Bare Board Roulette

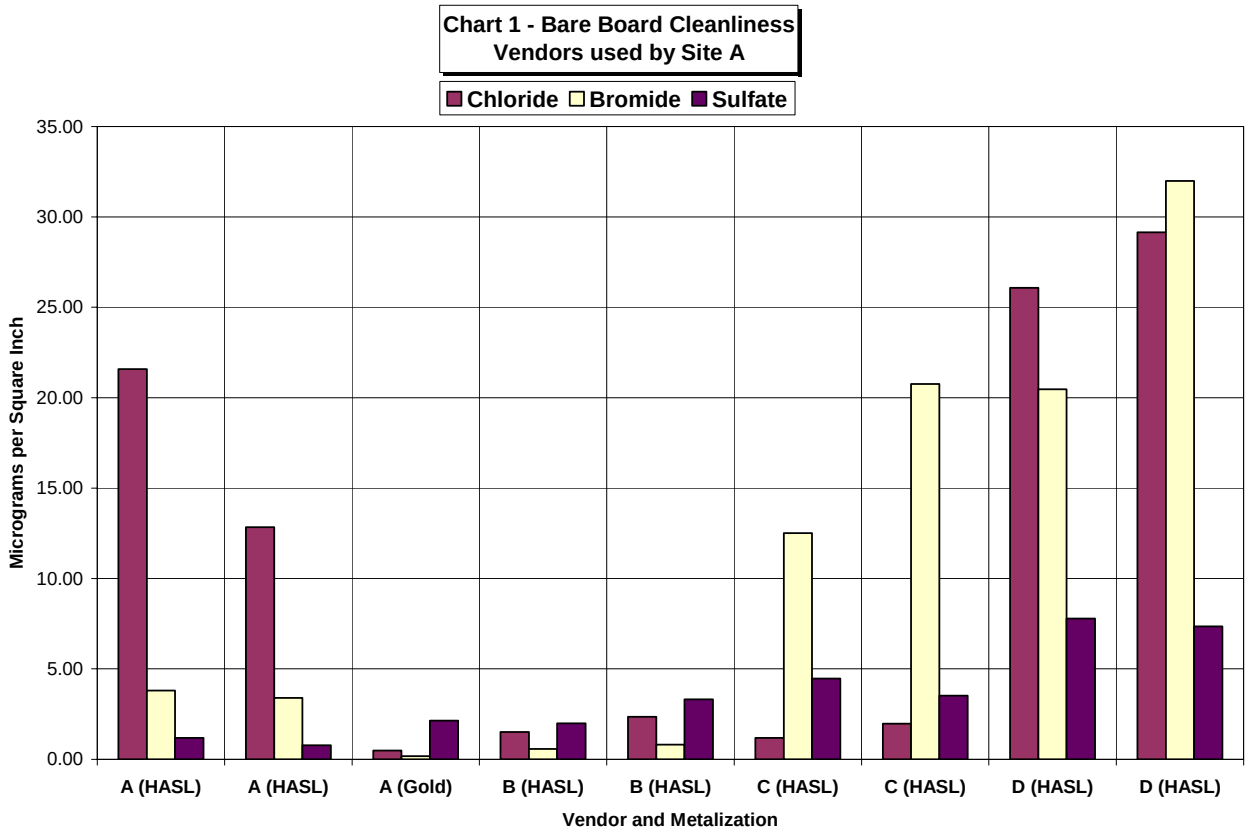
Bare board cleanliness directly impacts product performance

Foresite Inc.

This is the second of a two-part study. In part 1 (*Sure Hope I Don't Get Caught - March 1998)*, assemblies experienced high levels of corrosion, electrical leakage and metal migration. Two manufacturing sites (A and B) were examined. One was found to have good manufacturing practices and had a much lower incidence of failures, but enough to warrant concern. The corroded and stock assemblies were found to have high levels of halide and sulfate residues.

Whenever we see electrochemical failures on units manufactured with a no-clean assembly operation, one of the first things we examine is the bare board cleanliness, which is critical for no-clean assembly. Site A had four bare board vendors, as did Site B, with one vendor used by both.

Chart 1 shows the bare board cleanliness levels for the four vendors used by Site A. Chart 2 shows the levels for the four vendors used by Site B. Vendor A is the common fabricator for Sites A and B.



