Miller, Diane M. (CDC/NIOSH/EID)

From: Gary Smith [garyws@charter.net]
Sent: Friday, October 16, 2009 11:34 AM
To: NIOSH Docket Office (CDC)
Subject: PPE Requirements for Ammonia
Attachments: PPE Level B Prom.doc; PPE Standard April 07.docm

Thank you for the opportunity to give input to the NIOSH Personal Protective Technology Program 3rd Annual Stakeholders' Meeting on March 2nd. My name is Gary Smith and I am the President of the Ammonia Safety and Training Institute, a non-profit organization dedicated to making ammonia the most safely managed hazmat in the world. I retired from the fire service, spending 20 of my 33 years as a fire chief. PPE has always been a priority concern of mine. I am concerned that the end user use the right ensemble for the hazards of the work circumstance.
I have experienced an especially difficult and dangerous circumstance in the ammonia industry. It seems as if the regulatory community (specifically OSHA) has picked up on a strategy that results in requiring the highest level of PPE after reaching the IDLH level when responders to ammonia events. The concern is that IDLH represents a hallmark moment whereby life risks are extreme and levels of PPE must be the highest. Those who have studied the subject closely are not agreeing with this logic. The best PPE for levels of ammonia up to 10,000 PPM is an ensemble that provides chemical permeability protection and self contained breathing apparatus. The "Level A" approach actually offers far more risk to the responders than the emergency event when compared to the "Level B" ensemble that we would like to see approved, this is because of the stress of wearing the Level A gear. Furthermore, the availability of a trained and equipped hazmat team that is trained, certified, and equipped to wear Level A ensemble is beyond most communities and industrial facilities capabilities...many are giving up their response because of the strict PPE requirements. This is a sad state of affairs when those who work with ammonia KNOW THAT THERE IS A SAFE AND EFFECTIVE ANSWER! The Level B ensemble is more than adequate to protect the responder in environments that are under 10,000 PPM of ammonia.
We have been officially voicing this concern for some time. Unfortunately we have not invested as much energy working with NIOSH and OSHA as we should have to make changes. Today we are making our moves and our first effort would be to get this issue on your agenda. With that in mind I offer the following agenda topic: "The Best PPE may not be the Highest level of PPE available" I would be glad to make a presentation on the subject if that suits your needs. (Pun intended)...

THANK YOU!

Gary W. Smith
President, Ammonia Safety & Training Institute
Cell 831-818-1321

Letter to OSHA, EPA, Chemical Manufacturers Society

The Ammonia Safety and Training Institute is a non-profit organization dedicated to managing ammonia safely and we promote methods of preventing emergencies or stopping them when they are small. We also provide a valuable connection between public safety and the industry by promoting a cooperative and well organized joint response, using our 30 Minute Plan logic to formulate safe and timely response to ammonia emergencies. ASTI's President, Gary Smith is a veteran fire chief (retired) with over 30 years of fire service experience; the ASTI Training Coordinator, Jim Ennis is also a retired fire chief with over 30 years of experience. The Board of Directors for ASTI includes industrial leaders with over 150 years of collective experience in ammonia industrial and service related leadership. We feel that we have a great understanding of dynamics of an ammonia release and the best practices for controlling overpressure, fire, and release scenarios involving anhydrous ammonia.

One of the key components to controlling an ammonia problem is to recognize and act appropriately in the beginning phases of a potential release. The mitigations and methods of control are easier to apply and the consequences of the release significantly reduced when a trained operator can apply control mitigations and act swiftly to reduce impacts.

The problem: OSHA citations have been given for those failing to wear Level A PPE for incidents over 2500 ppm. Level A PPE requires 45 minutes to properly set up and a team of at least five trained members (2 inside, 2 outside, an incident commander/safety officer); the preparation for wearing Level A PPE require blood pressure and personal weight and medical evaluation before use, the on-going medical costs and training costs to maintain Level A response is prohibitive for most industrial users to implement. Furthermore the Level A suits are uncomfortable, stressful and difficult to maneuver in; this level of PPE should be used for trained responders to highly toxic release scenarios, not those incidents that can be safely mitigated with lesser forms of PPE.

The time lost in waiting for a Level A response gives the release scenario time to build to dangerous levels. A Level B response can be implemented in 10 to 15 minutes with three trained responders; the incident could have controlled and/or stopped with minimal downwind threat, while waiting for a Level A response would have already resulted in a much more significant downwind problem. Level B PPE is much easier to put on, less stressful to the body and can be implemented quickly during an emergency scenario. ASTI feels that Level B PPE can be worn by trained responders at levels that do not exceed 10,000 ppm. The responders must be appropriately trained in accordance to 1910.120 (q) requirements and the contaminated space must be monitored by the responders to assure that levels are below the 10,000 ppm limit.

