

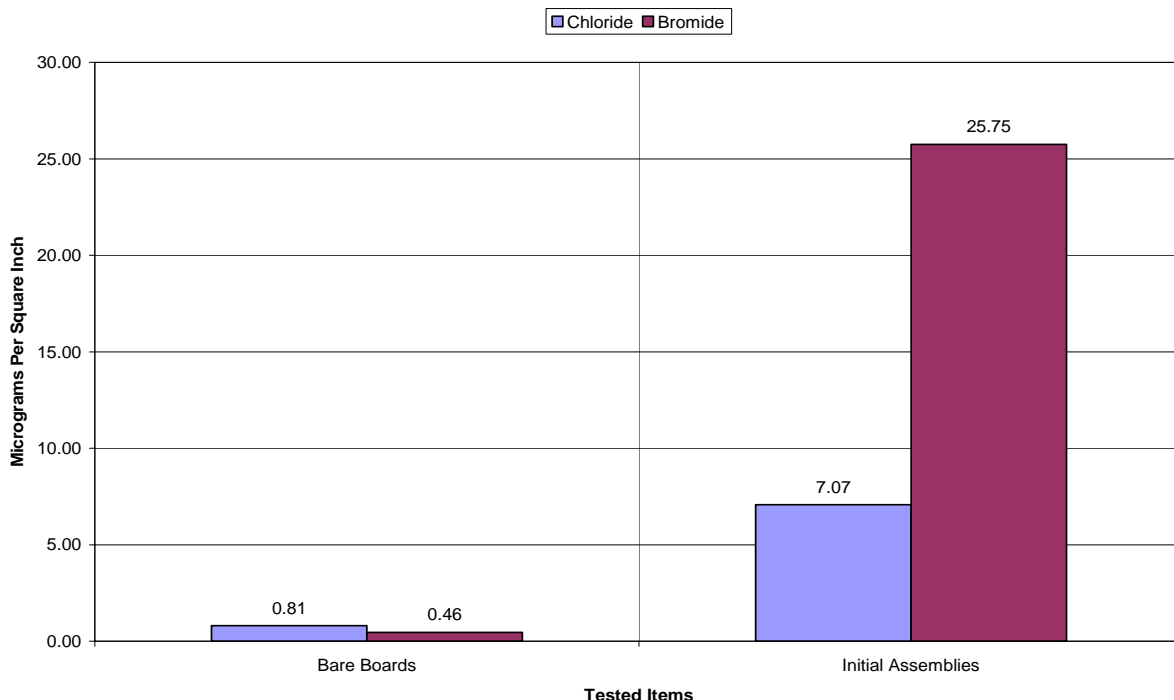
## No More Than I HAVE To

Materials & Equipment cost savings should be looked at as a big picture  
**Foresite Inc.**

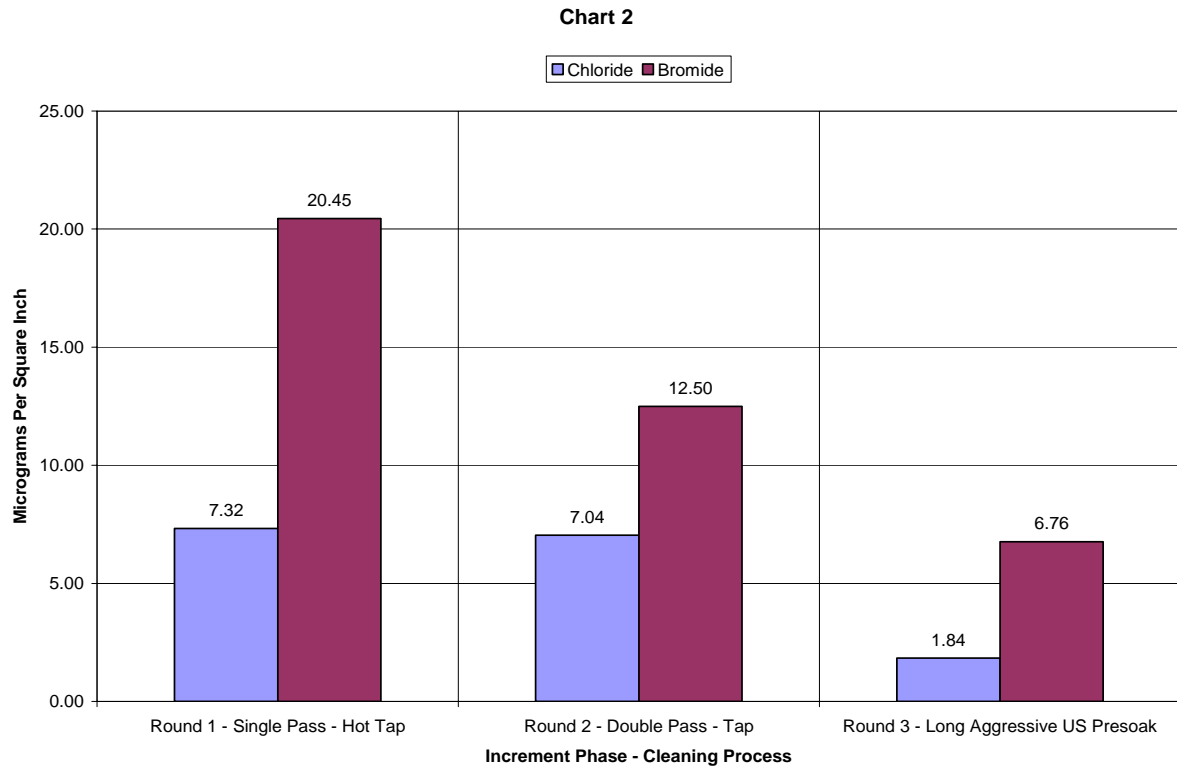
Anyone with a teenager is occasionally amazed at the effort put forth to avoid work. When three hours are spent avoiding one hour of work, we shake our heads and wonder where we went wrong. One would think we would all outgrow this tendency, but apparently the trait continues into the adult phase of life in many fabricators and assemblers. When we give an assembler or a fabricator an assessment of “dirty” boards or assemblies, which are susceptible to corrosion and metal migration, it is sometimes interesting to see the approaches made to addressing the problem. Perhaps the solution to the problem is a new cleaner for post-HASL cleaning, or the use of a cleaning service, if a limited duration problem. A common response is “we have no budget for that” or “we can’t afford that”, but will then spend an equivalent (or greater) amount of labor money with line personnel scrubbing boards or assemblies or some other labor-intensive operation. Apparently, labor money is a different color than equipment money. Many customers often take an “incremental” approach to the solution, not wanting to do any more than they absolutely have to, rather than biting the bullet once and doing it right the first time.

