



September 29, 2006

Alexander W Indorf
Program Coordinator, Environmental and Social Development
International Finance Corporation
2121 Pennsylvania Ave. NW
Washington DC 2043

RE: International Finance Corporation Environmental, Health, and Safety Guidelines
for Semiconductors & Other Electronics Manufacturing

The Semiconductor Industry Association (SIA) and IPC – the Association Connecting Electronics Industries are pleased to submit the following comments on the International Finance Corporations' Environmental, Health and Safety Guidelines for Semiconductors and Other Electronics Manufacturing.

SIA is a trade association representing over 95 companies responsible for over 85 percent of the semiconductor manufacturing capacity in the United States. IPC is an international trade association for the electronic interconnection industry, representing more than 2,200 member companies who manufacture printed circuit boards and electronic assemblies worldwide.

SIA and IPC appreciate the work of the IFC in promoting cleaner and safer electronics manufacturing worldwide. We believe that these guidelines are an important part of that work and appreciate the opportunity to provide comments on the draft documents. Overall, the guidelines are concise and reflect a good general understanding of the electronics manufacturing industries. It is our pleasure to offer the following suggestions that we believe will improve the accuracy and usability of the guidelines.

General Comments

We would like to recommend that the guidelines be divided by the particular segments of the electronics manufacturing industry to which they apply. While semiconductors, printed circuit boards, and printed circuit board assemblies are all vital parts of the electronics industry, they are quite distinct operations. Each relies upon specific chemical processes and thus has many unique Environmental, Safety and Health (EHS)

aspects. We believe that further identification and alignment of issues specific to separate areas within these sectors would greatly benefit the users of this document by allowing users to more readily identify the portions of the guidelines which are relevant to operations under review. For that reason we have provided comments that indicate the applicability of each comment to each sub-sector described as Semiconductor, Assembly of subcomponents into an end product or Printed Circuit Board Assemblies (PCBA) which was formerly known as Printed Circuit Boards or Printed Wire Boards. Additionally we have attached a color-coded mark-up of the comments to assist you in identifying sub-sectors.

Specific Comments

Section 1.1

Hazardous Materials and Wastes

- 1st paragraph. Spent deionized water and developers are incorrectly characterized as hazardous wastes.
- 1st paragraph. Spent epoxy material is generated during the manufacture of printed circuit boards (PCBs) and in Semiconductor manufacturing and not assembly processes as incorrectly noted. Copper residue is not a waste product of the assembly process. Circuit boards are now printed, not wired.
- 1st paragraph, 1st bullet, 3rd sub-bullet. Lead solder replacements are not environmentally benign. All metal solders have associated environmental issues including ecotoxicity of silver in the popular SAC (tin-silver-copper) alloy and increased energy usage for many of the lead free solders.
- 1st paragraph, 2nd bullet. The only cyanide plating solutions used in the printed circuit board industry are used for gold plating. Cyanides are not used in Semiconductor manufacturing. Chromic plating baths have not been used by PCB manufacturers since the 1980s and has never been used in the fabrication of semiconductors.
- 1st paragraph, 4th bullet. These primarily are used in the semiconductor and PCBA sectors.
- 1st paragraph, 5th bullet. PFOS is only used in Semiconductor manufacturing. This industry sector completed a voluntary agreement that should be cited and can be found at http://www.sia-online.org/pre_stat.cfm?ID=294 The voluntary agreement is a global agreement that describes elimination of all but critical uses and requires incineration of all non-wastewater emissions that contain PFOS.
- 2nd paragraph, fourth bullet, piping carrying hazardous materials should be designed also with low point drains, high point vents, and isolation valves every 100 feet maximum in order to avail in repairs of leaks or modifications in the system.

