Tracerco News

Volume 2 Edition 2

Delivering Precision Diagnostics Worldwide.

When Things Go "BUMP" In the Night (or Day) – Tru-Grid™ Scans Assist in Assessing Any Mechanical Damage

By Lowell Pless, *Business Development Mgr. — Sealed Source Technologies, Pasadena, Texas USA*

One of the more unfortunate events that process plant operators and support people face is an unexpected pressure surge. Whether the surge affects an entire plant, a unit or a single piece of equipment, assessing the physical condition afterwards can be a challenge. Recently a customer contacted Tracerco regarding an acid solvent recovery column. Since a pressure surge it had been experiencing poor recovery efficiency. Operations suspected damage caused from the pressure surge and they needed to confirm the extent of damage or find what other problem may exist.

This particular column was packed with two beds of random ceramic saddles. During upsets or pressure swings this type of ceramic packing can dislocate, compressing and crushing some of the packing. Alternatively liquid distributors, bed supports, and other internals can be dislocated or damaged preventing them from performing as they should.

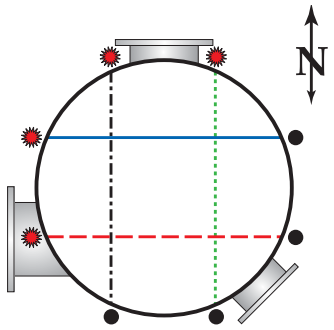

Figure 1 *A Tru-Grid™ Scan illustration of a series of four conventional column scans performed in a 2 x 2 orthogonal grid.*

A Tracerco Tru-Grid™ Scan was performed to verify that the beds and distributors were in place and to identify any problem before entering the column. A Tru-Grid™ Scan is a series of four conventional column scans, performed in a 2 x 2 orthogonal grid orientation as shown in Figure 1. Using this approach, the individual scanline chords are of equal length. With regard to liquid distribution through packed beds, the objective of a Tru-Grid™ Scan is to measure the degree of bias (or coincidence) between the four scans. If non-uniformity is detected between these this confirms bulk density differences that is usually attributed to an imbalance in liquid traffic. A Tru-Grid™ Scan can also show discrepancies in the liquid level on plate-type distributors, liquid overflowing vapor risers on distributor and chimney trays, or disparities in irrigation rates for spray-type distributors. It can also detect evidence of fouling and crushed or corroded packing which often results in flow distribution problems. Collapsed beds, displaced packing, flooding and foaming are other anomalies readily detectable by using a Tru-Grid™ Scan.

Damage to packed beds within columns can be detected by noting discrepancies in bed heights versus reference drawings, gross differences in

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Benefits of a Tru-Grid™ Scan

- Verify placement of packed beds and distributors
- Evaluate the quality of liquid phase distribution
- Detect problems such as fouled or crushed packing, overflowing distributors and collector trays, flooding, foaming, or vapor-induced maldistribution

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A Cost Effective Technique Used to Pinpoint Moisture Under Insulation (MUI) on Industrial Process Systems Before It's Too Late!

Benefits of TRACERCO Diagnostics™ MUI technology include:

- Detection of moisture under insulation without any preparatory work
- No destruction of integrity of insulation during the measurement process
- No interference from normal processing operations
- Can identify the precursor to corrosion before corrosion takes effect
- Eliminates the need to remove insulation from the vessel or pipeline

Prevention of Corrosion Under Insulation (CUI) is a major concern in today's process industries. The presence of CUI can lead to catastrophic failure of vessels, pipe work and transfer pipelines that can result in environmental discharge, explosion or harm to workers or members of the general public. It is therefore essential that an effective CUI inspection program is implemented as part of a process plant preventative maintenance schedule. However, traditional techniques employed tend to measure actual corrosion presence rather than moisture that acts as the pre-cursor to metal work degradation.

