TowerScan

Phone: (888) 724-1798

# Neutron Backscatter - Multiphase Level Measurement

**Pre Job Info:** The customer had a vertical drum which contained multiple phases - vapour, hydrocarbon, an emulsion phase, and water. There were both high and low level nucleonic level indicators installed on the vessel, the problem was that simultaneous high and low level alarms were being indicated.

**TowerScan Results:** TowerScan performed a series of neutron backscatter surveys at different process conditions, one of which is shown. This allowed the customer to recalibrate their installed nucleonic instrumentation.

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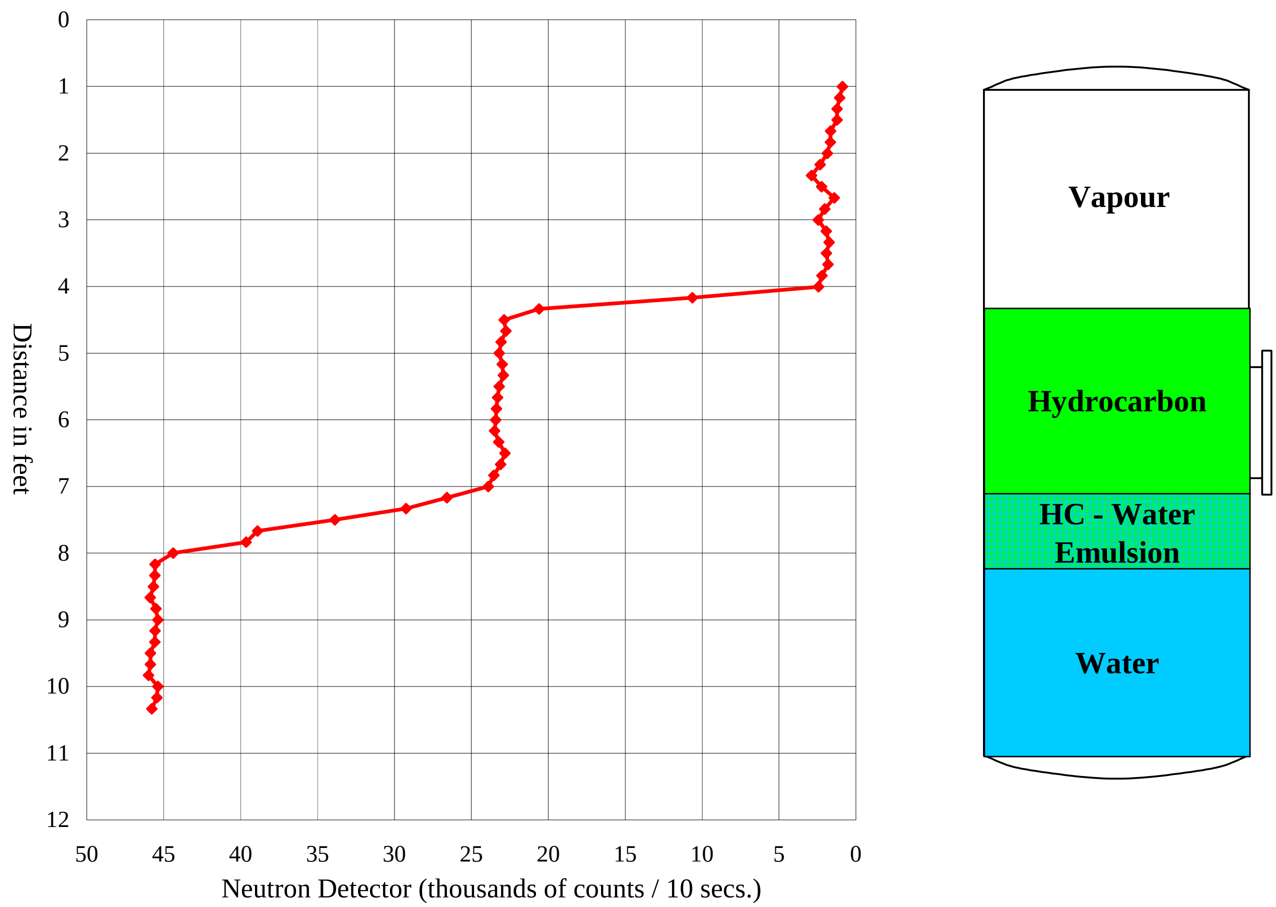
Neutron Backscatter - Multiphase Interface Level Measurement



