STABILIZATION OF MERCURY IN HIGH pH TANK SLUDGES

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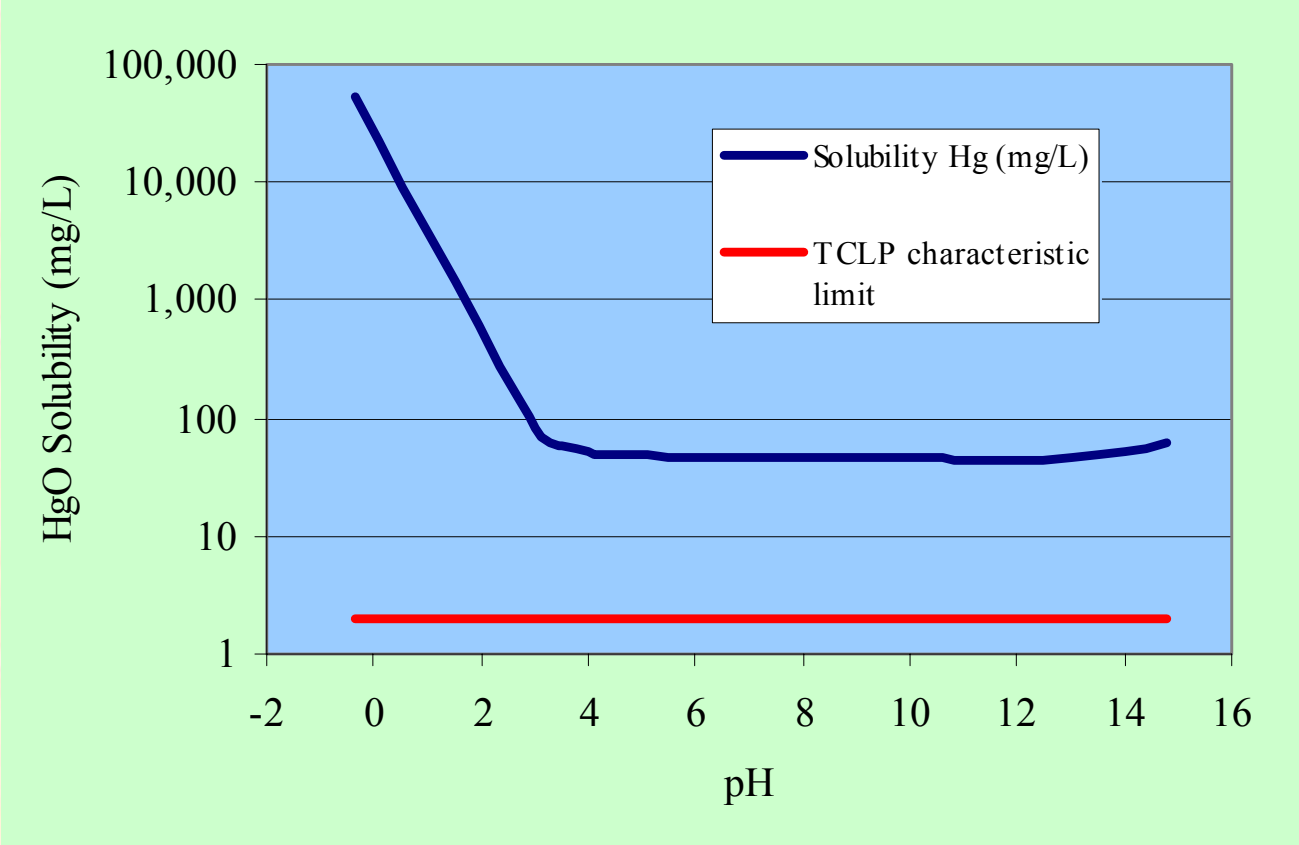
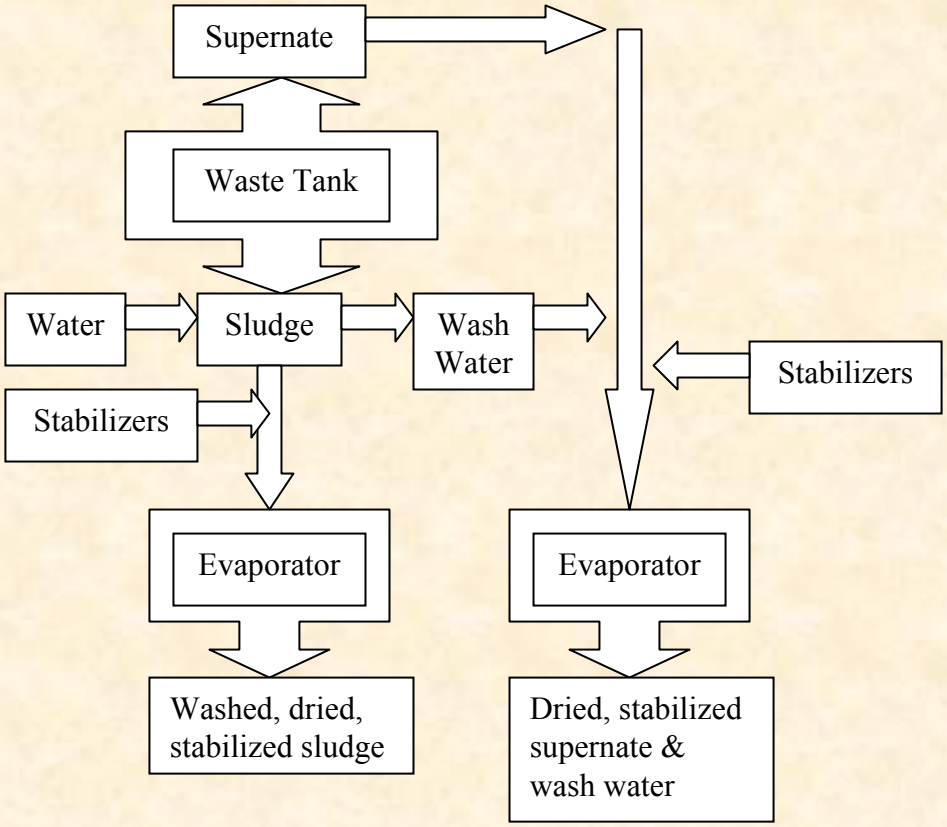
WM'03 Conference
February 23-27, 2003
Tucson, AZ

