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DESIGN-BUILD Solutions

ESI GROUP USA Smart Building Solutions

ESI specializes in food processing and distribution center design and construction.

Courtesy of SubZero Constructors

How to Build an Ammonia Room

WHEN IT COMES TO BUILDING an ammonia room, for many cold food processors and distributors, there is no one-size-fits-all solution. That's why design-build firms such as ESI Group USA, Hartland, Wis., work with industrial refrigeration contractors to ensure that today's ammonia machinery rooms are safe, legal and built to last.

Understand the challenges

Regulatory and insurance requirements are important factors to consider when building ammonia machinery rooms. OSHA's Process Safety Management (PSM) and the EPA's Risk Management Plan thresholds will often come into play, and even if either program isn't required, they are still better to implement than not, according to Larry Gilliland, vice president of engineering for SubZero Constructors, Rancho Santa Margarita, Calif.

"It is important to hire a qualified and experienced engineer or design-build contractor [like ESI Group]," he adds. "Most refrigeration plants of substantial size will have ammonia used as the refrigerant. These systems are often evaluated more carefully for code compliance by local jurisdictions. Taking note of the key items that inspectors will be watchful for during permitting (ammonia detection, machinery room ventilation, etc.) is important."

Likewise, in some jurisdictions, there is a requirement for ammonia plants to have trained and certified operators on duty around the clock, regardless of the production schedule.

"Whether required or not, having well-trained operators can help promote efficient operation of your ammonia refrigeration system and identification of system operating problems before failures occur," says Gilliland.

On the other hand, mechanical codes and recommendations from governing bodies are key when constructing ammonia (NH3) rooms.

"Know the difference between a code and recommendation (ventilation, NH3 detection and more), understand what OSHA and the EPA will be looking for when they audit the facility and become very familiar with PSM," says Dan Hinz, vice president of operations for Kuhlman, Inc., Menomonee Falls, Wis.

To build a more environmentally friendly ammonia machinery room, keep in mind that many energy providers offer incentives for investing in a more energy efficient system, adds Hinz.

"Understand the dollar impact of variable frequency drives, 90 degrees or less condensing, thermo syphon oil cooling, fly wheeling your freezer (pulling down at night when rates are low) and evaporator fan cycling," he says. "Review operating conditions and select the most efficient compression ratio possible per temperature needed in your system."

Lastly, plan and build for growth.

"Some things are much cheaper to do on the front end," says Hinz. "Leave space for more compressors, oversize vessels and larger

electrical services, considering these items will help determine the appropriate size of the overall room."

Follow a step-by-step process

To build an ammonia machinery room, firms must first determine how many different temperatures are required for the customer's needs.

"Will these temperatures be single-staged or multi-staged? How will you do oil cooling (thermosyphon, liquid injection or other)? How will we deliver liquid to the different temperature rooms?," asks Hinz. "With the use of 3D technology, place these components on the screen and arrange them for the cleanest layout. Calculate system charge to guarantee correct ventilation and relief network. Review codes for ventilation, NH3 detection, eye wash and other personal protective equipment. And, don't forget final approvals from the customer."

To select the location for an ammonia refrigeration machinery room, industrial refrigeration contractors must also consider adjacent buildings and rooms within the property as well as buildings adjacent to the property.

"Non-combustible construction is preferred and rooms should be built with one or more exterior walls with tight-fitting, self-closing doors leading directly outside, or even in a detached building (less common)," says Gilliland. "Separate ventilation intake louvers and exhaust fans should be arranged to promote mixing and generous airflow throughout the room. Exhaust should vent directly outdoors at ceiling level."

Leverage technology

California has been at the forefront of energy efficient building design with its comprehensive energy code commonly referred to as Title 24, says Gilliland.

"As energy and environmental conservation continues to gain momentum, we continue to look for ways to stay ahead of the curve," he adds. "We've designed systems to minimize ammonia charge, use waste heat for not just underfloor warming but also plant hot water usage and collected defrost condensate for evaporative condensing and/or irrigation. In addition, we've adopted control strategies that shed power, float operating conditions up or down in response to ambient conditions and refrigeration demand and made use of technological improvements to implement demand defrost."

For its part, Kuhlman introduced a variety of innovative features, including variable frequency drives on all motors, 90-degree condensing or less design using VFDs and floating head controls with wet bulb override where applicable, low TD on evaporator design, state-of-the-art control systems that manage capacity control of compressors and condensers, cycle lights and continuous ventilation when unoccupied, cycle evaporator fans and manage defrosts, fly wheels freezers where possible, liquid management to maximize sub cooling and refrigeration effect through the use of side port economizers, split suction levels where possible and pipe sizing for low pressure drops.

"All of these obstacles and more are overcome by good communication and education," adds Hinz.

ESI Group contracts with Kuhlman and SubZero, who are educated and skilled to build energy efficient ammonia rooms that meet safety codes and allow room for growth. **ESI**

Courtesy of Eric Oxendorf Photography

ESI Installs Ammonia Systems in Greenfield Projects

ESI's state-of-the-art design-build services allow today's cold food processors and distributors to install ammonia refrigeration systems regardless if the project calls for new or renovated construction.

The "standard rule" is that any refrigerated area of 40,000 square feet and larger should feature ammonia refrigeration systems.

"Generally it only makes sense to use ammonia refrigeration for warehouses that are minimally 60,000-90,000 square feet in size and up," says Don Olsen, vice president of ESI Design Services. "Initial install costs, local labor rates, utility and maintenance expenses vary and explain the gap. A larger building or the inclusion of process refrigeration quickly shows a positive return on investment. Smaller refrigeration needs will not supply a return on investment that is tolerable because there is a large initial investment to install an NH3 system. It is less expensive to install a Freon-based refrigeration system and cheaper to maintain."

Several clients including WinCo Foods, Martin-Brower, Reinhart FoodService, US Foods and Performance Food Group have built new distribution centers using straight ammonia refrigeration systems.

"An ammonia-based central system requires specialty contractors to install, is more difficult to maintain and is more expensive initially," adds Olsen. "However, it is much more efficient to operate, therefore leading to a quick ROI on larger buildings." ESI