

# Don't Let Your Profits Hssss Away!

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**M**any of you will recognize that hsssing sound. It's the sound that gas makes when escaping from a liquid cylinder, a liquid tank or a cryogenic tank during use, or during a tanker delivery. As gas escapes back into the atmosphere, it's not the sound of gas I hear. I hear the sound of your money evaporating. Yes, that's your money making that sound!

We all know that LIN, LOX and LAR become a gas when they are warmed up. In this report, I will discuss how to optimize your liquid consumption and minimize your cryo liquid losses while operating your various systems. During these days of tight argon supply, total monthly net losses of 20 - 35 percent of your argon purchases of one million scf/month, at a price of \$3.25/cscf, will amount to an extraordinary reduction of your operating income (EBIT) of \$75,000 to \$100,000 per year — that's a lot of your money!

## TANK OPTIMIZATION

Optimizing your liquid consumption begins with tank optimization, in particular, tank sizing. If your liquid tank is too small, you are probably getting deliveries of "hot liquid" too frequently, causing higher fill losses. If your tank is too large, your liquid will begin to warm up, and create gas in the tank. This gas will be vented through the safety relief valve when your tank reaches the protected pressure setting. Another risk of too large a tank is that your supplier may use you as an end-of-route dump to finish off his load. You incur higher losses with saturated liquid dumped into your tank.

It is important that you size your tank for the current volume but with an eye to future volumes or increases that you are likely to see. If your current tank is not the correct size, there is something you can do about that. Recent increases in steel and the resulting increases in liquid cryogenic tank prices, should make you look at changing out that tank when the opportunity presents itself. A large tank can be sold or used at another location where the volume demands it. A small tank can be used at another end-user location where the volume is appropriate. Make sure you examine your current assets when contemplating the purchase on a liquid cryogenic tank for use at a customer site or at another site. Don't forget to consider the pressure rating of your tank. Most cylinder fill plants only require a lower operating pressure tank. 245 psig tanks have much more value at customer sites to supply higher house-line pressures.

Once you have optimized your tank size, you need to optimize your deliveries. The transfer of liquid from a distributor-located-tank has several uses, including supply HP cylinder pumping and liquid withdrawals for filling liquid cylinders and mini/micro bulk trucks. The profile of these uses and their frequencies is important to tank sizing at the distributor's facility. The trend in tank sizing is to larger tanks with tougher supplier management of the liquid delivery schemes and a higher level of priority and scrutiny of the distributor. Tight argon supply forces the need for more facility inventory, but also requires that losses and their costs be minimized.

## DELIVERY OPTIMIZATION

Just because you have the optimum tank size does not mean that you will receive the optimum delivery. Your supplier wants to optimize his delivery system by making deliveries to your system when he is in the area and has some product he does not want to haul back to the plant. If your supplier uses your tank as a "dump tank," you will receive smaller deliveries of product than you want and more deliveries than you need. Remember, there are losses

during each delivery and those losses are yours. The more small deliveries you receive the more product loss you incur. There goes your money again. Take charge of your deliveries. If possible, you should schedule your deliveries. At a minimum, you should set the reorder point with your supplier and be certain that your supplier is not making many small deliveries that cost you money.

## OPERATING OPTIMIZATION

Now let's discuss optimizing your tank operating process. While there are many liquid level telemetry systems in use with end-use customers, there may be a payout in your use of that type of inventory control, particularly if you are moving into mini/micro bulk, and as initial investment and operating costs continue to be reduced.

While we find many distributors operating their fill tanks at 150 psig and higher, you should really be operating your tank at the lowest operating pressure your system allows. Liquid pumps generally like to operate below 70 psig and higher pressures only create maintenance issues, not operating efficiencies. If you operate your tank at a higher pressure, you increase the chance that you will eventually exceed the tank's operating pressure and that the tank will lift the safety relief valve, venting the gas. At some fill plants, operating

DAILY MEASUREMENTS FOR LOSS MANAGEMENT	
Tank Level at beginning of day	Inches
Tank Level at end of day	Inches
Tank Pressure at beginning of day	PSIG
Tank Pressure at end of day	PSIG
Your tank chart will aid you in calculating your usage	FT3 Used
Product Produced per production report	FT3 Filled
Losses <b>Used – Produced</b>	FT3
Losses <b>Delta / Used</b>	Percent

Figure 1

processes include turning on the liquid to the liquid pump in the morning and leaving it cold all day. This allows the filler to be able to just push a button and start the pump immediately. While it is a very good idea to cool down your liquid pump before starting it, a period of 15 minutes is generally sufficient. Remember, each time you have a 90 degree bend in your feed piping to the pump, you lose NPSH (net pressure suction head) to the pump, reducing pumping efficiency and reliability.

