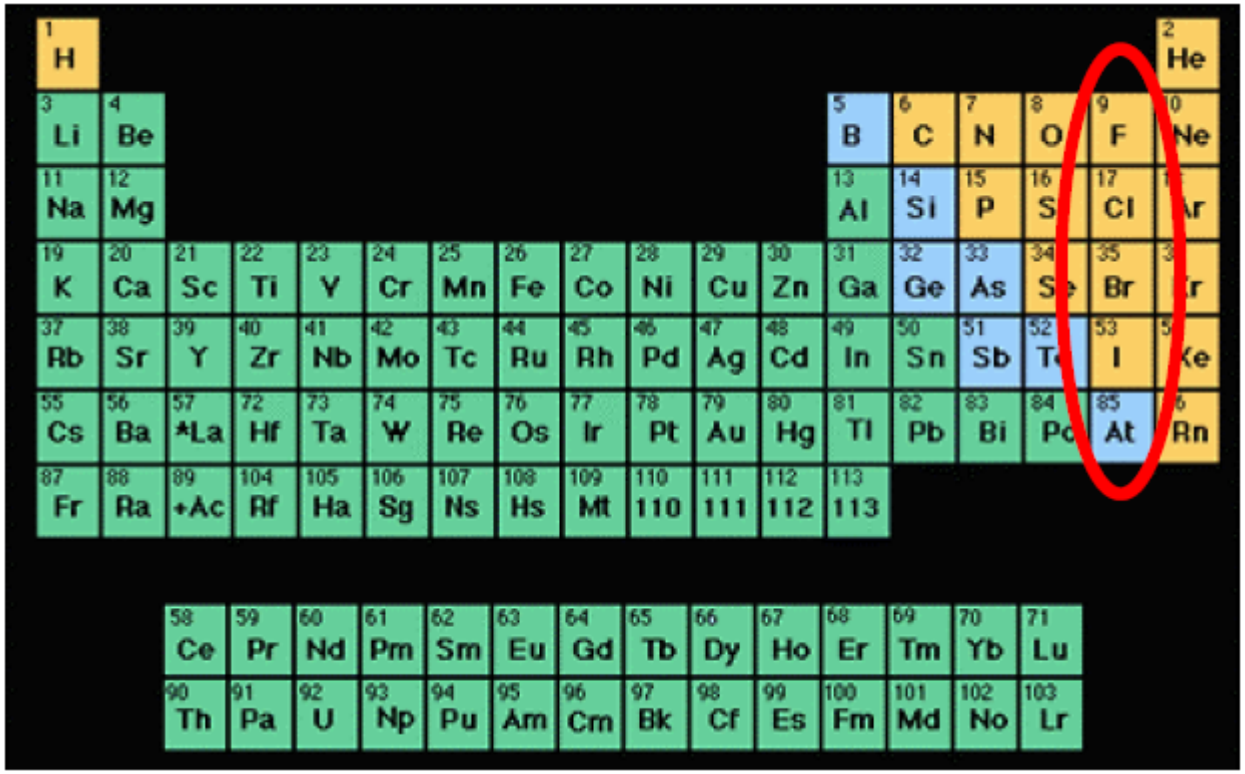
- Definition of Halogen-Free
- Background and Driving forces
- Industry expectations and readiness
- Halogen-Free Standards
- Guidance on how to prepare for Halogen-Free
- Q&A

Attempting to Define Halogen-Free

Attempting to define Halogen-Free

What are Halogens?

1. Fluorine
2. Chlorine
3. Bromine
4. Iodine
5. Astatine



Attempting to define Halogen-Free

- The term “Halogen-Free”, much like the term “Lead-free”, does not necessarily indicate a complete absence of Halogens.
  - Chlorine and Bromine – In scope
  - Fluorine proposed as possibly in scope for halogen-free electronics standard not currently in scope for PCB laminates
  - Astatine and Iodine - Not in scope
  - Current standards (for PCB laminate materials) define halogen-free as:
    - < 900ppm of Br and….
    - < 900ppm of Cl and….
    - <1500ppm of both combined.
      (Concentration limits are applied at the homogeneous level)

Attempting to define Halogen-Free

- The exact definition for halogen-free electronics is under discussion, and will likely include multiple “classes” or exemptions (more on that later).
- Some companies have defined halogen-free to be “BFR and PVC” free, while not restricting the elemental forms of the substances.
- Environmental NGOs (i.e. Greenpeace) reject the concentration limits defined in existing industry standards – they want to see zero amounts of both Br and Cl.

Background and Driving Forces

Background

How bad can Bromine be? After all, we submerge our children in it……

Background

And, why are we removing Chlorine from electronics while we are adding it to our drinking water?