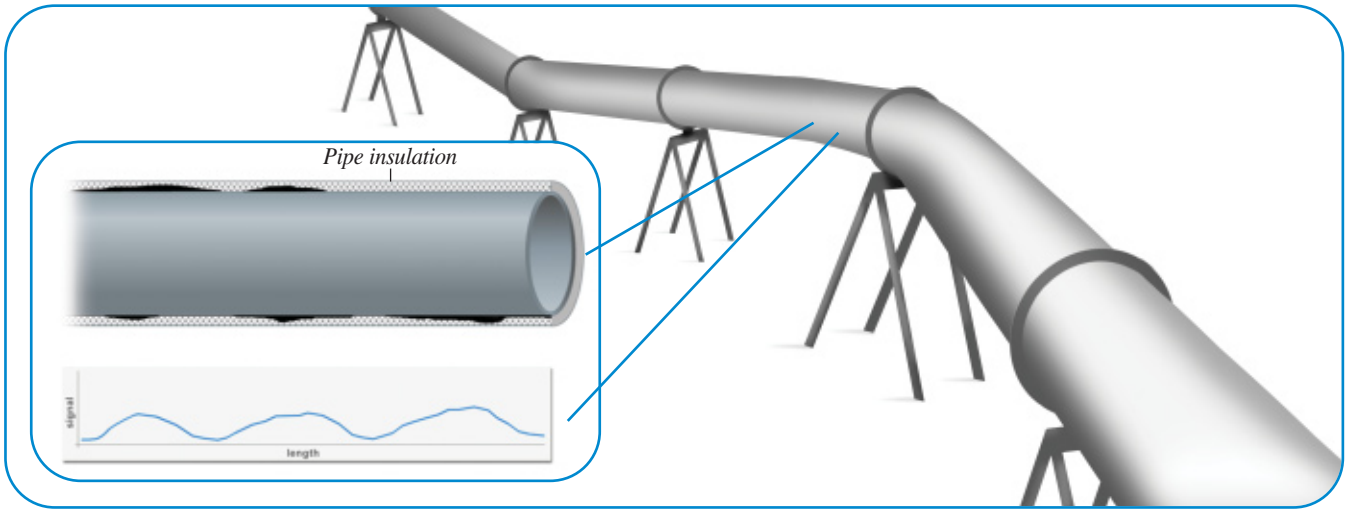
Working closely with a large refinery operator experiencing significant issues with CUI Tracerco has developed a non-intrusive measurement technology that is able to identify the presence of moisture in insulation that can be used on a wide range of process vessels and transfer lines.

A TRACERCO Diagnostics™ MUI Scan responds specifically to moisture presence within insulation. It can very quickly identify wet insulation that may lead to corrosion and ultimate failure of plant vessels and pipe work. The technique has been developed so that there is no requirement to remove any part of the insulation prior to measurement.

The service is carried out by a highly trained Tracerco field technologist using portable field equipment. The service has been designed to provide instantaneous results, allowing our field technologists to immediately identify sections of insulation containing moisture that can be quickly repaired or further measurements carried out to determine whether CUI has occurred.

The technique can determine the presence of moisture under insulation on any number of critical process and operational items while on-stream including:

- storage tanks
- separator vessels
- heat exchangers
- pipelines
- distillation columns
- reactors



Things Go "BUMP"

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bed density from one packing elevation to another, lower than expected liquid heights on distributors or liquid maldistribution.

The Revelation

Based on the Top Bed scan results (Figure 2) the top liquid distributor was shown to be holding approximately 24 inches of dense material and was operating in a flooded condition and/or had packing resting on the distributor tray.

30 inches of packing appeared to be missing from the top portion of the upper bed which could be due to lack of packing elements installed or displaced packing that was blown up onto the top liquid distributor. This bed was also operating with poor liquid distribution with liquid channeling through the south quadrant and liquid deficiency through the east quadrant.

The space between the bottom of the top bed and the liquid distributor above the lower bed should have shown a clear vapor space if all was well with the column. Instead this space was very dense with either liquid and/or packing material, especially in the eastern quadrant of the column. This could indicate a breach in the eastern portion of the top bed support that would have caused packing to collapse onto the distributor.

10 to 18 inches of packing appeared to be missing from the top portion of the bottom bed and the top of the packing was uneven with 10 to 12 inches missing in the southwest quadrants and 16 to 18 inches missing in the northeast quadrants (Figure 3). This missing material could indicate displaced packing that could have been blown up onto the bottom liquid distributor. The bed was also operating with a slight density gradient with more-dense material in the lower portion compared to the top indicating crushed or settled packing or fouling in the lower portion of the bed. The liquid distribution through this bed was fair-to-good in the top half but was worse in the bottom half of the bed.

