Tracerco News

Volume 2 Edition 1 Delivering diagnostic services and measurement solutions worldwide.

Baseline Scan Data Provides a Valuable Historical Reference Point for Analysis

By Lowell Pless – *Business Development Mgr. – Scanning, Pasadena, Texas USA*

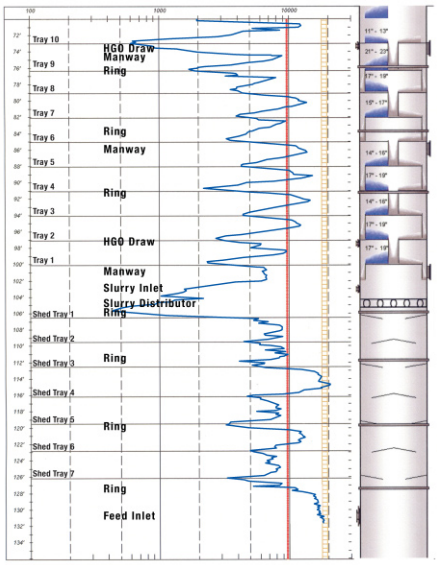

Figure 1 - *A baseline scan of the Main Fractionator indicated that start-up had gone smoothly with all trays present and holding suitable levels of liquid.*

Baseline scans provide a valuable reference that can be used to identify and monitor operating performance in a column over time. A baseline scan establishes a reference point, a historical marker for column performance. The baseline scan should be performed when the column is clean, known to be in good mechanical shape, and operating with no known problems. A baseline scan of a distillation column eliminates uncertainty on future column scans, and enhances their accuracy and sensitivity allowing more subtle operational changes to be determined.

Imagine for a moment a new engineer has started working in a unit. They look at the Column ΔP and comment, "The ΔP ***seems*** high and the column separation is marginal but on spec. The unit rates are a bit high so I guess that's what I would expect." However you have been monitoring this ΔP for months. You're aware that the ΔP has been gradually increasing and are becoming alarmed about what may be going on within the vessel.

You request a column scan from Tracerco. The Column has never been scanned before. Therefore we are in a similar position to the new engineer. Tracerco field personnel would normally not have the perspective of knowing the column history so unless the scan results show a dramatic problem, like some localized flooding, we may not be able to pinpoint the exact nature of the problem.

For example, a trayed column may operate with moderate-to-severe entrainment and be in spec; or a packed column may operate with some degree of liquid maldistribution and still meet product specifications. But on a "first-view" of a column we would be remiss if we did not point out these things as potential problems.

Continued on page 3

Isolate *Mystery* Flare Flow and Reduce Flow Rate Measurement Errors

TRACERCO Diagnostics™ Flow study technology offers a rapid, accurate, and cost effective method of determining flows of gas, water, and organic based materials. Flare gas flow measurement is a critical activity in chemical plants and refineries, but is often overlooked. Many devices exist to measure flare gas flow; some are simple and others complex; some are easy to operate, while others need regular attention. Each design has its own degree of accuracy, which is usually associated with cost.

Today's flare systems must also minimize smoke, odor, noise, light and burning liquid. Loss of process material to the flare can cost a refinery or chemical plant millions of dollars each year in profits and environmental costs. Flare systems can either have continuous or intermittent flow, even though process conditions are normal or stable. If the flare does not properly incinerate the material that is contributing to the flare flow, it quickly becomes "fugitive flow" or a source of a fugitive emission. Virtually any relieving device can

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Locate Leaks in Waste Heat Boilers to Minimize Downtime

By Dave Ferguson – *Business Development Manager – Tracers, Pasadena, Texas USA*

Tracerco offers several online techniques that can be used to obtain information about the performance of heat exchangers, condensers, and reboilers. Often operations will see evidence of a leak, such as a drop in process efficiency or the presence of a contaminant in their product. Tracerco's on-line radiotracer technology involves injecting liquid, solid, or gas radioisotopes or chemical tracers directly into the process to provide real-time data. Sensitive, externally placed detectors monitor the flow of tracer material (Figure 7) from heat exchangers, condensers, and reboilers.

