The Magazine for ENERGY EFFICIENCY in Compressed Air Systems

COMPRESSED AIR BEST PRACTICES

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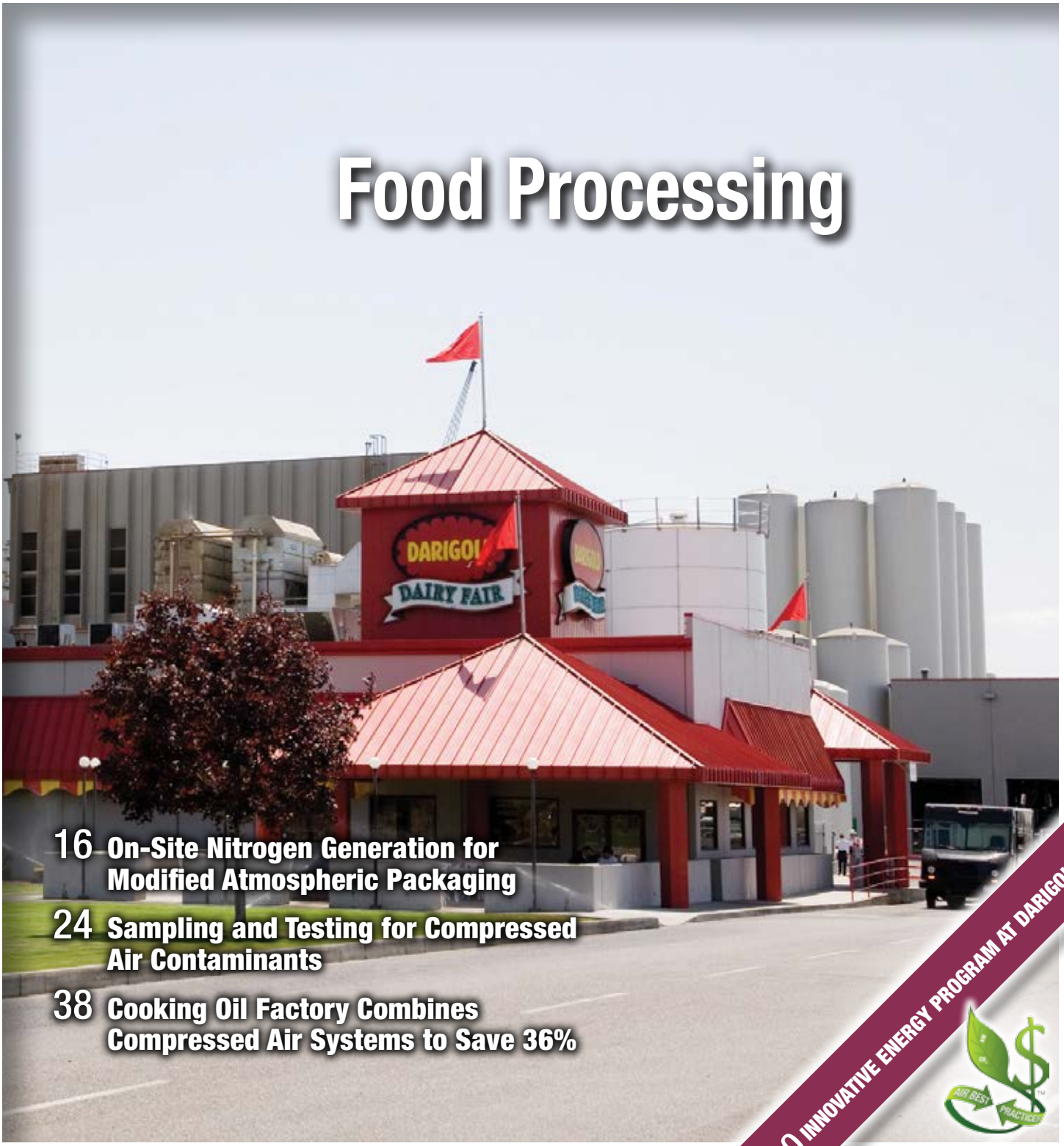
April 2016

Food Processing



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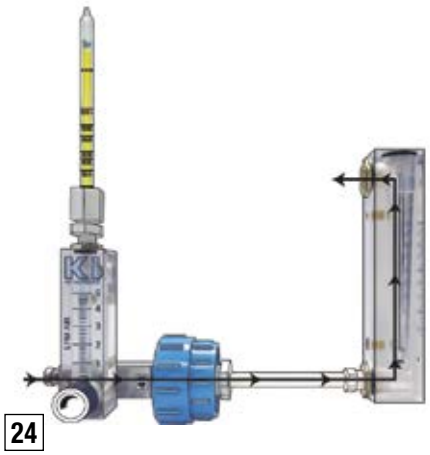

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FROM THE EDITOR | Food Processing

I have run into Darigold's Energy Engineer, Uli Schildt, for many years at the World Energy Engineering Conference. Darigold produces 2.6 million gallons of milk per day (to name one product of many) and operates 11 plants in the U.S. Pacific Northwest. Compressed air makes up roughly 20 percent of their energy spend and is monitored closely in their monthly energy report. What is innovative about their energy management program, however, is their use of annual Energy Program Assessments. Performed at the beginning of each fiscal year, Mr. Schildt invites Energy Team Members and utility providers to act as inspectors
to grade the progress of each plants' program. We hope you enjoy this feature article.

Compressed air quality, in food processing plants, will continue to be a focus of this publication. In this issue, we publish an article from ISEL's Dan Sandler on the use of H1 food-grade lubricants and another from Ruby Ochoa, from Trace Analytics, on sampling/testing processes used to check for compressed air contaminants.

On-site nitrogen generation, using compressed air, continues to gain momentum versus bulk delivery strategies consisting typically of cylinders, dewars and bulk liquid tanks. Jason Dodge, from Peak Industrial, supplies us with an interesting article on its' use in modified atmospheric packaging applications. There are useful tables with return-on-investments calculations and nitrogen purity specifications for different food segments.

Thank you for investing your time and efforts into ***Compressed Air Best Practices®***.

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➤ P.S. Learn to repair pneumatic circuits on production equipment – circuits working against the compressed air system – by signing up for our free April 28th Webinar titled, "Purging Demand-Side Demons", at www.airbestpractices.com/magazine/webinars.

Cover photo provided courtesy of Darigold. Pictured is the Darigold plant in Sunnyside, Washington.

INDUSTRY NEWS

Sullair Announces Multimillion-Dollar Investment in Michigan City Facility

Sullair, an industry leader in innovative compressed air solutions since 1965, recently announced it is making a multimillion-dollar investment to purchase seven state-of-the-art machines for use in its rotor shop located in Michigan City, Indiana. The enhanced machinery will increase efficiency and safety on the factory floor, replacing 30- to 40-year-old equipment.

Sullair recently invested in seven state-of-the-art machines for its rotor shop in Michigan City, Indiana.

"This is further evidence of our commitment to the Michigan City community and our strategic investment in the tools and equipment needed to continue to remain a leader in compressed air and rotary screw technology," said Sullair President Scott Nelson.

Sullair has long concentrated on its rotors, dubbed the "secret sauce" of its air compressors. Since the company's founding, Sullair has designed and manufactured its rotors and air-end assemblies in Michigan City. The company has been recognized as an innovator and leader in rotary screw design, and this most recent investment will allow Sullair to continue to deliver durable and innovative solutions.

The new machinery, expected to begin to arriving mid-2016 and continue into early 2017, will increase efficiency and productivity in every step of the rotor process, while improving quality and enhancing safety for machine operators.

"This is an exciting time for Sullair," said Ray Lewis, Machine Shop Senior Supervisor at Sullair. "Not only are we upgrading 30- to 40-year old equipment with state-of-the-art machinery, but the overall workflow at Sullair will be streamlined and safety will increase."

For more information, visit www.sullair.com.

Rogers Machinery Company Opens New Production Facility

Rogers Machinery Company, Inc., an industrial designer and packager of compressed air and vacuum systems for over 65 years, has announced the opening of an additional production facility for their Kobelco KNW Series Oil-Free Compressors. "The state-of-the-art manufacturing, assembly and R&D facility is an important advancement as we continue to grow our North American market share," said Mike Schmeltzer, President & CEO of Rogers Machinery Company, Inc.

This investment allows for more efficient production and testing of electric and diesel-driven, oil-free compressors up to 600 horsepower, and helps to better meet the delivery expectations of customers.

The new production facility will manufacture the Kobelco KNW Series Oil-Free Compressors.

INDUSTRY NEWS

In addition to other buildings on the corporate campus, this building will be partially powered by the sun. The solar-electric system will reduce and stabilize energy costs, allowing Rogers Machinery Company, Inc. to follow through on their long-standing commitment to energy conservation and the environment.

For more information, visit www.knw-series.com.

Metro Air Compressor Moves to New Facilities, Expands Offerings

Metro Air Compressor, a Michigan-based distributor of compressed air products, service, installations and rentals since 1975, announced it is expanding its service offerings and has moved two of its offices. As part of its growth and expansion, Metro Air has new offices in Saginaw and Roseville, Michigan.

In 2015, Metro Air moved its Saginaw facility from an 8,000-square-foot building to one that is 13,000-square-feet. The new facility is located at 1430 Agricola Drive in Saginaw. In late January 2016, Metro Air moved its headquarters into a new facility in Roseville, located at 15990 Sturgeon Street. The new facility is more than double the size of its old location, from 19,000-square-feet to 39,000-square-feet. It also condensed what was four separate buildings to everything under one roof.

"Our new facilities will not only be safer and provide a better overall working environment for our employees, but our customers will benefit from our expanded service offerings and our ability to be more reactive to their needs," said Kevin Merritt, president of Metro Air Compressor. "We've been in business for more than 40 years and have built a strong allegiance throughout the years. We look forward to continuing to provide the support and expertise our customers have grown to expect from Metro Air."

Metro Air moved its headquarters to a new facility in Roseville, Michigan.

The new Roseville facility will also allow Metro Air to expand its rental fleet and inventory. With

92 rental units, the company has the largest fleet in Michigan but looks to expand this to better serve customers. The additional space will allow better visibility and be organized in adherence with 5S, a workplace organization method designed for efficiency and effectiveness.

Metro Air currently offers Sullair portable and stationary compressors, refrigerated and desiccant dryers, flow controllers, and a full line of after-market parts and accessories. With its additional capacity, the company plans to enter emerging markets and launch a new division, which includes custom-built projects. It also expects to hire additional staff in the months to come.

In addition to Metro Air's locations in Saginaw and Roseville, the company also has a facility in Gaylord.

About Metro Air Compressor

Metro Air Compressor, established in 1975, is a full line distributor of compressed air products, service, installations, and rentals. These products include rotary screw compressors, piston compressors, vacuum pumps, dryers, filtration, and water cooling systems.

For more information, visit www.metroaircomp.com.

Edgetech Instruments Moves to New Facility

Edgetech Instruments, Inc., a global leader in the design and manufacture of chilled mirror hygrometers and other moisture and oxygen measurement devices, has moved to a 13,000-square-foot facility in Hudson, Massachusetts, where the company now houses its administrative offices, along with engineering, manufacturing and calibration areas.

All Edgetech Instruments' hygrometers are made and supported in the United States at the Hudson facility. Edgetech Instruments manufactures absolute and relative humidity hygrometers, as well as oxygen concentration measurement devices. Calibration of the devices takes place in a separate, environmentally controlled section of the building. In 2015, Edgetech Instruments achieved ISO/IEC 9001 certification at its new facility.

Edgetech Instruments' products include trace moisture analyzers and instrumentation, wireless and handheld portable hygrometers, absolute and relative humidity transmitters, aircraft hygrometers, humidity and temperature test chambers, and instrumentation for engine

INDUSTRY NEWS

The new facility gives Edgetech modern accommodations, in addition to room for expansion as needed to serve its customers.

test cells. The company takes a solution approach, customizing and integrating other instruments or alarm devices to provide complete systems when requested. The company serves industrial customers as well as the pharmaceutical, medical and metrology industries, with standardized and specialized products.

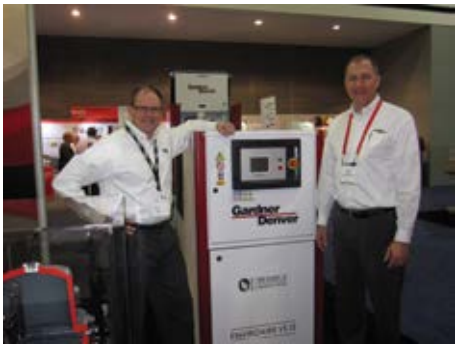
For more information, visit www.edgetechinstruments.com.