In general, high pH alone is not effective at stabilizing mercury.

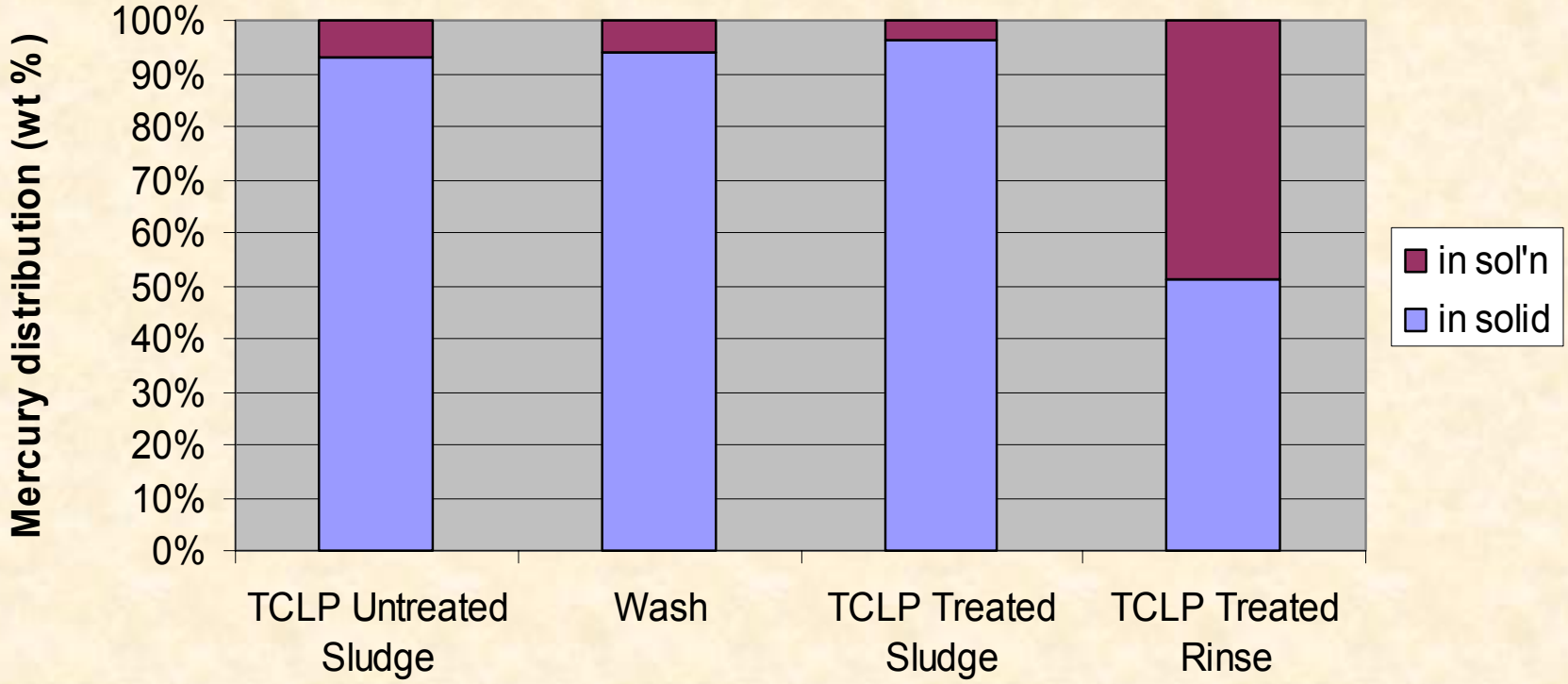


Vendor's process to treat MVST sludge

