# *Implementing Chemical Cost Saving in 14 nm High Volume Manufacturing Line*

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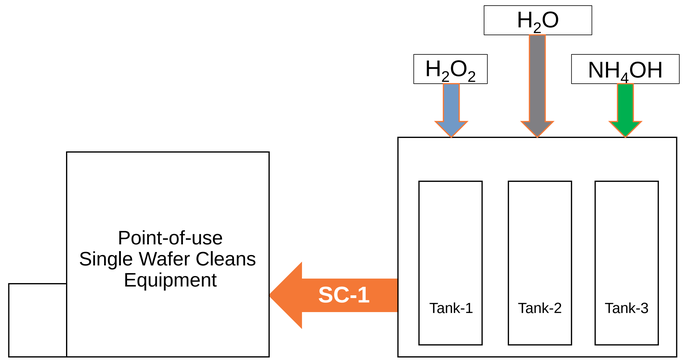
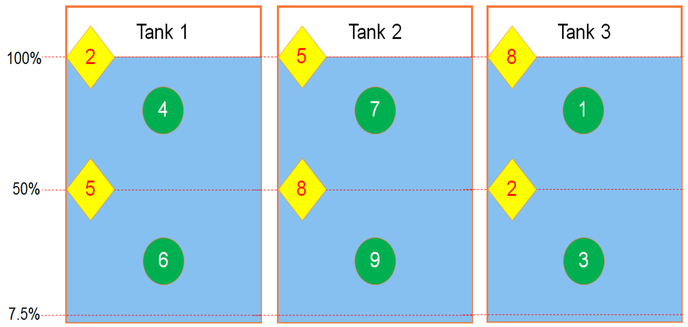
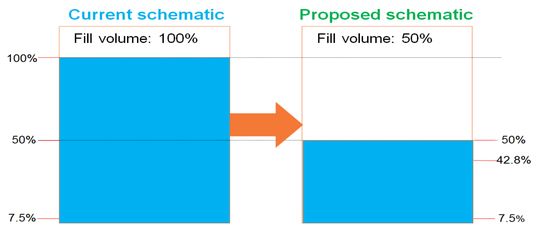
**Abstract**
A continuous supply of chemistry with the right concentration and temperature is essential to ensure uninterrupted processing of wafers by wet cleans tools in an HVM environment. Chemical utilization must be optimized to reduce wastage and costs irrespective of the number of wafers in process. In this study, the utilization and chemical costs of Standard Clean 1 (SC-1) were analyzed over a period of three months. Excessive wastage of the chemistry was observed, with utilization levels at an average of only 23%. To reduce chemical wastage and costs, the input volumes of ammonium hydroxide, hydrogen peroxide and water were reduced by 50% per mixing batch. The overall chemical cost per move through this toolset was also reduced by 27%. Total utilization and cost savings before and after the changes have been compared.



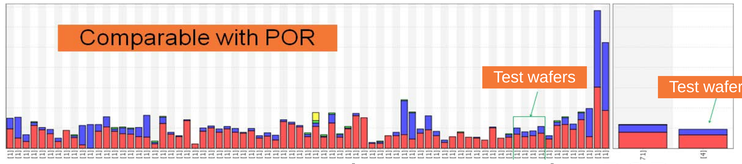

SC-1 supply schematic (3-tank configuration)



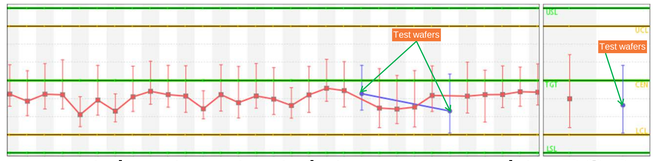

Tank Operating Sequence

| | 100% Volume | 50% Volume |
|---|---|---|
| **Principle** |   | |
| **Mechanism** | ➢ 100% working volume in each tank<br>➢ Mid level sensor at 50% volume<br>➢ Low level sensor at 7.5% volume | ➢ 50% working volume in each tank<br>➢ Mid level sensor at 42.8% volume<br>➢ Low level sensor at 7.5% volume |
| **Advantages** | ➢ None when compared to 50% volume<br>➢ Might lead to higher valve lifetime – not enough data to backup this point | ➢ Very low chemical wastage due to 66% rise in utilization<br>➢ Tank ready time – reduced by 30% |

## Qualification tests run on new tank volume configuration are comparable to process of record

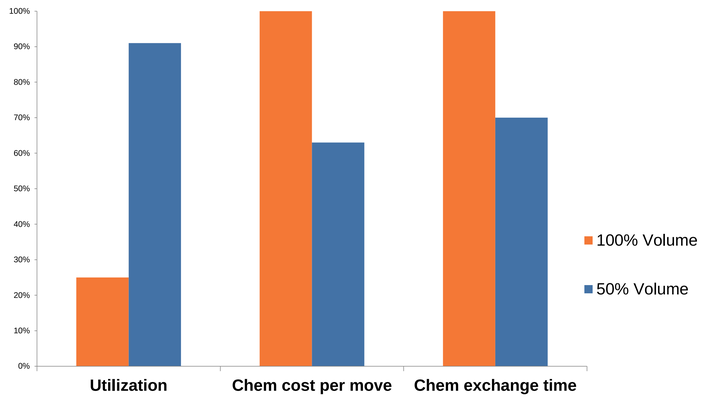



Particle count – test data compared to POR




Etch rate – test data compared to POR

## Benefit Analysis




## Summary

- Chemical cost savings by changing the working volume of mixing tanks must be executed with great care.
- No alarms due to chemical exchange of any sort have been generated after this change.
- When the WIP is low or the tool is idle, the chemical wastage is reduced by 67%.
- By reducing the working volumes in the mixing tanks, not only the costs of raw chemistries is reduced, but also the waste water treatment costs and the potential ecological impact[1] of ammonia is also greatly reduced.
- This method of chemical cost saving can be applied to other chemistries as well, as long as the tank configurations and chemical life times permit such a change.

## Acknowledgement

- Kim, Taehyun (Process Engineering)

## References

- [1] Pubchem-NCBI: https://pubchem.ncbi.nlm.nih.gov/compound/ammonium_hydroxide#section=UN-Number



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