Compressed Air Technology at IPPE 2016

The 2016 International Production & Processing Expo (IPPE), held in January 2016, had another great year with 30,277 poultry, meat and feed industry leaders from all over the world in attendance. There were also 1,301 exhibitors, a new record, with more than 464,750 square feet of exhibit space. The Expo is the world's largest annual poultry, meat and feed industry event of its kind and is one of the 50 largest trade shows in the United States. IPPE is sponsored by the U.S. Poultry & Egg Association, American Feed Industry Association and North American Meat Institute.

Gardner Denver's Industrial Products Group had a large booth featuring their compressed air technologies. Oil Free Compressors Product Manager, Bob Shade, presented their 15-110 kW (20-150 horsepower) EnviroAire oil-less rotary screw air compressors. This is a single-stage, water-injected, truly oil-free solution containing absolutely no lubricating oil, allowing the unit to offer ISO Class 0 oil-free air plus a 100% silicone-free guarantee. It features a direct-drive system running airend speeds of only 3700 rpm and compression temperatures of only 140 °F. The benefits of water-injection technology include the elimination of the gearbox and the final air cooler (due to the lower compression temperatures). The unit connects to potable water supply with pressures between 32-87 psig and consumes 4-10 gallons per day. A reverse osmosis water purification system filters the inlet water and is coupled with a storage tank. The unit is driven by a variable speed drive and capable of 80% turn-down and the water-injection system features a reverse osmosis system with a storage tank.

Kaeser Compressors had a very nice booth featuring their SFC variable speed air compressors with variable frequency drives (VFD). Kaeser Marketing Services Manager, Michael Camber, reviewed the product line. There are 26 models ranging from 10 to 700 horsepower (8 to 515 kW), flow capacities from 10 to 3045 cfm and standard pressures from 80 to 217 psig. The SFC units feature soft starts allowing them to go from zero to full load without current spikes or excess heat rises – allowing for unlimited motor starts. The units control system pressure, within a 2 psig



Gardner Denver's Industrial Compressed Air Products team at IPPE: Scott Springli and Bob Shade (left to right)

Joe D'Orazio, Kregg Brooks and Michael Camber at the Kaeser Compressors booth (left to right)

Kurt Peter and Keely Marlowe at the Compresyn booth (left to right)

band, using highly accurate sensors and the Sigma Control System to control motor speed.

I didn't know JAX Inc. has been a major food-grade lubricant supplier to the food industry for many years. Corporate Engineer and Product Manager, Kurt Peter, said the firm practically "invented" food-grade lubricants for the process equipment companies. COMPRESYN is the synthetic food-grade lubricant, for air compressors and vacuum pumps, the firm is introducing to the market. Kurt said Compresyn features 8000 working-hour life expectancy, longer than other similar lubricants.

Next year's International Production & Processing Expo will be held Jan. 31 – Feb. 2, 2017, at the Georgia World Congress Center in Atlanta, Ga. Show updates and attendee and exhibitor information will be available at www.ippexpo.org.

USING H1 FOOD-GRADE LUBRICANTS in Food Processing Plants

By Isel Staff & Dan Sandler, Isel Inc.

Health and safety issues are a major concern in the food industry. Not only can contaminated food products endanger consumers, but they also can cause significant damage to a company's reputation and bottom line. Contamination can come from many sources—industrial lubricants among them. With the abundance of lubricated machinery used in the food industry, lubricant dripping from a chain or escaping through a leak in a component can prove catastrophic. Even with the most prudent maintenance and operating procedures, along with a strict HACCP (hazard analysis and critical control points) plan, contamination may still occur.

Using H1 food-grade lubricants can help reduce the health and safety risks of a company's food products.

The FDA Food Safety Modernization Act

The U.S. Food and Drug Administration (FDA) prohibits any food contamination by a non-food-grade lubricant. Under the FDA Food Safety Modernization Act, each owner, operator or agent in charge of a food facility is required to identify and implement preventive measures to substantially minimize and prevent food safety hazards. The legislation also broadens governmental authority to order product recalls and to protect public health. The costs of a recall can add up substantially:

> "Today, advancements in lubrication technology have led to a new generation of food-grade synthetic lubricants satisfying food safety guidelines and able to withstand the challenging demands of modern food processing equipment."
>
> — Dan Sandler, Isel Inc.

- Retrieval and destruction of the product
- Notifying the public of the recall
- Possible legal expenses and fines/settlements in the event of any lawsuits
- Loss of market share due to negative publicity and declining consumer confidence/trust
- Extra efforts needed to help rebuild the company's reputation, brand image and market share

Notable Lubricant Contamination Recalls

Although some other types of contamination (such as bacteria and allergens) are more common, incidents of lubricant contamination in the food industry have made the headlines in recent years, including those seen in Table 1[1]

Implement an HACCP Plan and Lubrication Survey

To help prevent contamination issues at a facility, and correct any that might exist, a facility should implement an HACCP plan and lubrication survey. The HACCP program, originally developed by NASA to protect astronauts from food contamination issues, is a scientific approach for controlling and preventing food safety hazards in food processing, packaging and transportation. The program provides a system to:

- Identify any food contamination risks and the control points at which they may potentially occur
- Establish preventive measures for each control point
- Monitor and evaluate the progress of the new measures implemented

USING H1 FOOD-GRADE LUBRICANTS IN FOOD PROCESSING PLANTS

- Identify and enact subsequent corrective measures as necessary to achieve contamination risk prevention and control

A lubrication survey, which lubricant suppliers such as Isel can help conduct, provides a thorough analysis of lubricant contamination risks in a facility. Some of the key issues these surveys address:

- Do the properties of each lubricant suit the application for which it is used?
- Does the equipment design ensure lubrication maintenance without risk of incidental food contact?
- Is lubricant dispensing equipment used for multiple lubricants, thereby increasing risk of lubricant cross-contamination?
- Are the lubricant storage and handling procedures adequate to prevent contamination?

Answers to these and other survey questions will help determine the preventive and corrective measures needed, as part of the HACCP plan, to improve food safety.

Protect the Food and the Company

Using food-grade lubricants can help protect consumers and companies from the health, safety and financial risks of lubricant contamination. Thanks to recent technological advancements in the lubrication industry, products are available offering the benefits of food-grade formulation without sacrificing performance.

Lubricants used in the food industry are categorized across three types:

H1 Lubricants: These lubricants may have incidental contact with food. Formulations may only contain certain base stocks, additives and thickeners as specified by FDA regulations (21 CFR 178.3570). In addition, in the event of incidental contact, contamination of food by an H1 lubricant must not exceed 10 parts per million (i.e., 0.001 percent).

H2 Lubricants: These fluids may only be used where there is no possibility of contact with food. Their formulations do not face the restrictions applicable to H1 lubricants. However, H2 lubricants cannot contain carcinogens, mutagens, teratogens, mineral acids or intentionally heavy metals, such as antimony, arsenic, cadmium, lead, mercury or selenium.

H3 Lubricants: Also known as soluble or edible oils, H3 lubricants are typically used to clean and prevent rust on hooks, trolleys and similar equipment. After application, these lubricants must be washed or wiped clean from the equipment before it is put to use. H3 lubricants may only contain edible oils, certain mineral oils that meet FDA 21 CFR 172.878, and oils generally recognized as safe (GRAS) under FDA regulation.

Performance: Once An Issue, Not Anymore

Years ago, early food-grade lubricants often fell short on performance compared to non-food-grade alternatives. Many plants were forced to settle for inadequate lubrication for the sake of food safety, or accept the risks of using non-food-grade fluids to meet performance demands.

TABLE 1: NOTABLE LUBRICANT CONTAMINATION RECALLS	
PRODUCT RECALLED	**REASON FOR RECALL**
86,000 pounds of sliced and packaged turkey	Contamination by a non-food-grade lubricant, discovered following consumer complaints of off-color, off-odor, off-flavor product, and some reports of temporary intestinal discomfort.
490,877 pounds of smoked boneless ham	Exposure to gear lubricant, discovered after several consumers reported an unpleasant taste as well as a burning sensation in the throat lasting up to 3 hours after eating the product.
1,100 tons of powdered milk, manufactured over a 6-month period	Contamination by lubricating oil containing very fine particles of iron, discovered when a consumer reported a pale gray tint to the product. A leading distributor incurred losses of $6.5 million due to product recalls and sued the manufacturer for losses not covered by insurance.
4,740 pounds of turkey sausage	Grease contamination
142,182 cases of macaroni-and-cheese meals	Contamination from an air compressor lubricant
4,000 cases of canned soft drinks	Contamination from a conveyor lubricant
28,928 2-liter bottles soft drinks	Gear-lubricant contamination
Bottled soft drinks (unspecified quantity)	Lubricant contamination with the potential to cause irritation upon drinking the beverage
Canned baby food (unspecified quantity)	Mineral-oil lubricant contamination that made the food smell like tar and prompted a mother to contact environmental health officials
55 tons of seasoning	Mineral-oil contamination, resulting in a recall that cost the manufacturer an estimated $1.9 million
Wine grapes (unspecified quantity)	Contamination from a mineral hydraulic lubricant, which escaped through a ruptured hose onto the grapes during harvesting. The problem affected grapes harvested at two vineyards before it was discovered upon the breakdown of the harvesting equipment at the second vineyard. The second vineyard successfully sued the harvester and the first vineyard for a total of nearly $300,000.

[1]Sources: United States Department of Agriculture Food Safety and Inspection Service (USDA FSIS), U.S. Food and Drug Administration (FDA), Food Standards Australia New Zealand, The Straits Times, Youth Daily Shanghai, AFX News Ltd., Philippine Daily Enquirer, The Sentinel (Stoke on Trent, UK), High Court of New Zealand, Machinery Lubrication.

Today, advancements in lubrication technology have led to a new generation of food-grade synthetic lubricants satisfying food safety guidelines and able to withstand the challenging demands of modern food processing equipment. Thus, manufacturers can minimize the potentially costly risks of lubricant contamination of food products while also enhancing equipment reliability and plant productivity. BP

For more information, contact Dan Sandler, Isel, tel: (904) 378-3232 or visit iselinc.com/foodgrade.

To read more about the ***Food Processing*** industry, please visit www.airbestpractices.com/industries/food.

ON-SITE NITROGEN GENERATION

for Modified Atmospheric Packaging

By Jason Dodge, East Coast Manager, Peak Industrial

In the food and beverage industry, the moment a product leaves the production line, the clock starts ticking down to when that product will no longer be viable for sale or consumption. To combat the clock, modified atmospheric packaging (MAP) techniques are used to help maintain product freshness and increase shelf life. Nitrogen is the most cost effective, efficient and widely used industry solution for a company's packaging needs—

Application	Purity Range (% Nitrogen)	Increased Shelf Life due to Nitrogen
Beverage Market	99.5 - 99.9	1 - 2 weeks
Snackfoods	99 - 99.99	6 - 12 months
Coffee	99 - 99.9	6 - 12 months
Dried Food Products	99 - 99.99	4 - 16 months
Fresh Fruit and Vegetables	99 - 99.95	1 - 5 weeks
Grated Cheese	99.5 - 99.99	1 - 3 months
Ready to Eat Meats	99 - 99.99	1 - 2 weeks
Cooked Meats	99 - 99.99	1 - 2 months
Wine	99.5 - 99.9	Required for all sales.

Figure 1: When the proper nitrogen purity is used, modified atmospheric packaging can greatly increase a product's shelf life.

> "The vast majority of manufacturers purchase nitrogen gas through bulk delivery. However, there is a better, more sustainable option: To become self-sufficient, manufacturers can produce their own nitrogen gas with an on-site nitrogen generator."
>
> — Jason Dodge, East Coast Manager, Peak Industrial

whether it is for manufacturing cheese, coffee, dried snack foods, or fresh and ready-to-eat (RTE) foods. MAP also helps to decrease chances of contamination or spoiling, keeping products on the market for longer and ultimately increasing the reach of distribution (Figure 1).

The vast majority of manufacturers purchase nitrogen gas through bulk delivery. However, there is a better, more sustainable option: To become self-sufficient, manufacturers can produce their own nitrogen gas with an on-site nitrogen generator. This not only eliminates the ongoing costs associated with bulk delivery and storage, but it is also significantly safer.

If a business is not already producing its own nitrogen, there are mainly three ways of supplying nitrogen to a facility: cylinders, dewars and bulk liquid tanks. Beyond the costs of having these supplies delivered, each of these approaches has additional costs and safety considerations.