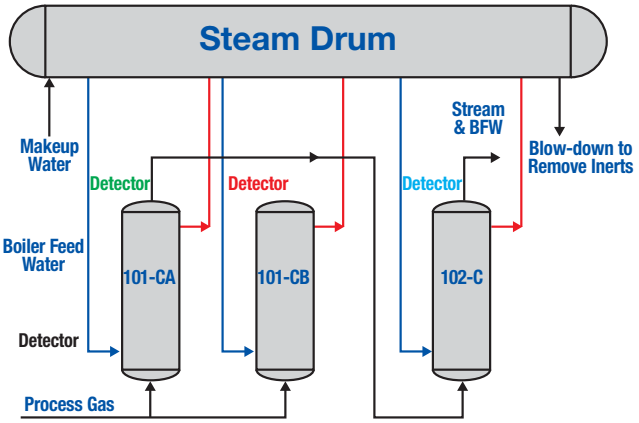

Figure 7 - *Detector placement for TRACERCO Diagnostics™ Leak Study on a WHB.*

Depending on the path the tracer material take in the process flow can determine the location and size of leaks. Sometimes the leak is too small for external detectors to detect it or the tracer must change phase from steam to aqueous liquid. In those specific cases, tritiated water is the tracer of choice. Tritiated water will vaporize when injected into a steam line and leak with the steam. If the steam condenses and exits with the bottoms product, the tracer will also. If the steam is carried overhead and condenses in the condenser, then the tracer will do the same.

Waste heat boilers (WHB) present a special problem in that the tracer is carried by the Boiler Feed Water (BFW), which would leak into a hot gas stream. WHB are tested by injecting a dissolved ionic salt into the steam drum. (Figure 7)

The tracer will disperse into the whole BFW system. In the WHB where the water leaks the tracer material, being ionic in nature, will absorb on the tube walls and exit piping as the BFW flashes in the hot gas. Because the tracer in the BFW will produce significant background radiation, the test relies on the fact that the BFW is typically blown down from the system at the rate of 5 to 10% per hour. This blow down removes the tracer from the BFW, leaving only "leaked" tracer behind on the tubes.

These results illustrated in Figure 8 show that the response of the detectors on the BFW line and on two of the three WHB was constant. The 101-CB exchanger, however, had a slower rate of decline, due to the deposition of the tracer on the process side of the exchanger. This was determined to be the leaking WHB.

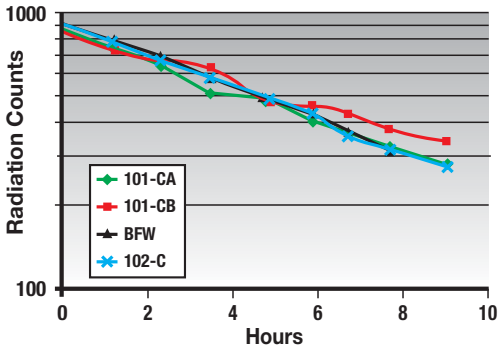

Figure 8 - *Test results indicated that the 101-CB exchanger had a slower rate of decay.*

Case Study 2

A customer had converted an old box-fired heater into a WHB by sealing the box and piping in hot process gas. BFW passed through the tubes. A leak of the BFW was suspected. Water soluble tracer was injected into the BFW. Readings were taken at three positions along both sides of the box and on the process outlet line (Figure 9).

The results showed that tracer was accumulating on the inlet end of the box at position 2A (Figure 10). Tracer did not accumulate anywhere else. When the customer opened the box, he found that one of the tubes on the outer wall of the box had split, spraying water toward the interior. But all of the water flashed quickly and the tracer stuck to the inside of the box and on the outside of the adjacent tubes within 5 feet of the split tube.

Once A **TRACERCO Diagnostics™** Leak study provides plant personnel with the information to diagnosis their problem, they will have the confidence needed to take corrective action to alleviate the problem.