Background

- Halogens do not cause harm to humans or the environment in the form contained in electronics
- The main concern is the disposal of the halogenated material at it's end of life (incineration)
  - Incineration of halogenated materials releases dioxins and furans into the atmosphere.
  - Dioxins and furans have been shown to be present in increasing levels in soil, ground water, and humans.
  - The proliferation of uncontrolled product disposal in developing countries means control of EOL processes is near impossible.

Driving Forces

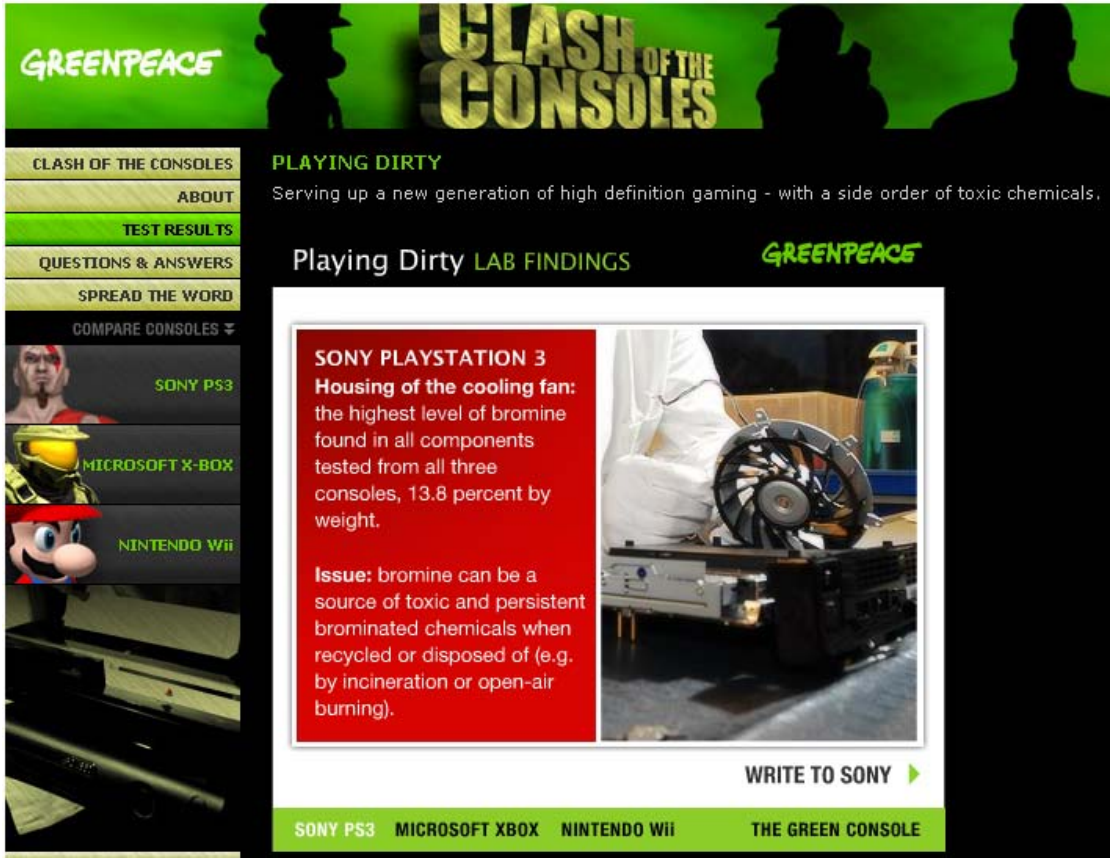
Halogen-Free is ….

- NOT a government mandated requirement
- an industry sponsored effort driven by…
  - Demand by increasingly environmentally conscious consumers
  - Competition
  - Pressure from environmental non-governmental organizations (NGOs)
  - Desire to preempt restrictive legislative action viewed as eminent
  - Desire to do the right thing

Driving Forces – a little on the NGOs….

Greenpeace publishes a quarterly guide which scolds tech companies on everything from halogen content to recycling to carbon emissions.

Driving Forces – a little on the NGOs….



A PR nightmare after Greenpeace dismantles and tests game consoles and publishes the results – gaining national TV news coverage.