Cylinders for Nitrogen Supply

High-pressure cylinders are the most expensive form of bulk gas supply, and there are many hidden costs associated with their usage.

- **Safety:** High-pressure cylinders are dangerous if they are knocked over or mishandled. Direct supervision is required when they are moved to or from storage. Even when empty, the cylinders are very heavy, and can cause injuries if they fall. Furthermore, changing high-pressure lines can be hazardous if not done properly, and turning lines on when they are not secured properly can lead to explosive results.

ON-SITE NITROGEN GENERATION FOR MODIFIED ATMOSPHERIC PACKAGING

Cost Analysis			
Cylinder Breakdown Rental Fee per Month $10	Cylinder Cost $25	Fuel Charge / Delivery Fee $5	Hazmat Fee $15
Cylinders per Delivery 15	Deliveries per Month 5	Monthly Cost $2,025	Annual Cost $24,300
Typical ROI for this scenario 8-14 months			
Cost Analysis			
Dewar Breakdown Rental Fee per Month $12	Cylinder Cost $62	Fuel Charge / Delivery Fee $25	Hazmat Fee $10
Dewars per Delivery 15	Deliveries per Month 5	Monthly Cost $4,885	Annual Cost $58,620
Typical ROI for this scenario is 8-24 months			
Cost Analysis			
Bulk Tank Breakdown Tank Rental Fee per Month $800	Cost per Liter $0.92	Fuel Charge / Delivery Fee $25	Hazmat Fee $0
Liters per Week 800	Deliveries per Month 5	Monthly Cost $7,805.00	Annual Cost $93,660.00
Typical ROI for this scenario 8-14 months			

Figure 2: Although gas costs vary from state to state and projects differ in scope, this chart provides typical ROIs for switching from bulk supply to on-site nitrogen generation.

- **Nitrogen Waste:** It is physically impossible to get every cubic foot of gas out of a cylinder due to progressively falling pressures and the accumulation of impurities. So when a business returns "empty" cylinders to a gas company, they are effectively giving around 10 percent of the gas back.
- **Product Damage/Loss:** If operators are not monitoring gas supply levels and forget to switch tanks in the middle of a run, then products can be damaged or entirely lost. Running without nitrogen renders the same results. This is a rather large liability, and often requires additional systems to monitor. Failure to do so can result in massive costs.
- **Rental Costs:** Many companies may also be paying rental charges for cylinders or tanks. Businesses should be cognizant of contracts in order to avoid additional rental fees.
- **Added Costs for Logistics:** If a business operates in a remote area or outside the gas supplier's main route, they will probably be familiar with the issues created by untimely supply. It often results in delayed production or having to turn down new business altogether.

The Downside to Dewars

Another common solution for supplying bulk nitrogen is to have liquid delivered directly to a facility. The gas is usually stored in dewars, large stainless steel tanks with a volume of liquid nitrogen in them. They share all of the aforementioned issues with gas cylinders, in addition to one particularly unique concern: off-gassing. Off-gassing is a problem common to all types of gaseous liquid storage, as liquid nitrogen is constantly being converted to gas. Consequently, the gas leaks from the dewars. Therefore, if a company is not constantly using their supply, it is slowly being wasted.

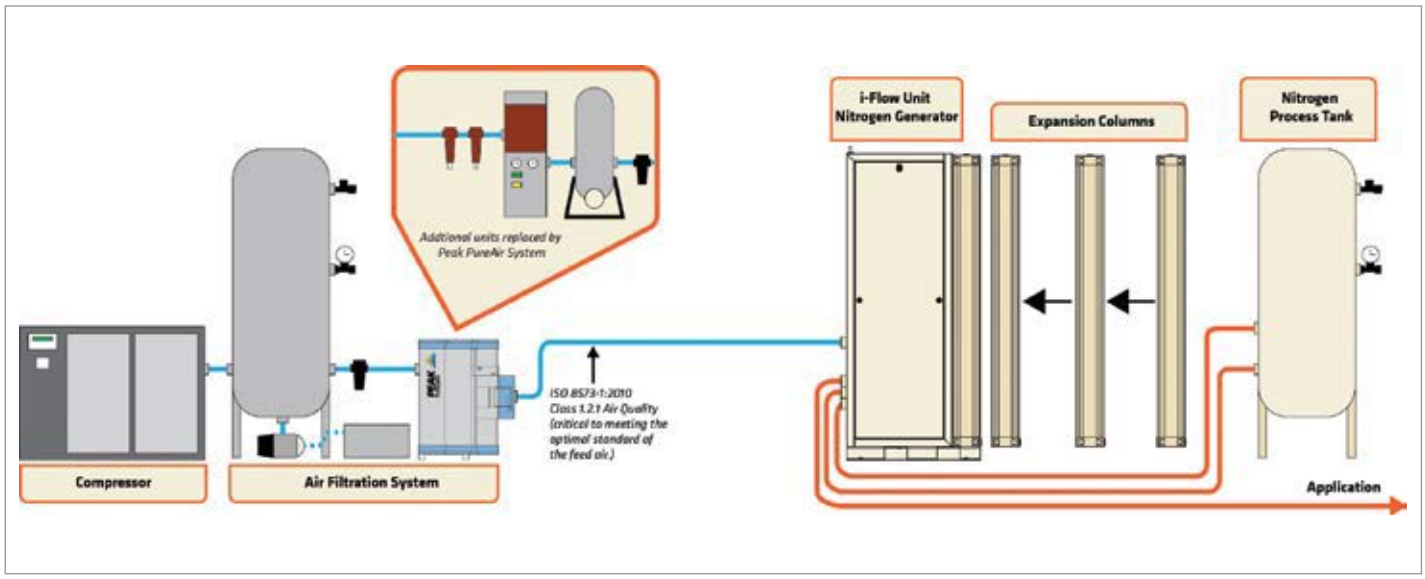


Figure 3: Self-contained nitrogen generation systems include an air compressor, filtration, and drying systems that feed into the nitrogen generator.

Bulk Storage Tanks For Nitrogen Supply

While companies don't have to worry as much about operator liability or workplace safety, bulk storage tanks have their own set of hidden costs.

- **Off-Gassing:** Just like dewars, off-gassing is also a major problem with tanks.
- **Installation/Rental Costs:** Bulk tanks can be pretty big (on average, they range from 10 to 50 feet in height, occupying 25 to 100 square feet) and have to be installed outside the facility, meaning they require a fair amount of square footage. Also, there are monthly payments for equipment rental and upkeep. Lastly, depending on the extent of a company's needs, bulk delivery charges may apply.
- **Long Contracts:** Bulk suppliers will often tie businesses into multi-year contracts (on average 5 to 10 years) and will prosecute for early withdrawal, subsequently limiting a company's ability to find better deals or solutions.

ON-SITE NITROGEN GENERATION

Switching to On-Site Nitrogen Generation

Ultimately, the main justification for switching from bulk supply to on-site nitrogen generation is return on investment. However, this can seem quite complicated, as gas costs are subject to a host of variables, which can vary from state to state. Performing a cost analysis demonstrates how quickly returns can be made, and subsequently re-invested into the business. While the scope of each project will vary based on business needs, some typical examples of bulk supply costs that an average business could relate to are provided in Figure 2.

As Figure 2 demonstrates, deliveries, rental costs and hazmat charges contribute a great deal towards annual costs. Furthermore, the upfront charges of gas cylinder or dewar supply doesn't take into consideration any additional costs related to labor, storage and potential product wastage when nitrogen supplies run out. With on-site nitrogen generation, there is an opportunity to repurpose such potential losses into operational improvements, such as building more production lines, upgrading existing equipment or even hiring/training employees.

Demystifying On-Site Nitrogen Gas Generators

Nitrogen generators are nothing new: However, general awareness within manufacturing has been quite low, and as a result, on-site nitrogen generators have not yet reached a high level of market penetration. In addition, the technology involved has advanced significantly in recent years, and most perceptions of nitrogen generation are out of date.

FOR MODIFIED ATMOSPHERIC PACKAGING

For the food and beverage sector, the main technology used for nitrogen generation is pressure swing adsorption (PSA), and it works in a relatively simple way. Each generator consists of carbon molecular sieve (CMS) material packed into dual pressure vessels. Compressed air is fed into these vessels, and due to molecular size, the sieve adsorbs the oxygen, while allowing nitrogen to pass through. As oxygen builds up in the vessels, it is purged through a cycle of compression and decompression (hence, pressure swing adsorption).

ISO8573-1:2010 Class	Solid Particulate				Water		Oil
	Maximum number of particles per m^3			Mass Concentration mg/m	0.1-0.5 micron	0.5-1 micron	Total Oil (aerosol liquid and vapour)
	0.1-0.5 micron	0.5-1 micron	1-5 micron				mg/m^3
0	As specified by the equipment user or supplier and more stringent than Class 1						
1	≤ 20,000	≤400	≤10	-	≤-70°C	-	0.01
2	≤400,000	≤6,000	≤100	-	≤-40°C	-	0.1
3	-	≤90,000	≤1,000	-	≤-20°C	-	1
4	-	-	≤10,000	-	≤+3°C	-	5
5	-	-	≤100,000	-	≤+7°C	-	-
6	-	-	-	≤5	≤+10°C	-	-
7	-	-	-	5-10	-	≤0.5	-
8	-	-	-	-	-	0.5-5	-
9	-	-	-	-	-	5-10	-
X	-	-	-	>10	-	>10	>10

Figure 4: On-site nitrogen generators from Peak Industrial need compressed air that meets ISO 8573-1:2010 Class 1.2.1 specifications.

ON-SITE NITROGEN GENERATION FOR MODIFIED ATMOSPHERIC PACKAGING

Figure 5: Peak Industrial i-Flow nitrogen generators are modular, and a system can use multiple units working in parallel.

Nitrogen generators come in numerous shapes and sizes, but they all require compressed air to operate. A fully self-contained system includes an air compressor, filtration and drying systems that feed into the nitrogen generator. However, investment in much of this may not be necessary, as the generator can be set up to run from existing compressed air systems. In terms of flow rates, the nitrogen generation system includes a generator and a buffer tank. As the generator is cycling, the buffer tank ensures that nitrogen flow rates are never impacted downstream.

Proper Compressed Air Purification for Nitrogen Generation

Compressed air quality is critical for proper operation of an on-site nitrogen generator. For instance, the Peak Industrial i-Flow nitrogen generator requires compressed air meeting the ISO 8573-1:2010 Class 1.2.1 specification (as seen in Figure 4). This means that prior to entering the generator, compressed air must be filtered by a two-stage filtration system to remove nearly all particulates, along with a carbon filter to remove any oil vapor. This specification also requires air to be dried down to a -40˚F dew point with a desiccant dryer. As long as there is clean, dry compressed air being provided to the generator, it can effectively operate without supervision. However, not meeting these specifications may lead to decreased equipment life span and reduced performance.

Key Nitrogen Specifications: Flow Rate, Purity and Pressure

In order to develop a nitrogen generation system for a business, there are three

specification points that are required: flow rate, purity and pressure. In simpler terms, the end user needs to know how much nitrogen is used, what level of purity is required, and the delivery pressure required downstream.

Within the food and beverages industry, most applications are low pressure (sub 100 psig, or close to atmospheric), and require purity levels between 99 and 99.99 percent (as shown in Figure 1). Packaging equipment will regulate the gas pressure suitable to its own operation, and purity requirements will depend on the product type (on average 99.9 percent will suffice—the higher the purity requirement, the greater the quantity of compressed air needed, consequently increasing the costs). Flow rates will also vary depending on the equipment and production requirements. To establish what is needed, consulting with the packaging equipment manufacturer is usually the best place to start.

Installation, Infrastructure and Distribution

Installation space and infrastructure vary when comparing different nitrogen generator manufacturers. In the past, with the likes of twin tower nitrogen generators requiring greater than 20-foot ceilings, size alone would have turned a company away from considering the technology. However, the size of units has changed dramatically over time.

Peak Industrial's i-Flow generators are under 6 feet in height, and are modular in design, meaning they can be expanded with additional CMS columns or built with multiple units working in parallel (Figure 5). This allows flexibility for growth at low costs and integration without major alterations to workspace. Also, in most cases, there will be no special requirements in terms of infrastructure or distribution of nitrogen gas from a generator (i.e. it will use existing distribution lines), and no special material will be required outside of a company's specifications.

