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Path Forward for the Reduction of Mercury Vapors in ETP Operation Areas

June, 2016

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From:	**P. Norris**	**241-152H**
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Mercury Vapor Reduction Path Forward

1.0 Subject:

Mercury is present in feed streams into ETP. Based on the design of the process, some Hg vapor is expected. Minimizing vapor concentrations limits potential for exposure to personel. The purpose of the path forward is to identify steps that reduce the presence of Hg vapor in the ETP process areas.

2.0 Background and Discussion

2.1 Mercury Source in the Feed:

Proportionally the most significant sources of influent to ETP are Tank Farm Evaporator (2H) overheads and H-Canyon Acid Recovery Unit (ARU) and General Purpose Evaporator (GPE) overheads. Of the streams, the 2H total mercury concentration is the greatest. Thus, so long as mercury is present in the high level waste system and DWPF operates (producing recycle for 2H to subsequently produce overheads) soluble mercury will be present in the feed material into the ETP process.

2.2 Problem Area 1, Process Building Sumps:

The first treatment step at ETP is a pH adjustment to acid ~2.5 pH with flocculent, Aluminum Nitrate (AN), added. The prepared Waste Water is then sent to pH adjustment. There the pH is elevated to ~8 to precipitate the flocculent. This facilitates better filtration. The ‘Norton’ filter system then concentrates the insoluble fraction of the waste. It is postulated that mercury may adhere to the solids and flocculants, contributing to observed mercury vapor concentrations in the process building sump areas. Funnels at multiple locations along the sump trench feed into the Evaporator #1 sump. These funnels serve as an air gap between the drain for their respective vessel and a common header pipe that runs through the sump trench. Of these funnels, the ones of most notable concern are at resin removal and the pH adjustment tanks. Repeated flushes of the sump header with nitric acid would dissolve elemental mercury present and

would potentially reduce solids build-up in the evaporator sump area.

2.3 Problem Area 2, Organic Removal Area:

The soluble portion, filtrate, is fed forward to Organic Removal, the second problem location identified. There the mercury vapor problem has manifested as vapor evolution from the sump. Cleaning evolutions in the Organic Removal system push material into the sump system. From there the process solution is introduced to the open air and the mercury vapors are elevated above IH action levels (0.008 mg/m^3).

2.4 Problem Area 3, Evaporator Feed Tanks:

Mercury vapor issues were noted in the evaporator feed tank area when the tanks were drained as part of the September/October 2015 Organic Removal system cleaning evolution. Processing constraints (steam outage) led to a situation where it was beneficial for the Evaporator Feed tanks to be recycled to the Waste Water Collection Tanks. To accomplish this transfer, the tanks were drained to the sump. One of the two tanks was drained with acceptable levels of mercury vapors released. Draining of the second was stopped due to unacceptable levels of mercury vapor in atmosphere. The circumstances leading to the draining of the evaporator feed tanks were very uncommon and were a result of high liquid inventory, a processing imperative to clean the Organic Removal system, and an impending steam outage. Based on the low frequency of this operation, immediate actions are not required.

Residual solids from cleaning the building sump and, potentially, the Filter Feed Tank, may propagate to the Evaporator Feed Tank. Thus, continued observation of the contents and flush of the sump is recommended.

2.5 Conclusion:

While mercury concentrations are present in the feed to ETP, mercury vapor will be present in the process. The goals of the path forward actions are to minimize vapor concentrations. In general the actions are directed towards ‘keeping it in the pipe’. Where practical, use of the sumps for fluid transfer will be replaced with piped routes. Repair or replacement of leaking components that contribute to vapor release from sumps will be performed along with increased sump clean up and improvements.

3.0 Recommended Path Forward Actions

3.1 Actions for 241-84H Building

Change procedure SW22.2-IOP-1 to discontinue draining pH Adjustment Tanks 1 and 2 prior to 'line-out' of pH. (Complete: 10-26-15)

Change procedure SW22.2-IOP-1 to include steps to flush the sump line serving the pH adjustment tanks following 'line-out' of pH. (Complete: 10-26-15)

Perform a flush of the pH adjustment tanks sump line following 'line-out' of pH with nitric acid supplied from the clean solution mix tank. Repeat as desired to clean out the sump line. (Complete: 12-10-15)

Inspect the Filter Feed Tank. Solids are suspected of being present and contributing to mercury vapor levels. (E. Harrison: Complete, Solids discovered)

Initiate inspection of pH Adjustment Tanks 1 and 2. (M. Stringfield: Complete, Work Requests issued, WO#1469900, activity complete, solids discovered in pH Adjustment 2 and to a lesser extent pH Adjustment 1).

Contingent on the presence of solids in the Filter Feed Tank and pH Adjustment tanks, direct the circulation of low pH Waste Water through the vessels per IOP, SW22.2-IOP-1. (E. Harrison: 2-7-16, Complete 1-23-16, follow up inspection showed little effect)

Install NAS-V-200. This valve installation will reconnect the pH Adjustment tanks to the Nitric Acid Day Tank. This reconnection will allow the pH Adjustment tanks and Filter Feed Tank to be treated with 12.5 wt% Nitric Acid. (WO # 1488267, Date: 6-28-16)

Develop procedure change to allow for the acid addition to pH Adjustment tanks and Filter Feed Tank. (E. Harrison: Initiate PCR Date 6-9-16)

Repair Filter System vent valves, one valve for each filter stage for a total of nine. Due to a common header it is unknown which of the nine is leaking by, thus repairs ordered for each. (Work Orders approved, #'s 1466865 thru 1466873: Train 2 complete, Train 1 next.)