Customers Conclusion:

After reviewing the scan results the customer entered the column a few weeks after the scan to make repairs. They found that the top bed hold down plate was missing so packing from the top bed had been carried up onto the top liquid distributor. This caused the top distributor to appear flooded. The top hold down grid for the top bed was found buried in the lower portion of the packing. The bottom support grid for the top bed was still in place so no packing from the top bed had collapsed onto the bottom liquid distributor.

Like the top bed, the hold down plate for the bottom bed was not in place so packing had carried up from the bottom bed onto the bottom liquid distributor. This accounted for the high density in the vapor space between the top bed and the bottom

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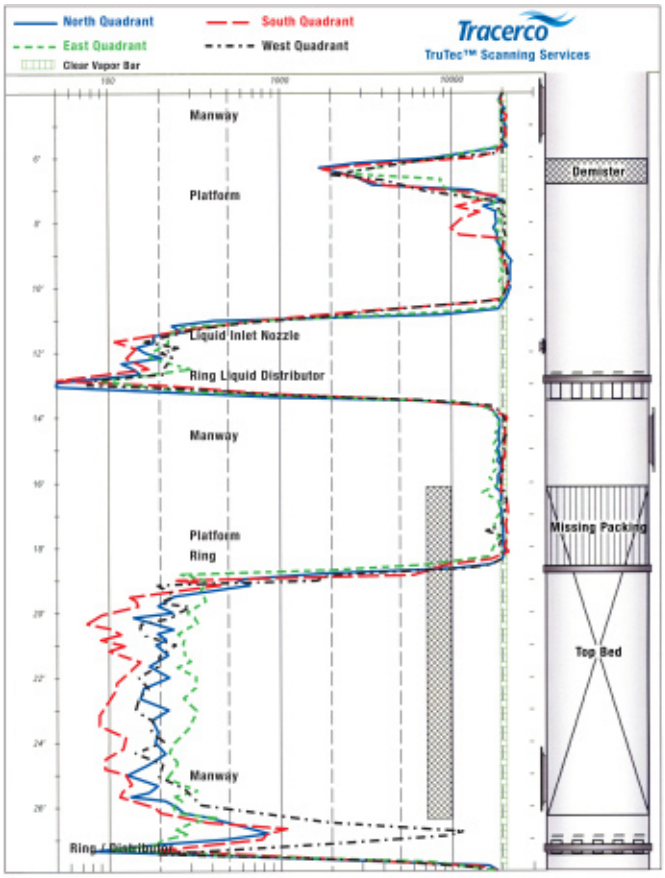

Figure 2 *Scan results indicated the top liquid distributor was holding approximately 24 inches of dense material and operating in a flooded condition and/or had packing resting on the distributor tray.*

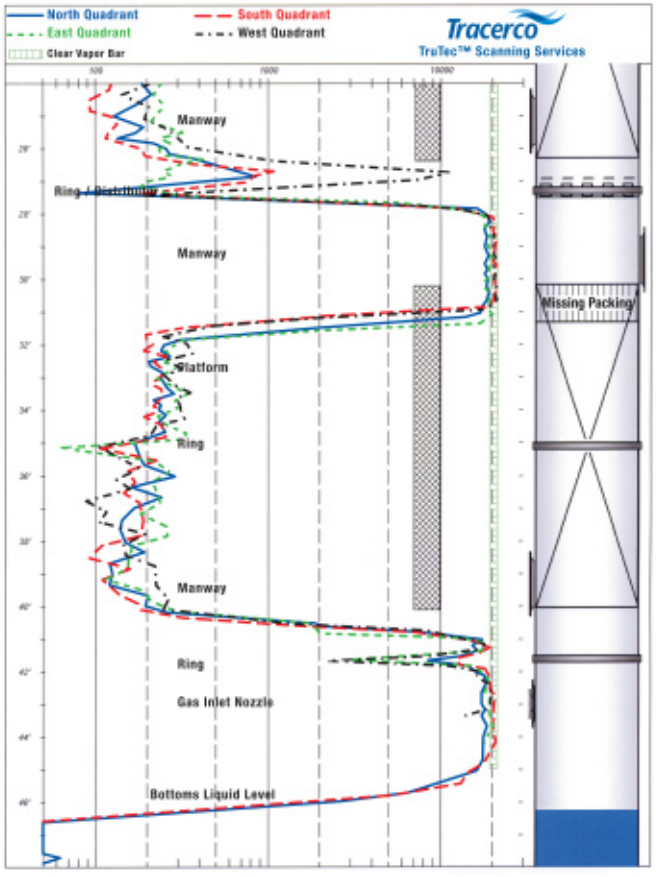

Figure 3 *The bottom bed was missing 10 to 18 inches of packing and the top of the packing was unlevel with 10-12 inches missing in the southwest quadrants and 16-18 inches missing in the northeast quadrants.*