Why Investing in On-Site Nitrogen Generation Makes Sense

The information covered in this article helps demonstrate that on-site nitrogen generators are the most cost effective and sustainable method of providing nitrogen for a manufacturing facility. They can deliver any level of flow, pressure and purity. While the initial capital investment may be slightly higher than bulk delivery, the investment would pay for itself within 6 to 18 months (on average). Such an investment not only minimizes the impact of ongoing supply costs on a company's bottom line, but it also helps take steps toward self-sufficiency. BP

For more information, contact Peak Industrial, tel: 1-866-647-1649, email: marketing@peakindustrial.com, or visit www.peakindustrial.com.

To read more about ***Nitrogen Generation,*** please visit www.airbestpractices.com/technology/air-treatment.

Sampling and Testing for Compressed Air Contaminants

By Ruby Ochoa, President and Owner, Trace Analytics, LLC

According to the Compressed Air and Gas Institute (CAGI) and the International Organization for Standardization (ISO), the three major contaminants in compressed air are solid particles, water, and oil. CAGI promotes proper use of air compressors with various educational tools, while ISO 8573 is directed at the very specific areas of compressed air purity and test methods, which this article will address. Microorganisms are also considered a major contaminant by CAGI, but will not be discussed in this article.

ISO 8573 consists of nine parts or sections that address compressed air. ISO 8573-1 is the primary section that provides contaminants and purity classes. The other eight sections address sampling techniques and analytical methods for various contaminants. Each contaminant discussed will reference the appropriate ISO 8573 section, along with the current version date.

Particle Testing by Size per ISO 8573-4:2001

Particle testing is performed by size or by mass, depending on the selected purity class. Under ISO 8573-4:2001, this testing

ISO 8573-1:2010 Compressed Air Contaminants and Purity Classes

Class	Particles				Water			Oil
	By Particle Size (maximum number of particles per m^3) See Note 2			By Mass	Vapor Pressure Dewpoint		Liquid	Liquid, Aerosol, & Vapor See Note 1
	0.10 – 0.5 microns	0.5 – 1.0 microns	1.0 – 5.0 microns	mg/m^3	°C	°F	g/m^3	mg/m^3
0	As specified by the equipment user or supplier and more stringent than class 1							
1	20,000	400	10	-	≤ -70	≤ -94	-	< 0.01
2	400,000	6,000	100	-	≤ -40	≤ -40	-	< 0.1
3	-	90,000	1,000	-	≤ -20	≤ -4	-	< 1
4	-	-	10,000	-	≤ +3	≤ +37	-	< 5
5	-	-	100,000	-	≤ +7	≤ +45	-	-
6	-	-	-	0 – 5	≤ +10	≤ +50	-	-
7	-	-	-	5 – 10	-	-	0.5	-
8	-	-	-	-	-	-	5	-
9	-	-	-	-	-	-	10	-
X	-	-	-	> 10	-	-	> 10	> 5
	Microbiological Contaminants				Other Gaseous Contaminants			
	No purity classes are identified				No purity classes are identified Gases mentioned are: CO, CO_2, SO_2, NOX, Hydrocarbons			

determines the number of solid particles within specified size ranges. Not all methods discussed in ISO 8573-4 can be used for all size ranges. Selection of a method will depend on the particle purity class required.

ISO 8573-1:2010 establishes three particle size ranges: 0.1 to 0.5 microns, 0.5 to 1.0 microns, and 1.0 to 5.0 microns. The maximum allowable number of particles per cubic meter varies by purity class. The specification does not allow the presence of particles greater than 5 microns for purity classes 1 through 5.

In the 2010 edition of ISO 8573-1, the particle size and maximum number of particles were harmonized with current filter manufacturer's capabilities. This harmonization created an effective method to communicate requirements for a compressed air system between the end user, filter and compressor manufacturer, and testing laboratory.

Different Methodologies for Particle Testing

Laser Particle Counter: A laser particle counter (LPC) is a high-performance, sensitive electronic instrument, and it is an excellent method for determining all three particle size ranges for particle purity classes 1 and 2. The LPC provides rapid, on-site particle determinations. Operation is straightforward and typically takes about 10 minutes per sample. Many models have a printable tape and/or the ability to download the data to a computer or USB flash drive. While LPCs can be cost prohibitive if only a few samples are to be taken on an infrequent basis, they can be extremely helpful when a particle contamination problem exists. Not all LPCs include the ranges specified in ISO 8573-1.

Because the LPC can be used to sample multiple locations rapidly with on-site test results, it is an excellent troubleshooting device. We have had customers identify particle

The LASAIR II-110, manufactured by Particle Measuring Systems, Inc., is a helpful tool when experiencing contamination problems. Photo credit: Trace Analytics, LLC

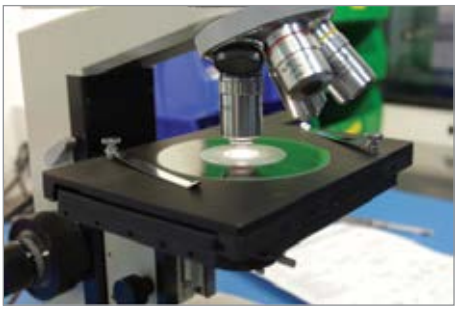
SAMPLING AND TESTING FOR COMPRESSED AIR CONTAMINANTS

contamination sources as O-rings in valves and filter housings, flexible tubing, distribution piping, and plastic or metal fittings. In most cases, the contamination was not part of the sampling process but part of the actual manufacturing process.

Trace has a rental program that includes necessary calibration documentation, simplified sampling instructions, and a high-pressure diffuser to prevent damage to the sampler. Sampling procedures include a background test and tubing background test. This assures that the sampler is operating correctly prior to sampling compressed air outlets.

Filter Collection with Microscopy: Particles can also be sampled by using a gridded membrane in a suitable holder and analyzed using an optical microscope. Full flow sampling can be used with this type of sampling equipment. This method cannot measure the smallest range of particles, from 0.1 to 0.5 microns, for particle purity classes 1 and 2.

ISO 8573-4 describes a sampling probe that is inserted into a pipeline to capture a sample. To avoid the necessity of tapping into the actual pipe and performing the steps required to ensure isokinetic sampling (the matching of linear flow rates between the product and sample streams), Trace's AirCheck™ Kit connects at the point of use, which allows for sampling the quality of compressed air in a manner that is representative of how it is being used in the manufacturing process.



Microscopy is often used for particle determination. Photo Credit: Trace Analytics, LLC

Trace's analytical method requires 12,000 liters of compressed air to meet class 1 requirements. Depending on the pressure and flow rate available at the sampling outlet, sampling may take two or more hours to collect. All other purity classes require 1,200 liters or less of air volume and only 12 minutes or less for sampling time.

Samples are analyzed using an optical microscope. This method is time and labor-intensive, but if performed by an accredited laboratory, the method provides customers with a third party, ISO 17025-accredited laboratory report. In some cases, useful information can be determined about the type of particles present. Samples are lightweight and easily transportable worldwide. Additionally, samples can be held indefinitely for re-analysis by microscopy or other more specific techniques.

There are other methods mentioned in ISO 8573-4 for particle determination that are not covered in this discussion. They include condensation nucleus counting, differential mobility analysis, and scanning mobility particle sizing. These techniques must generally be performed on site, and may be considerably more complicated than filter sampling. In addition, they may not provide results in terms that are readily converted to the units employed by the standard.

Solid Particle Content by Mass Concentration per ISO 8573-8:2004

Particle purity classes 6, 7, and X are typically used for industrial tools and pneumatically powered and operated machines with air filtered by general-purpose filters. Analyses for these classes specify mass concentration of particles by mass only. No particle size or quantity is determined. Results are reported in mg/m^3.

The method for collecting the sample is similar to the membrane method, except that the weight of the membrane must be recorded prior to use and then re-weighed after collection of the sample. This gravimetric method of analysis must take into consideration the influence of temperature, pressure, water vapor and other contaminants that may be present.

Particle Sampling Tips for Compressed Air Systems

Whenever a sample is taken from a compressed air outlet, it is important to ensure that the sampling process itself does not contribute to contamination. The connection between the point of use and the sampling equipment should be short, straight, and made of stainless steel without elbows, tees, valves or dead ends. This enables easy

"Be aware that the use of quick disconnect fittings, valves, gauges or anything with O-rings can lead to sporadic particulate contamination."

— Ruby Ochoa, President and Owner, Trace Analytics, LLC

cleaning in between multiple samples. The straight connection is important so as not to lose or trap particles before they are sampled.

Be aware that the use of quick disconnect fittings, valves, gauges or anything with O-rings can lead to sporadic particulate contamination. This is particularly crucial when attempting to meet the lower limits of particulate purity class 1. It may be beneficial to use high-purity valves and fittings along with the sampling set up to ensure compliance with low particle requirements, such as class 1.

When stainless steel cannot be used, specify flexible tubing with low particle shedding properties. Particle Measuring Systems, Inc. (manufacturer of the LASAIR® II-110 laser particle counter) provides the following list of preferred tubing material types in order of preference: stainless steel, conductive polymer, polyester, vinyl (if plasticizer does not interfere), polyethylene, copper, glass, Teflon, and aluminum.

Care should also be taken to avoid or minimize the loss of particles in the tubing. Keep bends to a minimum and lay the tubing flat if possible, and the bend radius/inside curvature should not be less than 6 inches.[1]

Photo Credit: Trace Analytics, LLC

Water Vapor Testing per ISO 8573-3:1999

ISO 8573-3 describes several methods for measuring water vapor, the level of uncertainty, and the detection range. Methods listed are in preferred order. The first tier of methods includes hygrometers, such as a psychrometer (wet and dry bulb thermometers), a chilled mirror (condensation), and electrical sensors. Secondary methods include chemical reaction, such as detector tubes, and spectroscopy.

It is quite common for air compressor systems to have a permanent, fixed-mount hygrometer that can provide the dew point at various points throughout a system.

Other hygrometers are better suited for in-laboratory use—either due to expense or lack of portability. A number of hygrometers are available, ranging from insensitive and cheap to very precise and expensive models. There are a number of keys to selecting a hygrometer:

1. It must cover the range required by the specification.
2. It must be capable of being calibrated.
3. The accuracy and precision of measurement at the desired level should be known.
4. It must have the capacity to be adapted to sample from pressurized air streams.

Handheld portable hygrometers for measuring dew point in compressed air are more readily available than when ISO 8573-3 was written in 1999. Detector tubes are the least expensive, portable method for determining an approximate dew point for either refrigerated or desiccant dryer systems. Certainly not as accurate as a calibrated hygrometer, detector

SAMPLING AND TESTING FOR COMPRESSED AIR CONTAMINANTS

tubes can still provide sufficient information to comply with ISO 8573's water purity classes. There are several chemical reaction tube manufacturers and sampling devices that use detector tubes. Typically, these require a known quantity of compressed air to flow through the tube at a specific flow rate. A color change or chemical reaction will occur between the water vapor in the air sample and the chemicals in the tube. This will be represented by a length of stain that can be read using the scale printed on the detector tube. Normal sampling times vary between 2.5 and 12.5 minutes—depending on detector tube type, type of dryer installed, and purity level.

Water Sampling Tips

To prevent the interference of ambient moisture permeating into the compressed air sample stream, select impermeable materials, such as polished stainless steel or PTFE. Avoid using hygroscopic materials like rubber, as these materials can allow ambient moisture to permeate into the tubing and affect the results. The use of polished or electro-polished stainless steel is important to prevent any water from collecting on the inner surface of the sampling apparatus.

The filter cassette holds three layers of membranes for oil aerosol collection and charcoal tube collect oil vapors. Photo Credit: Trace Analytics, LLC

Any type of connection between the sampling apparatus and the sampling outlet should be short, straight and without dead ends. Avoid the potential for leaks by limiting elbows, tees, and valves.

Total Oil Testing

There are so many different words to describe oil. To name a few, common terminology includes condensed hydrocarbons, oil mist, oil aerosol, oil vapor, total gaseous hydrocarbons, and total volatile hydrocarbons—and the list goes on. Oil aerosol is frequently referred to as condensed hydrocarbons or oil mist with limits/results noted in milligrams per cubic meter (mg/m^3). Oil vapor or gaseous hydrocarbons are frequently noted in parts per million (ppm). ISO 8573-1 combines both oil aerosol and oil vapor for total oil and is reported as mg/m^3.