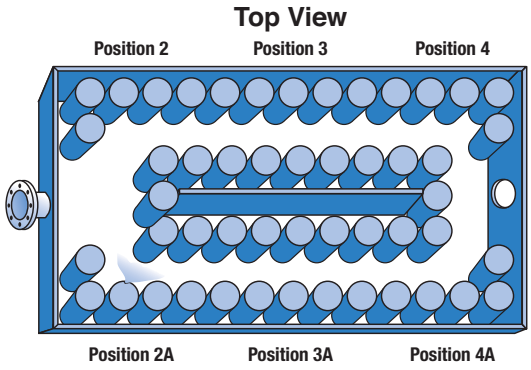

Figure 9 - *Top View illustration of detector placements.*

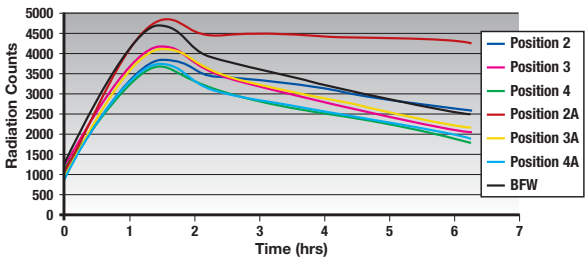

Figure 10 - *Results indicated tracer was accumulating on the inlet end of the box at position 2A.*

Baseline Scan

(Continued from page 1)

However, with a baseline scan in either of these situations we would have historical reference data allowing us to know that the degree of entrainment seen from a scan is the same or it has increased, perhaps as a result of fouling; or the liquid maldistribution is the same or it has worsened since the time of the baseline scan. These more defined results show what has changed with the column operation, moving us closer to resolving the problem or confirming that there is no new hydraulic issue inside the column meaning the problem lies elsewhere.

Baseline Scan Case Study

In December 2005 a Refiner had finished a mini-turnaround in their FCC Unit. The mini-turnaround had largely been unplanned since the FCC Main Fractionator had become inoperable due to flooding. Upon entry into the column some lower trays and the disc-n-donut trays had been coked. The disc-n-donut trays were replaced with shed trays and the rest of the column was cleaned. The customer contacted Tracerco to conduct a baseline scan first to determine if the startup had proceeded without incident with no tray damage or other problems present, and to document the hydraulic operation of the column for future reference particularly with regard to monitoring any coke buildup. The refinery planned to scan the Main Fractionator periodically to monitor for coke buildup so they could better plan any needed shutdown for cleaning rather than having it "forced" upon them.

The baseline scan results for the lower section of the Main Fractionator are shown in Figure 1, page 1. Fortunately the scan showed that the startup had proceeded smoothly as all trays were present and holding suitable levels of liquid. The trays appeared to be operating with moderate-to-severe entrainment but this would be considered "normal" or acceptable mode of operation and not cause undue alarm when seen on future scans. The most important benefit from the scans however was the documentation of the scan response from the insulation support rings. A couple of trays, Trays 4 and 9, appeared more dense than the other trays but this was now documented being due to the presence of the support rings and not falsely due to any presence of coking.