Things Go "BUMP"

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liquid distributor instead of a top bed collapse. The hold down grid for the bottom bed was buried in an almost vertical position in the lower portion of the packing.

After all repairs were complete and the column restarted, the customer requested a baseline scan. The baseline scan results can be viewed in Figure 4.

The baseline scan indicated that all internals remained in their proper places during startup and both beds were operating with fairly good liquid distribution. The baseline information will provide invaluable reference data for future troubleshooting scans.

The application of a Tracerco Tru-Grid™ Scan allowed confirmation to the customer that significant packed bed displacement had occurred and pinpointed those areas of most concern. This allowed the customer to verify that a shutdown was necessary, understand the areas within the column of most concern and prepare equipment and field services for the necessary repairs in advance minimizing down-time at the site. If you would like to learn more about this technology or schedule a presentation highlighting Tracerco's non-intrusive diagnostic services please contact a representative in your area.

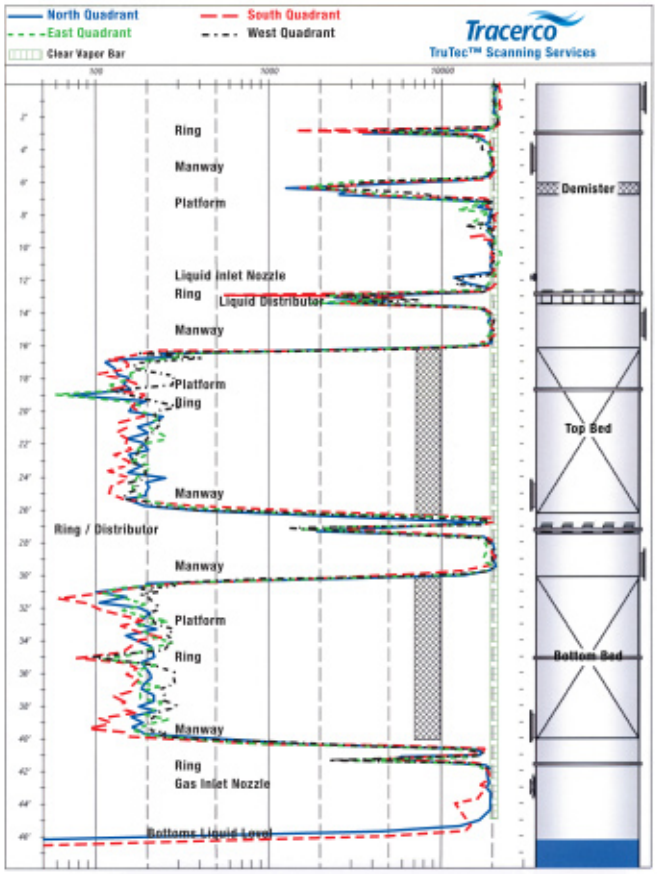

Figure 4 *A baseline scan was performed following repairs to the column which indicated that all the internals remained in their proper places during startup.*

Assist with the Control of Liquid and Interface Levels in Highly-Corrosive Systems

Due to the nature of the highly corrosive contents such as a refinery alkylation unit careful consideration must be given to selection of an instrument to measure liquid level and interface between two immiscible phases.

The instrument selected must be reliable, as maintenance free as possible and ideally non-contact with the fluids to minimize potential leak points.

The TRACERCO™ Smart Interface gauge and TRACERCO™ Smart Level gauge are two instruments that meet the above criteria and are commonly used in alkylation process level control applications.

The technology provides real time data, no moving or wetted parts, leading to reduced maintenance and high reliability. The instrument is externally mounted and intrinsically safe / explosion proof.