ISO 8573 has a few definitions that help clarify which hydrocarbons are to be tested:

- **Oil:** A mixture of hydrocarbons composed of six or more carbon atoms (C6+)
- **Oil Aerosol:** A mixture of liquid oil suspended in a gaseous medium having negligible fall velocity/settling velocity
- **Organic Solvent:** A mixture of or a combination of the following identified groups: alcohols, halogenic hydrocarbons, esters, esters/ether alcohols, ketones, and aromatic/alphatic hydrocarbons
- **Wall Flow:** The proportion of liquid contamination no longer suspended within the air flow of the pipe

Oil Aerosol Testing per ISO 8573-2:2007

ISO 8573-2 describes Method A and Method B for collecting oil aerosol and oil liquid samples. Oil vapor is discussed in 8573-5. Method A is intended for sampling where heavy contamination levels exist, wall flow is present, and the contamination level is between 1 mg/m^3 and 40 mg/m^3. The liquid oil is collected with two high-efficiency, coalescing filters (one is a backup). Typical testing time is between 50 and 200 hours.

Method B consists of two separate techniques—B1 for full flow, and B2 for partial flow sampling. Both techniques are intended for oil contamination levels between 0.001 and 10 mg/m^3. Typical testing time is between 2 minutes and 10 hours, depending on the flow rate, the pressure available, and the oil purity class limit.

In general, the sampling procedure includes valves, the membrane holder, and the ability to measure flow rate, temperature, and pressure. Three high-efficiency membranes are stacked inside the membrane holder. The membrane must have a surface mass of 80 to 100 g/m^2, particle penetration of <0.0005 percent, and have a sturdy support base. In addition, Method B2 uses a straight sampling probe for partial flow sampling under isokinetic conditions. The distribution piping must be altered to allow for the insertion of the probe while maintaining identical velocity conditions.

Trace uses sampling method B1, as it is less intrusive and can be used at various points of use. A minimum air volume of 5,000 liters is required to meet class 1 purity level of 0.01 mg/m^3. Other purity classes require 500 liters of air or less.

The analytical method in ISO 8573-2 requires dissolution of the oil on the membrane by an unspecified solvent and analysis of the resulting

solution by infrared spectrometry. Trace's analytical technique gravimetrically determines oil by using pre-weighted membranes. After sampling, the membranes are weighed, extracted with n-pentane, and re-weighed.

Oil Vapor and Organic Solvent Content Testing per ISO 8573-5:2001

This section specifies collection of oil vapors consisting of hydrocarbons with six or more carbon atoms (C6+) on a charcoal tube. Oil vapor analysis is required only for classes 1 and 2.

The primary analytical method is by gas chromatography for vapor content in the range of 0.001 mg/m^3 to 10 mg/m^3. Chemical indicator tubes can be used only as a preliminary method (they lack the sensitivity and specificity required for quantitation at low levels). Lighter hydrocarbons composed of five or less carbon atoms are not included in total oil purity classes. These lighter hydrocarbons—as well as other gases like carbon monoxide, carbon dioxide, sulfur dioxide and nitrogen dioxide—are addressed in section 8573-6 Gaseous Contaminant Content. There are no established ISO 8573 purity classes or limits for these other gases.

Once again, the sampling procedure calls for a sampling probe, this time being installed into a stainless steel extraction tube filled with coconut charcoal. The sampling procedure as described in Annex A includes a membrane holder installed in front of the stainless steel charcoal-filled tube, a pressure and temperature gauge, valves, and a flow meter. The membrane in this case protects the charcoal tube from aerosol contamination.

Trace uses commercially available charcoal tubes made of glass. These tubes possess the advantages of being less expensive and having a more reliably low level of contamination than laboratory-prepared tubes.

Sampling Tips for Oil

Oil aerosol and vapor are determined at very low levels. Therefore, clean, oil-free fittings are critical for a true determination of airborne contamination. A slight amount of hydrocarbon contamination in a fitting is enough to produce unacceptably high levels of oil vapor (OV) on the charcoal tube. There should be no sudden pressure drops to avoid damaging membranes. Inner pipe diameter should be constant and crevice free—with the size of hole in the ball valve matching the size of piping to avoid loss of oil.

Avoid cleaning agents with solvents that can affect hydrocarbon content of a sample. Solvents can remain trapped in O-rings and fittings for a surprisingly long time, so only solvents that are not C6+ should be employed. And, as always, ensure that the air compressor inlet is not situated near a source of C6+ materials, such as cleaning baths, solvent waste cans, process solvent/materials, or other ambient sources of hydrocarbons.

If a number of compounds are expected to be present in the ambient or process air, it is best to have the laboratory perform OV analyses using gas chromatography/mass spectrometry, a technique that quite readily discerns between OV and other compounds. These other compounds can be reported separately, thus not impacting the OV level as might occur with gas chromatography with a non-specific detector, such as flame ionization detection (FID). BP

For more information, contact Ruby Ochoa, tel: (512) 263-0000 ext. 4, email: CDATest@AirCheckLab.com, or visit AirCheckLab.com.

References

(1) Particle Measuring Systems, Inc., Basic Guide to Particle Counters and Particle Counting, www.pmeasuring.com

(2) ISO 8573 specifications referenced above are copyrighted and are available for purchase online at http://webstore.ansi.org/.

To read more about ***Food-Grade Air,*** please visit www.airbestpractices.com/food-grade-air.

Innovative Energy Program Assessments at Darigold

By Clinton Shaffer, Associate Editor, Compressed Air Best Practices® Magazine

Darigold's facility in Sunnyside, Washington, is the company's largest plant.

Imagine a dairy farm. Do pictures of idyllic pastures populated by grazing, happy cows come to mind? What about the not-so-idyllic image of farmers milking cows by hand? Modern dairy farms work a little differently. Darigold, a farmer-owned dairy co-op located in the Pacific Northwest, has the happy cows, but production is more sophisticated. The company has eleven state-of-the-art production facilities churning out high-quality dairy products at mind-boggling rates. Milk, for instance, is produced to the tune of 2.6 million gallons per day. To maintain efficient production at scale, Darigold also has an innovative energy management program in place.

There are nearly 500 farmers across the Pacific Northwest who provide milk for Darigold's eleven plants. The factories vary in size: The plant in Bozeman, Montana, is relatively small, while the biggest facility, located in Sunnyside, Washington, is quite large. The plants also vary in what they make.

Darigold manufactures a wide variety of high-quality dairy products.

"Basically, we have two separate divisions," Uli Schildt, Energy Engineer, Darigold, told Compressed Air Best Practices® Magazine. "The Ingredients Division makes products that are used as ingredients for other food products, such as milk powder, whey powder, and butter for bakeries and other food processors. Then we have our Consumer Products Division, and they make products that you would buy in a grocery store—like fluid milk, cottage cheese, sour cream, and similar products."

Compressed air is a key part of the manufacturing processes at Darigold, regardless of the division. The resource is also energy intensive. As a partner of the Environmental Protection Agency's (EPA) Energy Star program, and a member of the Department of Energy's (DOE) Better Plants program, Darigold set the bold goal of reducing energy intensity by 25 percent over 10 years—with an aggressive annual target reduction of 3 percent over the first four years. To achieve those goals, the company keeps a close eye on the compressed air systems across every manufacturing facility.

Darigold Energy Team members Tom Rouleau and Derek Bauman, along with Uli Schildt, were kind enough to speak with us about the company's energy management program. During our discussions, they described how Darigold's energy management program goes above and beyond traditional means of self-assessment to drive greater awareness of key energy users. They also explained how compressed air is used and managed as part of the overall energy management program.

Energy Management at Darigold

As Darigold's energy engineer, Schildt works with each of the company's eleven plants to drive the energy program. Darigold measures energy intensity in BTUs per pound of product. The metric allows the energy management team to evaluate each facility with the same key performance indicator—regardless of the product being made. On average, compressed air encompasses about 20 percent of a Darigold plant's electrical energy spend, depending on the type of facility. At about 4,000 BTUs per pound, Darigold's energy intensity for the Ingredients Division is much higher than the Consumer Products Division, which can be as low as 130 to 140 BTUs per pound.

INNOVATIVE ENERGY PROGRAM ASSESSMENTS AT DARIGOLD

Energy use is monitored and recorded in a monthly report covering every facility. The reports are sent to all the plant managers and senior directors, who are responsible for overseeing several plants. The document also goes to the VP of operations. In addition to energy use, reports include Energy Team meeting minutes, and a list of action items for each plant, allowing upper management to see exactly how each plant is performing.

"With our energy report, we show how each plant is doing every month, and how that compares with our annual goal and our overall goal," Schildt explained. "On a bi-annual basis, we also conduct an Energy Program Management Review where we discuss the challenges in various plants and how management can help overcome those challenges."

Resources for Driving Corporate Sustainability

Darigold's energy management program is largely based on ISO 50001, an international standard for establishing an energy program. While the company is not compliant with the standard, the guidelines nevertheless provide a systematic framework for improving the energy efficiency of each plant. Being a part of the DOE Better Buildings, Better Plants program also offers valuable resources for Darigold's energy management team.

"We are part of the DOE Better Buildings, Better Plants program, and by signing up for that program, we've adopted their goals," Schildt commented. "The DOE provides a technical account manager that we work with, and I consult with him regularly for assistance towards meeting our goal. Another benefit of being a Better Plants partner is the free training offered by the program. In 2015, Frank Moskowitz conducted a three-day compressed air training at Sunnyside, offered at no cost."

Darigold is also a partner of EPA's Energy Star. While they are separate programs, Schildt said, "Each system, each agency, is complementary. The DOE focuses more on the technical aspect, and Energy Star more on the energy program management aspect. I think there are benefits by keeping them separate and having them focus on different aspects."

Energy Program Assessments Share Best Practices Across Plants

Darigold believes building a strong, cross-functional team at each plant is key to making real progress. At Darigold, each plant has a cross-functional energy team comprising a diverse selection of individuals—from

In 2015, Frank Moskowitz of the DOE's Better Buildings, Better Plants program provided a free, three-day training at Darigold's Sunnyside plant.

Plant Energy Program Assessment Summary - FY 2015

DARIGOLD

Last Updated 6/26/2015

		Assessment Results																			Score	Grade %	
		Site Assessment Date	Cross-Functional Energy Team	Team Charter	Regular Plant Energy Team Meetings	Participation in DG Energy Team Conference Calls	Utilization of Energy Team Bulletin Board	Identify Energy Efficiency Opportunities	Conduct Energy Program Self-Assessment	Employee Awareness	Employee Suggestion Process	Visitor Suggestion Process	Energy Awareness Campaign	Energy Awareness Month Event	Continuous Air Leak Reduction	No-Loss Air Drains	Conduct Annual Steam Trap Audit	Replace High-Wattage Lights in Refrigerated Areas	Point-of-Use Regulators Are Set to Proper Pressure	Implement Automatic Drum Washing	ISO 50001 Manual			
Maximum Points		25	25	100	125	50	200	25	50	25	25	25	100	25	25	25	25	25	25	25	950	100%	Comments
Plant A	5/5/15	24	23	100	125	46	188	25	28	21	22	16	93	15	0	0	25	3	0	25	779	82.0	
Plant B	6/16/15	21	25	100	125	46	191	25	50	23	21	23	100	22	25	21	23	20	18	25	904	95.2	
Plant C	5/7/15	23	25	0	0	48	187	25	37	25	25	10	100	21	25	25	25	1	0	25	627	66.0	
Plant D	4/21/15	25	21	100	25	46	188	25	53	25	21	25	100	25	25	25	NA	25	31	25	810	87.6	
Plant E	6/10/15	5	0	0	0	28	58	25	11	8	0	11	100	8	25	25	25	0	0	25	354	37.3	
Plant F	5/6/15	25	25	100	0	45	181	25	41	18	12	25	100	25	NA	25	NA	17	NA	25	689	78.7	
Plant G	4/29/15	23	25	0	25	40	188	25	48	23	0	12	100	25	23	25	NA	0	0	25	607	65.6	
Plant H	4/23/15	23	24	100	0	46	200	25	50	25	21	21	100	14	25	25	21	10	28	25	783	82.4	
Plant I	4/30/15	23	25	100	75	50	188	25	37	25	25	23	100	0	17	25	21	13	8	25	805	84.7	
Plant J	4/8/15	25	25	0	75	38	143	25	48	23	20	25	100	8	20	25	21	8	25	25	679	71.5	
Plant K	4/7/15	24	25	100	125	47	200	25	43	23	24	6	105	23	25	25	24	11	25	25	905	95.3	
																				Company Average	722.0	76.9	

Notes: Plant Energy Program assessments are conducted on an annual basis. The assessment criteria is made available well in advance. Plants are notified of the assessment date and time at least several weeks prior. Assessments are performed by a team consisting of 2 - 4 people. Each assessment score is the average of all team member's individual evaluations.