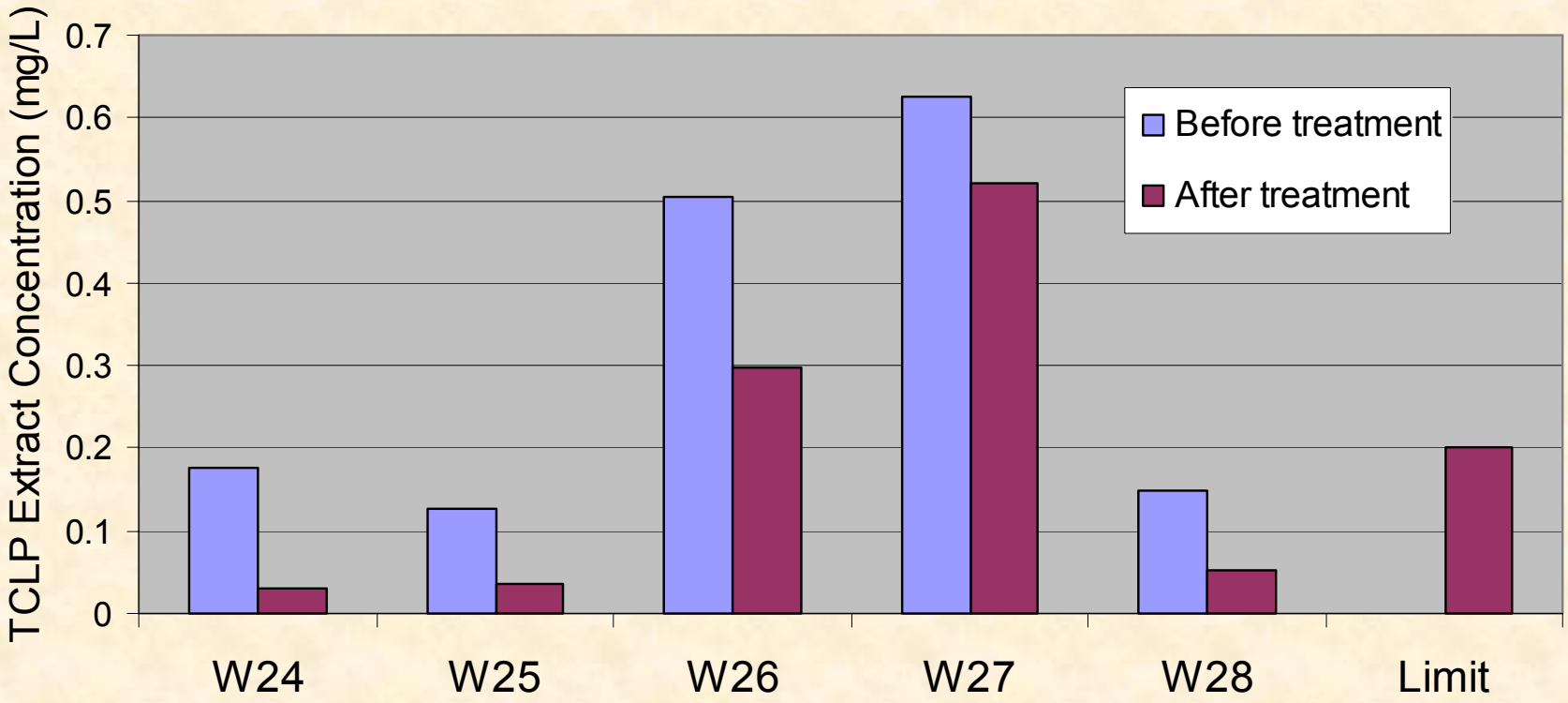


Samples of sludge from six MVST tanks were subjected to bench scale testing using the vendor's treatment protocol.

