

To: J. R. Holcomb

From: B. K. Donley
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Interoffice
Communication

Subject: Tank Farm Vent System Evaluation

VISTA

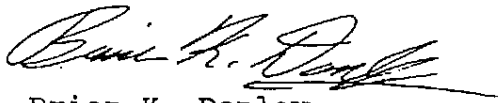
As a result of the study performed on the tank farm vent system, the following conclusions have been made:

- 1) The vent system is not exceeding the capacity of the vent system blower, BL-412.
- 2) The individual tank vent rates do not exceed the capacity of their respective pressure-vacuum vent.
- 3) Due to frictional losses in the vent system piping, backpressure has prevented normal venting through the pressure-vacuum relief valves.
- 4) Due to inadequate operation of the pressure-vacuum vents, blowoff manways have been handling normal tank out-breathing, resulting in exterior tank staining due to condensing EDC vapor.

Based on these conclusions, the following recommendations are made to prevent further staining and unnecessary emergency venting:

- What about
T-453 Blowoff
Manway?
(SEE NOTE ON
RECOMMENDATIONS)*
- 1) Reset the pressure-vacuum vents according to the values tabulated in Table 1. These new settings will compensate for backpressure in the vent system.
 - 2) Replace any deteriorated seals on both the emergency and the pressure-vacuum vents.

The attached discussion describes, in detail, the basis for these conclusions and recommendations. If you have any questions or comments, please contact me.


Brian K. Donley
Summer Process Engineer

Distribution: RAC-PEM-GEH-WPS-MRK-SCR-HOA-RAS-File
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CWH 000009744

BACKGROUND

The tank farm vent system was designed to collect the vapor released during normal tank out-breathing. The pressure-vacuum relief vent outlets are connected to a vent header, which feeds to S-412, the vent system knock out drum. BL-412, the tank farm vent blower, draws suction off of S-412, and discharges the vapor to the wet vent header. During normal tank in-breathing, regulators feed nitrogen into the tanks and S-412, to prevent a vacuum from occurring inside the vessels.

During large vapor expansion, such as external fires, blowoff manways open to release the large vapor volumes. These emergency vents are designed to operate only when the internal tank pressure is within 5-10% of the tank roof design pressure, and vent directly to the atmosphere.

During large vapor compression, when the nitrogen fails to pressure the tank fast enough, vacuum relief is provided by the PV-vent, which opens to the atmosphere. This only occurs during extreme cases, such as a high liquid outflow, and is normally not a problem.

Extensive staining has occurred on the exterior of several storage tanks tied into the tank farm vent system. Inspection has shown that the stains originate from the blowoff manways, due to excessive lifting of the manways during normal operation. Normal venting should be handled by the pressure - vacuum relief valves with the manways venting only in emergency situations. An investigation and study was made to determine the cause of excessive manway venting.

DISCUSSION

In order to define and accurately model the system, detailed drawings of the tank farm vent system were made (Figures 2A - 2F). Included in these diagrams are details of the piping connections and total equivalent lengths of the system. Table 2 shows the specifications for the tanks, including the roof design pressures and relief vent settings.

To evaluate the limitations of the system, the maximum expected vent rates were calculated. These rates are normally determined using the American Petroleum Institute's (API) Standard 2000. API 2000 is based upon an hourly vapor temperature rise of 60 degrees F, resulting in a vent rate, due to thermal expansion, of 90,000 SCFH for the six tanks involved. This method is actually very conservative and does not give an accurate estimate of the actual vent rates occurring.

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A more realistic temperature change of 25 degrees F (75 F to 100 F) was chosen as the basis for venting due to thermal expansion. This choice was based on the PED study made in 1977, concerning the vent system. This temperature change was applied to the maximum vapor space in the tank, based on the minimum liquid operating level. Ideal gas law relationships were used to calculate the net vapor volumetric change, assuming no change in the overhead pressure. The results are tabulated in Table 3, showing a vent rate of 12,288 SCFH due to thermal expansion.

Additional venting due to displacement from liquid inflow is also tabulated in Table 3, showing a vent rate of 2,340 SCFH. The liquid inflow rates used were obtained from the 1977 PED study, based on actual plant operations when a net increase in liquid volume occurs. Combined with the thermal expansion vent rate, the expected maximum vent rate comes to 14,628 SCFH.

Using the maximum vent rate, pressure drops were calculated for the vent header and the tank piping, resulting in the pressure profile shown in Figure 1, and tabulated in Table 4.

Flow limitations due to the vent system itself were also examined. Flow from the vent header is routed to S-412, where it is passed to the incinerator by the tank vent blower, BL-412. BL-412 is designed to handle a constant 300 SCFM. This rate is controlled by recycling the discharge of BL-412 back to S-412 during low vent periods. Current operating conditions show that BL-412 is operating at 300 SCFM, with approximately half the discharge being recycled.

CONCLUSIONS

The total required vent rate (14,628 SCFH) is less than the capacity of BL-412 (18,000 SCFH), indicating that the vent system is not limited in flow capacity by BL-412. This conclusion is also supported by the current operating conditions of BL-412, showing half of the discharge being recycled.

The capacity of each PV-vent was determined from the vendor's operating curve, and was compared to the expected vent rate of the corresponding tank. The PV-vent capacity was found to be significantly larger than the expected vent rate, indicating the PV-vent size is not a limiting factor. The PV-vents were originally sized using the API 2000 standard, explaining their large capacity.