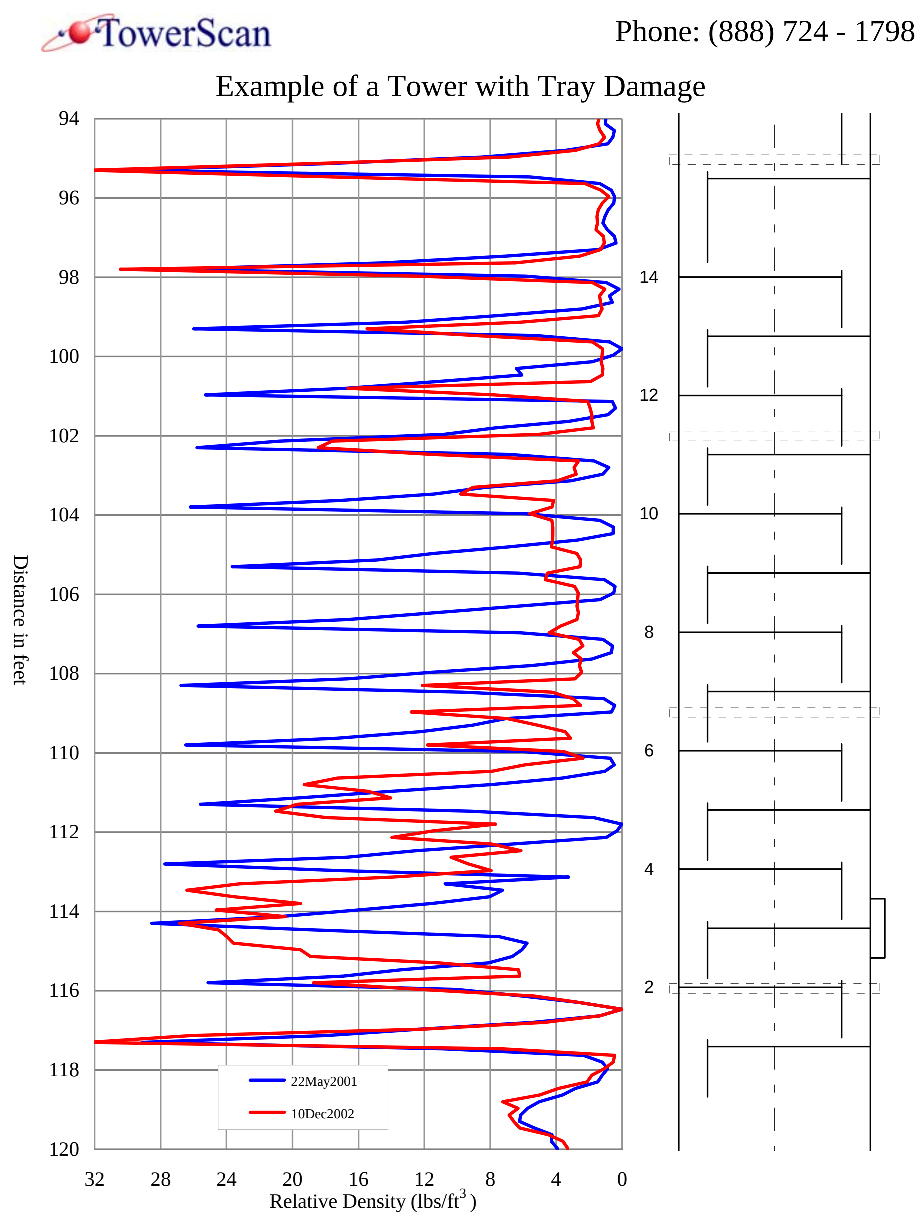
# Profiles of Normally Operating vs. Damaged Trays

**Pre Job Info:** The customer was experiencing problems operating the column in a stable manner. The column had been scanned the previous year, thus providing baseline data for comparison.

**TowerScan Results:** The most recent scan plotted in red, revealed that the tower had suffered extensive damage to trays 2 through 13. The damage was easily identified, especially when compared to the blue profile showing normal operation a year earlier.

Knowing which trays were in need of repair, the customer was able to pre-order tray parts and arrange to have sufficient labour on hand in order to minimize their downtime.

The customer was soon back operating profitably again.