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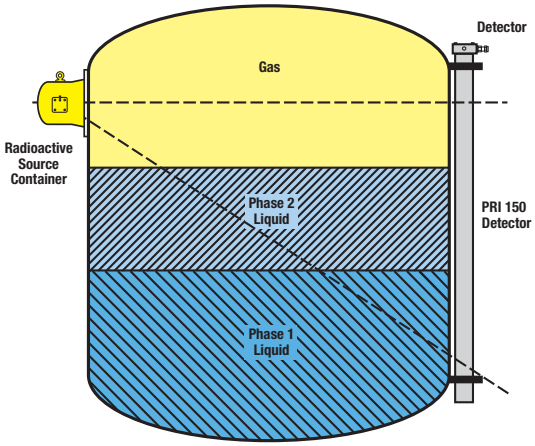

Figure 5 *Typical TRACERCO™ Level gauge arrangement.*

TRACERCO™ Smart Level gauge – Liquid Level Measurement

Advanced features utilizing HART™ technology to enable accurate and reliable level detection, including;

- Automatic correction for radioactive source decay
- Automatic correction for changes in vessel operating pressure
- Linear, table and logarithmic linearization options for level correction
- Extensive self-checking and error reporting facilities
- HART™ Digital Interface

Assist with Control

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Liquid Level Measurement

In the case of liquid level measurement a nuclear gauge is designed with a small radioactive source on one side of a vessel that is housed in a shielded container. The container is designed such that it emits a fan beam of electromagnetic radiation across the vertical length of measurement range required. On the opposite side of the vessel a sensitive detector is positioned within the fan beam. In the case of a TRACERCO™ Level gauge, the detector will be positioned in a vertical orientation across the span of level range required. If a level alarm is used this will be positioned in a horizontal position at a specific vertical height. Figure 5 (page 4) shows a typical arrangement for a level gauge.

When the vessel is empty the electromagnetic radiation penetrates the vessel wall, across the inside of the vessel and through the other wall providing a small radiation signal at the detector.

In the case of proportional level measurement, as the level of liquid in the vessel rises above the minimum, it reduces the amount of radiation reaching the detector over an increasing length of the vertical range. This causes a decrease in detector count rate. Using calibration data recorded within the instrument the detector response is directly proportional to liquid level within the vessel. The detector response is converted to a 4-20 mA and / or digital signal and relayed to a control system.

Alarms allow high or low level liquid positions to be detected. In the case of a high level alarm the detector will measure a specific radiation signal when vapor is present between the vertical position of the radiation source and the detector position. As the liquid level reaches this vertical point the radiation is attenuated to background radiation levels. At this point, the detector can be used to send a warning signal to the control room (High Level Alarm) or actually trip a process activity. In the case of a low level this acts in the opposite manner. When liquid level covers the radiation signal between source and detector the radiation reaching the detector is at background levels. When the liquid level falls below this point there is a rapid increase in radiation reaching the detector. In much the same way as the high level system, the detector will send a warning signal to the control room (Low Level Alarm) or actually trip the process activity.

In the case of nuclear gauge alarms it is very easy to test the systems on a regular basis. In the case of high level alarm testing the operator simply has to shut off the radiation using the shutter located on the shield. With zero radiation emitted from the shield, the alarm will act as if liquid level has reached the alarm set point and will trip. In the case of a low level alarm a small radiation test source can be manually positioned close to the detector. The increase in radiation signal acts in the same manner as if liquid level has fallen in the vessel and a low level condition has occurred. Due to the very sensitive detectors used, the test radioactive source is very small and will cause no safety concerns to process operators.

Finally, in order to minimize radiation source use, it is common within an instrument design to use one source of radiation and position a proportional level gauge across the measurement span together with critical alarm detectors at alarm and trip points. All of the detectors utilize the same radiation source.