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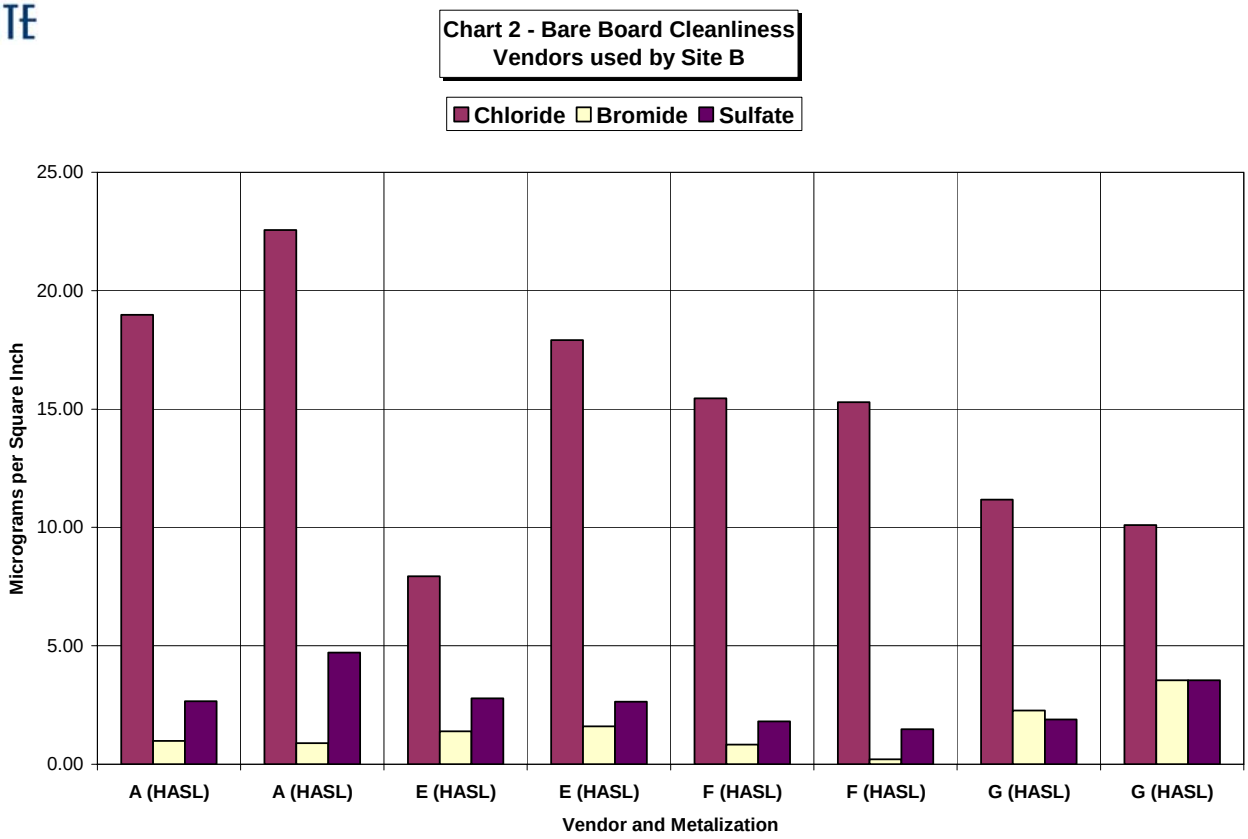


