Managing Fluorine Emissions at Semiconductor Fabrication Facilities

Michael Smylie
ENVIRON International Corporation
4503 Carlyle Court, Suite 2307
Santa Clara, CA 95054

Historically, perfluorocompounds (PFCs) have been used to generate fluorine ions and radicals in the semiconductor industry for plasma etching and chemical vapor deposition (CVD) chamber clean applications. However, PFCs are recognized as greenhouse gases and international attention has been focused on efforts to reduce the emissions of these gases.

In recent years, several tool manufacturers have developed new technologies aimed at reducing PFC emissions, in particular for CVD tools. These efforts have led to the introduction of remote plasma clean processes for CVD tools. In this application, a remote plasma source is used to efficiently decompose nitrogen trifluoride (NF_3) for the generation of fluorine ions and radicals.

Several recent publications have suggested that the efficiency of remote plasma clean processes has resulted in an increase in odor emissions from fabrication facilities. In a study completed by ENVIRON, the most likely source of these odors was determined to be excessive fluorine emissions. Based on this information, a management plan for fluorine emissions was developed that focused on the following elements:

- Emissions abatement procedures;
- Enhanced monitoring of fluorine emissions throughout the exhaust ventilation system;
- Adoption of management of change procedures into the design review process; and
- Recordkeeping procedures to ensure proper documentation and historical review of operations.

This paper will provide an analysis of the processes for the generation, abatement, and emission of fluorine as well as discuss the elements of the management plan. In addition, the toxicological effects resulting from exposure to fluorine will also be presented.