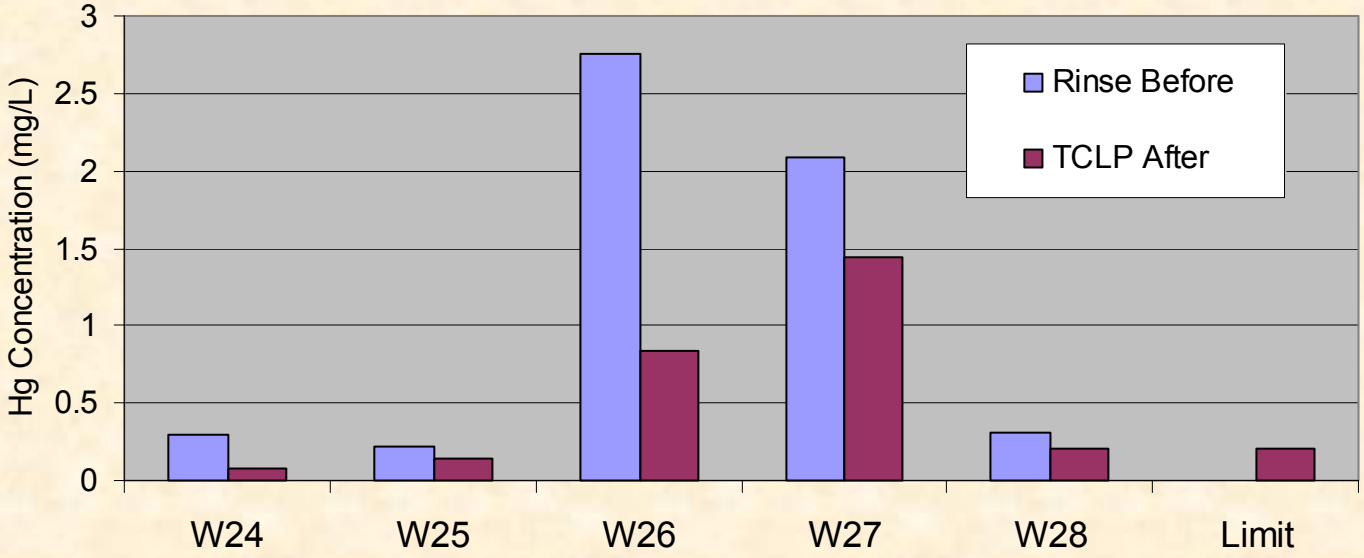
Most of the mercury remained with the sludge after washing, but the fraction that did dissolve resisted stabilization in the high pH tank chemistry.



Treatment improved sludge TCLP performance, but not enough for the two samples not meeting the characteristic limit.



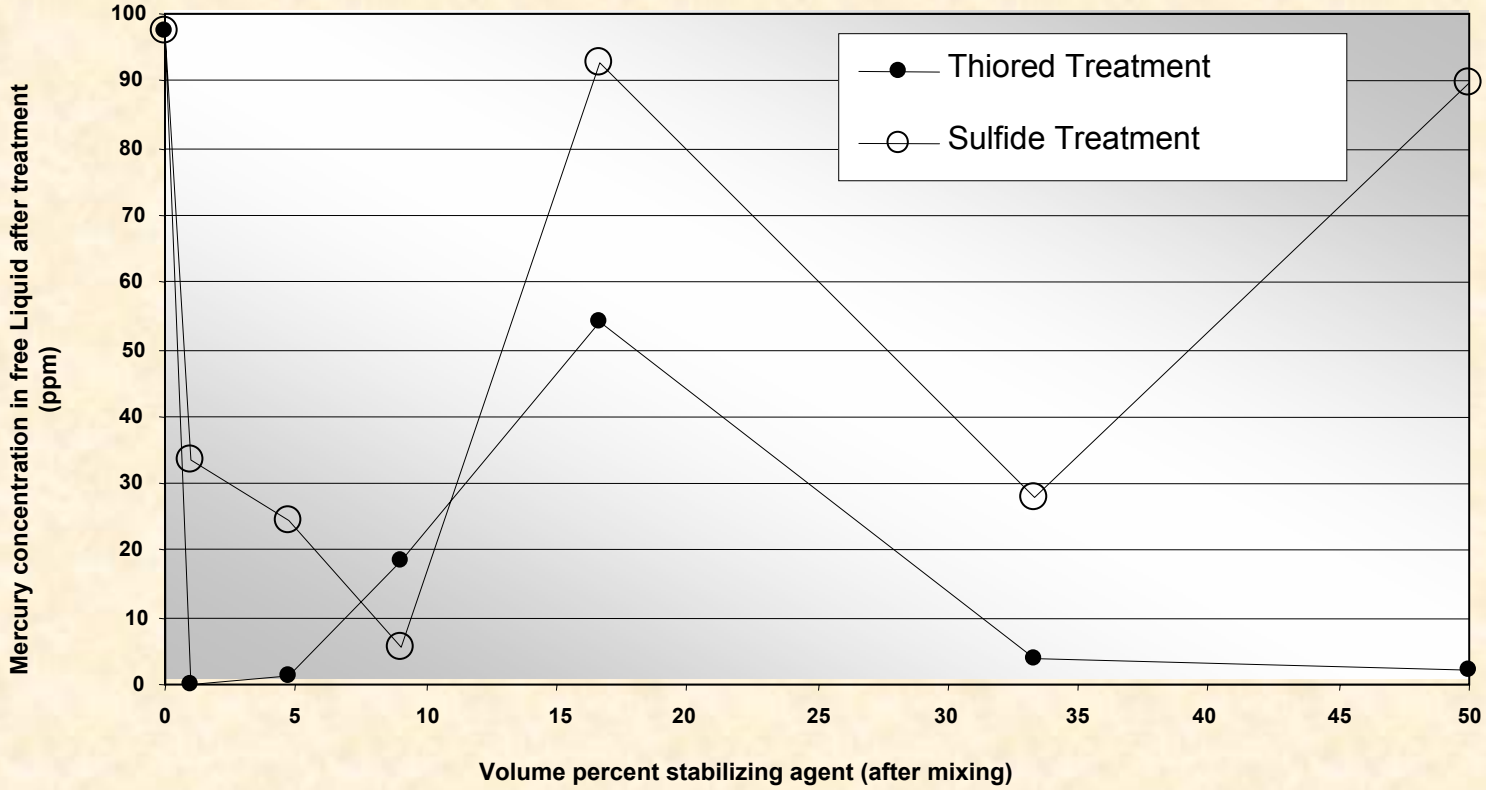
The TCLP extract concentration of the stabilized wash water was lower than the original concentration, but not enough for the two samples that exceeded the characteristic limit.