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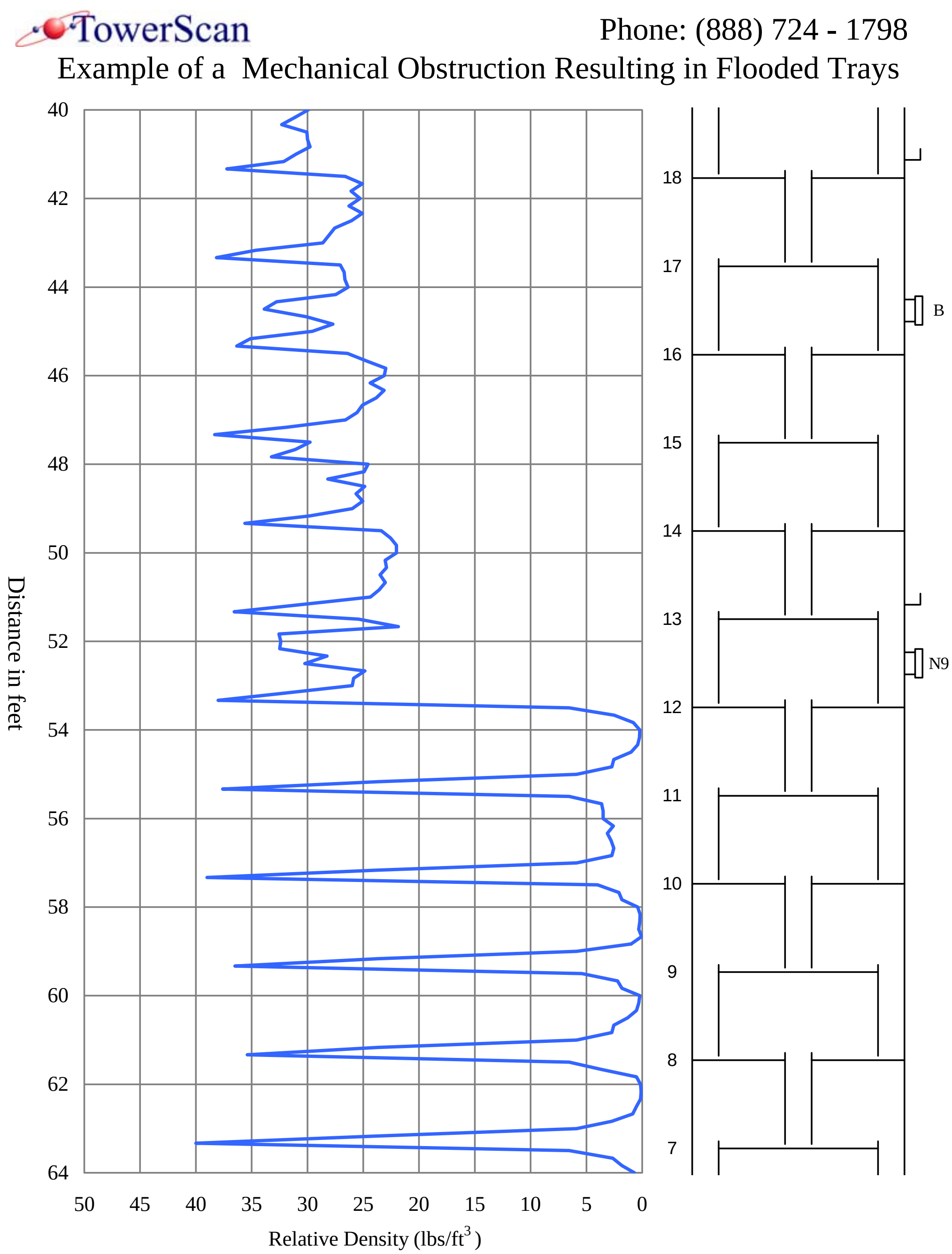
# Trayed Column - Flooding Due to a Mechanical Obstruction

**Pre Job Info:** The client was unable to meet their product specifications, and there were indications of liquid being carried overhead. The client suspected either foaming or flooding. There was no reliable pressure differential available for the tower.

**TowerScan Results:** The scan revealed the tower to be flooded from tray 12 upwards. The sharpness of the transition from a flooded condition to a normally operating tower above and below tray 12 indicated an obstruction in the tray 12 downcomer. As the tower had a history of solids (salts) building up on the trays, the customer performed a water wash of the tower, after which the tower's operation returned to normal.



# Trayed Column - Optimizing Use of Anti-Foam

**Pre Job Info:** This customer's tower required regular injection of anti-foaming agents in order to maintain stable operational conditions. However, they wanted to ensure that they were making optimum use of the anti-foam and not unnecessarily spending money on additional volumes that didn't provide any benefit.

**TowerScan Results:** A series of scans were performed with changing amounts of anti-foam being injected. Gradually decreasing the volume of anti-foam, the red scan showed foaming just starting to develop. The next reduction in anti-foam volume showed a significant increase in the number of trays experiencing foaming, thereby allowing the customer to determine the threshold level of anti-foam that would allow them to maintain stable process operating conditions and minimize cost.

