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United States Environmental Protection Agency
Washington, D.C. 20460
Office of Solid Waste and Emergency Response

July 12, 1994

Mr. Christopher R. Rhodes
Director of Environmental, Safety & Governmental
Relations Programs, IPC
7380 N. Lincoln Avenue
Lincolnwood, Illinois 60646-1705

Dear Mr. Rhodes:

This letter is in response to your March 9, 1994 letter in which you requested a regulatory interpretation regarding photoresist solids ("skins") generated in the printed circuit board manufacturing industry. You asked for a decision as to whether these wastes are or are not F006 listed hazardous waste. This longstanding issue arose originally when the Virginia Department of Environmental Quality asked EPA's Region III office for assistance in making a site specific hazardous waste determination at a printed circuit board manufacturing facility in Virginia.

We have reviewed the data available to us, including the State and Regional interpretations you have provided, and have conducted further analyses of the manufacturing processes involved. Based on this review, I have made the following determination regarding the status of photoresist solids.

For the reasons stated below, we cannot categorically state that photoresist solids generated in stripping operations are not F006 wastes. Their regulatory status is dependent on the type of operation employed at each individual facility. Therefore, the determination as to whether or not skins are hazardous waste will be dependent on the analysis of the individual facility by the State or Regional regulatory authority. Regulatory authorities should make this determination based on the following interpretation of the F006 hazardous waste listing description:

- The crux of this issue is whether the stripping of photoresist solids from printed circuit boards is an

electroplating operation included within the scope of the F006 listing as defined by the Agency in the Interpretative Rule on this subject which was published in the Federal Register on December 2, 1986 (51 FR 43350). Please note that although the printed circuit board manufacturing industry is no longer specifically identified in the F006 listing as a result of the December 2, 1986 interpretive rule (51 FR 43350), the processes used (e.g., electroplating, chemical etching, and cleaning and stripping) may still cause wastewater treatment sludges to meet the F006 listing. The interpretive rule was merely a correction to reflect the Agency's policy of referring to "processes" only, rather than specific industries in the "non-specific source" F listings; the notice did not otherwise change the scope of the listing with respect to the printed circuit board industry. This was also explained in the attached memorandum from Sylvia K. Lowrance, Director, Office of Solid Waste, to Ted A. Hopkins of the Oregon Department of Environmental Quality.

If stripping solutions are within the scope of the listing and are, therefore, electroplating wastewaters, the filtering of skins from that solution should be considered the generation of wastewater treatment sludge from electroplating operations and thus would be considered F006 listed hazardous wastes. If stripping solutions are not electroplating wastewaters then the skins would not be wastewater treatment sludges and thus not F006.

- Because the "cleaning and stripping" subcategory of electroplating operations is a conditional one (cleaning and stripping operations are only defined as electroplating operations when they are associated with common and precious metals electroplating, anodizing, or chemical etching and milling operations), and because there has not been specific guidance issued as to when there is a strong enough "association" between a cleaning and stripping operation and another included process, we are issuing the following determination as to when a cleaning or stripping operation is defined as an electroplating operation for purposes of the F006 listing:

- If the stripping operation is in line with or contiguous with an electroplating operation, then the stripper solution itself becomes an electroplating wastewater. "In line with or contiguous with" in this case would mean the stripping operation is not physically separated from these operations and the printed circuit boards are not rinsed and dried prior to the photoresist stripping operation. The stripper solutions thus could be mixed or intermingled with electroplating wastewater.

Photoresist solids generated in this case would be F006 wastes.

- If the stripping operation is not in line with or contiguous with an electroplating operation the stripping solution itself does not become an electroplating wastewater.

Photoresist solids generated in this case would not be F006 wastes.

The rationale for this interpretation is based on the intent of the listing of F006 wastewater treatment sludges. F006 hazardous wastes were listed for reasons explained in the November 14, 1980 RCRA Background Document for listed hazardous wastes. Among the reasons was the conclusion that these wastes frequently contain cadmium, hexavalent chromium, nickel, and complexed cyanide in significant concentrations. The listing process is designed to insure that wastes which meet the listing criteria are managed as hazardous wastes. (Please note that wastes which meet the listing description but do not contain the constituents or do not exhibit the properties for which they were listed can petition the Agency or authorized State for a site-specific exclusion). If there is any possibility of skins stripping solutions being mixed or commingled with other electroplating wastewater, or if the hazardous constituents generated by other electroplating processes can otherwise be "carried forward" by the nature of the association of the two processes, the skins themselves could become contaminated with these hazardous constituents.