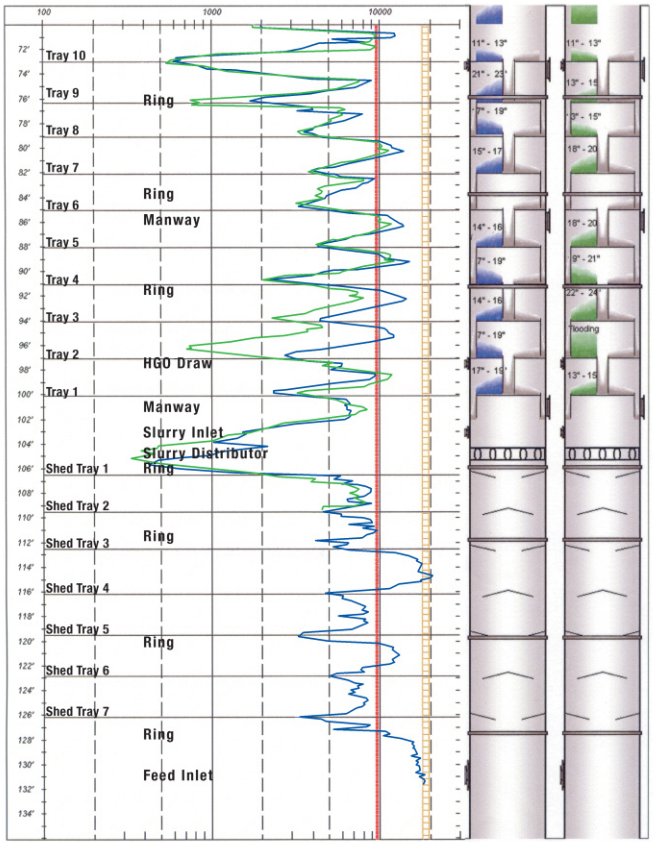

Figure 2 - *When compared to the baseline scan a second scan of the Main Frationator indicated Trays 2 and 3 showed observable differences in the liquid level on these trays.*

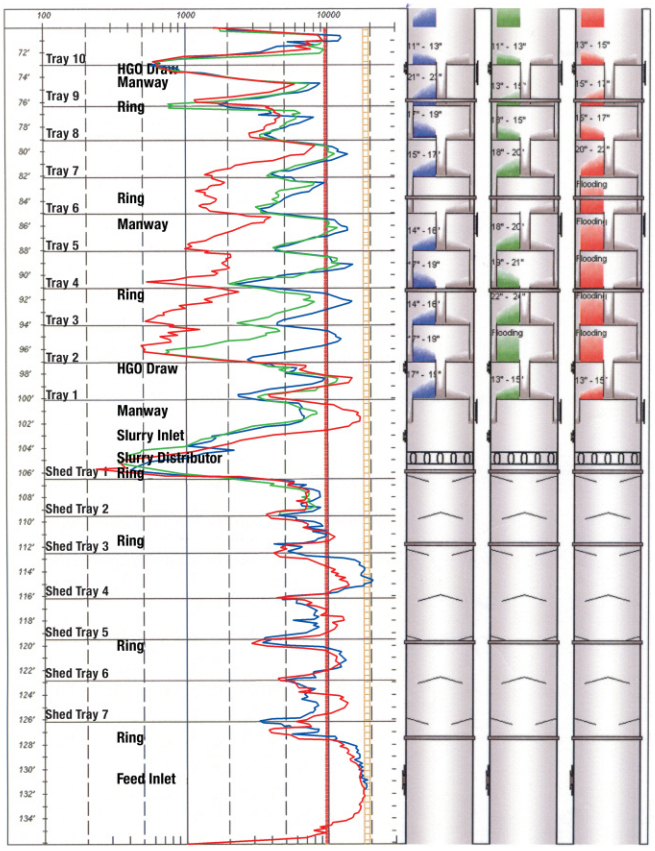

Figure 3 - *Comparing scan results from January 07 to the June and December 06 scans indicated that flooding had increased from Tray 2 in June 06 to Trays 2 - 7.*

Six months later another scan was performed to verify the operating condition of the FCC Main Fractionator. The column was still operating well with no symptoms of problems but it was decided to scan to be sure there was no indication of coking. The results of this scan are shown in Figure 2 along with the baseline profile obtained earlier. This scan showed observable differences with Trays 2 and 3. Previously the baseline scan showed Tray 2 holding 17 – 19 inches of liquid; now Tray 2 was flooding. Tray 3 had been holding 14 – 16 inches of liquid; now Tray 3 was holding 22 – 24 inches. Other than these differences the results showed that the Main Fractionator was mostly in the same condition as when the column was scanned previously. Since it was known from the baseline scan what Trays 2 and 3 looked like under normal conditions then this amount of liquid could be concluded with certainty as excess liquid building up on Tray 2, most likely from the formation of coke.

After another seven months the column was scanned again to monitor the column's

Continued on page 6

Gas Flow

(Continued from page 1)

contribute to fugitive emissions or flare flow.