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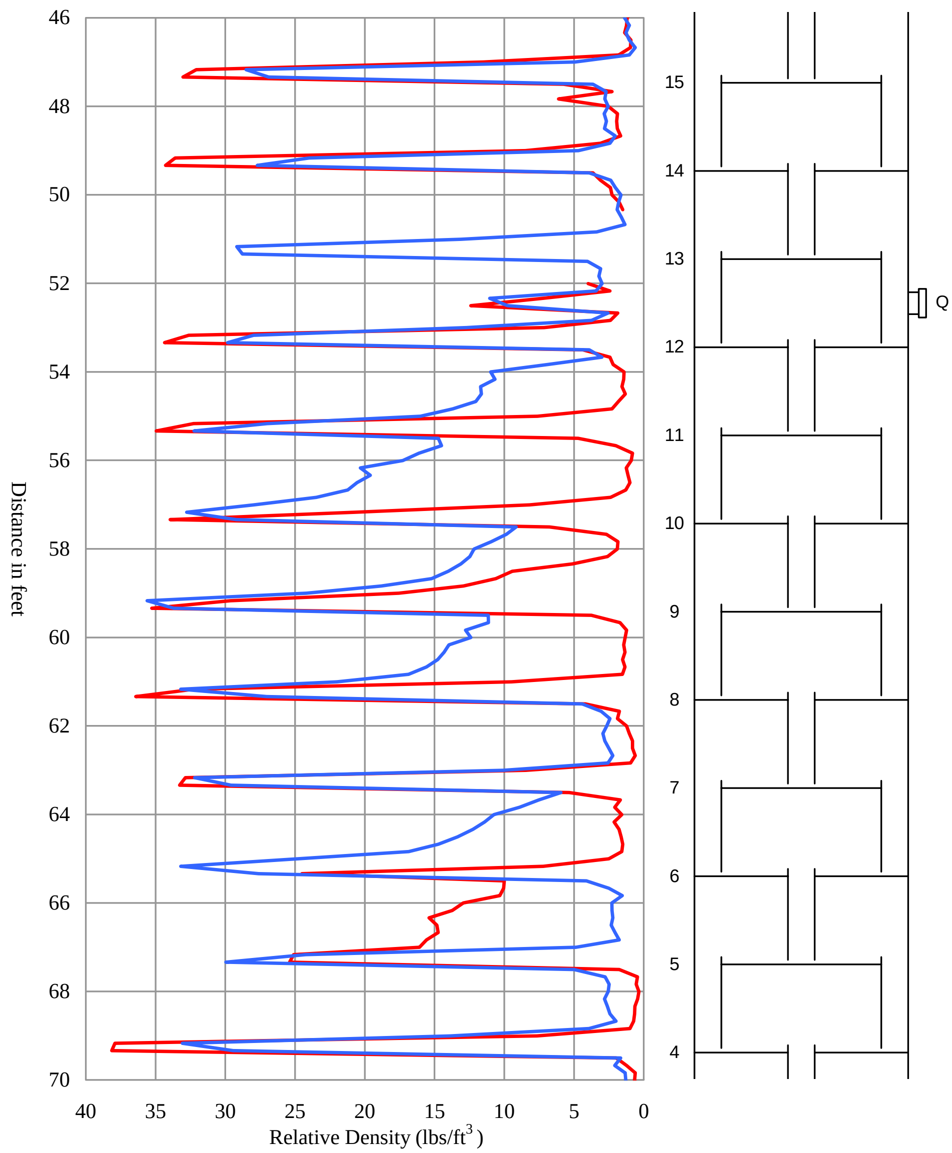
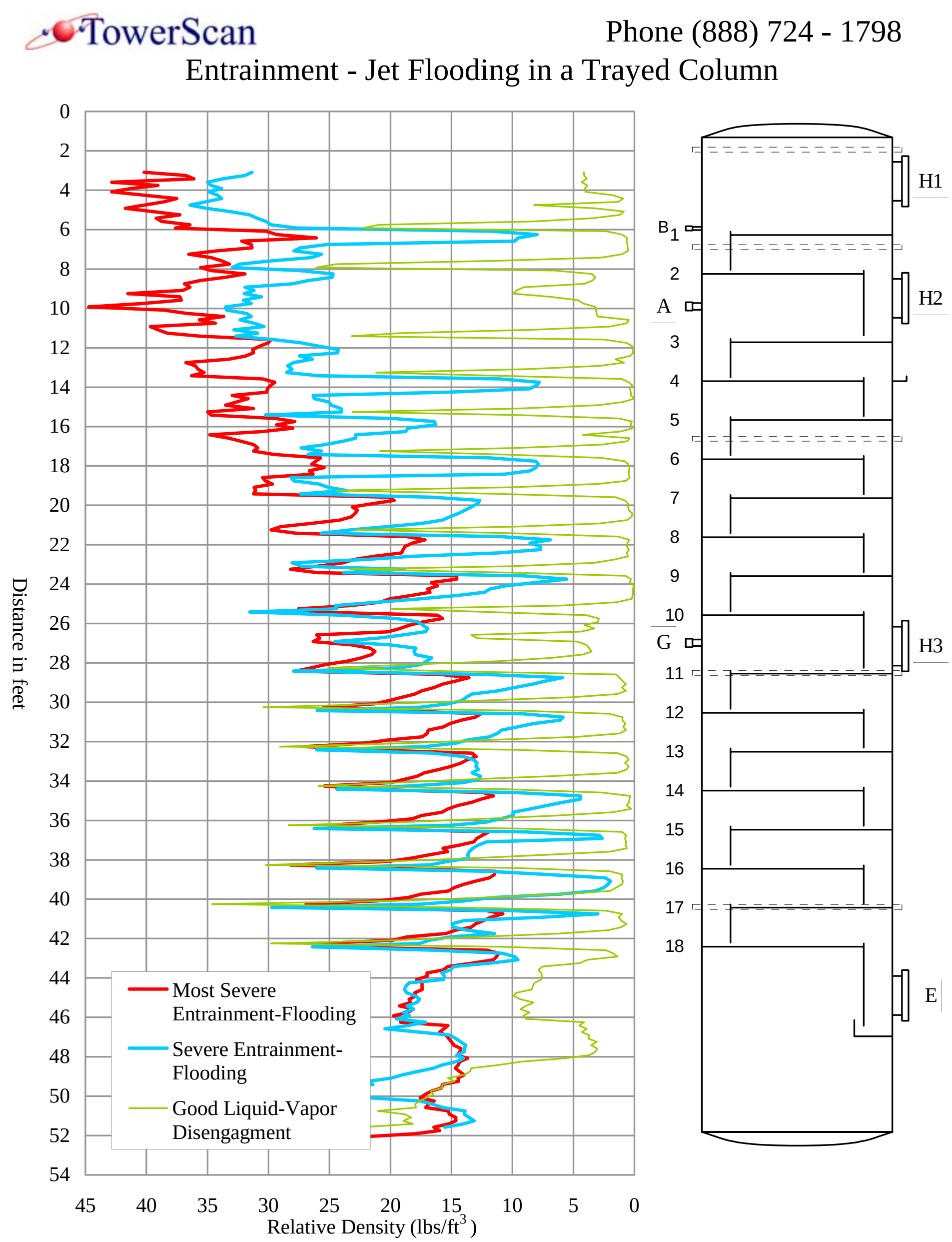
Foaming: Optimizing Use of Anti-Foam