>100%	Above and beyond
90 - 100%	Fully implemented
20 - 89%	Some elements / degree
0 - 19%	Little or no evidence

Figure 1: Where a scorecard might provide a given amount of points, Darigold Energy Program Assessments detail the gradient to which a plant's energy program can improve.

equipment operators and maintenance personnel, to accounting and human resources. This provides a unique blend of perspectives, and fosters creative solutions.

Another unique attribute of the energy management program at Darigold is its use of annual Energy Program Assessments. Conducted by teams of two to four people, Energy Program Assessments provide an objective evaluation of each plant's energy team. They are performed at the beginning of every fiscal year, usually between April and May. Plant energy teams also perform self-assessments prior to formal energy reviews. Typically completed by January 31, the self-assessments are designed to find and correct any issues before the actual review, which involves outside parties.

"The Energy Program Assessments involve all people from outside the plant—either from our other plants, or from outside the

INNOVATIVE ENERGY PROGRAM ASSESSMENTS AT DARIGOLD

company," Schildt told us. "We have invited people from Seattle City Light, the Energy Trust of Oregon, Idaho Power, and other utility companies. That provides an additional inspector with a totally different perspective, and an unbiased view. We work quite closely with utility companies for energy rebates and incentives, so the more they know about what we're doing, the better. It's really a partnership."

Energy Program Assessments are comprehensive evaluations more advanced than a basic scorecard, a common grading method for determining the efficacy of an energy management program. Darigold's annual Energy Program Assessments advance on the scorecard methodology by detailing how well a plant is doing, where it can improve, and to what degree. As shown in Figure 1, the Energy Program Assessment matrix looks in depth at a plant's processes.

Milk powder dryers are major pieces of equipment within Darigold's plants.

Darigold considers scorecards a passive method of assessing how good a program is—whether it's energy or anything else. With a scorecard, if you perform a certain task, you get points. For one task, you may earn 5 points, or receive none. In Darigold's Plant Energy Program Assessment, each team member evaluates and scores the various criteria items independently. The average of the individual scores is then used for the final grade. Each assessment team member must also provide suggestions on how the plant can improve its score for the next year. It has been found that plants achieving high assessment scores also do well on energy intensity reductions.

Darigold recognizes the Energy Team that achieves the highest annual assessment score. The Green Light Award trophy is bestowed to the winning plant. Each member of the Energy Team gets an all-weather jacket as well as all plant employees receive a nice lunch cooler with Energy Champions embroidered on it.

Energy Teams Target Lower Plant Compressed Air Pressures

Like most industrial facilities, Darigold uses compressed air in just about every aspect of production—whether it is for actuating valves and cylinders, or for packaging and palletizing. Darigold typically utilizes rotary screw air

compressors between 100 and 200 hp, but there are always outliers. One or two of the air compressors will be fixed speed, running fully loaded while a VFD acts as a trim. Flow rates differ between plants, but can escalate to between 1800 and 2500 cfm. Plant compressed air is typically supplied at about 100 psi. The problem, at times, is keeping it there.

"One of the things we struggle with, and I don't think it's unique to our company, is people use a much higher pressure than we need, especially on the machines themselves," Schildt explained. "It seems to be a common belief that if 60 psi is good, then 70 must be better, and 80 must be even better than that."

Despite the challenge, Darigold Plant Energy Teams have made progress with reducing overall plant pressure. Before implementing the energy management program, many plants kept compressed air pressure at around 125 psi. Most plants are now maintaining a pressure of approximately 100 psi. There are times when a plant will need to increase pressure again, but as Schildt commented, "These are just the daily struggles that every facility faces."

The Green Light award is given annually to the Energy Team with the highest Energy Program Assessment score.

Demand Reduction Projects at Darigold's Medford Plant

When speaking with Derek Bauman, Chief Engineer and Plant Energy Team Leader at the Medford facility, he described many compressed air projects implemented to lower compressed air demand. The facility was idled last year but was part of Darigold's Consumer Products division and packaged and processed fluid milk. Compressed air was used to supply air valves, actuators, and package handling equipment, in addition to pushing product out of manufacturing lines. Bauman, who is still taking care of the facility, shared specific demand reduction projects for several pieces of production equipment, including one involving a "case diverter," a machine for directing and conveying cases of milk.

"The empty cases don't weigh very much coming in, but the point-of-use regulator [on the case diverter] was factory set at 90 psi," Bauman explained. "If and when there was a jam up, it would actually damage milk cases, permanently deforming them into the wrong shape. As we lowered the compressed air pressure, not only were we saving air every time the arm moved back and forth to move cases, but if it did jam, it didn't deform or break a case. Where it was running at 90 psi, we found it ran just fine and kept up with our demands at 35 psi."

INNOVATIVE ENERGY PROGRAM ASSESSMENTS AT DARIGOLD

The Energy Team at Medford had similarly successful results when augmenting the point-of-use regulators on their "packing caser," or pieces of equipment designed to fill cases with milk cartons. Much like the case diverters, the packing caser, whose cylinders required a large compressed air supply, tended to do more harm than good when running at high pressure.

"The caser has multiple cylinders for counting and building 5x5 patterns of cartons before another cylinder comes down with a head to grab the cartons, lift them, and set them in a case," Bauman said. "For it to keep up, it was typically set around 80 psi. At 80 psi, if a case came in and was misplaced, broken, or had an issue, the head came down to pick up the carton of milk before the PLC could detect the fault. It would crush a carton, and milk would squirt all over the place. Then you'd have a mess to clean up, and it was still a jam."

Bauman and his colleagues ended up setting the point-of-use regulator down at approximately 45 psi. The solution saved compressed air, and prevented damage to the product if the machine ever had a misalignment issue. Instead of crushing milk cartons, the head would come down, pause, fault, and retract. Overall, the plant was able to modify its casers, case diverters, and case shunts to operate at 45, 35 and 30 psi, respectively, rather than the factory preset of 90 psi. These measures, in conjunction with leak detection and other energy management activities, helped the plant to run solely on one 30-hp air compressor, as opposed to both a 30-hp and a 50-hp machine.

The Medford facility had nearly reached their 10-year Energy Goal in only three years. The Plant Energy Team won Darigold's Green Light award two years in a row, for achieving the highest annual energy savings and for the highest Energy Program Assessment score.

Compressed air leaks are common in the cheese towers at Darigold's Sunnyside location, so the Energy Team installed flow meters to monitor leak rates.

Darigold Sunnyside Equips "Cheese Towers" with Flow Meters

Darigold's Sunnyside facility is its largest, and some of its applications are gargantuan. Sunnyside's Energy Team is a very diverse group with members from different backgrounds and skill sets. The team is continuously looking for improvement opportunities and also won Darigold's Green Light Award in 2015 for achieving the highest Energy Program Assessment score. Part of the Ingredients Division, the Sunnyside plant processes about 7.3 million pounds of milk per day, a number that may jump as high as 8.5 million after an upcoming increase in scale.

When speaking with Tom Rouleau, Technical Manager at Sunnyside, he discussed one fascinating application called the "cheese tower," which is a 15-foot tall square column used for compacting cheese curd. "When the cycle begins, vacuum is used to fill the tower with curd—up to about 15 feet in depth," Rouleau explained. "Once the level is met, we compress that curd into a block of cheese by shutting off the valve at the inlet, and allowing the tower to increase in vacuum. Then we release that vacuum, and open up some air valves on the vent of the tower. The venting allows atmospheric air in, and that action compresses the curd."

The block of cheese is then sent below the tower to the guillotine underneath, where pneumatically powered cylinders push a blade to slice the cheese into blocks. Cut into 14.5- x 11-inch pieces, the cheese is moved by additional pneumatic cylinders. The cylinders are large, ranging from 4 to 6 inches in diameter, and they have long strokes, dropping about 7 or 8 inches per stroke. The ejection

stroke is perhaps the largest user of compressed air, with strokes of about 14.5 inches in length. Considering the Sunnyside plant has 18 cheese towers, these cylinders are a major burden on the compressed air system.

To add more complexity to the application, a cleaning solution used around these cylinders makes the seals brittle which creates compressed air leaks. Before installing flow meters, the Plant Energy Team never knew how much leakage occurred. With newly installed flow meters, the cheese towers are now monitored on a continuous basis. The Sunnyside Energy Team also installed one flow meter exiting the compressor room, one for the packaging area of the plant, and another at the bagging area, helping keep track of how much compressed air is used in those areas.

Driving Behavioral Change

At the end of the day, energy management is about changing behavior. Darigold's Energy Program Assessments drive change by providing more constructive feedback than a point total. The actionable feedback is shared across the entire organization—along with valuable best practices—to help optimize energy use.

"Everyone understands compressed air is the most expensive utility," Schildt explained. "But to have people really comply, that's a continued struggle." For Darigold and their Plant Energy Teams, the struggle has paid dividends, with an average reduction of plant compressed air pressure of 25 psig. Ongoing and innovative Energy Program Assessments play an important role in the continued success of Darigold's energy management program.

To date, the Energy Program Assessments have helped Darigold Energy Teams share a great deal of best practices across the entire organization—whether it is installing flow meters, reducing pressure at point-of-use regulators, or implementing zero air-loss condensate drains. BP

For more information, visit www.darigold.com.

To read more about ***Energy Management,*** please visit www.airbestpractices.com/energy-manager.

COOKING OIL FACTORY COMBINES COMPRESSED AIR SYSTEMS TO SAVE 36%

By Ron Marshall for the Compressed Air Challenge®

KNOW PRESSURE
COMPRESSED AIR CHALLENGE

➤ To produce healthy, high-quality cooking oil, this food processing company crushes and processes oil seeds shipped in from local farms. The oil produced is thought to be the healthiest cooking oil available, because it is low in saturated fat, high in monounsaturated fatty acid (MUFA), and polyunsaturated fat (PUFA), like omega-3 fatty acids. To increase the energy efficiency of its oil seed crushing and processing facility, the company optimized its compressed air system by combining three separate systems into one. Some end-use optimization was done to correct low pressure, particularly caused by some critical high-flow, short-duration events. Although all of the recommendations in this article were not followed, the facility still managed to reduce annual energy costs by 36 percent—or the equivalent of $48,000 per year (at 10 cents per kWh)—and earn an energy rebate to alleviate capital costs.

Uncovering Compressed Air Inefficiencies

The site uses compressed air for a variety of production processes. Dominating the load profile is the need to back flush the filter press used to separate the oil from the mash. Due to its high flow, the installation uses a separate compressed air system consisting of a single air compressor, large storage, and a back-pressure regulator. Other systems are in place to feed the dry charge fire suppression system and general production processes. Because some of the piping is subject to freezing temperatures, a desiccant dryer is used for general instrument air. A separate compressed air system was installed in a new expansion to feed production processes in the new processing area.

CONSTITUENTS OF DEMAND

CONSTITUENT	PEAK (CFM)	SHIFT 1 (CFM)	SHIFT 2 (CFM)	WEIGHTED AVERAGE (CFM)	PERCENT
Production Machines	134	122	75	120	27%
Filter Blast	85	34	0	33	7%
Filter Purge (Raw)	290	160	5	154	34%
Main Dryer Purge	20	20	20	20	4%
Refinery Dryer Purge	15	6	2	6	1%
Elev Dryer Purge	6	4	2	4	1%
Blowing	30	25	15	25	5%
Poor Applications	30	27	20	27	6%
Drains	10	7	7	7	2%
Leaks	35	35	35	35	8%
Artificial Demand	20	20	7	20	4%
Total	**675**	**460**	**188**	**451**	**100%**

Table 1: The table above itemizes the constituents of demand discovered by measurement.

Fundamentals of Compressed Air Systems WE (web-edition)

Join Compressed Air Challenge for the next session of ***Fundamentals of Compressed Air Systems WE*** (web-edition) coming soon. Led by our experienced instructors, this web-based version of the popular *Fundamentals of Compressed Air Systems* training uses an interactive format that enables the instructor to diagram examples, give pop quizzes and answer student questions in real time. Participation is limited to 25 students. Please visit www.compressedairchallenge.org, to access online registration and for more information about the training.

If you have additional questions about the new web-based training or other CAC training opportunities, please contact the CAC at info@compressedairchallenge.org

A compressed air system assessment was conducted at the site, and uncovered the following major findings:

- There were four separate, independent compressed air systems, each running at partial loading, with a combined system specific power of 33 kW per 100 cfm, and significant unloaded run time.
- Two of the three systems had poor pressure control. The load was dominated by filter cleaning pulses and an unknown timed load that pulled down system pressures.
- There was significant pressure differential across dryers and filters.
- The desiccant dryers produced a poor dew point, and some wet air was allowed to enter the dry charged fire suppression system, which is subject to freezing conditions.
- Various blowing and drainage issues were identified.