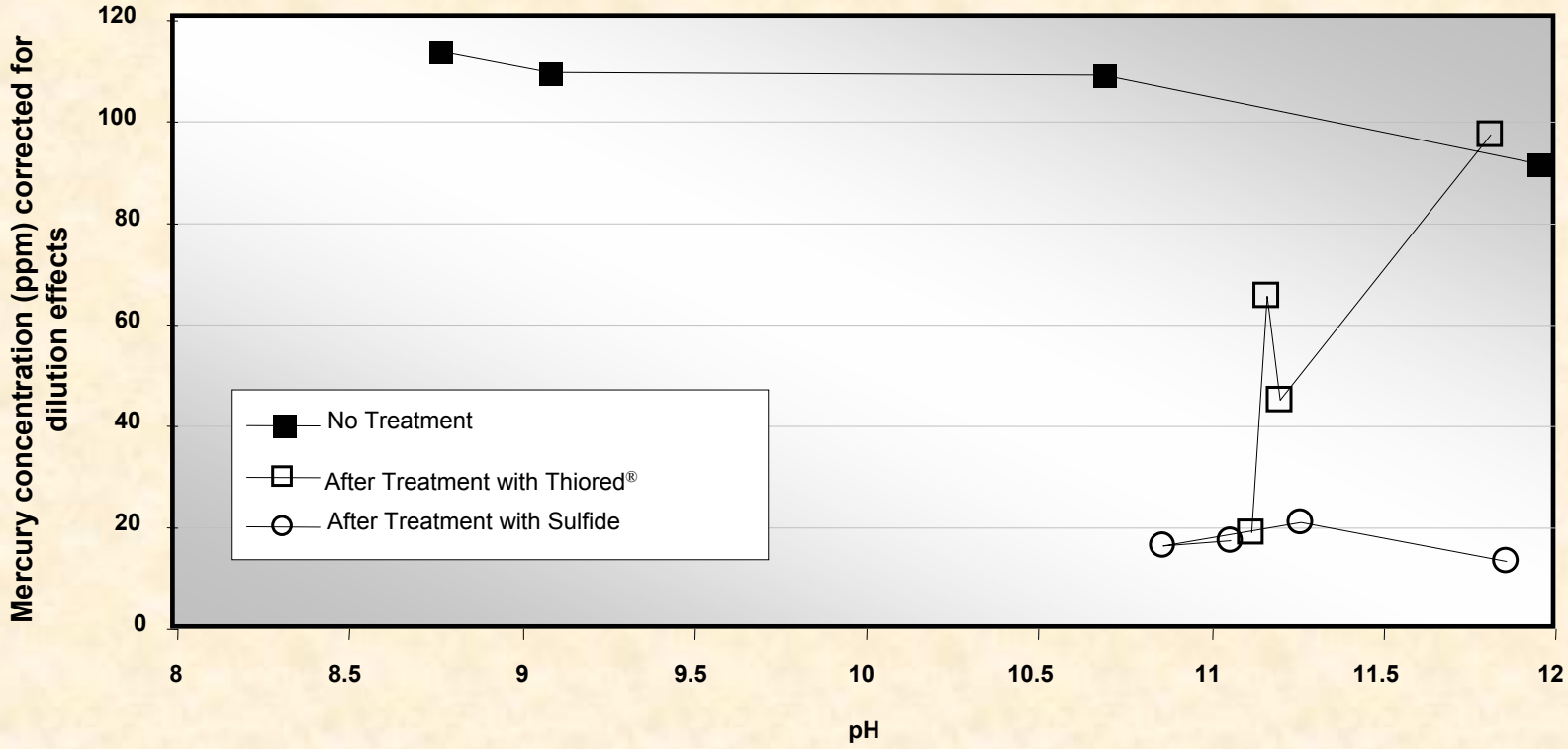
Does standard Hg stabilization work in the high pH tank sludges?