# Trayed Column – Entrainment

**Pre Job Info:** This customer had made modifications to their tower during a shutdown. Ever since the turnaround it had not been possible to operate the tower in a stable manner or make product that was on specification, even though the operating parameters seemed comparable to pre-turnaround.

**TowerScan Results:** The first scan (plotted in red) revealed the trays to be severely entrained and in a "jet" flood. In addition, the base liquid level appeared was highly aerated and above the vapor inlet, almost reaching the bottom tray. As changes were made to the tower's operating conditions, especially the reboiler and base liquid level, the process personnel were able to eliminate the entrainment (green plot) until the tower was operating in a stable manner at the "new post turnaround normal conditions" and the product was on specification.



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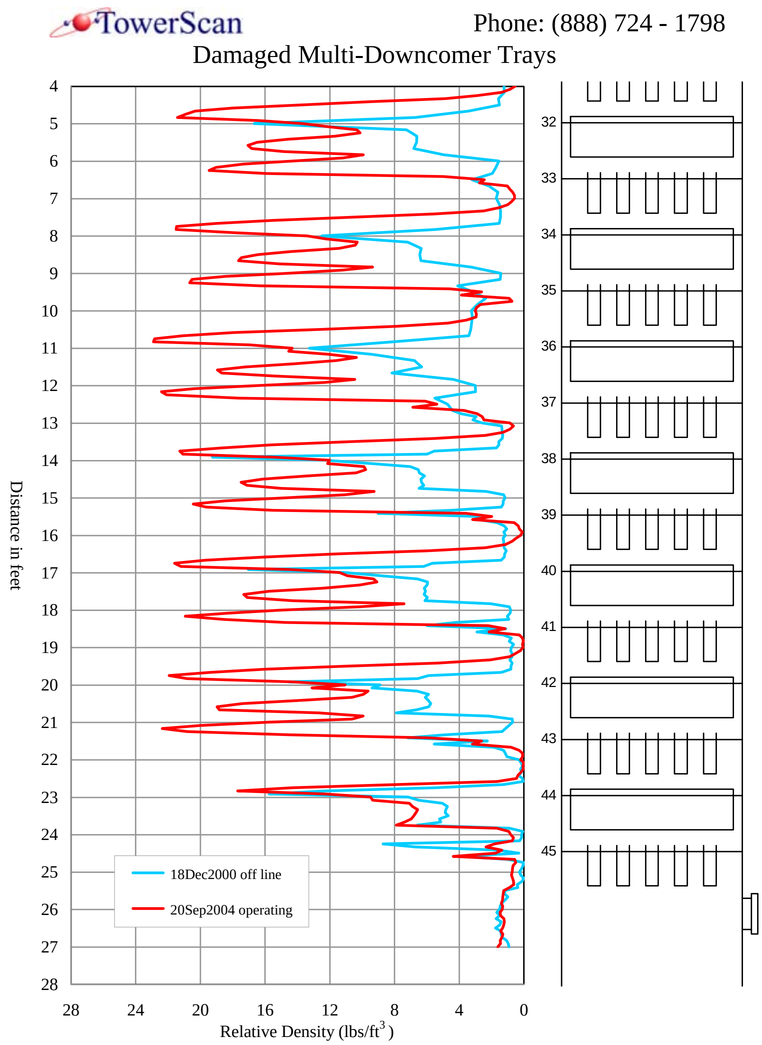
# MD Trays – Damaged