Our analysis suggests that physical separation of the two operations together with rinsing and drying operations of printed circuit boards prior to stripping serve to prevent the carryover of

potential hazardous contaminants from the electroplating and etching operations to the stripping operation.

Conversely, our analysis suggests the lack of separation and rinsing and drying operations can result in the carryover of wastewater from the electroplating processes into the stripping solution. In these cases, the filtering of the skins from the contaminated stripping solution would constitute treatment of an electroplating wastewater and would result in the generation of F006.

Although skins may in some cases be determined to not be F006 listed hazardous waste under federal regulations, the skins may be subject to more stringent state or local regulations. However, even if the skins do not meet the listing description for federal or state regulations, they are still subject to evaluation for hazardous waste characteristics, as specified at 40 CFR Part 261 Subpart C.

The Agency may revisit this issue at a later time based on new information or facts which it may gather.

Thank you for your patience in this matter. If you have any further questions, please contact Rick Brandes of my staff at (202) 260-4770.

Sincerely yours,

Michael Shapiro, Director
Office of Solid Waste

cc: Waste Management Division, Directors, Regions I - X

Attachment

-----IPC

7380 N. Lincoln Avenue
Lincolnwood, Illinois 60646-1705

March 9, 1994

Mr. Michael Shapiro
Director, Office of Solid Waste
U.S. Environmental Protection Agency
401 M Street, SW/5301
Washington, D.C. 20460

Dear Mr. Shapiro:

For almost two years, the IPC and the American electronic interconnection industry have been seeking a resolution from your office on a regulatory interpretation problem brought about by the EPA Region III office. Unfortunately, we have still received no written response. Therefore, we are writing you today on behalf of the 800 independent circuit board manufacturers in the United States and strongly requesting an expedited resolution of this issue.

To briefly restate the issue, on 24 June 1991, John Humphreys, Chief of the General States Permits Section for U.S. EPA Region III, issued a written interpretation to a PWB fabrication facility in Virginia that photoresist solids separated from the facility's stripper solution (commonly called "skins") should be classified as a hazardous waste, designated as F006. As you know, the RCRA waste code F006 is reserved for waste water treatment sludges from electroplating operations.

Mr. Humphreys' decision was apparently based on two opinions. First, Mr. Humphreys considered an in-process filtration operation that separates photoresist solids from the stripper solution in order to recycle the stripper solution to be a waste treatment operation. In addition, Mr. Humphreys considered the residue resulting from the recovery of the resist stripping solution to be a categorical hazardous waste because of its connection with electroplating operations. A copy of Mr. Humphreys' letter is enclosed.

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This issue has been carefully reviewed by members of the IPC Environmental, Health, Safety & Transportation (EHST) Committee, as well as several industry suppliers who provide photoresist for circuit board manufacturing and other uses. After carefully reviewing all facts including process flow information, TCLP data, and other regulatory documents, IPC's EHST Committee feels that Mr. Humphreys' interpretation is erroneous for numerous reasons.

First of all, we disagree that solids filtered from an in-process recycle loop should be considered "waste water treatment sludges." This filtration process is a closed recycle loop, and the resist skins are filtered out to prevent plugging of spray nozzles, prevent redeposition on panels, and prolong bath life for the stripper solution. Such a closed loop recycling system qualifies for the 261.4 (a)(8) "closed-loop" exemption.

Second, we argue that photoresist skins are not categorical F006 waste because they are not inherently connected to the plating operation. Photoresist application and stripping is distinct from electroplating in PWB manufacturing. In fact, in some cases, no electroplating appears anywhere in the manufacturing process at all. This operation is called "print and etch" in which a photoresist pattern is applied to copper clad laminate, which is then etched prior to photoresist stripping.

In addition, the IPC has collected TCLP data from more than 20 companies on their photoresist skins and solid residues. All samples passed the TCLP test. None showed toxicity characteristics high enough to be classified as characteristic hazardous waste. In order to properly monitor and control the filtered skins, IPC encourages all of its members to conduct periodic TCLP testing on the skin residues. We feel that these photoresist skins are already properly regulated through the present TCLP testing regimens.