As can be seen in Table 1, some significant waste of compressed air was occurring due to artificial demand, inappropriate use, and artificial demand caused by higher-than-normal pressure.

Inefficient Air Compressor Operation

Because separate systems of air compressors were running independently at this site, it was difficult to produce air at optimum energy efficiency. Although, on average, each system was running at partial loading, the pressure profile on two of the systems was so poor that maintenance staff resisted the possibility

> "Because separate systems of air compressors were running independently at this site, it was difficult to produce air at optimum energy efficiency."
>
> — Ron Marshall for the Compressed Air Challenge®

COOKING OIL FACTORY COMBINES COMPRESSED AIR SYSTEMS TO SAVE 36%

of tying the systems together to increase efficiency. If the pressure issues (as seen in Figures 1 and 2) could be identified and fixed, then the systems could be combined into a single, well-controlled system running at lower pressure with minimal part-load operation. Installation of a new VSD could reduce air compressor unloaded run time and improve overall system efficiency.

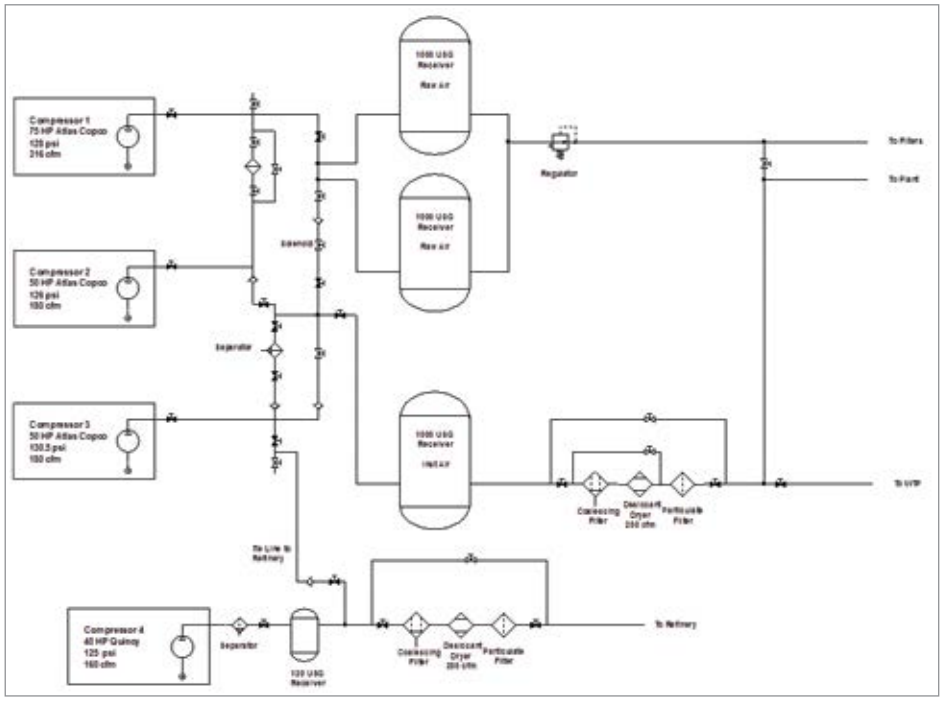


Figure 1: Three separate compressed air systems ran independently at reduced efficiency.

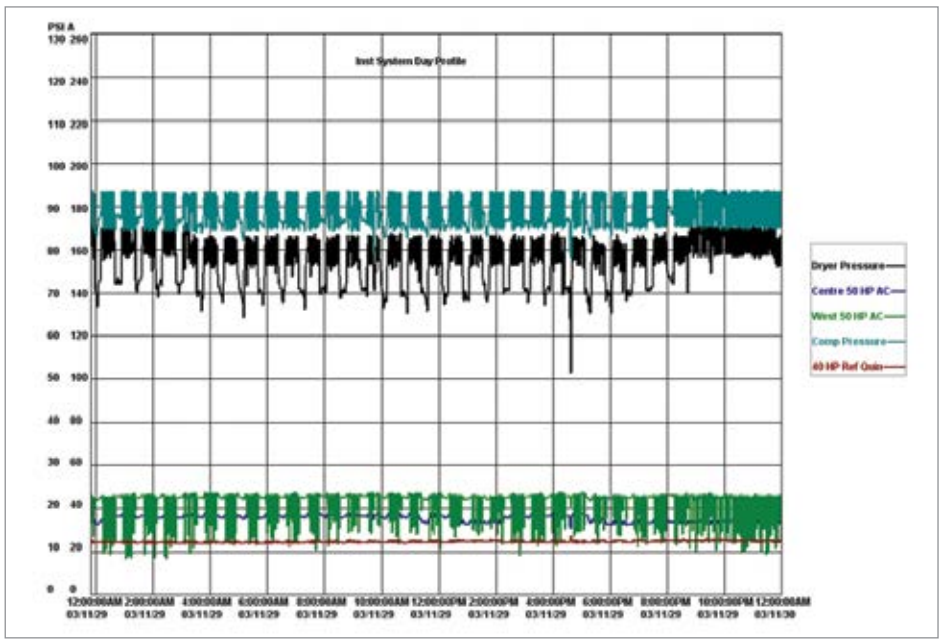


Figure 2: A filter cleaning operation on an outdoor bag house consistently caused pressure issues.

Searching for the Unknown Load

As can be seen on the pressure profile in Figure 3, the instrument compressed air profile was dominated by a regular event that pulled plant pressure down to around 70 psi for 14 minutes spaced every 43 minutes. Interviews were conducted to try to determine the cause of this load, and although much time was expended, nobody knew what could cause such a pattern. During the course of the audit, the load was finally found by thoroughly reviewing each air demand one at a time until the offending end use was found. The problem was a misadjusted bag house set to pulse excessively.

Trouble was being experienced on an outdoor bag house filter that uses pulses of compressed air to clean filter elements. These units are normally adjusted to fire 0.10-second pulses every 10 minutes. While troubleshooting, the maintenance staff had altered the timer settings so the pulses were occurring 0.75 seconds every 2 seconds. This caused a significant air pressure differential on the compressed air lines, as they were not designed for the resulting flow. The increased demand was enough to overload the instrument air system, pulling down main compressed air system pressure.

Filter Cleaning Application

A separate compressed air system (raw air) existed to supply compressed air to the three crude oil filters in the crusher building. This system consists of a 75-hp, 128-psi air compressor tested at 290 cfm output capacity, with two 2000 gallon storage receivers (18.5 cf/psi), a pressure regulator, and various distribution pipes and control valves. The filters, which filter crude grain oil,

are taken out of service one by one at semi-regular intervals during the course of normal production activities and blown to clean the filter elements.

Each cleaning operation starts by pressurizing the filter to force the liquid in the filter vessel to backflow into the crude oil storage tank. Once the filters are empty, compressed air is allowed to flow backwards through the filters to cool and dry the filter elements. After 8 minutes of drying, the compressed air is turned off, and air-powered vibrators shake the filter elements.

Figure 1 shows the operation of the system over a period of time. Note how the raw air pressure in the receiver is pulled down to as low as 50 psi when compressed air is removed from it. Note also how the raw air compressor goes to full load during blow cycles and unloads between cycles. During this unloaded period, the air compressor continues to run—yet it still consumes about 16 kW of energy. Operation of a lubricated screw compressor in this manner will also cause high lubricant carryover, which will contaminate the filters. It was determined this power could be saved if the air compressor was turned off between cycles. Alternatively, if the air compressor continued to run, it could supply load to the instrument air system.

Further investigation revealed that a back-pressure regulator had been installed between the air compressor/storage tanks and the filter presses. This regulator was supposed to restrict the flow of air once the pressure in the receiver tanks got to a certain low level, but the valve had failed. This failure allowed the pressure to fall too low at the air compressor, making the system unsuitable to tie into the instrument air system.

Attaining Proper Dew Point and Saving Compressed Air

The instrument air dryer had manual purge adjustment that had been altered over the course of time. Dew point readings showed that the dryer was only producing compressed air with levels slightly below zero—instead of the rated -40˚F requirement. Adjustments were made (as shown in Figure 4) by increasing the purge flow to normal, which allowed the output dew point to fall to more normal levels. Ultimately the air dryer was replaced with one featuring dew point dependent switching to save wasted purge air.

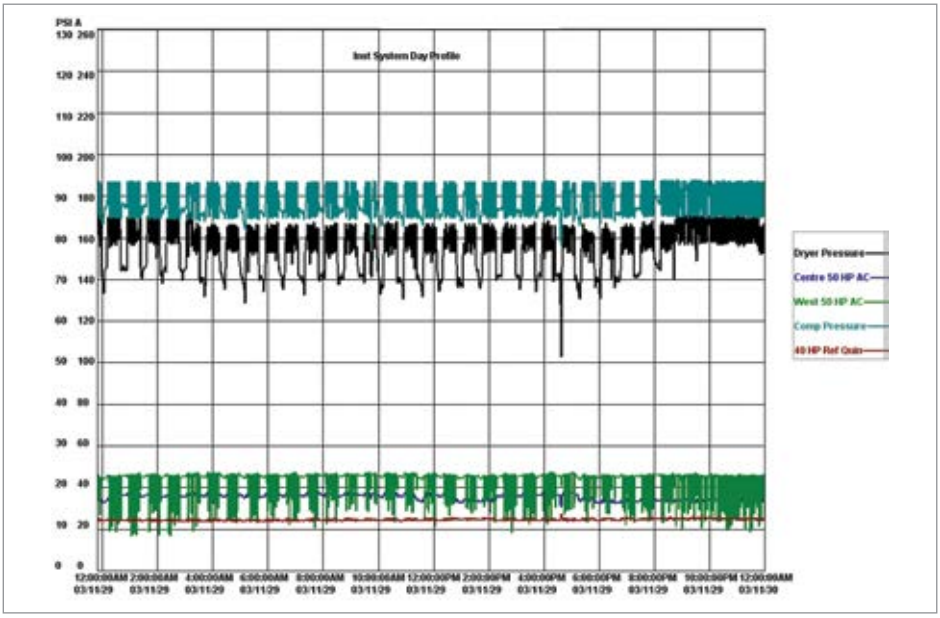


Figure 3: The instrument compressed air pressure profile was dominated by an unknown load.

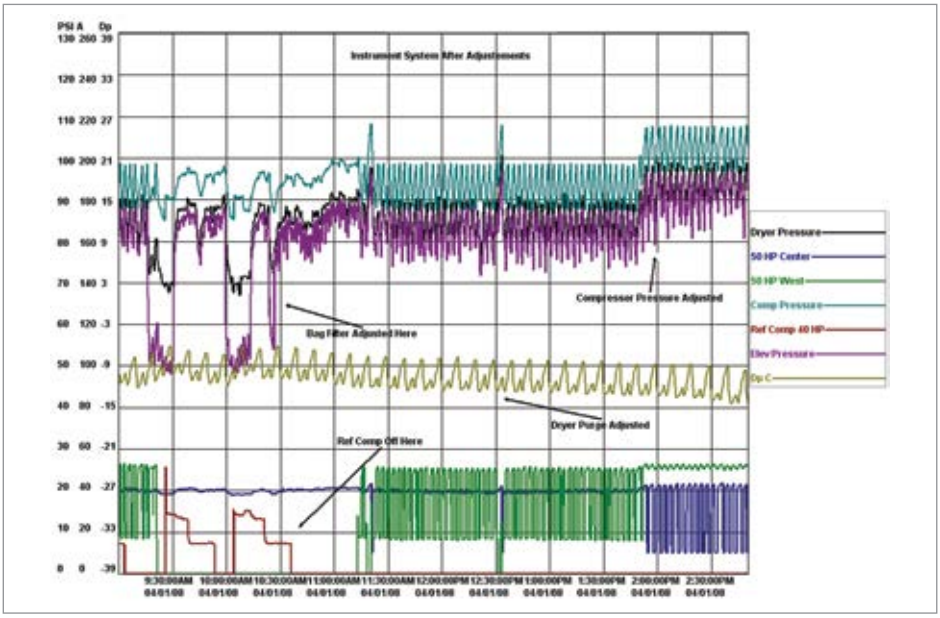


Figure 4: Adjustments were made to the air dryer to correct low-pressure occurrences and increase efficiency.