Chemical plants and refineries have relief valves and rupture disks scattered all over their sites. Flare and relief devices are primarily installed to prevent injury to personnel and damage to equipment.

TRACERCO Diagnostics™ Flow study technology is used to identify fugitive flow in a flare system by injecting a tracer material into the flare line and placing sensitive detection devices externally on the piping to monitor the tracer's position and movement. Flow rate measurements through sections of the flare piping system are performed in strategic locations to detect and isolate the sources of fugitive flow. Once it is determined which unit(s) are contributing to the flare flow, each PSV, block valve or relief valve can also be individually tested to determine which is leaking.

CASE STUDY - Costs of "Flare Flow"

As well as isolating where the flare flow is coming from, Tracerco's flow measuring capability also determines the volume, and thus the value of the material being lost to the flare.

A refinery with nine units tying into their flare system, estimated they were losing 7.5 MMscfd of natural gas. The flare recovery system was able to recover most of this release, until the summer when losses increased as temperatures started to rise. Operations decided to perform an integrity audit on their flare systems, which included performing a **TRACERCO Diagnostics™** Flow study. Unknown flare flows were measured in six of the nine piping systems equaling a net loss of 6MMscfd of fuel gas. Repairs were made to the leaking PSV's and other valves. Additionally, fouled equipment was cleaned to minimize the risk of higher than normal operating pressures.

Follow-up flow studies were performed after the repairs. Of the remaining 1.5 MMscfd, 500,000 scfd was measured and accounted for from three units. Based upon the heating value of fuel gas and market prices at that time, the refinery losses would have exceeded $5.5 million if the unknown flare flows had been left undetected and uncorrected.

Reduce Gas Flow Rate Measurement Errors

Errors of gas flow rate measurement in industry can result from actual operating conditions, meter installation errors, or degradation of meter performance over time. An on-site (in-situ) gas meter proving method is the best way to reduce these errors, especially for large diameter pipelines in natural gas transmission and refinery flare systems.

A new and convenient gas meter proving method, based on the tracer pulse velocity technique, has been developed and demonstrated by Tracerco on a commercial scale pipeline metering facility. The tracer technology was tested on 4-in and 12-in natural gas pipelines at seven gas flow velocities ranging between 1-122 ft/s. The average difference was less than 1%, compared with the reference velocity of NIST-traceable mass flow rate.

With the new method a small amount of radioactive isotope is injected into the upstream pipeline, and one or more pairs of radiation detectors are placed along the line to measure the tracer time of flight, from which the gas velocity can be calculated. Different from liquid flow, gas flow frequently involves faster linear rates, shorter transit times and significant velocity changes between the measurement points. Properly designed procedures for the signal capture and analysis plays an important role in the meter proving accuracy and repeatability.

Case study: Proving the gas flow measurements on a large-scale refinery flare pipeline

A refinery flare line had an ultrasonic meter, but it was showing higher than expected flow. Instrument personnel had checked it out, but could not find any faults. The Process Engineer decided to measure the flow at two conditions to verify the meter.

A ¾ inch nozzle on top of the flare line 4.5 feet downstream of the flow meter was used as the tracer injection point. The flare line was a 48-inch ID line. Detectors were positioned downstream of the injection point. (Figure 4).

Three injections of tracer were made into the flare line at normal operating condition. Operations personnel then opened a fuel gas line to the flare to increase the flow for a second velocity. The results are shown in Figure 5.

The meter was reading 4.3 ft/sec for the first velocity measurement. The first average velocity measured 4.39 ft/sec. The second average velocity was measured at 9.84 ft/sec. The data showed that the meter was reading correctly. The

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Configuration for Flare Flow Measurement

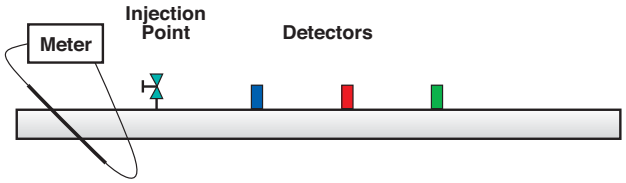

Figure 4 *Illustrates the placement of detectors that are mounted externally on the pipe and placed downstream of the injection point.*

