

<b>Midland Engineering Co., Inc.</b> Safety Management System			Doc No:	PSM
			Initial Issue Date	12/14/15
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<b>Chapter 29-PSM-Ammonia Awareness</b>			Revision No.	0
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**PURPOSE:**

Midland Engineering Co., Inc. in accordance with OSHA 1910.119, is implementing this Employee Participation Guideline. This guideline outlines Midland Engineering Co., Inc. plan to implement and maintain a successful (safe) Process Safety Management Program. The purpose of employee participation is improved safety for all employees. Process Safety Management (PSM) will not be effective without the involvement of the employees, contract employees and/or their representatives.

**SCOPE:**

All employees affected or potentially affected by the ammonia refrigeration process shall be aware of the PSM program being implemented in the facility. Those employees directly involved with operation and maintenance of the ammonia refrigeration system shall be intimately involved with the development and execution of the PSM program and shall have input as procedures and policies are established. All employees shall have ready access to all PSM files and documents upon request at all the facilities that require them to have a PSM program.

**REFERENCES:**

29 CFR 1910.119 Process Safety Management of Highly Hazardous Chemicals, Explosives and Blasting Agents, paragraph (C).  
 Section 1910.111(d) – Refrigerated Storage Systems  
 29 CFR 1910.1200 Hazard Communication

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**BACKGROUND:**

Ammonia is a naturally occurring compound, made up of one atom of nitrogen and three atoms of hydrogen, with the chemical formula NH<sup>3</sup>. Ammonia is a key intermediary in the nitrogen cycle, and under normal conditions, is essential for many biological processes. Most of the ammonia in the environment comes from the natural breakdown of manure and dead plants and animals. Ammonia can be found in water, soil, and air, and is a source of much needed nitrogen for plants and animals. In fact, ammonia is among the most abundant gasses in the environment. It can be a liquid under pressure. Its pungent and distinctive odor at concentrations of 10-20 ppm range would be very noticeable by nearly all individuals.

Ammonia is extremely soluble in water and is frequently used as a water solution called aqua ammonia. Household ammonia is a diluted water solution containing 5 to 10 percent ammonia. Refrigerant grade anhydrous ammonia is a clear, colorless liquid or gas, free from visible impurities and it is at least 99.95 percent pure ammonia.

Employees could be exposed to ammonia during their job duties if working on/near industrial refrigeration machinery rooms, equipment, piping or when working with or near agricultural fertilizer. Ammonia refrigeration is used significantly in the food processing and preservation industries and to a certain extent in the chemical industries. Ammonia refrigeration is the backbone of the food industry for freezing and storage of both frozen and unfrozen foods. It is the workhorse for the post-harvest cooling of fruits and vegetables, the cooling of meat, poultry, and fish, refrigeration in the beverage industry, particularly for beer and wine, refrigeration of milk and cheese, and the freezing of ice cream. Practically all fruits, vegetables, produce and meats, as well as many beverages and juices, pass through at least one facility that uses an ammonia refrigeration system before reaching the end user.

**HEALTH HAZARDS**

Ammonia can be corrosive to human tissue depending on the concentration and exposure time. The odor of ammonia can be detectable at concentrations as low as 5ppm in air. At concentrations of 10-20 ppm range ammonia is pungent and a very distinctive odor noticeable by most individuals. It becomes uncomfortable in ammonia atmospheres of 30-50 ppm, but ammonia vapor is generally not hazardous at concentrations below 50 ppm.

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Ammonia can cause harm if inhaled and/or if it comes in contact with the eyes or skin. Respiratory contact can result in runny nose, coughing, chest pain, severe breathing difficulties, severe burns and/or death. Eye exposure can cause burning, tearing, blindness and/or permanent damage. Skin contact can result in severe burns and/or blistering. Exposure to intermediate concentrations of ammonia for limited periods can cause mild irritation to skin, eyes and respiratory system. High concentrations can cause obstruction of breathing, edema and severe damage of the mucous membranes of the respiratory tract with possible fatal results. Exposure to high concentrations of ammonia can cause significant health problems and be fatal in extreme cases.