Emissions

- 1st paragraph. The opening of this applies only to Semiconductor manufacturing and several of the bullets underneath this paragraph only apply to other sub-sectors of electronics manufacturing as described below.
- 1st paragraph, footnote 3. The only glycol ethers used in the Semiconductor industry are propylene glycol ethers and their acetates.
- 2nd paragraph 1st bullet. This section only applies to Semiconductor manufacturing.
- 2nd paragraph 1st bullet, 1st and 2nd sub-bullets. These bullets only apply to Semiconductor manufacturing.
- 2nd paragraph 1st bullet, 3rd sub-bullet. Combustion applies to Semiconductor and PCBA manufacturing.
- 2nd paragraph 1st bullet, 4th sub-bullet. Plasma reactors are used by the Semiconductor industry sector.
- 2nd paragraph 1st bullet, 5th and 6th sub-bullets. Cold adsorbers, traps, filters and precipitators are used by the PCBA industry sector.
- 2nd paragraph 3rd bullet. Emergency release scrubbers are not essential to prevent uncontrolled releases. Most toxic gases are controlled in special cabinets that are scrubbed or scammed to atmosphere after review of the concentration to insure that a safe release can be made.

Perfluorocarbon Compounds and Other Greenhouse Gases

- 1st paragraph and 3rd paragraph. PFC's are used in the Semiconductor sector. Add C₃F₈ to the list of PFC's. The Semiconductor industry has initiated a voluntary program to reduce the emissions of PFC's. Information regarding that agreement can be found at http://www.sia-online.org/pre_stat.cfm?ID=58
- 3rd paragraph. PFOS is actually not classified as a PFC. It belongs to a separate class of chemistries. Also, to state that PFOS can be released to the air through its use in Semiconductor manufacturing is incorrect. There are no expected or measured emissions of PFOS from this use.

Acid Fumes

- 1st paragraph. This section applies only to PCBA and Semiconductor manufacturing.
- 1st paragraph 3rd bullet. Operations in PCB manufacture that might generate acid fumes include cleaning, surface preparations, cupric chloride etching, and plating. Acid fumes are not generated during drilling or resist stripping, which is carried out with an alkaline process. Semiconductors do not use acid sprays only

performed in enclosed interlocked chambers that are required to be purged to a scrubbed exhaust system prior to opening.

Volatile Organic Compounds

- These are used in PCBA and Semiconductor manufacturing.

Dust

- Drilling and routing processes during PCB manufacture generate significant amounts of dust. Dusts are not created during PCBA or Semiconductor manufacturing.

Wastewater

Organic Compounds

- The techniques described for processing small amounts of organics in wastewater primarily applies to the PCBA and Semiconductor industries.
- 1st paragraph. After the words ether-based, please add “resists, isopropyl alcohol, and tetramethylammonium hydroxide” and delete “or ether based solvents” and replace “almost all” with “a number of”.
- Replace the rest of the Organic compounds section and bullets with a new paragraph reading “Almost all of these solvents are drained to segregated solvent drains and the small quantities that do result in the wastewater are so dilute that they typically do not require treatment.”

Metals

Acids and Alkalis

- This section applies to the PCBA and Semiconductor industries.
- 1st paragraph. Chromium is no longer used and the sentence referencing it should be deleted.

Cyanide

- Copper cyanide plating baths are not used in the printed circuit board or semiconductor industries. Also, we recommend adding a statement that best practice dictates that cyanide bearing waste water treatment systems must have:
 - a) Properly designed ventilation
 - b) Ventilation system must be equipped with fume scrubber capable of handling a cyanide load that could occur from a mistreatment or equipment malfunction to prevent the release of cyanide to the atmosphere.

Suspended Solids

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- This section applies to the PCBA and Semiconductor industries. The types of solids generating processes are from Chemical Mechanical Polishing slurries, dicing of the wafers to separate the devices and prepare them for packing in frames and during the backgrind process that is used to reduce the thickness of the wafer prior to dicing.
- 1st paragraph, 1st sentence. Please add in front of the existing 1st sentence “If solids are at high enough concentrations to cause high levels of total suspended solids (based on the manufacturing sites permit requirements) any film residues and metallic particles (derived from”.