- A commercial Hg stabilizer (ThioRed™) did not appear effective for the tank sludge samples
- ThioRed™ and Na_2S tested in stabilizing bench-scale solution of Hg_2Cl with increasing quantity of stabilizer and over a range of solution pH using a background matrix of dissolved $NaNO_3$

Stabilizer additions above the recommended amount were counterproductive. The characteristic limit is 0.2 ppm.



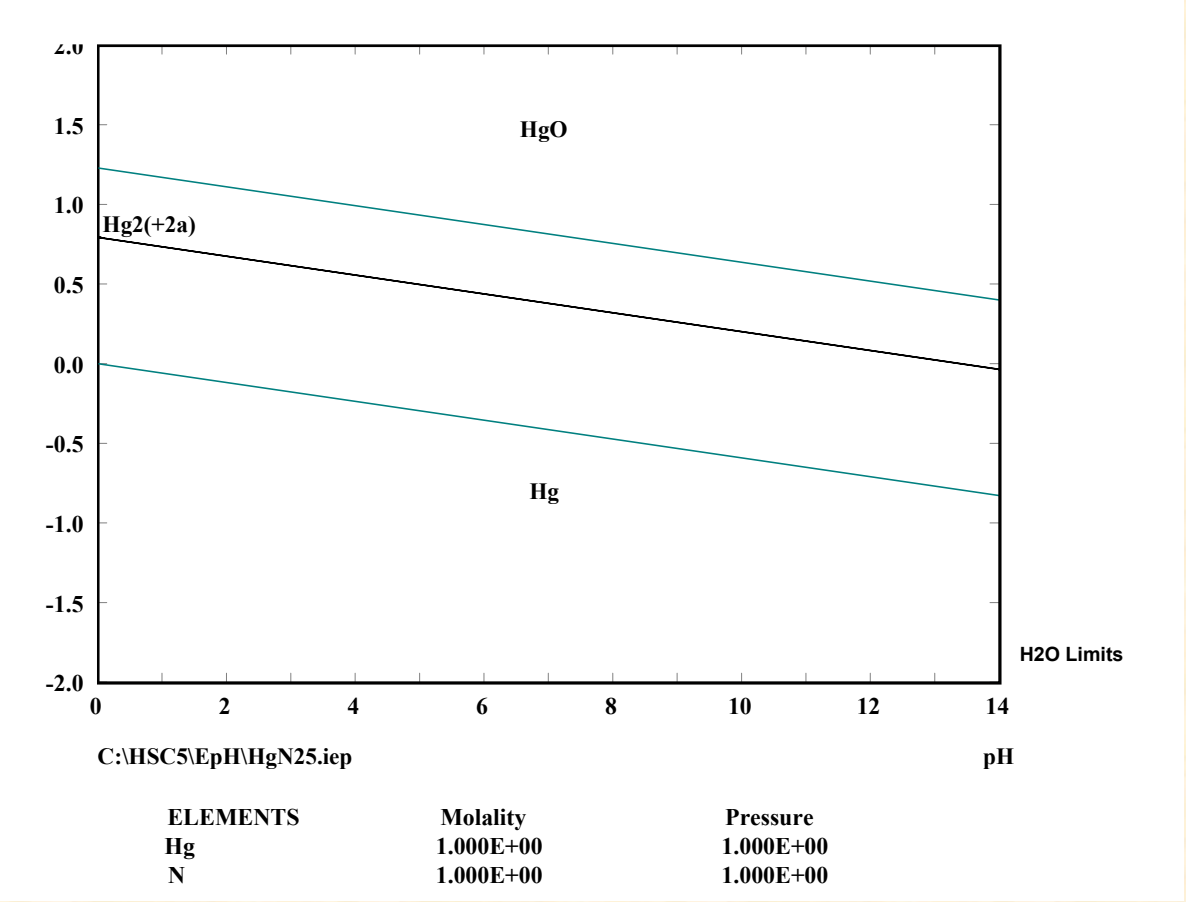
Higher pH appears to compromise stabilization with Thiored™. Even the significant reduction in concentration at high pH was not below the characteristic limit of 0.2 ppm.