**Pre Job Info:** The customer had been experiencing an erratic bottoms temperature profile, as well as unstable operation of the column for several weeks ever since an upset in the unit. From their instrumentation and analysis, they were confident the problem was in the bottom half of the column, but they could not pinpoint the cause of the trouble. The customer called TowerScan in the morning; a crew was on site that afternoon.

**TowerScan Results:** The trays involved were MD or multi-downcomer trays. Due to their generally tight tray spacing, and the large amount of metal in the form of boxed downcomers, it is very important to obtain precise scan line orientation. In addition, the trays should be scanned at a 1" interval rather than the normal 2" increment or a significant loss of definition occurs.

TowerScan had performed a baseline scan on the same tower, offline, four years earlier (blue plot). The current scan in red revealed that the bottom tray (45) was missing, and the next tray up (44) was severely damaged. With this knowledge the engineer was able to adjust the operating parameters in order to manage the damaged tower in the best way possible. In addition, they were provided with adequate planning time for them to go into the tower during their next shutdown, which was less than a month away, knowing what had to be fixed.



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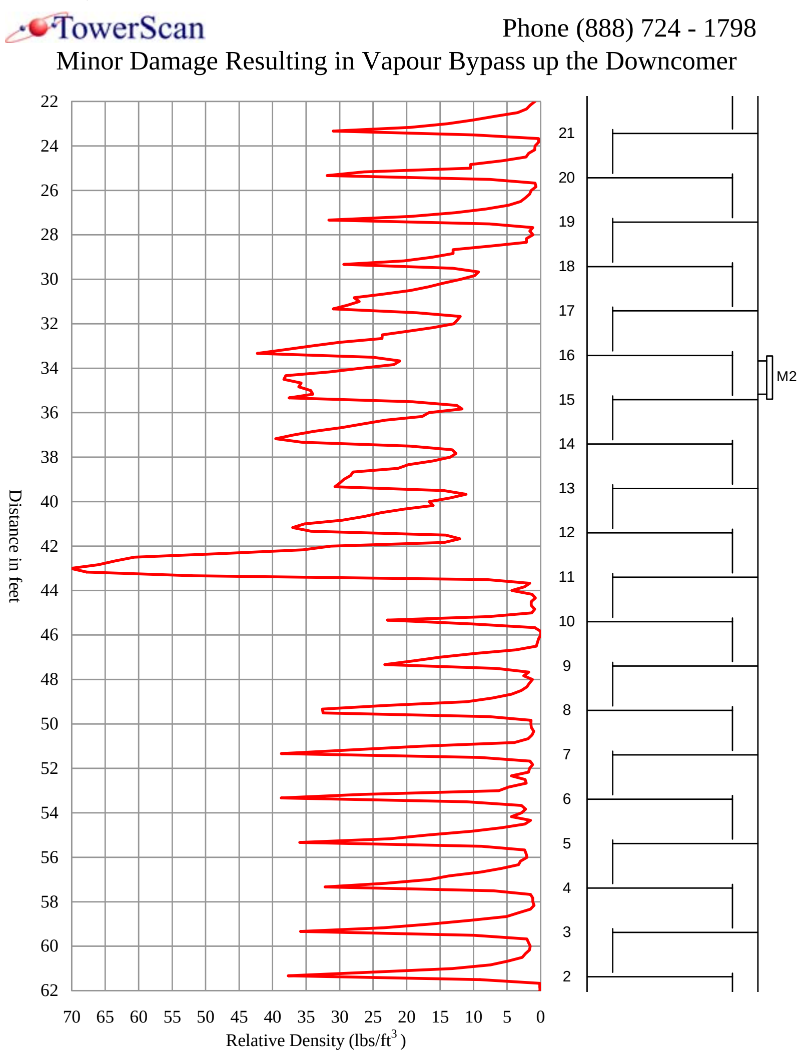
# Minor Damage Resulting in Vapour Bypassing & Flooding

**Pre Job Info:** Under normal operating conditions, this tower was experiencing a high pressure differential across the column with liquid being carried overhead.

