

# WHITE PAPERS

## UNDER PRESSURE

*the importance of safety for ammonia refrigeration valves  
& relief valve header piping*



From cold storage warehouses to meat processing plants, all ammonia refrigeration systems run the risk of dangerous ammonia leaks, particularly older systems with piping that is aged and outdated. While these refrigeration systems are widespread, companies that own older systems or are updating existing systems need to be aware of the safety issues and requirements related to the systems' relief components.

## RELIEF VALVES AND RELIEF VALVE HEADER PIPING

One of the most critical components in the safety of an ammonia system is the relief valve pipes and their corresponding venting systems. In refrigeration systems that use pressurized anhydrous ammonia, the relief valves and piping maintain safe pressure levels within the system piping and components. If the pressure reaches hazardous levels, ammonia, which is toxic under ambient conditions, could leak and lead to explosions, danger to employees and product loss.

## CONSEQUENCES OF A LEAK

When the pressurized liquid ammonia found in these systems is released, it can aerosolize and become a dense gas. This gas can then travel along the ground, rather than rising into the air and dissipating. As a result, it can present numerous hazards to human health, with effects of the chemical ranging from moderate irritation, to severe respiratory injuries, to fatalities when released in high concentrations.

Authorities have not yet definitively linked an old pressure valve system failure to a catastrophic event involving an ammonia leak. However, accidental ammonia releases have been reported throughout the industry, and older systems can leave a facility exposed to the possibility of the dangerous consequences that have occurred from other leaks. Ammonia leaks have led to death and injury to employees, emergency response personnel and people in surrounding communities. This includes a 1989 incident, which required the evacuation of nearly 6,500 residents in the town where the affected plant was located. Fifty residents received medical treatment as a result of the ammonia gas leak.

These incidences and factors make it essential that facility management and engineers are aware of all applicable relief valve system codes, regulations and general precautions. Even if you are utilizing a third-party refrigeration facility, it is important to ensure systems are up to code.

## CODES AND REGULATIONS

Two key regulations help ensure safety in the relief valve systems. In 2001, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) changed refrigeration system regulations to increase safety and align codes with those in the chemical and petrochemical industries. While older equipment installed prior to 2001 is exempt from the new code, any new equipment or additions to older systems must comply.

The AHSRAE regulations—designed through a scientific approach—increased the size requirements of pipes in the relief valve venting system to accommodate pressure from multiple valve releases. In the event of an ammonia release from several valves at once, the new, larger pipes help prevent dangerous leaks by minimizing pressure in the relief headers. The older systems did not accommodate for the possibility of a simultaneous valve release, which could cause an increase in pressure within the relief header piping. The new systems—from a scientific and technical standpoint—provide additional safeguards to prevent a catastrophic event.

In addition, the International Institute of Ammonia Refrigeration (IAR) requires the replacement of pressure relief valves every five years. Documentation should be made each time the valves are replaced, including stamping the replacement dates onto each unit to help ensure ongoing compliance.

Facility management also should be aware of regulations falling under the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA). Refrigeration systems are regulated through OSHA's process safety management (PSM) regulations, which include detailed requirements and procedures for employers that use large amounts of hazardous chemicals, such as ammonia. These stringent guidelines require employers to continuously and rigorously analyze, update and maintain each element of their processes to ensure worker safety. Failure to meet these regulations can result in severe fines. Each facility should have regular process analyses performed to ensure compliance, that any danger or hazards have been identified and that the proper administrative and engineering controls are in place to deal with abnormal occurrences. Process hazard analysis (PHA) should be conducted to ensure the system's mechanical integrity, including the proper pipe thickness of the venting system. These services can be conducted through a PSM/PHA consultant.

## RETROFITTING

While leaks can occur in many areas of the cooling system, retrofitting valves in an older system is an important step toward protecting employees and investments—and is a requirement for systems that are not up-to-code. The length of time required for retrofitting a new system can range from days to a few weeks, according to the size and intricacy of the system. Cost also varies according to these factors.

## PHYSICAL WARNING SIGNS

Even if codes and regulations do not require replacement, facility staff should be aware of any physical signs that the mechanical integrity of the relief valve and its piping system have been compromised. Pipe pitting, flaking and rusting may be indicators of a problem and should be examined by an expert as soon as possible. Relief valve calculation studies are a very common service and offer an in-depth analysis of the overall relief valve system. Many times these studies can avert serious situations that may have otherwise been overlooked. Refrigeration systems also can incur failed insulation, rust and corrosion, and should be inspected regularly—even in newer systems—to avoid a costly or dangerous leak.

Through awareness of relevant regulations and vigilant oversight of facility equipment and procedures, facility management can help ensure a safe and stable refrigeration facility. For additional information on relief valve safety and applicable regulations, visit the websites for OSHA, IIAR and ASHRAE.

## ABOUT STELLAR'S RETROFITTING SERVICES

Stellar, a fully-integrated firm focused on construction, design, engineering and mechanical services worldwide, specializes in low-temperature facilities. The organization has significant experience updating these systems and has been retrofitting valves for a variety of clients since 2001. To avoid a dangerous and costly leak, Stellar can examine and retrofit an existing system and ensure its optimum safety.

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