### **PERSONAL PROTECTIVE EQUIPMENT**

Employees will be provided with and required to wear personal protective equipment (PPE) for exposure to liquid anhydrous ammonia or aqueous solutions of ammonia containing more than 10% by weight of ammonia and similar precautions will be taken to prevent the skin from becoming frozen from contact with vessels containing liquid anhydrous ammonia. Employees who work regularly with anhydrous ammonia and are subject to overexposure either to the liquid or the vapor shall be provided with proper safety equipment. Individuals working with ammonia (operations or maintenance) shall wear chemical splash-proof goggles plus a full face shield. The face shield should be worn over the goggles for additional protection of eyes, respiratory system and face, but never as a substitute for the goggles. In addition, those individuals should also wear rubber or plastic gauntlet gloves impervious to ammonia to protect hands and arms. Additional protection such as rubber aprons or slickers may be justified to protect critical body areas vulnerable to contact with ammonia.

### **PROCEDURES:**

The employee participation procedures fall into the following basic areas:

- 1) Employee awareness
- 2) Employee involvement/participation
- 3) Employee access to information

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## 1.0 EMPLOYEE AWARENESS

1.1 New employees will be made aware of ammonia refrigeration PSM as a part of the initial orientation process, in conjunction with hazards communication required by 29 CFR 1910.1200. New employees may wish to view the IIAR video "Ammonia, Refrigerant of the Future" to help them understand why ammonia is used in the facility. A document entitled "Ammonia Refrigeration Process Safety" will be reviewed with each new employee. They must acknowledge their awareness of PSM by signing the document. A copy of this signed document will be filed with the employee permanent record.

1.2 The Safety Committee shall be responsible for an annual update on PSM. The Site Safety Coordinator shall provide the Committee with update information, such as an annual PSM status report.

1.3 Any major ammonia refrigeration events such as incidents, near misses, major expansions or system modifications shall be communicated to the employees. This will be done via the posting of Management of Change Forms and company safety meetings.

1.4 Proper Personal Protective Equipment (PPE) is a full face respirator at 25ppm up to 300ppm and SCBA >300ppm, chemical splash-proof goggles and rubber or plastic gauntlet gloves impervious to ammonia.

1.5 An ammonia leak is readily detectable by its characteristically pungent odor. The location of a small leak may often be determined by holding a moist strip of phenolphthalein or red litmus paper near the suspected leak source. The rapidity and intensity of the color change in the paper will give some indication of leak proximity or size. In the presence of ammonia, phenolphthalein paper will turn from white to pink or deep red, whereas the red litmus will become blue

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## 2.0 EMPLOYEE INVOLVEMENT

2.1 An employee directly involved in the operation or maintenance of the ammonia refrigeration system shall be represented in all meetings and/or formal discussions concerning ammonia refrigeration PSM policies and procedures.

2.2 The Process Hazard Analysis team shall include several maintenance employees, Site Maintenance Supervisor/Regional Engineer, Site Safety Coordinator, and a refrigeration contractor representative.

2.3 PSM procedures affecting employees shall be reviewed by the Safety Committee or the PHA team:

2.3.1 *Employee Participation Program:* participatory workplace and a flow of information between employees and management concerning process safety. The employee participation section of the PSM program requires three actions:

2.3.1.1 Consultation with employees and their designated representatives in developing process hazard analyses and other elements of the PSM program.

2.3.1.2 Access to process hazard analyses and all other information required by the standard;

2.3.1.3 Implementation of a written plan of action explaining each of the elements of the standard. Contract employees who perform the same duties as direct hire employees must receive the same opportunities to participate in process safety. For example, the employer must consult with a contract employee who operates a PSM covered process just as it would a direct-hire employee.

2.3.2 *Process Safety Information:* requires employers to compile certain information concerning the process. Its primary purpose is to enable employers and employees to identify and understand the hazards posed by [the process]. The information serves as a resource for the Process Hazard Analysis team and other employees and may be used for many purposes, such as developing procedures and training programs. The process safety information must include chemical data, material safety data sheets, process technology information such as maximum chemical inventory levels and operating limits, reference drawings such as process flow diagrams and P&IDs, and process equipment design and maintenance materials.

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**2.3.3 Standard Operating Procedures:** Employers must develop and implement written operating procedures providing clear instructions for different phases of process operations. Written operating procedures serve several purposes. First, established procedures ensure that jobs are carried out consistently and correctly by operators. Second, written procedures allow the employer to communicate to the employee the proper way to perform a certain task. Finally, operators have quick access to materials allowing them to respond to particular process conditions.

**2.3.4 Safe work Practices:** The employer shall develop and implement safe work practices to provide for the control of hazards during operations such as lockout/tagout; confined space entry; opening process equipment or piping; and control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel. These safe work practices shall apply to employees and contractor employees.

