ChemScan® Process Analyzer

PROJECT REPORT AND DATA SUMMARY

ON-LINE CHROMIUM VI ANALYSIS FOR HEAT EXCHANGER LEAK DETECTION

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Project Summary
LTV Steel Tin Mill #2
Heat Exchanger Leak Detection

Introduction

The manufacturing process at this facility uses closed loop heat exchangers to remove excess heat from two locations within the process. A chromium based corrosion control treatment is used in closed loop heat exchangers. Nonpotable service water is used as the final heat sink to remove the collected heat from the heat exchanger. The service water can reach temperatures near 150ºF. The service water continuously flows from the heat exchanger to a drainage system that collects wastewater from the entire plant for pretreatment prior to ultimate discharge into the local municipal wastewater system. A leak of the chromium based corrosion treatment from the heat exchanger into the service water would result in discharge of wastewater that was potentially in violation of legal limits for chromium VI.

Previous Monitoring Strategy

Prior to installation of on-line automatic chromium analysis, the service water discharge had been manually checked for the presence of chromium in the form of chromate using a test strip. However, this manual check was a low priority event and was frequently skipped when higher priority events required attention. If makeup water was being fed to the loop in large quantities, a manual check for a chromium leak was immediately initiated. As can be surmised by this approach, the chance of catching a leak early is minimal.

Current Monitoring Strategy

A ChemScan Process Analyzer System, shown in Figure 1 is now being used by LTV for automatic chromium analysis. Figure 2 shows a functional block diagram of the system. The service water discharge line of each two heat exchange units were connected to the ChemScan Process Analyzer sample manifold using 3/16" i.d. stainless steel tubing. Two additional sample line connections on the ChemScan Analyzers are for future expansion. Stainless steel tubing was used to connect the ChemScan Process Analyzer drain to the same drain line into which the service water is discharged. Thus the samples into the ChemScan Process Analyzer are side streams from the normal discharge lines. The ChemScan Process Analyzer initiates a measurement cycle on an hourly basis to determine a chromium level in the service water discharge. More frequent analysis intervals were possible but were judged not to be necessary. The majority of the time, there is no chromium present in the service water. If chromium should be detected above a selected threshold, a dry contact will close which simultaneously activates a visual alarm and an audible alarm. The alarms remain activated until the ChemScan Process Analyzer measures a chromium level below the limit for the same sample or until the ChemScan Process Analyzer is removed from on-line operation.

The present strategy is to monitor the service water discharges hourly until an alarm condition occurs. The ChemScan Analyzer was calibrated to detect chromium VI over the range of 1.0 to 10.0 ppm, although lower detection limits were possible. A (kw) 5.0 ppm alarm limit was selected by LTV. When an alarm condition does occur, the ChemScan Process Analyzer will be manually adjusted by an operator to initiate measurement cycles in shorter intervals using a menu choice entered from the keypad on the front of the instrument. This adjusted interval can be as short as five minutes, which allows for adequate flushing of each sample line prior to measurement. This time period can be further shortened by deactivating one sample line and focusing on the contaminated sample line only, since most of the time is for sample flushing. The actual analysis, which is performed based on light absorbance measurements of the sample, requires only a few seconds.

Figure 1

Figure 2