The following statement by the National Research Council describes why 10,000 ppm limit for Level B protection is more than adequate as a recommendation for regulatory change:

> "The relationship between response and ammonia concentration has not been well described. A concentration of 10,000 ppm produces skin damage. The maximal

concentration of vapor tolerated by the skin for more than a few seconds is 20,000 ppm. Though no specifics of the experiment were given, one study indicates that 10,000 ppm is mildly irritating to the skin, 20,000 causes increase irritation and 30,000 ppm may produce blisters in a few minutes. Therefore, skin should be protected in air that has a concentration of over 10,000 ppm."

Ammonia: Written by the Subcommittee on Ammonia, Committee on Medical and Biological Effects of Environmental Pollutants, Divisions of Medical Sciences, Assembly of Life Sciences, National Research Council; published by University Park Press, Baltimore (page 274).

If the Level B suit were to rip or in some fashion fail to protect the user from exposure to ammonia vapors the responders can quickly escape the release and decontaminate without significant concern for skin damage.

ASTI has performed tests with Level B protection and we have testimony from certified public safety hazmat team responders that confirm the logic of safely and comfortably using Level B in 10,000 ppm or less atmospheres. We will be glad to reproduce this experience for you and help you understand our concern for making clear recommendations on when and where to use Level B for ammonia related response scenarios.

Sincerely,
ASTI Board of Directors signatures

Utilization of Personal Protective Equipment (PPE) for an Ammonia Emergency Event - Ammonia Safety and Training Institute – April 2007

There is no "one type fits all" strategy for using PPE. There are six key areas of concern that need to be addressed when setting or evaluating PPE requirements:

1. **Threats and Risk:** What are the life, environment, and product value that we protecting on site and off site? What are the downwind and downstream risks? Is there enough priority for "prevent them all and stop them small" approach? How well does the prevention, mitigation and preparedness efforts work? Are the employees trained and qualified to implement defensive strategy and incidental tactics? Is your onsite plan in sync with public safety to deal with the off-site concerns? What level of PPE do we need to be able to achieve the "stop them small" and "defensive" protocols? What level of PPE do we need to support public safety should we join with them on controlling the on-site problem?
2. **Chemical & Physical Characteristics of Ammonia:** What is the nature and hazard of the release: Aerosol, dense gas, vapor or liquid? The responder must be able to read the risks and predict the next level of threat when selecting the appropriate PPE. The location and spread characteristics of the release will affect the downwind and downstream risk factors; the likeliness for the worst case scenario involving each of the different types of release will help make clear the need for PPE and emergency response protocols that work best.
3. **The phase of the response:** During the discovery and initial response phase we are likely to "stop it small" with the right PPE and protocol. For sustained response the incident may still be growing out of the level of protection for the PPE. During termination we must stress the need to keep the appropriate PPE on to handle a potential return of problems (especially during restart). The timing of the responder support will affect the phase of response and that will ultimately affect the time, duration, and spread of the release. The greater the potential for dense gas and aerosol accumulation the higher the level of PPE will be required. It's important to gage entry when the release conditions are getting better rather than continuing to rise; levels can quickly pass through the level of safe entry when it's out of control and SIMPLE measures have not occurred.
4. **The response strategy:** Offensive, defensive, rescue, reconnaissance, etc. will establishes the challenge in developing an appropriate Incident Action Plan (IAP} and a Safety Plan. The availability and use of mitigations such as system pressure controls, isolation valves, containment, and ventilation systems will affect the ability to stabilize and reduce the impact of the overpressure, fire or release scenario which also affects the level of PPE and direction of the tactical objectives.
5. **The responder level of training and readiness to support operations:** Certification of training at the Awareness, Operations, Technician, Scene Manager, or Specialist level; and readiness to respond (medical/physical condition, fit test, etc.) will establish what type of responder expectations that can be included in the IAP tactical objectives. Provide adequate numbers of trained and equipped personnel that will support operations (entry, backup, decon., rehab, etc.) dictate the strategy and tactical objectives established in an Incident Action Plan and Safety Plan that really makes

the difference. The SOPs for the response strategy and tactical objectives must be clearly designated in the facility Emergency Response Plan.