In this month’s case study, we look at such an incremental approach. The assembler was a manufacturer of high-end graphic processor assemblies who desired an objective analysis of the cleanliness of their products. Chart #1 shows the initial residue levels as determined by ion chromatography. The bare boards were fairly clean. As a reference, Foresite recommends chlorides no higher than 4.5 micrograms per square inch ( $\mu\text{g}/\text{in}^2$ ) for chloride and no higher than 15.0  $\mu\text{g}/\text{in}^2$  for bromide. By these guidelines, the assemblies were at considerable risk of failure. The chlorides came from a water soluble flux bearing solder paste. The bromides were carryover from the use of a brominated flux in wave soldering. The post-assembly cleaning process was an in-line cleaner using 48°C tap water (30 psi max) for about 3 minutes cleaning time, with a 48°C DI water rinse for 3 minutes (60 psi).

**Chart 1**



We recommended cleaning the boards and assemblies at 60-65°C deionized water, with 5% of a good saponifier, 30 psi (but with a high flood rate), 60-65°C deionized water rinse at 60 psi, and 3-3.5 feet per minute belt speed. This was not that different from what they were already doing. But, converting to DI water throughout the cleaner and adding a saponifier represented costs. So, the next change involved hotter (60°C) tap water, but no other changes. Chart #2 shows the result.



There was still too much bromide and chloride. The next change involved two passes through the existing cleaning process. Chart #2 also shows the results. Results proved better on bromide, but still too much chloride. Still trying to work with them, we suggested the use of a hot presoak in saponified (DI) water in ultrasonics prior to cleaning (3 minutes max in a 60°C 5% solution, and the same parameters for ultrasonic DI water rinse) to give some additional solvency with minimal additional cost. Bromide residues largely ignore water cleaning, requiring some additional chemical or mechanical energy for full removal (in our opinion). Figuring that if 3 minutes in a 60°C 5% solution in DI water was good, then 8 minutes in a 60°C 15% solution with ultrasonics must be even better. Chart #3 shows the result. While the residue levels were now under our recommended maximums, this is a VERY aggressive cleaning method and our concern was a chemical attack of the laminate, mask, and epoxy inks. The next round (after some chastizing) used Foresite's recommended presoak, examined another saponifier, which the customer wished to use, and a longer ultrasonic wash, but with a more restrained saponifier concentration. The alternate saponifier cleaned, but not as well as the recommended material. The longer ultrasonic (lower saponifier) also worked, but the longer cleaning time added time to the manufacturing cycle, so the Foresite recommendation was considered as the final solution.

The customer now has a cleaning process that is acceptable (by our standards). While the customer now understands his process better, hundreds of man-hours were spent on this project, and a small fortune was spent on trans-ocean shipping. The incremental approach worked, but turned out to be very expensive when the total cost was examined. The customer even bought a second ultrasonic tank for DI rinsing, incurring the equipment cost they originally wished to avoid. Saving money can sometimes be a very expensive proposition.

**Chart 3**