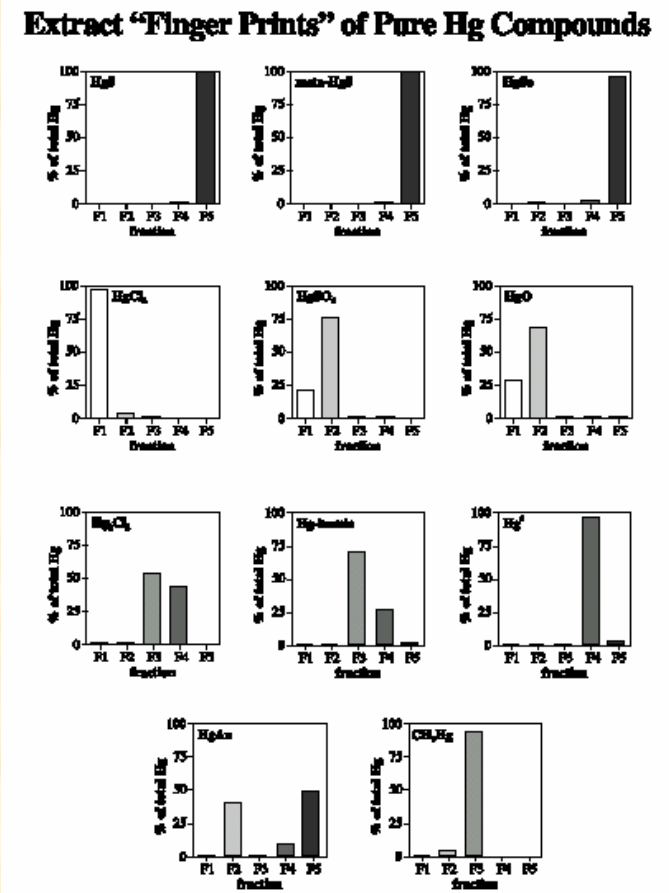
Some speciation studies were attempted.

- Theromdynamically predicted the equilibrium mercury specie(s) in the tank waste chemistry
- Sequentially extracted two sludge samples using a technique developed for mine tailings and benchmarked with likely mercury species
- Thermally desorbed two sludge samples at 100-300°C, also benchmarked with likely mercury species

Pourbaix diagram of the aqueous Hg-N system predicts HgO as the equilibrium specie (HSC 5.0). SOLGASMIX predicted distribution between solid HgO and dissolved $Hg(OH)_2$.



Sequential extraction "fingerprints" of mercury species in kaolin.



Application of Selective Extractions to the Determination of Mercury Speciation in Mine Tailings and Adjacent Soils

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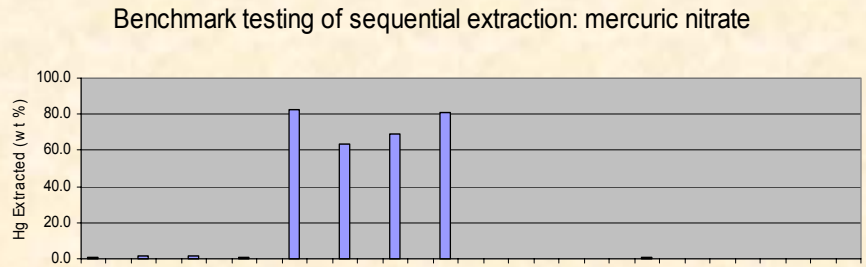
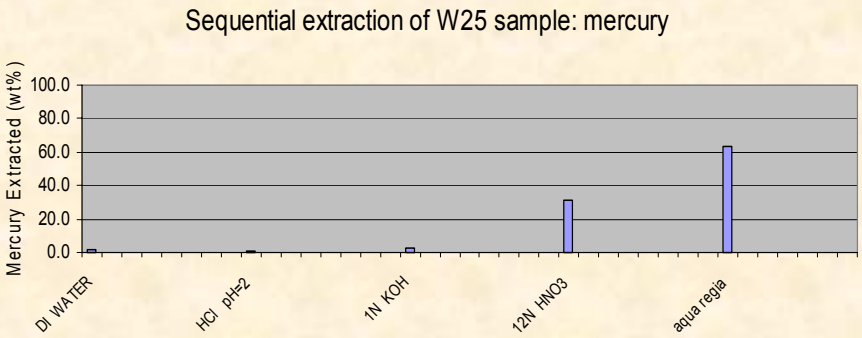
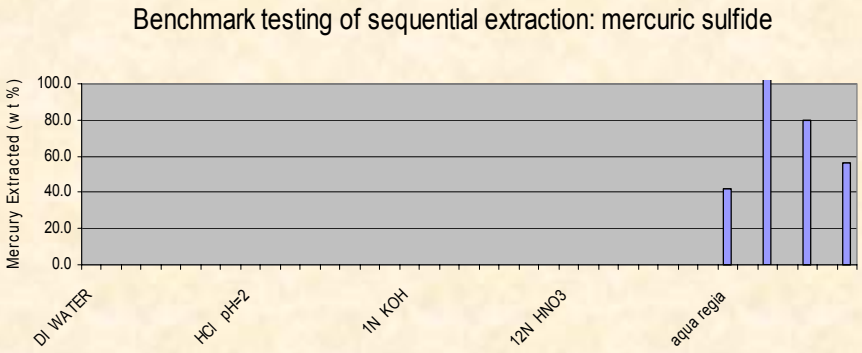
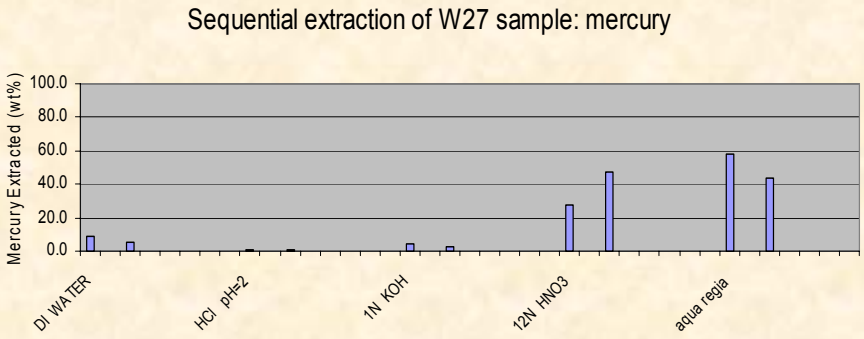
Hg extracted from the sludge samples in strong nitric acid and aqua regia. Elemental Hg and HgS extracted in the strong acids in the benchmark fingerprints.