Flow Flare Results

Velocity (ft/sec)	Velocity (ft/sec)	Velocity (ft/sec)	Velocity (ft/sec)		
1st Injection	2nd Injection	3rd Injection	Average	1 std dev	% Error
4.33	4.44	4.41	4.39	0.04	0.96
9.88	9.69	9.94	9.84	0.10	0.99

Figure 5 *Results from the flare study when operations opened a fuel gas line to the flare to increase flow for the second velocity.*

Gas Flow

Continued from page 4

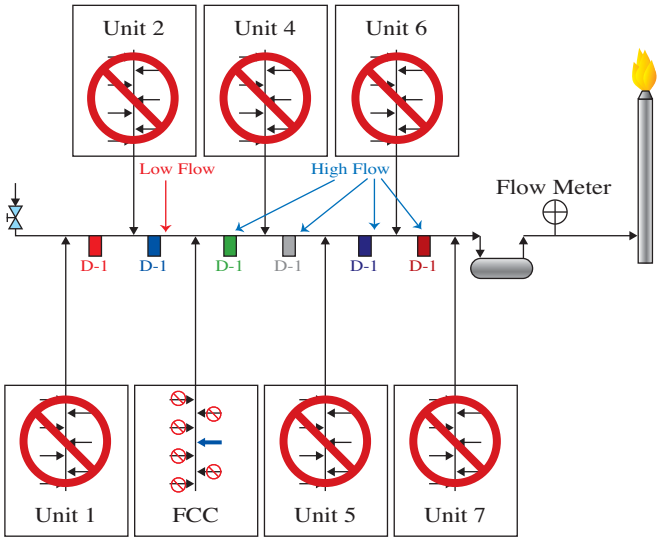

Figure 6 - *Flow studies were performed through several portions of the flare line to isolate which unit contained a leak.*

normal flow, however, should have been closer to 1 ft/sec. These results indicated that there was a leak of gas somewhere into the flare system.

To locate the leak, flow was measured through several portions of the flare line to isolate which unit had the mystery flow. The FCC Unit was found guilty. Measuring flows in the FCC Unit flare line identified a leaking PSV on the Main Fractionator as the culprit.

Conclusion

Whether you want to isolate where flare flow is coming from within your flare line system, verify and calibrate meters, or need **an independent verification** that data reported for environmental purposes is correct, **TRACERCO Diagnostics™** Flow study technology can provide you with all the information you need. Tracerco has offices strategically placed worldwide to provide our customers with the latest technologies for process optimization. Please contact a Tracerco representative in your area if you have any questions on how to isolate mystery flare flows and reduce flow rate measurement errors.

Tracerco Featured Product

The TRACERCO Profiler™ for Desalter Optimization

- Provides operators the position (height) of each phase in real time and determines the quality of each interface.
- This information gives the operator confidence to increase fluid throughput and minimize the use of various separation enhancement chemicals, and to automatically control interface levels within a DCS system.
- Eliminate process upsets resulting from water carry over or oil carry under from the desalter vessel.

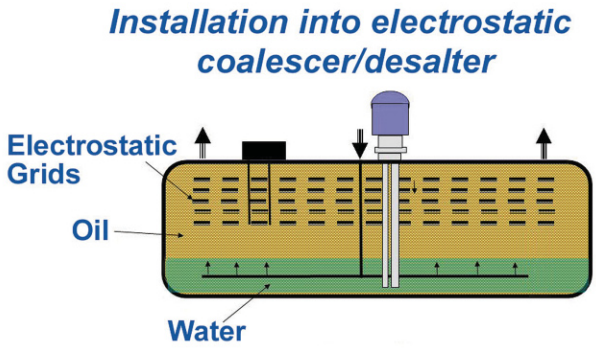

*Illustration of **The TRACERCO Profiler™** housed in dip-pipes and installed within a vessel through a single flange.*

The TRACERCO Profiler™ measures the vertical distribution of phases contained in desalter vessels and is designed to withstand the elevated operating temperatures typically experienced within a desalter.