**2.3.5 Hot Work Permit/Safe Work Practices:** Section 1910.119(k) of the Process Safety Management Standard requires the employer to issue Hot Work Permits and take other precautions when hot work such as welding or cutting is being performed on or near a process.

**2.3.6 Training:** Employers are required to give employees operating In PSM covered process an overview of the process and to train them in the operating procedures. The purpose of training operators is to enable them to safely operate the process, increase employee awareness of potential hazards, and provide an understanding of the causes of process problems.

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**2.3.7 Contractor Qualifications:** The Process Safety Management Standard requires employers using contract employers to evaluate the contract employer's safety performance and programs, maintain a contract employee injury and illness log, inform contract employers of potential known fire, explosion and toxic release hazards and the applicable provisions of the emergency action plan, and control the entrance and exit of contract employees into the facility and the process area. The contract employer provision has four general purposes. First, by reviewing the contract employer's safety performance and programs, the employer gains some measure of assurance that the contract employer can safely perform work around a process containing highly hazardous chemicals. Second, the employer's obligation to periodically evaluate the contract employer's safety performance provides an opportunity for the employer to request improvements or to develop more stringent safe work practices for contract employers. Third, the requirement that the employer and contract employer communicate concerning potential chemical hazards, the emergency action plan, and hazards posed by the contract employer's work or discovered by contract employees ensures that both parties are aware of the potential hazards of the process. Finally, the provision allocates responsibilities for process safety between the employer and the contract employer and thus establishes a clear understanding of each party's duties with regard to issues such as training.

**2.3.8 Process Hazard Analysis:** The Process Safety Management Standard requires employers to perform a process hazard analysis (PHA) for each covered process. The purpose of performing a PHA is to identify and analyze the significance of potential hazards associated with the process and to provide information to assist employers in making decisions for improving safety and reducing the chances of a catastrophic event

**2.3.9 Management of Change:** The Process Safety Management Standard requires employers to develop written procedures to manage certain changes to the ammonia refrigeration process, such as additions of new equipment or changes in operating, maintenance or other procedures. The purpose of evaluating changes to the process is to assess their potential impact on safety and health, to determine whether the changes should trigger changes to operating procedures or safe work practices, and to ensure that employees are notified of changes and given appropriate training.

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2.3.10 *Mechanical Integrity*: The Process Safety Management Standard requires employers to develop a mechanical integrity program to assure the continued integrity of process equipment to minimize the risk of a catastrophic ammonia release. One of the goals of a mechanical integrity program should be to substitute break-down maintenance with preventative maintenance where appropriate to the equipment used in the process. The mechanical integrity program must include the systematic identification process equipment and instrumentation, the development of written procedures for maintaining equipment, training for maintenance employees, a preventive maintenance program for process equipment, a means of assuring that deficiencies in process equipment that result in operation outside of acceptable limits are corrected, and a quality assurance program.

2.3.11 *Pre-Startup Safety Review*: The Employers must perform a pre-startup safety review (PSSR) in two situations: the construction of a new facility; or the modification to an existing facility that necessitates a change in the process safety information. The purpose of a PSSR is to ensure that certain safety and design issues are considered before hazardous chemicals are introduced into the process.

2.3.12 *Emergency Planning and Response*: The employer must develop and implement an emergency action plan specific to the site. Depending upon the needs of the specific facility, there may be a minimal plan which focuses on evacuation or a more complicated plan, focusing on response. All contract employees will be trained in the hazards associated with his/her job and the emergency response plan at any facility they work at. Employees must be informed where ammonia is used in the host facility and aware of additional plant safety rules.

2.3.13 *Incident Investigation*: The Process Safety Management Standard requires employers to investigate each incident which resulted in or could reasonably have resulted in a catastrophic release of a highly hazardous chemical in the workplace. The purpose of the incident investigation provision is "for employers to learn from past experience and thus avoid repeating past mistakes." The incident investigation should focus on obtaining facts rather than placing blame.

2.3.14 *Compliance Auditing*: Employers must evaluate their compliance with the PSM Standard at least every three years by performing a compliance audit. The purpose of the provision is to establish a procedure to verify that the employer's PSM practices and procedures are adequate and are being followed. Of the PSM program and determine whether the associated procedures and practices are being followed. For example, the audit should evaluate whether operating procedures are being followed, appropriate operator training is being conducted, and Process Safety



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### 3.0 EMPLOYEE ACCESS TO INFORMATION

3.1 The Site Safety Coordinator is responsible for controlling access to PSM information. All employees shall be provided access to ammonia refrigeration PSM files and information but access may be governed by the following limitations:

Approval should be given to remove any documents from the file. Original copies of documents should not be removed from the file area. Requests for copies of materials will be honored within 10 working days of the request. No markings should be made on original documents. Previously un-filed documents should not be added without proper authorization.

