Monsanto

FROM (NAME & LOCATION): K. E. Boucher, W. G. Krummrich Plant

DATE: May 16, 1975

SUBJECT: ELIMINATE AIR BLOWING OF CRUDE AROCLOR

REFERENCE:

cc: W. C. Engman
D. K. Lynch
J. R. Savage - B2SL

TO: G. L. Johnson
A. E. Leisy

We now have overwhelming evidence that stopping air blowing last April, 1974, significantly contributed to the failure of #2 intermediate storage tank and the blow tank demister. The intended use of an air sweep to lower the due point in the storage tank only helped to accelerate the rate of corrosion.

Air blowing was discontinued as part of our program to reduce PCB's to the sewer. Since we have resumed air blowing last January, 1975, sewer losses have not been increased.

RECOMMENDATIONS

The cause of the corrosion to #2 intermediate storage has been defined. Based on our study the following actions are recommended to:

1. Minimize future failures, and

2. provide better control over our increasing lime usage.

ACTIONS

1. Air blow both Crude 1142 and 1154. Only 1142 is now air blown.

2. After resuming air blowing of 1154, reduce lime usage for Aroclor 1254 from 200 lbs to 150 lbs of lime for every 15,000 gallons of crude.

3. Provide laboratory controls to determine if crude is properly lowered in HCl content by air blowing. The average amount of air for blowing 1142 has been lowered from 40 SCFM to 20 SCFM.

4. Provide the following engineering design changes for crude handling equipment:

   a. #1/#2 intermediate storage tanks

      (1) Provide positive N_2 blanket to exclude oxygen (air).

      (2) Neutralize crude feed prior to introduction into storage by mixing feed with circulated lined crude from storage.

      (3) Seal the storage tank from air by installing dip pipes for both the crude feed and 1-422 blow tank overflow line. Dip pipes should be within 4 feet of the tank bottoms.

DSW 329596

ACTIONS (Continued)

4. b. Continuous blow tank 1-422 (for 1142)

(1) Correct pump level control system.

(2) Have vapors go directly to blow tank demister, yet continue to allow overflow to be routed into the intermediate storage tank.

(3) Provide positive control to be assured air does actually blow through each compartment in the blow tank, provide some means of air flow alarm when air drops to a low level.

c. #2 Blow Tank (for 1154)

(1) Reroute piping to again air blow crude 1154.

(2) Get tentative amendment to allow batch chlorinations to be increased from 150°C to 190°C to reduce the amount of dissolved HCl that must be removed.

d. Initiate a research program to better understand the nature of neutralization. Dan Lynch has been contacted about this problem. Information on reaction rate, what happens to the water of neutralization and how much lime is needed are questions to be answered.

ADVANTAGES

With information now available we can control the corrosion at the storage tanks.

Corrosion in HCl, O_2, H_2O, iron system is caused by allowing the temperature of the system to drop below its due point. This due point is much higher than one calculated considering only the air-water system. This is because of the presence of $FeCl_3$, a very hygroscopic compound. Its formation is catalyzed by the presence of oxygen (air). Research references for this are in:

1. Corrosion in Reactor of the Oxidative Chlorination Unit, Research Report # 477, Plastic Division (Texas City) dated 9/8/60 by E.E. Drott, and

2. Condensation in the System HCl - H_2O - O_2 - Steel, HP/PT, Report #101 (Texas City), dated 8/24/67 by E.H. Gaure and P.W. Tidwell.

Jack Hinchen statistically correlated the date in the above references. Unpublished correlation is:

$$\frac{1}{T_K} = 0.00340 - 0.000158 \ln (P) - 0.000036 (\ln \% HCl) - 0.00011 (\ln \% H_2O) - 0.000085 (\ln O_2)$$

DSW 329597

ADVANTAGES (Cont'd)

When T_K is the due point in °K, percents are in moles and P is pressure in PSIA. Correlation usually gives T_K within $\pm$ 14°K for our system.

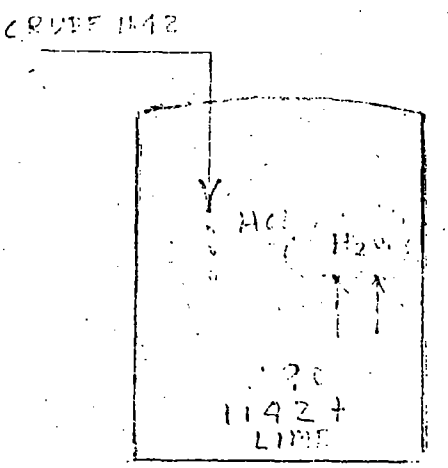
This correlation predicts the due point in crude storage could be as high as 140°C. Also Research reports that the high due points are initiated by the presence of oxygen.

Dario Cova recently published new data on the solubility of HCl in Aroclor 1242. Based on this data the department's past lime usage has barely been adequate to neutralize the unblown crude Aroclor.

Solubility of HCl in crude in terms of # lime/cwt Aroclor	0.0555 - 0.1667
Lime usage in 1975 April - December	0.20 - 0.30

Physical evidence of free HCl in the distillation system is revealed by the corrosion of the jets at #3 still for Aroclor 1254 and recent failures of the Aroclor column reflux piping.

Examination of #2 intermediate storage tank showed the feed dip pipe only extended half-way into the tank. Since crude pumped to storage is in-line contacted with lime slurry only a few seconds automatically every few minutes, most of time acidic crude is pumped directly into the storage tank allowing HCl gas to escape into the vapor space. Also, the Aroclor is at 190°C which would lead one to expect that the water of neutralization is boiled into the vapor space. You can see hydrochloric acid should usually exist in the tank when less than half full.



DSW 329598

During the last week samples of crude 1142 have been analyzed for HCl content. Two out of three samples analyzed high in acidity indicating inadequate air blowing. Based on this information the #1 intermediate storage tank may still be corroding at an accelerated rate.

Review of the lime usage since 1970 shows a steady increase from an average of 3000 #/month to 6000 #/month. Usage has increased over 2.5 times since the Aroclor column was installed in 1971. Yet corrosion which was practially unknown has been reported occurring in the crude storage tanks since 1972.

The program recommended is both intended to minimize the existing corrosion problem and help to make future reductions in lime usage. As we better understand the neutralization process, we may possibly help to improve the stability of Aroclor 1254 by this program by proper neutralizing dissolved HCl. And, if lime usage is lowered, the disposal of Montars may not continue to cause excessive downtime at the incinerator.

LIMITATIONS

This program involves both costs for making design changes while doing research on neutralization. Some of the design changes may later be altered if further improvement becomes economically desirable, based on this research work.

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