Within many refineries, there is a growing tendency to process heavier crudes or blend these into lighter feedstocks. During crude oil refining it is advantageous to optimize the blend to reduce overall feedstock costs while at the same time ensuring the final mix can be adequately processed with minimal upset. One of the fundamental needs is the efficient separation of water from the crude using a desalter after water washing the feedstock to reduce salt levels.

The vertical measurement of the various phases in the desalter provides real time information on the extent of inter-phase mixing that can be monitored to optimize fluid throughput while providing cost savings on chemical additives. The instrument is non-contact, has no moving parts and requires minimal maintenance. The results of adding chemicals can be visualized immediately in the control room so that the effectiveness of their addition can be monitored and appropriate action taken. Benefits of using **The TRACERCO Profiler™** has provided rapid payback in refinery desalter applications.

If you would like to learn more about **The TRACERCO Profiler™** for desalters please contact one of our Tracerco technical advisors in your area.

Baseline Scan

Continued from page 3

condition. An increase in ΔP had been observed and Operations and Maintenance needed to know the extent of flooding so they could begin preparations for a shutdown. Figure 3 shows the scan results compared to the baseline data and the previous scan.

This scan showed the column's operation was definitely worse. The flooding had increased from just affecting Tray 2 seven months ago to now flooding Trays 2 through 7. At this point the rate of trays succumbing to the flooding would likely increase so a shutdown was needed as soon as possible to rectify this situation. But now the refinery personnel were aware of the "approaching storm" and had time to plan, organize, and execute a solution before the "storm" hit.

Conclusion

The practice of establishing baseline data enhances the quality of all future scan interpretations. With baseline results to refer to, our skilled professionals can detect very subtle changes in a process column with either trays or packing. A baseline scan is most effective when the column has been entered recently and the condition of internal hardware has been documented in the form of mechanical inspection reports and photographs. The value of baseline scans are further enhanced when the material balance and operating details are documented in conjunction with the scan results. Additional information, such as simulations, the performance of auxiliary equipment, and the ratings on trays, packing, or distributors may also be useful at a later date. Baseline scans can also be used to evaluate the effects of tower revamps, and to document the start-up of a column.

Your Input is What Helps Make Tracerco an Industry Leader

Tracerco recognizes that customer input is valuable information for the research and development of our products and services. Since June 2006 Tracerco has distributed 4 issues of Tracerco News worldwide to keep you informed of new technologies, valuable news and real life case histories for the Refining, Petrochemical and Gas Processing industries.

We would like to request your input to help us improve on the content of featured articles and the appearance of our newsletter. Could you please take a few minutes to go on-line at www.tracerco.com to answer our survey questions or you can complete the attached postcard survey in this issue of Tracerco News.

Thank you for taking the time to complete our survey, we value your opinion.

Cordially yours,

Margaret Bletsch
Marketing Specialist
Pasadena, Tx, USA

Johnson Matthey wins Chemical Industry Awards Company of the Year

By Nicola Porter – *Tracerco, Billingham, UK*

Chemical businesses that have achieved excellence in 2007 were celebrated at the Chemical Industry Awards Dinner held in York. The awards, run by the Chemical Industries Association, are the premier accolades for the UK Chemical Industry.

Johnson Matthey in Royston, UK was awarded this honor. They were selected for their leading global and UK position in their chosen businesses, their financial and technological strength and their record of sustained growth. The judges believe that Johnson Matthey demonstrated both inside and outside the chemical industry that they are the company others aspire to follow. Across the board in manufacturing, product stewardship, human resources and sustainable development they have demonstrated excellence in performance and prospects for the future.

Steve Elliott, Chemical Industries Association Chief Executive, said, "I am delighted Johnson Matthey has won the Company of the Year Award. Their credentials are outstanding and they are held in exceptionally high regard as an employer and investment opportunity."

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Tracerco

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1=Unacceptable 2=Poor 3=Satisfactory 4=Good 5=Excellent

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