COOKING OIL FACTORY COMBINES COMPRESSED AIR SYSTEMS TO SAVE 36%

Best Practices for Compressed Air Systems Second Edition

Learn more about optimizing compressed air systems

This 325 page manual begins with the considerations for analyzing existing systems or designing new ones, and continues through the compressor supply to the auxiliary equipment and distribution system to the end uses. Learn more about air quality, air dryers and the maintenance aspects of compressed air systems. Learn how to use measurements to audit your own system, calculate the cost of compressed air and even how to interpret utility electric bills. Best practice recommendations for selection, installation, maintenance and operation of all the equipment and components within the compressed air system are in bold font and are easily selected from each section.

Compressed Air System Improvements Yield 36% Annual Energy Savings

Various compressed air system improvements were implemented to correct the situation and to gain a predicted 50 percent reduction in energy consumption with improved system pressure. The projects included:

- Install refill control and a new back-pressure regulator on the raw air system.
- Install check valve, needle valve and storage tank at problematic bag filters, and adjust filter blow to normal levels.
- Reduce or replace blowing on various air wands.
- Modify fire system supply to shut down separate system of failed dryers, and switch to dry air.
- Upsize various sections of supply piping to reduce pressure differential.
- Repair compressed air leaks, and start leak detection and benchmarking programs.
- Install a new 100-hp variable speed drive (VSD) air compressor to increase production capacity, and combine with fixed-speed air compressor system for unified central system.
- Upgrade compressor ventilation.
- Install a flow control valve to regulate instrument pressure to a lower required level.
- Install dual parallel filters on dryers to reduce pressure differential and reduce discharge pressure.
- Replace timer drains with zero air-loss condensate drains.

Improvements were verified about two years later, and although all recommendations were not followed, energy savings of 36 percent were gained—saving the equivalent of $48,000 of energy per year (at 10 cents per kWh). A substantial energy incentive was granted to help pay for the cost of a new air compressor, an air dryer, and other modifications. Estimated simple payback calculated to about 2.4 years. BP

For more information about the Compressed Air Challenge, contact Ron Marshall, email: info@compressedairchallenge.org.

To read more ***System Assessments on End Uses*** in plants, please visit www.airbestpractices.com/system-assessments/end-uses.

> "Improvements were verified about two years later, and although all recommendations were not followed, energy savings of 36 percent were gained."
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RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

Ingersoll Rand Releases RS30 and RS37 Air Compressors

Ingersoll Rand has introduced the new RS30 and RS37 models, the first in a series of next-generation, oil-flooded, rotary screw air compressors. The Next Generation R-Series Air Compressors deliver world-class performance and enhanced reliability, lowering operational costs for those in need of general-purpose plant air in support of assembly, manufacturing, mining and conveying applications.

The new Ingersoll Rand RS30 and RS37 oil-flooded rotary screw air compressors.

"Our customers are under unprecedented pressure to be leaner, more productive and more energy efficient," said Eric Seidel, vice president of global product management for Compression Technologies and Services, Ingersoll Rand. "The Next Generation R-Series air compressors provide enhanced compressor performance that can greatly reduce our customers' energy footprint while maintaining reliable compressed air to keep their operations running smoothly."

The new air compressors improve performance through a state-of-the-art airend. The new airend design was developed through advanced analytics and modeling, and includes—amongst other things—an optimized rotor profile that provides up to an 18 percent efficiency improvement compared to previous models. The new rotor profile also contributes to best-in-class airflow capacity, delivering up to 15 percent more airflow than previous models. An enhanced bearing arrangement and sealed drive system further improves performance and reliability while reducing the need for maintenance.

The Next Generation R-Series air compressors are equipped with the Xe-series controller, which allows easy remote access to, and control of, the compressed air system using any current, common web browser. Users can receive information on compressor performance and events by email, adjust compressor settings remotely, and program compressors according to specific events through real-time clock schedules. The new series of compressors also enhance reliability with Progressive Adaptive Control™ (PAC) systems software that continuously monitors key performance parameters and automatically adjusts settings to the application's needs.

Next Generation R-Series compressors also save customers money on equipment and operations by ensuring that discharge air powering equipment carries a minimal amount of moisture, which reduces the dependence on large downstream air dryers.

For more information, visit www.ingersollrand.com.

Kaeser Launches New Compressed Air Filters

Kaeser Compressors, Inc. has expanded their award-winning air treatment product line with new compressed air filters available in flows from 20 to 500 scfm. These rugged filters deliver reliable compressed air quality with exceptionally low pressure drop for energy savings year after year.

This comprehensive line includes a liquid separator, and particulate, coalescing and oil vapor adsorbing filters to meet a wide range of air

Kaeser's new compressed air filter line delivers air quality and reduced pressure drop.

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quality needs. Particulate and coalescing filters feature deep-pleated filter elements wrapped in stainless steel cages for superior filtration and increased efficiency. Vapor filters use high efficiency carbon matting to prevent channeling, reduce pressure drop, and prevent particles from escaping.

Robust, aluminum housings have a treated interior and a powder-coated exterior for extra durability and corrosion resistance. They are designed with larger flow areas to ensure the lowest pressure drop and provide easier installation, operation, and maintenance.

For more information, visit www.us.kaeser.com/filters.

NOXERIOR Announces New NITROSWING® Modular PSA Nitrogen Generator

NOXERIOR announced its family of new standard nitrogen and oxygen generators has been completed by adding the new NITROSWING® Modular PSA Nitrogen Generators as the last step of an extensive product modernization project.

"By adding the new NITROSWING® Modular PSA Nitrogen Generators to our product portfolio, we have concluded a strategic product redesign and modernization project for our company," commented Oscar de Groen, Managing Director of NOXERIOR. "This project was started back in April 2014 and already resulted in the market introduction of our NITROMEM® Membrane Nitrogen Generators and the new OXYSWING® Modular PSA Oxygen Generators during the last months."

By adding the new NITROSWING® Modular PSA Nitrogen Generator, NOXERIOR's family of new standard nitrogen and oxygen generators is complete.

"Our main objective was to reduce energy consumption and to make our nitrogen and oxygen generators ready for Industry 4.0 by dedicating special attention to the data exchange options of the control system of each standard generator," explained de Groen. "Our patented modular design for the unique NITROSWING® and OXYSWING® PSA nitrogen and oxygen generators allowed a maximum level of standardization, so that even the smallest models have all necessary features to integrate easily within so-called Smart Factories."

Optional instrumentation, such as moisture analyzers, and pressure and temperature transmitters, has been integrated in the process piping inside the cabinet of each generator, instead of loosely supplied components. The Siemens-based standard control system with touch-screen HMI, identical for all three product lines, includes methods of self-diagnosis and self-optimization—like the automatic regeneration procedure through the blow-off of off-spec gas in case of an insufficient nitrogen or oxygen purity.

Maintenance intervals or eventual system failures are monitored automatically in combination with real-time communication to the user through Profinet Industrial Ethernet Interface, Profibus DP or Modbus RTU. In addition, the user has the option to start and stop the nitrogen or oxygen generator, or to reset process parameter counters remotely—even by means of a special App developed by NOXERIOR for smartphones or tablets.

For more information, visit www.noxerior.com.

Suburban Manufacturing Unveils New Tsunami Rove

Suburban Manufacturing, Inc., an engineering-driven organization based in Monticello, Minnesota, recently released the new Tsunami Rove—a mobile air purification system for supplying clean, dry air wherever it is needed.

Developed based on high demand input from the industrial, automotive, and marine industries, the Rove system incorporates industry-leading Tsunami drying technology packaged as a complete system. The system includes a water separator, oil coalescing filter and automatic float drains to assure proper draining of water, oil and other contaminates. The system is mounted on a 30-gallon receiver tank to provide mobility and storage of clean and dry compressed air.

TECHNOLOGY PICKS

By simply plugging a compressed air connection into the ball valve inlet located on the Tsunami pre-filters, the unit is ready to go. The Rove provides shops with ultimate versatility by having the cleanest, driest compressed air available whenever and wherever needed.

The system is ideal for providing remote, point-of-use drying wherever dry compressed air is needed. The optimal compressor size for extremely dry air is between 5 and 10 horsepower.

For more information, visit www.gosuburban.com.

The Tsunami Rove mobile air purification system offers versatility to shops in need of remote, point-of-use compressed air.

COMPRESSED AIR BEST PRACTICES
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Sustainable Energy Savings with Compressed Air Best Practices®

Compressed Air Best Practices® is a technical magazine dedicated to discovering **Energy Savings** in compressed air systems — estimated by the U.S. Department of Energy to represent 30% of industrial energy use. Each edition outlines **Best Practice System Assessments** for industrial compressed air users — particularly those **managing energy costs in multi-factory companies.**

"We're in 75 to 80 locations. We've done literally hundreds of compressed air modifications, changes, upgrades and audits."
– William Gerald, CEM, Chief Energy Engineer, CalPortland (feature article in August 2015 Issue)

"Compressed air is essential to any manufacturing process, particularly in the automotive industry, and it accounts for about 23 percent of total energy costs at our powertrain facility."
– Mike Clemmer, Director/Plant Manager-Paint & Plastics, Nissan North America (feature article in October 2015 Issue)

"Demand Side" and "Supply Side" information on compressed air technologies and system assessments is delivered to readers to help them save energy. For this reason, we feature Best Practice articles on when/how to correctly apply **air compressor, air treatment, piping, storage, measurement and pneumatic control technology.**

Industrial energy managers, utility incentive program managers, and technology/system assessment providers are the three stakeholders in creating energy efficiency projects. Representatives of these readership groups guide our editorial content.

"Each of our 10 production plants has an Energy Coordinator who is part of the corporate energy team."
– Michael Jones, Corporate Energy Team Leader, Intertape Polymer Group (feature article in July 2014 Issue)

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THE MARKETPLACE

JOBS & TECHNOLOGY

MTA
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MTA-USA, LLC is seeking Regional Sales staff for both the North East and the South East USA territories. As a worldwide supplier of compressed air treatment products and packaged Industrial Chillers, our current growth requires the addition of experienced sales personnel to manage each territory.

The ideal candidate will have a college degree, a technical background and both territory sales and sales management experience. Travel required is 50% plus. Very competitive salary plus commissions, bonus, expenses, 401K, and heath care contribution is just a part of the package being offered. Please send resume to jmedeiros@mta-usa.com, www.mta-usa.com

CPS

SALES REPRESENTATIVE

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Compressor-Pump & Service, Inc. in Salt Lake City, UT (www.compressor-pump.com) is seeking an experienced, outside sales representative for the Utah marketplace. Applicants should be experienced in compressed air equipment including large rotary screw, centrifugal, pis-ton, vacuum and positive displacement blower sales and air treatment and ancillary equipment. Excellent compensation and benefits. Relocation expenses negotiable.

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Please send application to cpsrf@aol.com

Contact Rod Smith for ad rates: **rod@airbestpractices.com, Tel: 412-980-9901**

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A Publication of: Smith Onandia Communications LLC
37 McMurray Rd. Suite 106
Pittsburgh, PA 15241

Compressed Air Best Practices® (USPS# 17130) is published monthly except January-February combined by Smith Onandia Communications LLC, 37 McMurray Rd., Suite 106, Pittsburgh, PA 15241. Periodicals postage paid at Pittsburgh, PA and additional mailing offices. POSTMASTER: Send address changes to: Compressed Air Best Practices®, 37 McMurray Rd, Suite 106, Pittsburgh, PA 15241.

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PROBLEM:

A Tier 1 automotive seating and electrical supplier was interested in taking advantage of local utility rebate incentives. For their compressed air needs, they had been relying on four compressors manufactured in the 1980's, inherited from a sister plant. Each unit operated in modulation control and was manually switched on and off, leaving the units continually fighting each other, resulting in wasted energy, fluctuating pressure, and increased maintenance costs.

SOLUTION:

Kaeser performed a complete Air Demand Analysis (ADA) to identify the plant's current compressed air needs and to develop a plan for implementing the most energy efficient solution possible. Additionally, Kaeser recommended a Sigma Air Manager (SAM) master controller to properly control the system and ensure the most energy efficient combination of units would be selected to meet current plant demand.

RESULT:

Thanks to better controls and adding an energy efficient variable frequency drive compressor, the customer was able to reduce their annual maximum power consumption by 865,440 kWh—the equivalent of removing 100 homes from the power grid for one year—all without compromising stable system pressure. With the older compressors relegated to back-up, annual maintenance costs have been reduced from $37,000 to $18,000. Less maintenance also means less downtime, for increased productivity.

Specific Power of Previous System:	28.93 kW/100 cfm
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Annual Energy Costs of Previous System:	$252,988 per year
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