If the liquid is constantly cooling a non-operating pump, you in effect have a vaporizer that will just build tank pressure and eventually lead to product losses through the safety relief valve. If possible, schedule your filling and cool down of the pump once and only use the Pressure Building System when required. Do not leave it on all the time.

Your gas supplier can assist you in keeping your tank pressure low during the refill process. If your supplier top-fills the tank and maintains your desired pressure, you will have a head-start on keeping the pressure low during your filling process.

The filling of liquid containers should be accomplished at relatively low pressures and these pressures do not substantially increase filling time. In fact, filling liquid containers at higher pressures actually create extraordinary losses because the gas is escaping at a higher rate. Low loss systems that control the outlet pressure with respect to the inlet pressure can reduce your losses during this operation from 25-30 percent to less than five percent.

### KEEP YOUR EYE ON YOUR MONEY

Now, if you have the right size and pressure tank, proper control over your deliveries, and are optimizing the operation of your systems, how can you assure the continuation of these best practices?

One of the easiest ways to keep your eye on product losses is to engage your team in tracking and measuring the system and your losses. That begins with well scheduled deliveries, daily tank readings, and attention to your operating system. Each day, the operating personnel are responsible for certain measurements as shown in Figure 1.

Make sure you account for deliveries that occur. Add delivered volumes and record the tank level and pressure readings on your daily charts. This will aid in monitoring your deliveries and the supplier's delivery process.

In addition to daily operational management, you should make an end-of-the-month calculation of losses by comparing the total

volumes of liquid bought with the total volumes of all the product sold, adjusted for month-to-month changes in inventory. These calculations will show the significant losses and can drive an effective loss reduction program. If you keep an eye on your losses, you should be able to compete with the best in the industry. Bench marked "best in class" have accomplished the levels of product loss shown in Figure 2.

Cost and loss savings your company achieves depends on your product mix (gas, liquid) and, most importantly, your attention to details and your commitment to minimize losses. Do not forget to measure the volume delivered by your supplier and compare it to the volume of your tank readings. While you should have some expectation of losses during a delivery, these losses should not exceed five percent.

If you are making mini-bulk deliveries, you should have those delivery units filled by your supplier. Only fill them from your tank when other arrangements cannot be made. If you fill them from your tank, you double the delivery losses associated with the product — you have losses once when your supplier makes the transfer and again when you make the transfer.

### SHOW ME THE MONEY

Let's look at how much money there is to save. Figure 3 lists the assumptions for the cost analysis of liquid loss. How much of your money is escaping into the air?

Do the assumptions in Figure 3 surprise you? I see a significant number of distributors with the kind of losses shown in the "Losses Before" column as well as those who could experience the type of savings shown in the two "Savings" columns, if they put their mind and their organization to it. Note that the mix of product volumes could be markedly different depending on the markets you serve. Also, you may pay more or less for product than is shown in Figure 3.

I hope that many of you are already performing the important optimization and operational tasks outlined here. For those of you not paying attention to losses at your fill sites — Hssss! That's your money you hear.

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BEST IN CLASS LOSS MANAGEMENT BENCHMARKS	
Product	Losses
Nitrogen	< 10% (1)
Oxygen	< 10% (1)
Argon	< 3% (2)

(1) Depends on the volume of liquid containers filled  
 (2) Assumes a Low Loss Fill System

Figure 2

COST ANALYSIS OF LIQUID LOSS							
Product	Monthly Volume Used	% Losses Before	% Losses After	Monthly Volume Saved	Cost	Monthly Savings	Year Savings
LAR	1 mm scf	30%	3%	270k scf	\$3.25/cscf	\$8,775	\$105,300
LIN	5 mm scf	30%	10%	1mm scf	\$0.35/cscf	\$3,500	\$42,000
LOX	5 mm scf	30%	10%	1mm scf	\$0.40/cscf	\$4,000	\$48,000

Figure 3