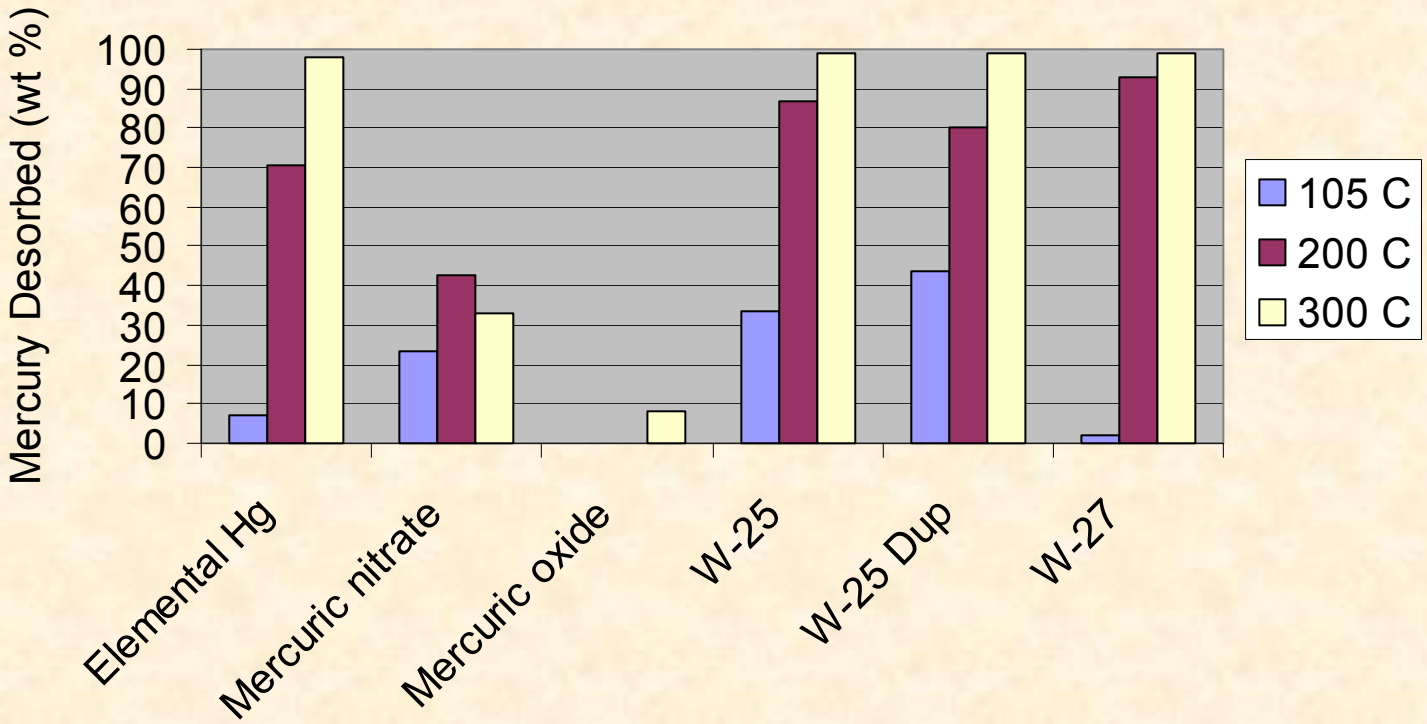








Hg desorbed from the sludge samples similar to that observed for elemental mercury. Mercuric nitrate may decompose to HgO by 200°C, complicating its cumulative behavior.



Summary and Conclusions

- The commercial Hg stabilizer did not perform well on the tank sludge samples
- Excess stabilizer worsened performance, as predicted by the supplier
- High pH compromised stabilization of a pure solution of $HgCl_2$
- Speciation studies suggested the presence of elemental Hg in the sludges, but were not definitive and do not rule out the presence of other Hg species