**TowerScan Results:** The rates were reduced in order to obtain a scan under stable operating conditions. The first scan showed trays in the middle of the tower (11-17) to be flooded, with evidence of entrainment on the trays higher up the tower. The unusual aspect of the scan profile was the extremely high density seen for the liquid on tray 11. Given that tray 11 was holding liquid, and therefore mechanically sound, TowerScan personnel were confident in predicting that the vapour was bypassing the tray via the downcomer, as there was no aeration of the liquid.

The mechanism causing the vapour bypassing wasn't 100% certain from the profile. Trays 10 and 9 immediately below 11 showed reduced liquid loadings on the tray. Typically this is due to damage, however the possibility of the trays from 11 upwards loading up with liquid and then dumping, temporarily starving the trays below of liquid remained as an alternative explanation.

Subsequent inspection of the tower revealed that the tray deck panel immediately underneath the downcomer from tray 11 was damaged. As such it allowed the vapour to bypass tray 11, and most of the liquid to bypass trays 10 and 9 even though the remainder of that decking was mechanically sound.



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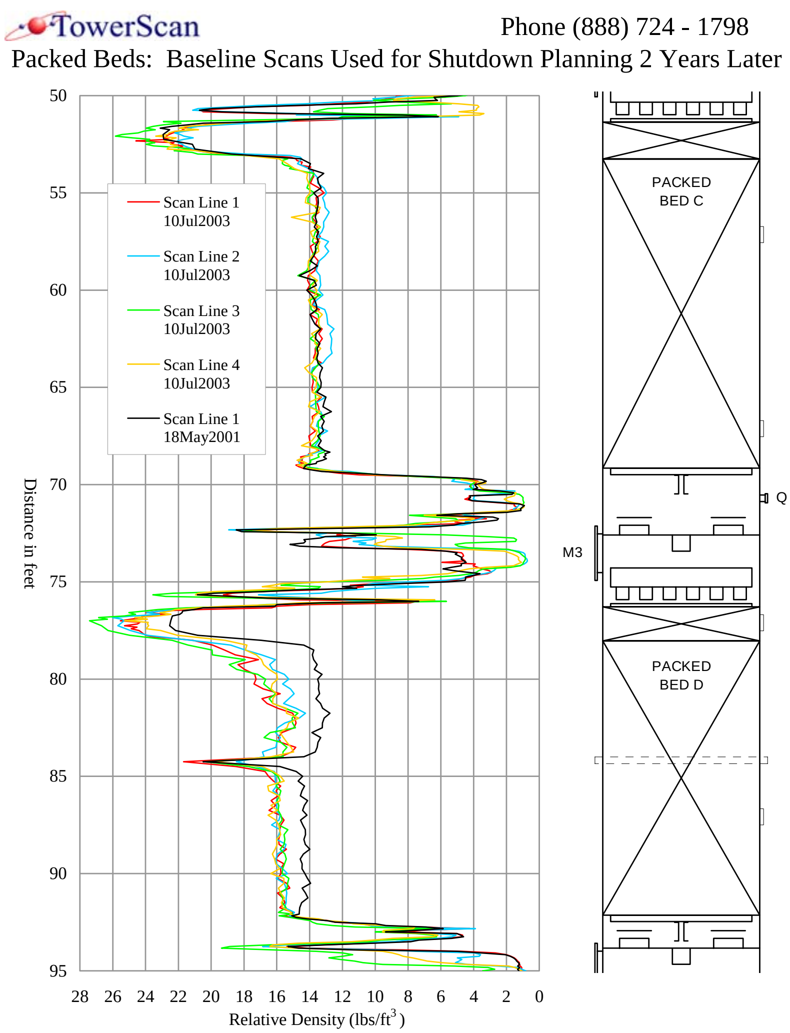
# Packed Bed Tower - Baseline Scans Used for Shutdown Planning

**Pre Job Info:** Historically, this tower with multiple packed beds was relatively stable in its operation but running over several years between shutdowns it was prone to fouling. Therefore, the customer had TowerScan perform baseline grid scans so that in the future they could minimize the time spent on turnarounds.