Industry Expectations and Readiness

Industry Expectations

Public Company BFR/PVC Free Goals
(From corporate web sites)

- Dell – Eliminate BFRs in new products by 2009
- Intel – Integrated Circuits halogen-free by end of 2008
- Apple – Eliminate BFRs and PVC by end of 2008
- Lenovo – Eliminate BFRs and PVC by 2009
- HP – Eliminate BFRs and PVC by 2009

Industry Readiness

IPC J-STD-709 Supplier Readiness Survey (Jan 2008)

J-STD-709 Committee Update Commodity Type	BFR & PVC Capability	Elemental Br / Cl Capability	Comments
PCB Laminates	Y	Y	Default to existing standards
Substrate Laminates	Y	Y	
Solder Mask	Y	Y	
Conformal Coating	Y *	N	Parylene C
Solder Pastes (4)	Y	Y / N	Technical Issues / Concerns with processability / testability
Connectors (4)	Y	N	PPS
Adhesives	Y	Y / N	Only one Supplier Capable of Elemental Br/Cl
Plating	?	?	
Cables	Y	Y	
Inks	Y	N	
Paints (2)	Y	N	
Films / Tapes / Insulators	Y	N	
Molded Plastics	Y	Y	
Mold Compounds	Y	Y	
Underfills	Y	Y	
ODMs (4)	Y	N	

* with exception of chlorinated conformal coating that does not contain PVC

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Halogen-Free Standards

Halogen-Free Standards

- Existing Standards
  - JPCA-ES-01-2003
    - "Test Method for Halogen-Free Materials"
    - Japan Printed Circuit Association (JPCA)
    - First Edition published November 1999
    - Available for free download: http://www.jpca.net/jp/e/standard_pdf/jpca-es01-2003.pdf
  - IEC 61249-2-21 (2003)
    - "Materials for printed boards and other interconnecting structures – Part 2-21: Reinforced base materials, clad and unclad – Non-halogenated epoxide woven E-glass reinforced laminated sheets of defined flammability (vertical burning test), copper-clad"
  - IPC 4101B
    - "Specification for Base Materials for Rigid and Multilayer Printed Boards"
    - 2 Amendments released against this document
    - Available for free download: http://www.ksumg.com/ch/ind/IPC4101B.pdf

Halogen-Free Standards

Comparison of Halogen-Free Definition for existing standards

Standard	Objective	Requirements
JPCA-ES-01-1999	Japan Printed Circuit Association (JPCA) defines criteria and method for "Halogen Free"	Br < 0.09wt% (900ppm) Cl < 0.09wt% (900ppm)
IEC 61249-2-21	International Electrotechnical Commission (IEC) finalized requirements	900 ppm max Cl 900 ppm max Br 1500 ppm max total halogens
IPC - 4101B	Has adopted the IEC definition of halogen free	900 ppm max Cl 900 ppm max Br 1500 ppm max total halogens

Above standards relate only to PCB laminates and materials

Halogen-Free Standards

New emerging standard: Halogen-Free Electronics

- IPC Halogen-Free Electronics Standard working task group 4-33a
- J-709 “Definition of Maximum Limits on Bromine and Chlorine used in materials for Halogen-Free Electronic Components and Assemblies”
- First standard to take halogen-free requirements beyond PCB materials
- Currently in development – no draft versions available for public review
- Goal: Develop an industry standard to enable supply chain consistency and help influence emerging regulatory proposals based on sound scientific data as the basis for removal

Halogen-Free Standards

Latest Status update on J-709 committee activity:

- Multiple Compliance Classes to be included. Definition of each class currently under discussion. Current position:
  - Class 4 – All halogens below detectable limits (<50ppm)
  - Class 3 – Elemental Br and Cl <900ppm each with no exemptions
  - Class 2 – Same as class 3, with exemptions
  - Class 1 – “Low Halogen” – BFR/CFR/PVC < 900ppm. List of Flame Retardants in scope to be included.
- Note 1500ppm total Br/Cl content limit is not carried over from PCB standards
- Combining Classes 1&2 and 3&4 has been proposed.
- Committee chose to align with existing halogen-free standards and use 900ppm instead of aligning with RoHS and using 1000ppm
- PVC in data cables and power cords considered in scope

How to Prepare for Halogen-Free

How to Prepare for Halogen-Free

Wait – I'm a safety engineer. Why do I care about this?

- Increased diligence required for Halogen Free designs
  - Halogen-Free materials for plastic parts are limited and require manufacturers to retool. Not feasible to produce both halogenated and non-halogenated versions.
  - Material sets may require re-thinking flammability requirements in new designs. (i.e. can we use V1 or V2 here instead of UL94-V0?)
- Selection of unproven Halogen-Free components can have impacts on product safety, EMC, and reliability profiles
- Knowing flammability ratings of components up front can reduce redesign efforts later in the development process.