Despite letters and supporting data from the IPC (enclosed) and state EPAs as well as extensive communication from DuPont and other photoresist suppliers, we have still received no written clarification or resolution of this issue from the Federal EPA office. As a result, the Region III interpretation has caused industry-wide confusion and is increasing waste handling costs for circuit board manufacturers without yielding any environmental benefit. Capturing non-hazardous photoresist solids under the RCRA F006 classification greatly increases manufacturing costs while

using up precious hazardous waste landfill capacity that is needed for genuine hazardous waste.

If the Region III ruling is allowed to stand, it could add up to 10 million pounds annually to the national hazardous waste stream. This unnecessary and costly expense would further reduce the competitiveness of an industry already hard pressed by foreign competitors operating under less stringent environmental and safety regulations.

While waiting for a response from your office, a number of IPC member companies or regional circuit associations have proceeded with seeking interpretations from the state and local authorities. We have enclosed copies of all such rulings received to date. Thus far, every single state ruling has contradicted the Region III interpretation.

For these reasons, we feel that the Region III decision is clearly erroneous and should be overturned by your office. We respectfully ask that you please expedite resolution of this issue at your earliest convenience. If you need additional information or have questions, we would be happy to discuss this issue and answer and questions at your convenience.

Thank you for your time and consideration.

Sincerely,

Christopher R. Rhodes
Director of IPC
Environmental Safety & Government Relations
708-667-2850

Dr. John Lott
Senior Technical Consultant
DuPont Company
919-248-5046

Michael Kerr
Circuit Center
Chairman, IPC HST Programs
513-435-2131

cc: Rick Brandes, Chief

Waste Identification Branch

Enclosure

DuPont Electronic Materials
14 TW Alexander Drive, P.O. Box 13999
Research Triangle Park, North Carolina 27709-3999

Chronology of Appeal on Resist Skins

□ June 16, 1992 - DuPont letter to U.S. EPA asking for clarification on why resist stripper skins and sludge were classified as F006 classification, based on industry data that there were no hazardous materials in the skins and sludge.

□ July 2, 1992 - IPC letter on behalf of the industry was sent to Sylvia Lowrance, USEPA, asking that a clarification and reconsideration be made of EPA Region III decision on F006 classification for photoresist skins.

□ Feb. 3, 1993 - Meeting between EPA Chief of Waste Identification Branch, Rick Brandes, and his staff with DuPont representatives and their lawyer. EPA asked for additional information to confirm the contention that PWB manufacturers do not intentionally allow metals into their stripper solution in order to dispose of them. EPA indicated at the time that Federal EPA was in agreement with at least the skins NOT being F006, but would need some time to "mend their fences with the regions". Nothing was put into writing.

□ August 2, 1993 - letter sent to EPA by DuPont with arguments answering questions raised at the February meeting, among them were ones showing that the metal concentration in strippers were not being used as a method of disposal for metals.

□ December 6, 1993 - DuPont spoke to Rick Brandes by phone to find out what had been done with respect to the F006 issue. Mr. Brandes indicated that there were still problems with some of the regional EPAs as to their interpretation. DuPont indicated that Minnesota had decided that both skins and sludge were NOT F006 and give Mr. Brandes the name of the EPA official who had been sent the Minnesota information.

□ January 24, 1994 - DuPont discussed the problem with Mr. Gregory Helms (Chief, Characteristic Section - Waste Identification Branch) who was standing in for Mr. Brandes at the AESF/EPA convention in

Orlando. Mr. Helms indicated that Region III was still not cooperating with Washington EPA on the interpretation. Mr. Helms said that another follow-up letter might help.

□ February 3, 1994 - DuPont sent a follow-up letter to Mr. Brandes - reiterating all the above, indicating that the Minnesota state EPA had found that the material are not F006, and that the interpretation was causing the industry an unnecessary expense and loss of competitiveness. A copy of the letters from Minnesota and Midwest Circuits Association was included.

□ March 1, 1994 - We met with Mr. Brandes, but were unable to reach a resolution of the skins issue.

Summary of States/Regions Findings on F006

Region 2 - New York State - finds resist skins and sludge are NOT F006 [Hadco]

Region 4 - Florida State - finds that skins and sludge are NOT F006 [Name withheld]

Region 5 - Minnesota State - finds that resist skins & sludge are NOT F006. [Midwest Circuit Association]

Region 9 - Arizona (and soon to be California) - find that resist skins & sludge are NOT F006. [Continental Circuits Inc.] [Printed Circuit Alliance].