The pressure profile (Figure 1 and Table 4) shows considerable backpressure at the pressure-vacuum vents. Since the PV-vents are designed to relieve against atmospheric

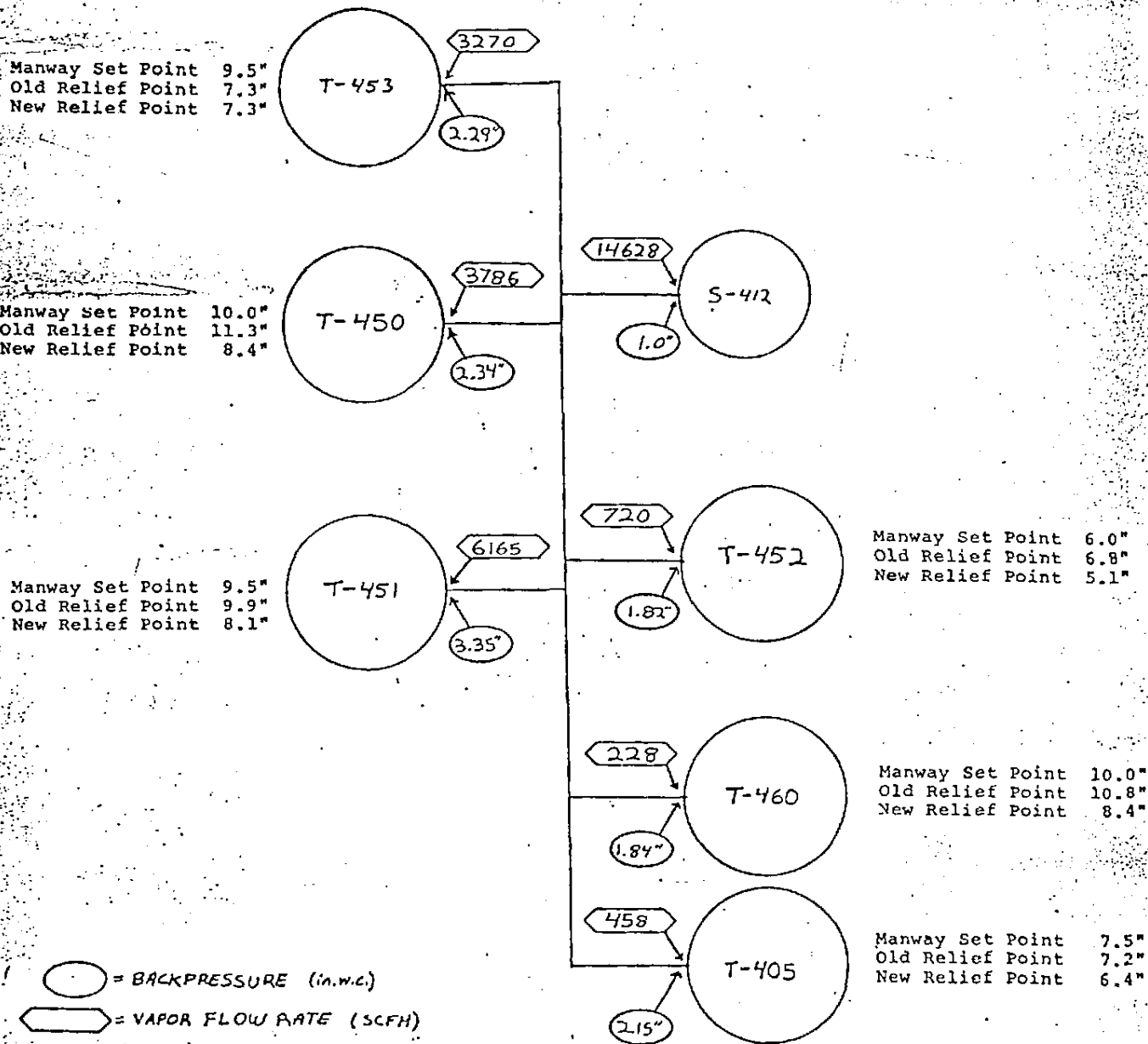
pressure (0 psig), the backpressure prevents relief at the normal set point. For example, on T-451, the current PV-vent setpoint is 6.5" W.C. With the indicated backpressure of 3.4" W.C., the setpoint becomes 9.9" W.C., 0.9" higher than the blowoff manway setpoint, and 0.1" less than the roof design pressure. T-451 shows the most staining, supporting the fact that excessive backpressure is present at the PV-vents.

Due to excessive emergency venting, corrosion and deformation may have occurred at the seals of some of the blowoff manways. The poor seal allows a small, continuous leak through the manway, contributing to the staining.

RECOMMENDATIONS

- What about T-453 blowoff manway?*
- 1) Adjust the pressure-vacuum vent setpoints to compensate for backpressure.
These new setpoints, shown in Table 1, will allow the PV-vent to open below the emergency vent setpoint, with at least a 15 % margin before the manway will relieve.
 - 2) Inspect the manway and PV-vent seals for corrosion. The seals should be replaced if signs of deterioration are present.

MY INFORMATION SHOWS A CURRENT SETTING OF 5.5" W.C. FOR THE MANWAY ON T-453. THE ROOF DESIGN IS ^{10.0}~~7.5~~" W.C. (THE MANWAY) AND THE MANWAY SHOULD BE SET HIGHER IF IT IS STILL AT 5.5" W.C. THIS WAS OVERLOOKED IN MAKING THE RECOMMENDATIONS. THANKS FOR BRINGING IT TO MY ATTENTION.



All relief points are in. W.C.
 Old refers to the current setting
 New refers to the recommended setting

Figure 1 - Pressure/Flow Profile