6. **Readiness of PPE and the availability of ammonia monitoring:** equipment and a clear understanding of the capability and service condition of the PPE, as per the manufacturer specifications as tested and approved by national safety standards. The type of response equipment and PPE should be identified in the SOP and/or Incident Action Plan and Safety Plan for an emergency event. All of those who enter atmospheres in excess of 300PPM of ammonia must carry a hand-held monitor that reads at the levels of ammonia within acceptable limits of entry for the PPE worn.

Levels of Personal Protective Equipment:

The EPA has designed four categories of PPE as follows: Level A is the highest level of PPE which is fully encapsulated entry suit and self contained breathing apparatus; outer layers for flash fire protection and cryogenic protection can be added or specified in the Level A suit. Level B is a chemical over-suit with self contained breathing apparatus; the level of permeation of a given chemical is measured and indicated by the manufacturer as guided by nationally accepted testing practices. Level C protection involves coveralls or over-suit for splash protection and an air purifying respirator; Level C is designed for protection while performing dangerous or hazardous maintenance or service jobs. Level D protection involves the basic daily routine worker outfit, with overalls, helmet, safety boots, etc.

The decision to utilize personal protective equipment must supported by response logic that appropriately considers the seven points listed above. Your choice of PPE will be dictated by the level of concern your facility management has for stopping an incident from escaping the property; the downwind hazards, as well as the on-site protection needs for employees, visitors, and the product.

It is not as simple as buying the equipment and stating that "we are Level A or Level B equipped and trained"; nor is it appropriate to say "we will use Level A protocols for all emergency events", quick action on the part of a person trained at Level B or C PPE will clearly the small incident or key defensive action needed in the early stages of an emergency event will pass you by before you get your Level A crew ready to respond (a 30 minute experience if performed correctly).

The logic behind the 1910.120 (q) training and emergency response requirements and the 1910.134 personal protective equipment requirement is sound; it's the regulators, trainers, facility managers and response team members who struggle with the interpretation of those requirements. The purpose of this paper is to clear up the gray area and cross communication that occurs between the regulators, responders, facility manager and the public safety responders as we interpret and attempt to comply with the Code of Federal Regulations that guide hazardous materials response.

The following is a summary of what the Ammonia Safety Training Institute suggests when selecting and utilizing the proper PPE for the emergency response strategy and tactic to be implemented:

1. Understand the hazards and risks that need to be well understood before determining the level of PPE required.
2. Understand the different strategies, especially "offensive" and "defensive" strategies.
3. Understand the response expectations for dealing with an ammonia release during the four phases of an emergency event (discovery, initial response, sustained response, and termination phase).
4. Determine the response tactics and corresponding type of PPE that should be worn during potentially dangerous service and maintenance protocols; examples would be fire (welding & cutting), overpressure (working outside low/high SOP pressures), and when performing service, repair, or maintenance that could in some way compromise the system, causing a release (e.g. while draining oil, cleaning a strainer, defrosting, or when doing service, repair or maintenance that will in some way open the system to potentially cause and emergency event).

Hazards & Risks to be Considered as a Part of the Incident Action Plan

There are several important rules to response that should be considered before developing an IAP that would involve entry into an environment requiring PPE. For the purposes of this explanation "hazards" are given concerns about what the ammonia event will present to the health and welfare of the entry team member and "risk" defines the circumstances that exist for the responder should they choose to enter a hazardous environment.

Hazard	Risk
1. **Sudden deflagration (flash fire)** of ignition of a dense formation of ammonia gas inside a building – the flash potential is dependent on the contamination of compressor oil mixed with the dense gas cloud; PPM levels of between 80,000 ppm and 280,000 ppm should be suspect	Flash fire will ignite and have the force of action to cause structural damage and quick fire spread throughout the room and contents; the deflagration is survivable, but the fire spread could be deadly if flash protection and back up fire and rescue attack is not immediately available.
2. **Aerosol Release** is the fastest and strongest potential ammonia release challenge. Droplets of liquid ammonia mix with dense gas to drop temperatures to near -100°F and the exposure to this level of ammonia will cause chemical burns and asphyxiation.	Direct exposure to skin tissue, especially eyes, airway, and other areas of moisture, will cause immediate long term damage and potential death. If the skin (gloves and overalls) eyes (face goggles) and airway (respirator mask) is protected escape from an aerosol event without significant injury is likely. A helmet and proper safety boots are also important to the safety of the person caught in this type of hazard.
3. **Dense Gas Release** can quickly increase to levels that exceed 30,000 ppm and higher. The dense gas risk can easily raise to the same level of concern explained for "Deflagration" and "Aerosol" releases; the interior temperature of	Entering a dense gas release is cause for the same level of risk associated with the risks defined in the "Deflagration" and the "Aerosol" release. The potential ignition of the dense gas cloud confined in a structure should