**TowerScan Results:** The adjoining scan profile shows the grid scan performed two years after the baseline scan, as well the profile (black) for one of the four baseline profiles. Each of the six packed beds consisted of a shorter section of structured packing in the top of the bed, with the majority of the bed consisting of dumped packing.

The greatest contrast was between the two beds shown, beds C and D. While all of the beds showed some fouling in the smaller structured packing element at the top, the remainder of the beds, consisting of the dumped packing, were seen to be still operating with a uniform density profile, clear of significant fouling. The exception was bed D below the feed inlet, which showed appreciable fouling throughout the bed. Armed with this knowledge going into the shutdown, the unit engineer was able to minimize the downtime by planning to clean the distributor above each bed, as well as the top structured packing element, while leaving in place all of the dumped packing except for that in bed D which was replaced.



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# A TowerScan in a Different Plane

**Pre Job Info:** The customer had seen a very small change in the indicated pressure differential measured on their disengagement drum. In addition, one of the process operators noted an unusual “noise” in the vicinity of the drum, leading the process engineering/operations staff to suspect that the internal riser may have sustained damage. TowerScan was contacted to first confirm if there had been any damage to the internal riser, and if so, to determine the current orientation of the riser as different orientations would have various safety implications.

**TowerScan Results:** The scans were conducted by erecting a square horizontal framework of scaffolding poles at two different elevations. The source and detector were suspended from the scaffolding frame and then positioned so that they were past the edge of the drum, i.e. there was nothing between the source and detector. The source and detector were then moved in two inch increments, horizontally, to in effect take a cross-sectional cut of the disengagement drum. The source and detector were then repositioned so that the same process could be repeated at 90 degrees to the original orientation. This process was carried out at both the upper and lower elevations.

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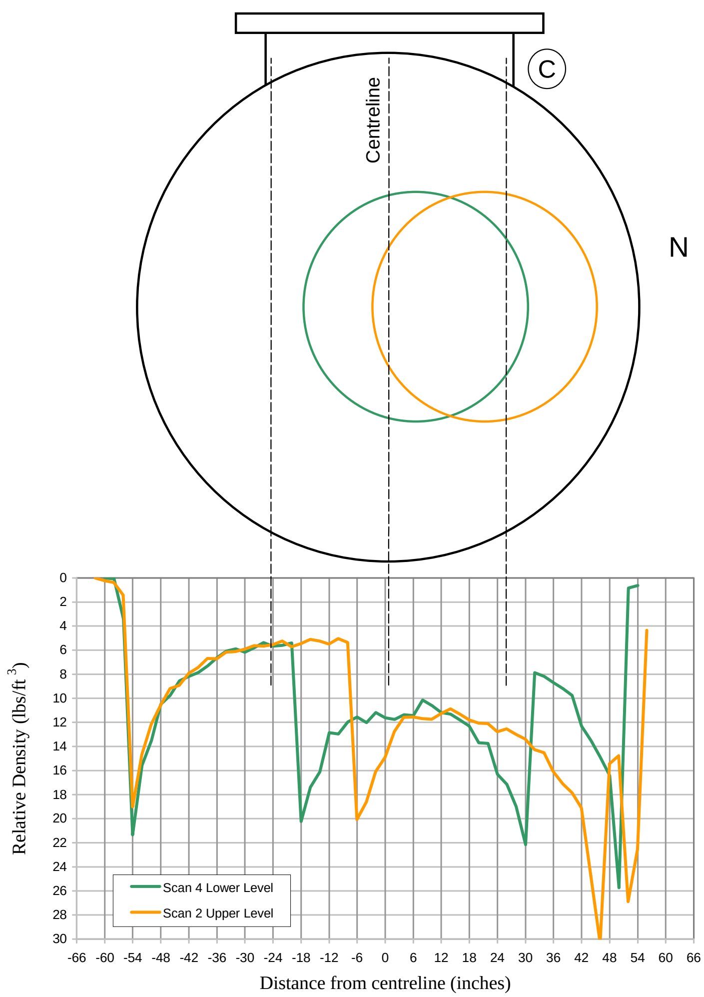
Horizontal Scans on Reactor-Internal Riser: East - West



# A TowerScan in a Different Plane (Continued)

If the riser was undamaged and in position, the density profiles should essentially be that of a smaller empty pipe (the riser walls), centered on, and superimposed upon a larger empty pipe (the drum walls). The scans indicated that the internal riser had in fact been broken off. The density profiles indicated that the top of the riser was leaning against the west wall of the drum, offset slightly to the south of the east-west centerline. Armed with this knowledge, process operations determined that with additional precautions they could continue operating the unit until the next scheduled shutdown.