Q: metal embrittlement: how deep does Hg penetrate in metal?

A: It is unclear from the reports I read on the actual plant failure how deep the embrittlement was before the failure. So, I don't have an actual answer. It seems that as long as elemental mercury continues to reform as the oxide layer decomposes the embrittlement continues.

Q: any data of Europe, e.g. North Sea Oil and gas fields?

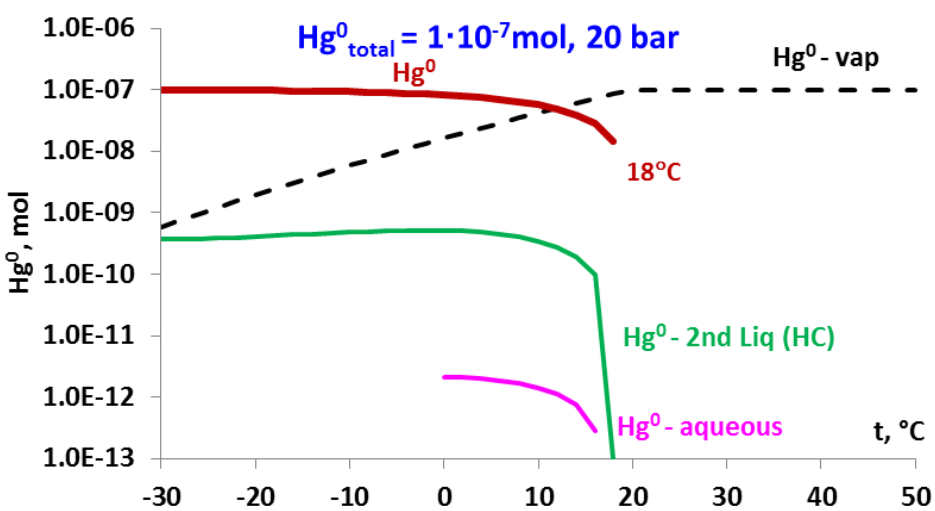
A: This actually turned out to be far more difficult to find than other areas in the world. I don't have an answer for this but will keep looking in my travels. I did find one reference (for Europe) to have concentrations of 100 to 150 µg/m^3. Link: http://www.klmtechgroup.com/PDF/EDG/ENGINEERING_DESIGN_GUIDELINES_mercury_removal_unit_Rev01web.pdf

Q: is Hg reaching the Al as a vapor or as a liquid or as Hg+ ?

A: It is assumed that it is in a vapor form initially, sort of like an aerosol. The boiling point of mercury is rather high at 357 °C. See: https://www.nuclear-power.net/mercury-melting-point-boiling-point/

However, some literature considers Hg as a vapor which then condenses on the surface of the metal. So, it is unclear which phase is present. OLI considers it a vapor which will condense to a metal liquid. We call this metal liquid a "Solid" or a "PPT." This is entirely an artifact of the OLI software.

We have made some predictions where Hg will form



In the OLI software a pure phase is normally considered a solid. For example, solid $CaCO_3$ is a single phase. If you have multiple solids, they form a solid mixture and not a solid solution. In

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the case of Hg, it forms a pure separate phase. OLI has arbitrarily assigned to the class of solid variables, hence PPT.

Q: Aside from mercury removal unit can you talk about other options for prevention including chemical washes etc.

A: I am not really an expert here. I think mercury removal is usually a physical process such as adsorption or chemical treatment

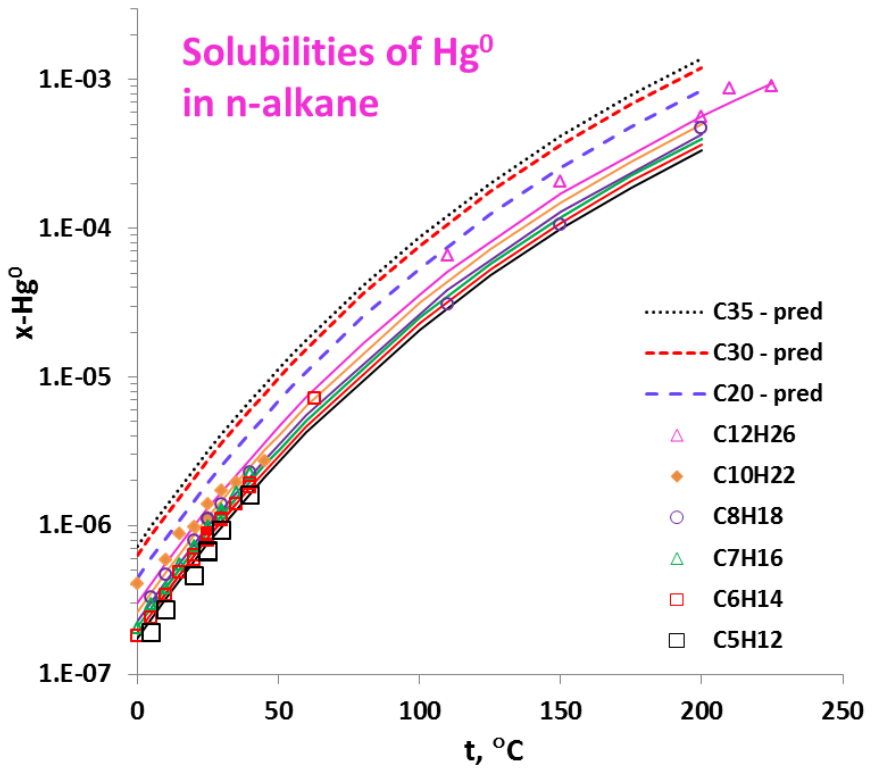
Q: In ethylene plant, how is Hg removed?

A: I believe mercury is removed in a similar fashion by using adsorbents.

Q: Which thermodynamic framework do you recommend performing these calculations? Any difference in mercury speciation capabilities (dimethylmercury, diphenyl mercury)?

A: OLI almost always recommends MSE for these calculations. Unfortunately it appears that we did not perform and data work for organomercuric compounds.

We have a fairly extensive data validation set for Hg in hydrocarbons, below is just for alkanes.



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Q: Does OLI have all the chemistry needed to model the entire flowsheet shown on the three-tiered flowsheet picture. Specially, I mean can OLI also model the mercury removal process

A: OLI has the phenomena for using adsorbents, but we do not have the actual partitioning data. We would need start a data project to do this.

Q: when you need to work below 50 C, yet you were below that. can you "trust" the results below 50? is the software extrapolating even though the model limit is there?

A: The lower temperature is actually -50 ^{o}C (223.15 K). When data fitting the hydrocarbons in our model we picked an arbitrary lower temperature. We did not collect or evaluation data below that temperature, so all bets are off. Extrapolations to lower temperatures should be considered with a high index of suspicion.

In the presentation I had a case that did converge to -93°C. Mathematically this is a stable answer, but I don't know if it matches reality. Our data validations do not go that low so I don't have anything to compare against.

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