Energy Consumption

- This is not specific to electronics and should be removed and added to the General Industry Guidelines.

General Process Modifications

- This section is specific to the PCB manufacturing process only.
- We recommend adding another general recommended process modification for recovery technologies for waste rinse waters to return treated water to the process for reuse.

1.2 Occupational Safety and Health

- We recommend adding to the list of safety hazards: “Exposure to hazardous energy including: kinetic, electrical, pneumatic and hydraulic.”

Substrates

- This section is specific to Semiconductor manufacturing. This section should be clarified to identify correctly that the substrates are not hazardous but that the dust from the substrates may be hazardous. This should read that “exposure to material released by a substrate during handling or mechanical manipulation...”
- 2nd paragraph, 1st bullet. The words “in a fume hood” should be replaced with “undertaken employing local exhaust ventilation”.

Hazardous Process Chemicals

- 1st paragraph 1st bullet. Ethylene based glycol ethers are no longer used by the semiconductor industry.

- 1st paragraph 1st and 4th bullet. These are specific to Semiconductor manufacturing.
- 1st paragraph 2nd and 3rd bullet. These are specific to PCBA and Semiconductor manufacturing.
- 1st paragraph. A sentence should be added to the first paragraph that indicates that “worker exposure should be protected from process chemicals including but not limited to: acids, bases, solvents, metals powders and metal sludge as well as toxic, cryogenic and pyrophoric gases...’

Lasers

- This section should be a subsection of non-ionizing radiation.

2.0 Performance Indicators and Industry Benchmarks

2.1 Environment

Table 1. Air emission levels

- What are the units of measure cited (mg/Nm³)? These are not a recognized unit of measure.
- *Table 1, Notes.*

The Semiconductor industry does not use ethyl benzene, toluene, xylene, methylene chloride, carbon tetrachloride, chromium compounds, perchloroethylene, 1,1,1-trichloroethane, or trichloroethylene.

Table 2. Effluent Levels.

- Please note that Effluent levels are subject to national, state or regional, and local regulation.
- *Note e.* For total toxic organics please add a note that none of these chemicals are used in the manufacturing processes. Please check the references for the total number of TTO’s. We believe it is incorrect since the City of Austin, Texas cites 1006 instead of 31.

Table 2 Guideline values and notes.

- For the TTO Pollutants, remove the guideline value of 1.6 for Cathode ray tube manufacturing. Remove “Cyanide, total” as a pollutant. Also remove cathode ray tube values for “chromium, total”, “Cadmium”, and “Zinc”. Remove “Note: d and f” since they are incorrect.

Annex A

Semiconductor Manufacturing

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Please add a short description of “negative resists”. Also, passivation steps should include formation of both silicon nitride and silicon dioxide since they are both referenced in the general overview.

Printed Circuit Board (PCB) manufacturing

- The first sentence is misleading. The attachment of semiconductors and passive components to printed circuit boards is the Assembly process which is profiled in the following section. The manufacture of PCBs is related to the etching and pattern plating of circuits on base materials, which are often layered.
- The ‘solder coating process referred to in this section is more commonly known as HASL or hot air solder leveling.

Printed Wiring Assemblies (PWA) Manufacturing

- As previously mentioned, circuit boards have replaced wiring boards in current use. The appropriate term for this section is Printed Circuit Board Assembly (PCBA). The information in this section regarding soldering is incorrect. Soldering processes include wave soldering, surface mount technology (SMT), and hand soldering.

Conclusion

IPC and the SIA appreciate the opportunity to comment on the International Finance Corporations’ Environmental, Health and Safety Guidelines for Semiconductors and Other Electronics Manufacturing. We hope that these comments will help to improve the accuracy of these important guidelines. Please feel free to contact us should you have any questions regarding our comments.

Sincerely,

Chuck Fraust
Director, Occupational Health and Environment
Semiconductor Industry Association

Fern Abrams
Director of Environmental Policy
IPC – the Association Connecting the Electronics Industry