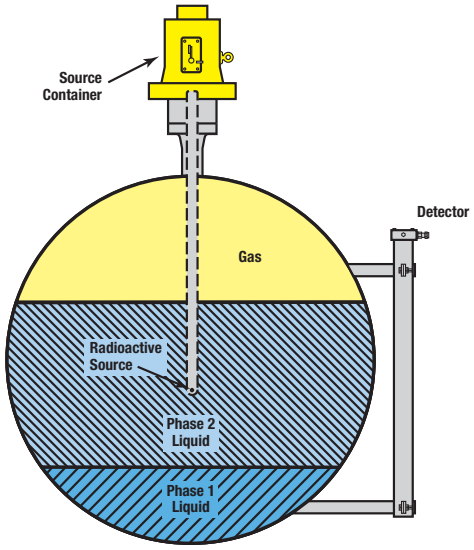

Figure 6 *Typical TRACERCO™ Smart Interface gauge arrangement.*

TRACERCO™ Smart Interface gauge – Liquid Interface Measurement

Key features that differentiate the TRACERCO™ Smart Interface gauge from other industrial level gauges;

- Provides real-time, in vessel measurements
- It has no moving or wetted parts, leading to reduced maintenance and high reliability
- Externally mounted detectors allowing it to cope with harsh process conditions, fluids or solids
- Intrinsically safe, allowing it to be used in Zones 0, 1 and 2 hazardous areas

Liquid Interface Measurement

The TRACERCO™ Smart Interface gauge, uses a small radioactive source that is mounted internally through a 2" nozzle using a sealed 1" pipe that looks similar to a thermowell. The radioactive source is transferred from the shield external to the vessel to the end of the pipe inside the vessel. An external radiation detector is located on the outside of the vessel close by the internal pipe. The source is designed so that it can be pulled through the pipe and back into the shield. This allows the vessel to be entered with no safety concerns. Figure 6 shows a typical arrangement.

In the case of a proportional

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Assist with Control

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interface level measurement the radiation signal passes through the 1" pipe wall, liquid and vessel wall before reaching the detector. When the path between the source and detector is filled with the lower density liquid (alkylate) the signal intensity at the external detector is relatively high. When the higher density phase increases in height (HF solution) the radiation intensity at the detector is reduced. Through calibration of the system the interface position between the two immiscible phases within the vessel can be measured and controlled.

In a similar manner to liquid level measurement, detectors can also be positioned at specific vertical heights across the interface range to act as alarms. The detectors are tuned to alarm or trip at specific radiation signal strength. In the case of a high level alarm, radiation will be relatively high due to the less dense phase presence. If lower phase increases or an emulsion band moves upwards through the vessel the detector radiation signal will reduce and a signal will be sent to the control room warning of the condition. In the case of a low level alarm the reverse conditions would apply with an increase in radiation signal due to lighter density liquid presence lower in the vessel.

Tracerco offers a range of non-intrusive specialist measurement instruments to ensure reliable control of a production process, even when operating under extreme process conditions. Each instrument is tailor designed for the particular application in order to measure liquid level and interface between two immiscible phases. Incorporation of HART™ technology in the field mounted detectors allows communication via the customer's DCS and eliminates the need for safe-area control units. If you would like to learn more about our specialist measurement instruments please contact a Tracerco representative in your area.

Tracerco On the Move...

Tracerco will soon be opening 2 new bases located in Paramount and Concord, California. It is believed that opening these 2 offices serving the Los Angeles and Bay Areas will continue to foster Tracerco's commitment in providing a rapid and reliable service while keeping travel and mobilization expenses to a minimum. Martin Rizo, West Coast Regional Manager, will continue to oversee operations.

Contacts for the Paramount, California office will be Jacob Messing and Jeff Coyle with Mario Renteria as a contact for the San Francisco Bay area. A scheduled opening date for both locations is January 2008. Visit our website at www.tracerco.com for additional contact information on our San Francisco Bay area location.

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In keeping with our practice of opening new bases worldwide Tracerco has opened 2 new bases located in Shanghai and Beijing, China. Tracerco now has 28 offices located worldwide and employ's over 200 employees. Visit our website at www.tracerco.com to find an office in your area.

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Please send me additional information on Tracerco's Specialist Measurement Instruments:

- ❑ The TRACERCO Profiler™
- ❑ TRACERCO™ Density gauge
- ❑ TRACERCO™ Level gauge
- ❑ TRACERCO™ Interface gauge
- ❑ TRACERCO™ PhaseGauge
- ❑ TRACERCO™ Radiation monitor
- ❑ TRACERCO Diagnostics™ RapidScan
- ❑ The TRACERCO™ SmartGauge
- ❑ TRACERCO™ Level alarm
- ❑ TRACERCO™ Contamination monitor
- ❑ TRACERCO™ Diagnostics MUI

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