3.2 All employees directly involved with operation and maintenance of the ammonia refrigeration system shall be encouraged to periodically review the process safety information and most recent process hazard analysis. Such reviews should be considered to be a training activity and can be conducted on company time.

### 4.0 AWARENESS TRAINING

4.1 Employee awareness training is done annually at the yearly safety training day to refresh personnel that PSM programs exist at all facilities we work with and they have a right to request this information about their program.

4.2 Employers shall make all information necessary to comply with available to those persons responsible for compiling the process safety information. Those assisting in the development of the process hazard analysis, those responsible for developing the operating procedures and those involved in incident investigations, emergency planning and response, and compliance audit without regard to possible trade secret status of such information. Nothing shall preclude the employer from requiring the persons to whom the information is made available of this section to enter into confidentiality agreements not to disclose the information as set forth in 29 CFR 1910.1200. Subject to the rules and procedures set forth in 29 CFR 1910.1200(i)(1) through 1910.1200(i)(12), employees and their designated representatives shall have access to trade secret information contained within the process hazard analysis and other documents required to be developed by this standard.

4.3 Employers shall respect all trade secrets and confidential information contained within the PSM program. Employers and employees entering into confidentiality agreements regarding trade secrets will be subject to any and all recourse outlined within the confidentiality agreement should the agreement be broken.

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## FIRST AID

The best way to reduce risk of injury from anhydrous ammonia is to wear protective equipment and to know what to do in case of emergency. Always wear ventless goggles or a full-face shield, rubber gloves with a long cuff that can be rolled to catch drips and a long sleeved shirt. Non-rubber gloves made of ammonia-proof materials may also be acceptable. Never wear contact lenses around ammonia because the lenses collect the chemical and will intensify caustic effects. Always carry a personal water supply (6-8 ounces) in a squeeze bottle to use for instant first aid. Federal law requires at least 5 gallons of water be carried on vehicles transporting anhydrous ammonia.

The best first aid treatment for anhydrous ammonia exposure is water - *large amounts of it*. Work fast! Flush all exposed areas for at least 15 minutes. If the nose or throat is exposed, flood the area repeatedly for 15 minutes, being careful not to choke the victim. Even a brief or mild exposure to the eyes requires irrigation for a minimum of 15 minutes. Remember to flush underneath the eyelids. Always begin flushing immediately. This reduces injuries, caused as soon as anhydrous ammonia contacts skin or clothes. If water is not available, use any nontoxic liquid such as cold coffee. Orange juice and other mildly acidic liquids will help neutralize the chemical. Water from a nearby lake or pond also can be used until other water supplies are available.

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Even with proper first aid, seek medical help as soon as possible. Explain the source of the injury so medical providers will not apply oils or ointments, as this treatment intensifies damage from burns. If you find someone in a continuous stream of anhydrous ammonia, do not attempt to rescue without proper equipment. Rescuers must wear a self-contained breathing apparatus (SCBA) and protective clothing. Always take care in removing a victim's clothing. Clothing could be frozen to the skin and removal could cause additional injury. Clothing frozen to the skin by ammonia can be loosened with liberal application of water.

## EQUIPMENT/VALVE OPERATION

1. Opening control valves too quickly may cause excess flow valves to shut.
2. Manual valves should be opened wide when transferring liquid ammonia from tank car to storage tank.
3. Purge all air from ammonia system before filling.
4. Relief valves must be stamped with the replacement date.
5. Never use copper, brass or galvanized parts on ammonia equipment.
6. Keep tanks well coated with white or light-colored paint

## SAFETY CHECKLIST

1. Wear protective equipment
2. Always have ample water supply nearby
3. Always stand upwind and out of line
4. Do not allow bystanders in the area when handling
5. Inspect and replace hoses and valves as needed
6. Do not pick up a hose and valve by the handle
7. Never fill a tank over 85% of capacity
8. Bleed off hose pressure before disconnecting
9. Stay clear of hose and valve openings
10. Never leave liquid ammonia trapped in hoses or pipelines.
11. Follow regulations when working with ammonia

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**DOCUMENT MANAGEMENT:**

If after reading this program, you find that improvements can be made, please contact the Safety Director. We encourage all suggestions because we are committed to the success of our PSM Safety Program. We strive for clear understanding, safe behavior, and involvement from every level of the company.