a dense gas will become less of a concern as the gas spreads beyond the area of release and into the atmosphere. The outside release of a dense gas cloud is not a risk of deflagration unless large amounts of ammonia is released suddenly (e.g. the entire vessel of ammonia suddenly opens from a vehicle crash) in an area where source of ignition exist.	be monitored and mitigated before considering entry. Never enter a cloud of ammonia and stay away from the aerosol release unless you are outside and trained to use a Level A type of PPE with flash and protection from the extreme cold.
4. Vapor Release may travel for miles and cause concern and discomfort for those who inhale the gas. The gas is cool and the warm air movement (boiling point of ammonia is -28ºF) will eventually move it to atmosphere where it eventually harmlessly breaks down to hydrogen and nitrogen. Levels can quickly rise to 300 PPM which is an action point for considering immediate life and health threat; short exposure to levels under 7,000 ppm is survivable but breathing will be difficult; at levels above 7,000 ppm the gag reflex begins to initiate which will automatically stop the human body to breath.	The first shot of ammonia will dictate the survivability of the victim; if levels above 7,000 ppm immediately hit a person with no protective equipment, especially respirator mask and goggles, the likeliness of falling victim to the release is high, unless that person can quickly step out of that atmosphere moving lateral and upwind, move to a room or building to shelter in place, or close the door on the release and step back to fresh air. Those affected in the downwind to levels above 50 ppm will likely not experience long term damage as they will move out to fresh air or shelter in place.
5. Liquid can be fairly stable once it flashes while absorbing heat from its surroundings; the addition of water will cause a sudden splashing and active mixing of ammonia and water; this is especially true when adding water into anhydrous ammonia. Addition of reactive chemicals such as chlorine will agitate the liquid and cause a chemical reaction that could be toxic and explosive.	The potential for splashing or cold freezing as you walk through a puddle of ammonia liquid is a concern. Keep the contained liquid covered and minimize any agitation and it will stay relatively calm.

Understand the different strategies

The following is a summary of the most frequently used strategies for handling an ammonia release; the strategy and level of PPE is described within the following table

Strategy	**PPE**
Reconnaissance: Investigating an area where the release has occurred to find the source and conditions of the release.	When entering an unknown atmosphere of ammonia that is rising in levels of ammonia saturation the level of protection should be set to meet a changing environment and be ready for the highest level of risk; the environment must be monitored
Rescue: helping a person who is trapped or has become overcome by ammonia while still in a dangerous accumulation of ammonia	The same level of PPE concern for rescue is as described for Reconnaissance; do not become a victim while you are valiantly trying to save another victim!

Defense: The operations needed to contain, control and minimize the effects of a release while working within monitored levels of ammonia.	PPE must give the responder protection from vapors; no entry into aerosol or dense gas; the responder must also monitor the level of ammonia to assure that the PPE is within standards (manufacturer specifications) and no more than 20,000 ppm (which is one quarter of the lowest known ignition range of an oil contaminated dense gas release)
Offense: Moving into a hazardous environment to bring isolation and control to a release; monitored levels are showing an increase and are within the specifications of the PPE utilized.	The support with ventilation fans
Termination: The worst case has peaked and the conditions are getting better; ammonia levels are coming down and are monitored. The emergency event is deemed under control yet there may be some clean up and overhaul that still needs to be performed. The system restart operations need to be monitored with the emergency level of PPE	

Phases of Response

Phase of Response	**PPE**
Discovery: the first arriving person should be prepared to investigate, size up and initiate LANCE	
Incidental Response: Small incident, no immediate threat (below IDLH)	Ammonia Safety Protection Gear: Air Purifying Respirator, radio, total skin coverage, ammonia monitor, gloves, helmet, boots. One in and one out (notified by radio and responding to the scene of the incident)
Initial Response: Engaging Reconnaissance, Rescue, or Defensive SIMPLE within 5,000 PPM	Level B PPE and Technician level training with buddy system entry and notification of the back-up
Sustained Response: Entry into greater than 5,000 PPM requires highest level of PPE and Hazmat Team readiness	An Incident Action Plan, Safety Plan, 2 in 2out readiness, zones and controls and Level A readiness.
Termination: Incident is under control levels of ammonia have dropped to below IDLH	PPE is absolutely essential in that a secondary system failure is a high risk potential; the facility emergency coordinator will determine the level of PPE, but in no circumstances should it be less than what is used for Incidental release response.