Issue a Work Request as a follow up clean out of Filter Feed Tank (and pH Adjustment tanks) for inspection of the vessels to determine the extent of solids removal. (E. Harrison: Complete, WO#1469900)

Perform acid flush of the sump lines and trenches. Flush may be performed at Operation's discretion. (E. Harrison: initial performed 1-26-16: flushing is typical each iteration)

Evaluate installation of a sump liner for the trench serving the filter system that would be more resilient to acid cleaning than bare concrete and with less potential for adsorption of mercury infused solids. (A. Wiggins Complete, Attachment 1).

Filter train header draining is conducted to the sump trench via a hose. Previously the hose ended in the sump trench in the filter operating area. As of 1-22-16, the hose was extended to reach the Evaporator Sump. This has been beneficial in reducing the mercury vapors in that area of the process building. (M. Stringfield, Complete 1-22-16).

Initiate modification (MT) to sump header to remove funnels open to atmosphere (replace with check valves where needed). (J. Pateracki: MT initiated, 2-9-16, current status: On hold with design engineering)

Apply temporary wraps sealing the process area funnels. (Initial installation Complete; regular IH rounds measure Hg vapor at wrapped funnels and the nearby process areas. Wraps to be repaired as needed.) Wraps to be modified to include vent lines to prevent opening during pressure transients. (M. Stringfield: Date 6-30-16)

Perform a smoke test and flow measurements for the building process areas and based on result initiate a ventilation modification to provide air circulation through the mezzanine level at the pH adjustment and filter feed tanks. (J. Pateracki: Path Forward complete, SRNL date to perform the test pending)

Provide supplemental ventilation to evaporator area (sumps) and coverings for the sump trench serving the filter trains. (J. Titcher: Complete)

Apply mats to cover sumps and sump trenches. (J. Titcher: Complete in the Filter train area, application in the pH adjustment/RO/IX area Date 6-30-16)

3.2 Actions for Organic Removal Sump Area

Repair and rework on Organic Removal Mercury column #1 will potentially result in a discharge of mercury removal resin into the sump. Follow this activity with a clean-out of residual resin from the Organic Removal area sump. (WO#1384752 approved: 6-18-16)

OR Carbon column vent, backflush and cleaning can not be accomplished without the need of breathing air support due to the positioning of valves being over the trench and sump into which the vessels vent. Restore operation of the dewatering tank and its use to take the vent off of the carbon columns as opposed to the trench and sump

Initiate PCR to direct vent path to dewatering tank as opposed to sump. (E. Harrison:6-16-16)

Repair level instrumentation in Dewatering Tank (ETP maintenance: Date TBD)

Evaluate the addition of ventilation to push or pull mercury vapor enriched air away from the zones occupied by personnel during operations in the Organic Removal area. (E.

Harrison, date 2 weeks following completion of OR Hg Column 1 repair and sump clean out, estimated date)

Extend OR Mercury column vent hose to reduce splash when venting the vessels during cleaning. (J. Titcher, Date 6-16-16)

3.3 Actions for Evaporator Feed Tank Area

Flush out the Evaporator Feed Tank area sump. (WO#1120401 approved: 9-20-16)

3.4 Investigative Actions

Collect Samples from Organic Removal. This is a test for the conversion of elemental or ionic mercury to dimethyl mercury. (Complete: Cuno filter sample shipped and undergoing analysis. Preliminary results indicate presence of aluminum and biologic material.)

Approvals:

D. C. Baumgardner, Tank Farm and ETP Operations Facility Manager	6/15/16 Date
I. P. Amidon, Tank Farm and ETP Operations Manager	6/14/16 Date
Phillip Nowak for John Contardi per telecon J. S. Contardi, Tank Farm and ETP Engineering Manager	6/14/16 Date
M. B. Schweder, Tank Farm and ETP Industrial Hygiene	06/14/16 Date

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Pateracki, John
Wiggins, Arthur

Attachment 1

Re: Eric Help
Arthur Wiggins to: Phillip Norris
Cc: Eric Harrison
02/22/2016 07:54 AM

Here is my evaluation (I can make it more formal if you like):

Problem: Mercury vapor in excess of IH limit of 0.008 mg/m3 in the Norton filter area. Frequent acid flushes of the trench would degrade the concrete.

Cause: Primary cause appears to be draining of the filter feed header at the start of pH line out sequence. Secondary causes include leaks on the filter trains (primarily the three way backpulse valves); draining liquids from trains to sump during sampling, turbidity meters (now valved off), and vent valves?

Possible solutions: 1. Extend drain hose at end of the filter feed header all the way to the evaporator area sump (completed 1/21) - this should greatly reduce the Hg vapor released during pH line out. All readings in the filter area BZ since the hose extension (1/21/16) have been 0.001 mg/m3 or less.

2. Line the trenches with either stainless steel or some kind of acid resistant coating - difficult to do since there are pipes in the trenches that would have to be removed before lining can be done. Only needed if we intend to clean/flush the trenches with nitric acid. Using oxalic acid would be less corrosive to the concrete trench and should still provide some removal of deposits (They used to use oxalic acid to clean the trenches at TNX before tours to remove DWPF sludge simulant deposits), Recent IH Hg measurements show very low Hg vapor levels in this area, hence frequent acid flushes are not needed at this time.

3. Manifold all lines from the filter trains that go to the trenches to a single hose that would extend all the way to the evaporator sump(s). This would mitigate the accumulation of solids in the trench but would be difficult due to the number of lines involved and the tight space in the trench. An alternative may be to manifold only the major sources,

4, Fix the filter train leaks. There are already WOs out to repair the 3-way BP valves to reduce leaks.