ENDURING BLOCK LLC
6515 Lussier Dr. Sugar Land, TX 77479

MEMORANDUM

RE: Safety Best Practices

When using porta pak tanks for process uses there are some unique risks that may not be readily apparent. These issues are also relevant for other users:

1. **Support Tank Legs.** The tank legs soil pressure for our largest portable tank can exceed 106 psi. This is in excess of the load bearing capability of most semi-improved surfaces, especially when water saturated. There are many methods to support tank leg landing gear including crane mats, steel plate, and self-constructed remedies. The tanks have sunk into the earth on prior occasions. Any displacement can risk pipe rupture, gas or liquid leaks or damage to the tank. The tank landing gear legs must be placed on an appropriate surface. Enduring Block will rent mats if any clients are interested.

2. **Support Piping and Avoid Vibration.** The tank valves and associated piping are not designed to carry the load of un-supported pipe. One tank did experience a failure in a close nipple at the internal valve because of unsupported, vibrating pipe. Best practice is to include a flex connector if there is any question about transmitted loads or vibrations. Always support all pipe. Be aware that stacked wooden blocks and other temporary means of support can become dislodged at any time and are not recommended.

3. **Control Process Pressure on High MDMT Tanks.** Most tanks have a Minimum Design Metal Temperature that is well higher than -20F. This means that the tank cannot hold design pressure if the metal of the tank is very cold (0F to -20F). *The relief valve set points do not change with temperature and cannot be changed.* This is not an issue with most propane operations, as the vapor pressure of propane drops with temperature. However, when tanks are used in a process situation and the pressure is provided by a compressor, it is possible to pressurize a cold tank above its (cold reduced) nameplate capacity which could be well below the relief valve set points. This is a particular issue with post-cryogenic operations that are not heated or that have a heater failure. Please design your process and piping to provide redundant safety for this situation (i.e., pressure control plus pipe relief valve set to MDMT pressure at expected temperature). If the MDMT is not listed on the tank, consult an engineer. **An example:** A tank is rated for -2F @250psi and -20F @ 190 psi. This tank could exceed its nameplate rating if the steel were -20F and more than 190 psi is applied to the tank. The relief valves do not know the temperature, and will not open until the "hot" name plate rating of 250 psi is exceeded. Therefore, the nameplate rating of the tank would be exceeded by 60 psi, or 32% overpressure before the relief valves on the tank would activate at -20F. Another thing to consider is that if the steel is less than -2F, some overpressure would occur prior to relief valve activation.

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4. **Do Not Move Tanks Containing Product.** The tanks are transportable, they are not made for transit. It is not legal to move the tank on a public road with more than 5% water capacity of product in the tank. Do not attempt to move the tank or "get under" the tank with a truck when the tank contains product. The landing gear and chassis are not made to be pushed with the weight of product in the tank.

5. **Use Proper Procedures to Get Under Tank with Truck.** Chock wheels. Pressurize and set brakes with glad hands before backing under. Some brake systems may have lost pressure during long deployments and spring systems can stick. Check tire conditions and pressures before moving on highway. Check lighting and tank systems.

6. **Review and Use Operational Procedures.** The above list is not exhaustive.

Sincerely,

Cary Ratterree