Solving Problems with Sloping Piping

Upgrading Existing UST Systems
Many tank systems are being upgraded to comply with state and federal UST regulations. These upgrades include replacing single-wall piping with double-wall piping as well as adding overfill valves and spill containment manholes, electronic tank gauges, containment sumps and dispenser pans. In some areas of the country, upgrading also includes the addition of Stage II vapor recovery piping. In most cases, the UST upgrade work being done today is straightforward and requires only adherence to industry standards and equipment manufacturers’ installation instructions. However, some facilities were originally constructed in a manner that now creates problems. One particular problem is insufficient tank burial depth to permit recommended sloping of piping back to the tank.

Why slope?
Sloping the piping serves several purposes. On suction systems equipped with check valves located at the tank, sloping ensures the correct operation of the check valve because the gravity causes the liquid in the piping to “run down hill” to the tank. This back pressure seats the check valve, preventing both liquid from passing back into the tank and the resultant loss of prime.

Vent and vapor recovery piping is sloped to prevent the accumulation of liquid in the piping that occurs from condensation or when a tank is overfilled. If the vent and vapor return piping is uniformly sloped, liquid flows freely back into the tank by gravity. While use of overfill prevention devices reduces the incidence of liquid entering vent or vapor recovery piping from overfilling, accumulations may still occur from Stage II nozzle splash-back or condensation.

Product piping for pressurized (submersible pump) systems must be sloped, but the sloping does not have as great an effect on the check valve as that described for suction systems. A check valve built into submersible pumps is used to prevent the loss of prime with or without the product piping sloped.

The principal reason for sloping product piping is to eliminate any possibility that vapor—which could cause problems with line pressure leak detection and tightness testing—will not be trapped in the piping. Vapor is forced from the piping with the flow of fuel.

Another reason for sloping double-wall product piping is to facilitate the flow of liquid from the piping interstice back to the submersible turbine pump sump at the tank for purposes of leak detection. Leaked product or infiltrating ground water flows to the sump where it can be readily detected by a...
liquid sensor. Traps in the secondary piping could result in the delay in detection of liquid from small leaks.

Since 1979, the American Petroleum Institute (API) has recommended that piping be sloped back to the tank at least \( \frac{1}{8} \) inch per foot (Installation of Underground Petroleum Product Storage Systems, API 1615). The Petroleum Equipment Institute made a similar recommendation in the 1987 edition of Recommended Practices for Installation of Underground Liquid Storage Systems, PEI/RP100. (See Figure 1.)

**Figure 1:**
Typical Piping Trench

The U.S. Environmental Protection Agency and the National Fire Protection Association adopted these recommendations in the underground storage tank regulations (40 CFR 280) and the Flammable Liquid Code (NFPA 30), respectively, making them universally applicable.

However, what is easily overlooked is that these recommended practices relate to new construction—situations in which the system designer and installation contractor have the option of burying the tank at a depth that permits the required piping slope. At some existing facilities, these sloping requirements cannot be met because the tank burial depth is inadequate. Therefore, alternative measures are required.

Removing and re-installing the tanks at a greater burial depth would be impractical, unsafe, unnecessarily expensive and clearly not the intent of the standards’ writers. Among other disadvantages, the tanks would require recertification by the manufacturer before reburial. In some locations, local fire officials may prohibit reinstallation of used tanks under any circumstances.

**Figure 2:**
Liquid Collection Point

**Alternative measures**
If the tank burial depth is inadequate to allow the recommended sloping, other measures may be taken that will provide equivalent protection and operating efficiencies:

1. Drop-out tanks can be utilized to collect liquids and prevent blockage of Stage II vapor return piping.

2. While we do not advocate their elimination, the combination of Stage I and Two-point Stage I vapor recovery renders normal vents virtually unnecessary. Any deficiencies in piping are of little consequence.

3. Sufficient slope to eliminate traps in vent piping can be accomplished by raising the riser end of the underground piping, lowering the tank end connection or by relocating the vents closer to the tanks.

4. If the product piping line pressure leak detectors function normally, the lack of sloping is not significant. The combination of double-wall piping with liquid sensors at the tank and line pressure...
leak detectors provides redundant security against piping leaks, whether or not the product piping is sloped.

5. Sloping of Stage II vapor return piping to collection and removal points ("drop out tanks") is a generally accepted alternative to uniform sloping described in the PEI publication, Recommended Practices for the Installation and Testing of Vapor Recovery Systems at Vehicle Fueling Sites, PEI/RP300-93. (See Figure 2.)

Regulations on upgrading of underground tank systems are intended to eliminate the potential for releases. Where providing adequate piping sloping is impossible, alternatives can be employed that provide comparable security. Requiring unnecessary, costly work is in no one’s best interest as it will only delay compliance and increase costs.