Partnerships to Address ESH Aspects of Chemical Management in the Semiconductor Industry: Lessons from the PFAS Experience

Murrae J. Bowden
Director, R&D
Arch Chemicals, Microelectronics Materials
200 Massasoit Ave.
East Providence, RI 02914

Laurie Beu, P.E
Motorola
3501 Ed Bluestein Blvd.
Austin, TX 78721.

Sally Pawsat
Motorola Assignee to International SEMATECH
2706 Montopolis Dr., Austin, TX 78741

The semiconductor industry utilizes chemicals in virtually every step of the device manufacturing process. These chemicals range from simple solvents and acids to complex specialty chemicals such as photoresists, antireflective coatings, etchants and strippers that are specifically designed to meet stringent performance criteria. Both suppliers and users (device manufacturers) of these chemicals maintain a strong commitment to Responsible Care whose purpose is to make environmental health and safety (EHS) an integral part of a product's life cycle - from manufacture, marketing and distribution to use, recycling and disposal.

Successful management, therefore, of EHS issues associated with new and existing chemicals in the semiconductor industry requires a close partnership between chemical suppliers and device manufacturers. The industry has a strong record of addressing chemical issues that negatively impact EHS. Ideally, one would like to address such issues before introduction into commerce, balancing the need for performance with EHS concerns. However, information can surface throughout the product lifecycle based on new studies, or new analytical capability, that raise EHS concerns that must be addressed through proper risk assessment. On October 18, 2000, the U.S. Environmental Protection Agency (EPA) issued a Proposed Significant New Use Rule (SNUR) covering 90 Perfluorooctyl Sulfonates (PFOS) and other fully fluorinated alkyl sulfonates (PFAS). EPA took this action in response to data provided by 3M, the company that manufactures >95% of PFOS chemistries world-wide, indicating that PFOS is highly persistent in the environment and strongly bioaccumulative in humans and wildlife. The intent of the proposed SNUR is to limit the manufacture and import of listed PFAS chemistries. When the proposed SNUR was published, EPA and much of the semiconductor industry were not aware that PFAS chemistries are used in the semiconductor process chemistries; moreover, the criticality of PFAS in certain applications was not understood. PFAS has been in commerce for over 40 years and, prior to the proposed SNUR, material suppliers believed them to be benign. PFAS chemicals have been adapted to meet specific applications in semiconductor manufacturing where the underlying chemistry imparts unique performance characteristics not matched by alternative designs, and hence not easily replaced.

Late in 2000, International SEMATECH began facilitating meetings between semiconductor manufacturers and chemical suppliers; these meetings resulted in formation of a partnership between the Semiconductor Industry Association (SIA) and the Semiconductor Equipment Manufacturers International (SEMI) to identify uses, understand environmental fate, and determine criticality of PFAS in semiconductor applications. By developing a clear understanding of the risks and benefits of the PFAS materials in semiconductor processing applications, SEMI/SIA was able to develop appropriate risk mitigation strategies designed to minimize the risk while preserving the benefits offered by the technology. Clearly, where replacement is an option without compromising performance, that is the preferred choice. Where replacement is not an option, however, other strategies must be considered consistent with Responsible Care principles.

This paper discusses the PFAS issue to date, the industry impact and response developed through close partnership of SEMI and SIA members to address EPA concerns while maintaining focus on the needs of the industry. The lessons learned from this successful partnership suggest a model for dealing with future chemical management issues.