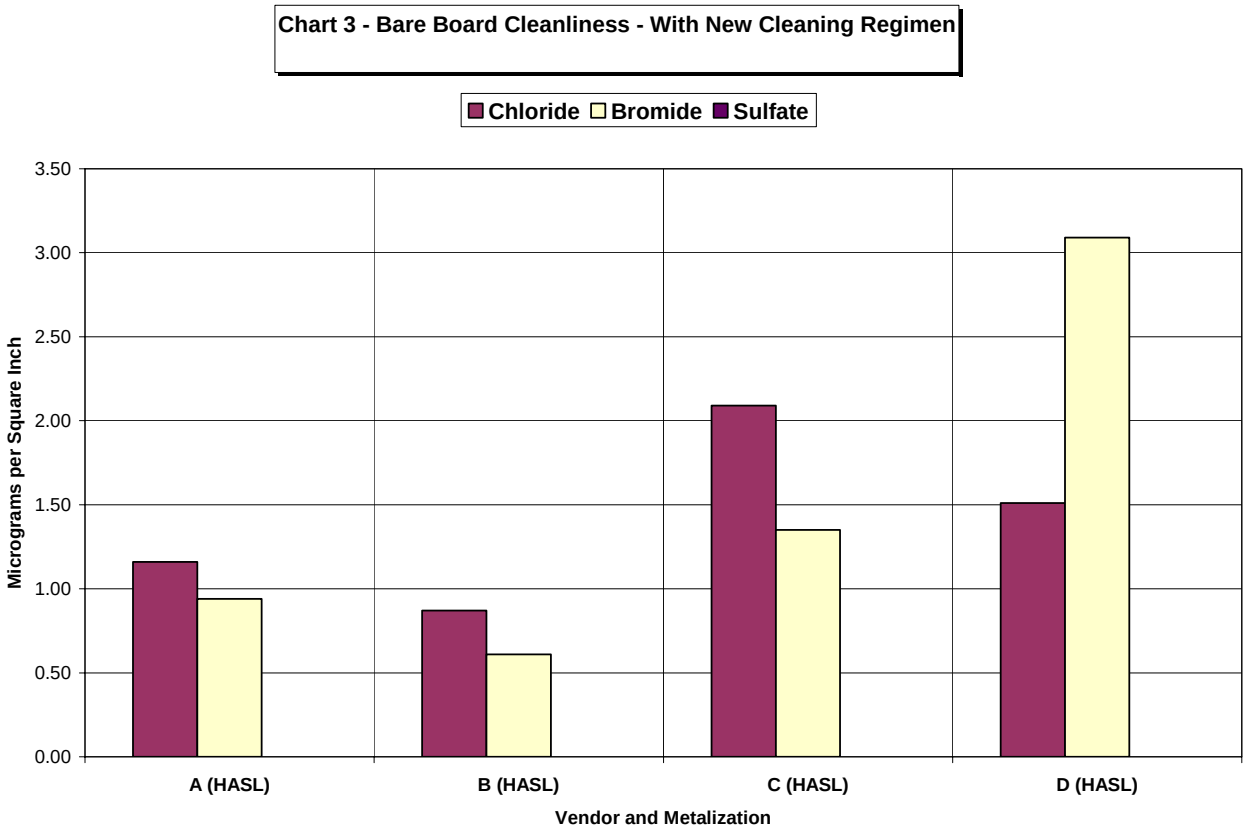
As a basis for comparison, we recommend maximum chloride levels of 2.0 micrograms per square inch ($\mu g/in^2$) and maximum bromide levels of 15 $\mu g/in^2$, for assemblies processed with low solids flux technology and no cleaning. In our experience, halide residues above these individual levels experience a progressively greater incidence of electrochemical failures.

For Site A, two of the four fabricators (B and C), which comprised the bulk of the boards used for Site A assemblies, were acceptably clean, by our standards. Failures were not experienced with boards from these vendors. Vendor A had boards which were very high in chloride. Vendor D had boards high in both chloride and bromide. When assemblies were produced with these boards, corrosion and metal migration occurred.

For Site B, all of the vendors used had chloride levels which we consider to be hazardous to reliability. Since the halide levels carry through to the final product, it was easy to see why Site B had such a high failure rate. As my granddad used to say – you can't make a silk purse from a sows ear.

All hot air solder leveling (HASL) come in three "flavors": high in chloride (e.g. hydrochloric acid); high in bromide (e.g. hydrobromic acid); or a mixture of the two. The site B vendors all used a chloride-charged HASL flux. Site A – Vendor D, used a HASL flux charged with both chloride and bromide. Vendors B and C had acceptable cleaning processes following HASL, which accounts for the low halide residues. All others had post-HASL cleaning processes based on tap water, which is a very poor cleaner, and so had high levels of residual halides.

After the understandable screaming, bloodletting, and threats had subsided, different cleaning regimens were adopted by the primary fabricators. The cleaning media was changed from tap water to hot deionized water with a small amount (4-5%) of an effective saponifier. Chart 3 shows the bare board cleanliness after these changes were made.



With the bare board cleanliness issue addressed, and now periodically monitored by ion chromatography and modified-ROSE testing, and the poor processing techniques at Site B corrected, no electrochemical failures have been noted in burn-in testing or in the field since these changes were implemented.

If you do not currently specify bare board cleanliness levels, or have multiple bare board vendors, or do not closely monitor incoming cleanliness, you should be feeling very nervous right about now.