How to Prepare for Halogen-Free

- Step 1 – Talk to your customers
  - Customer requirements key to formulating a plan.
    - What are your customer's halogen-free roadmaps?
    - What are their customer's expectations?
    - Do all products need to be compliant? Certain products?
- Step 2 – Talk to your suppliers
  - Supplier readiness key to executing a plan
    - Send written inquiries on halogen-free Status of key suppliers
    - Be specific – state definition of halogen-free and expected dates of compliance
    - Push on key suppliers without a roadmap to develop one.
    - Begin to identify alternatives to suppliers who do not intend to support halogen-free efforts

Example of supplier inquiry letter

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Emulex Design and Manufacturing
3333 Susan Street
Costa Mesa, California 92626 USA

Sept 20, 2007

Halogen-Free Status Inquiry

Dear valued supplier,

Emulex is currently evaluating the Halogen content status of all supplier provided products and components. Please complete the questionnaire shown below and return via email to the contact information provided. Your response is requested on or before Sept 24, 2007.

PRODUCT/COMPONENT:

Description: **1) ASSY CHASSIS EMULEX 870/875**
2) COVER EMULEX 870/875

M/N or P/N: **1) 00302233-701**
2) 00302238-001

Please check one:

☑ The homogenous material in the above referenced item(s) DOES NOT contain more than a maximum concentration of 1000 ppm** bromine or chlorine.

☐ The homogenous material in the above referenced item(s) contains levels of bromine or chlorine which exceeds the maximum concentration level of 1000 ppm**. No alternative Halogen-Free components or products are available as a compatible replacement.

☐ The homogenous material in the above referenced item(s) contains levels of bromine or chlorine which exceeds the maximum concentration level of 1000 ppm**. However, a compatible Halogen-Free part is available for use in place of the above listed part.

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How to Prepare for Halogen-Free

- Step 3 – Make a plan
  - Use your Customer communications and supplier surveys to formulate a plan for your organization's halogen-free roadmap
  - Ensure to communicate your plan to customers and suppliers, and inform suppliers you will be tracking their progress. Obtain commitments from suppliers on sample availability
  - Always include disclaimer in your communications to customers and the public stating that compliance is based on supply chain readiness
  - Full disclosure materials database will likely be required
- Step 4 – Execute
  - Assign a responsible party within the organization to track and manage the halogen-free rollout
  - Cross functional team will be required as the effort will involve multiple disciplines, including hardware engineering, Component engineering, materials engineering, and manufacturing.
  - Close interface with key suppliers will be required. Remember – we're all in this together!
  - Participate in standards development activity. You'll have to comply with these standards – why not get input into the requirements?

How to Prepare for Halogen-Free

- Risks of not preparing for Halogen-Free requirements
  - Loss of market share – more companies are specifying Halogen or BFR/PVC free as a requirement to suppliers
  - Typical time to collect and rollup material content of a small product is 8-12 weeks. Waiting until the customer asks for halogen-free is too late.
  - Although halogens are not specifically restricted by the EU RoHS directive now, additional BFRs are expected to be added to the RoHS directive as well. Additionally, the Reach Law will control these substances. Failure to act could ultimately put you in non-compliance with these EU directives and laws.
  - Public relations – If your competitors are compliant and you are not, they'll let the world know!

Summary

- The Definition of Halogen free varies by standard applied
- Incineration of halogenated products, not direct human or environmental exposure, is the concern driving Halogen-Free efforts
- NGOs such as Greenpeace have used the public's newfound interest in environmental impact to pressure technology companies to remove halogens from electronic products
- Industry is hungry to implement, the supply chain is struggling to catch up
- Existing standards relate only to PCB materials, however, a Halogen-Free electronics standard is in development
- Safety Engineers should be involved early in the design stage of newly developed halogen-free products to ensure safety design impacts are captured
- Early interaction with your customers and supply chain is the key to a successful halogen-free transition
- Join the standards committee now – and have a say in the requirements you will be forced to meet in the future!

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Q&A

Additional Information

- IPC Halogen-Free Website
  http://www.ipc.org/ContentPage.aspx?PageID=3.4.7
- IPC Halogen-Free Materials Sub-Committee 4-33
  http://www.ipc.org/CommitteeDetail.aspx?Committee=4-33
- IPC 4-33A Low Halogen Electronics Standard Task Group
  http://www.ipc.org/CommitteeDetail.aspx?Committee=4-33a
- Indium Halogen Free Blog
  http://www.halogen-free.com/blog/
- Download IPC 4101B
  http://www.ksumg.com/ch/ind/IPC4101B.pdf
- Download JPCA-ES-01-2003
  http://www.jpca.net/jp/e/standard_pdf/jpca-es01-2003.pdf
- Greenpeace Guide to Greener Electronics
  http://www.greenpeace.org/international/campaigns/toxics/electronics/how-the-companies-line-up
- Greenpeace “Clash of the Consoles”
  http://www.greenpeace.org/international/clashoftheconsoles/

Thank you!

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