









Foresite was also asked to design a cleaning protocol to recover parts built with the original process. We proved out a process that included saponified cleaning, and the use of a hand held steamer that produces 195 psi continuously directed heavily around the PQFN.

After the cleaning process, a few boards were sacrificed, and the PQFN was sheared off of the board, and the area locally extracted for ion chromatography. The results were very similar to the boards processed with the recommended changes, and to date are performing well in the field.

**Issues with Vias and Micro-Vias**

A companion issue to flux residue beneath the PQFN package is a concern with contaminated vias, especially when directly under components. We have found a few bare board fabricators that historically have had no issues with bare board cleanliness that were being asked to put tighter cleanliness acceptance levels in place because of the sensitive nature of the surface mount PQFN problems previously discussed. When the process window tightens, all of the materials involved must be held to cleaner standards than ever before. For years, vendor X produced boards with typical levels of <3 +/- 2 from time-to-time on sulfate without issue, but when one of the assembly houses began building with several of the PQFN packages, a series of field failures were found directly related to cleanliness underneath these low standoff components. A study of via cleanliness was performed, and areas with vias >.15 mm were found to be much cleaner than the vias that were smaller than that. Simple surface tension was the main culprit. The normal DI water alone was not able to penetrate the smaller vias, and remove the etchants used in processing. The level of sulfate residues in addition to other process residues, and a normal amount of humidity found in service, was enough to cause the failures (see table 3). A 5% solution of saponifier/DI water was put in place, and this was enough of a decrease in surface tension to access the etchant residues entrapped in the smaller vias, and adequately rinse them out (see table 4). Levels dropped to very comparable sulfate residue amounts across the surface of the bare board. We have not found any further field failures to date with this product related to the cleanliness in vias issue.

**Table 3-Bare Board IC Sulfate Results DI Water Only-Micrograms per in<sup>2</sup>**

