

# 20<sup>th</sup> Anniversary AEA Annual Conference

Ammonia Energy Annual Conference

Atlanta, GA, U.S.A

November 13-15, 2023

Theme: “Replace Fear Of Ammonia With Knowledge And Confidence That Ammonia Will Be Recognized As The Safest Managed Hazmat In The World”

# SIMPLE can be Harder than Complex

Oliver Wendell Holmes Sr.

*“You have to **work hard to get your thinking clean to make it simple. But it’s worth it in the end because once you get there, you can move mountains.**”*

*“The role of **genius is not to complicate the simple, but to simplify the complicated.**”*

*Einstein - “**Everything must be made as simple as possible. But not simpler.**”*



Power transformer began to arc flash.

No fire attack.

Power service had to be shut down.

Plant was fed with power from two power pole transformers.

This incident marks the beginning of ASTI.

## Tripod Solutions for One Plan Readiness

### INDUSTRIAL COMMAND

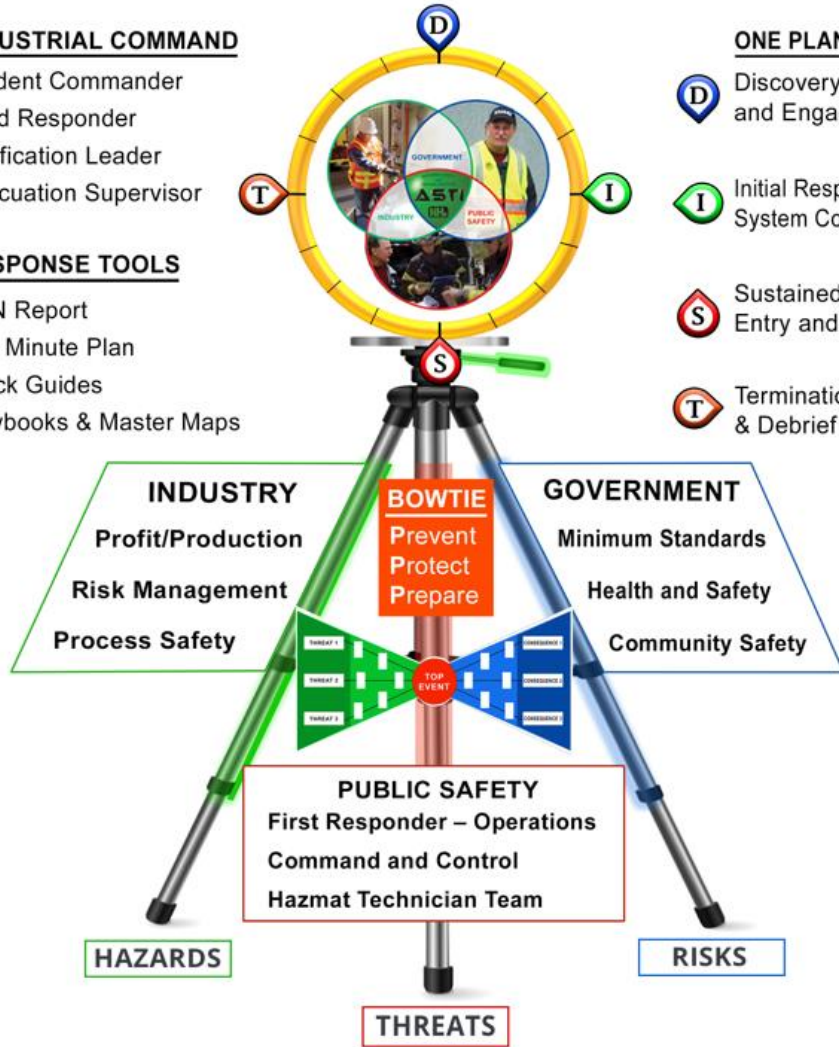
Incident Commander  
Lead Responder  
Notification Leader  
Evacuation Supervisor

### RESPONSE TOOLS

CAN Report  
30 - Minute Plan  
Quick Guides  
Playbooks & Master Maps

### ONE PLAN RESPONSE

- D** Discovery Escape harm and Engage Command
- I** Initial Response Emergency System Control
- S** Sustained Response Entry and Control Plan
- T** Termination Recover & Debrief



## Prevent Loss of Containment



The One Plan four stages of response  
**LANCE CAN** do  
**SIMPLE PLANS** to  
**RECOVER.**

# 30-MINUTE PLAN EMERGENCY CONTROL GUIDE

### 1. DISCOVERY - "LANCE"

**Life Safety: Clear the Isolation Zone (NH<sub>3</sub> = 100 ft. to 1,000 ft.)**

- Clear the Isolation Zone and escape laterally and upwind or SIP
- Set up for rapid entry rescue, decontamination, and medical care

**Alert: Record Size-Up on Alert Form**

- Who? (your name)
- What? (casualties, rescue, medical, fire, or chemical release)
- Where? (specific location)

**Notification: Coordinate Checklist Notifications with IC**

- 9-1-1; give response route and on-site meeting location
- LEPC: ( ) SERC: ( )
- NRC: (800) 424-8802 OSHA: ( )
- Contractor: ( ) CORP: ( )

**Command and Control**

**Action:** Identify Hazard Zone, Level of Concern, size of Isolation Zone, and location of the Incident Command Post (ICP)

**Plan:** Engage the Command Team; Set the Life Safety Objective

**Hazards** (chemical/physical), **Risks** (life and environmental), **Threats** (fire, pressure, reactivity, slip/fall, structural integrity)

**Level of Concern:** 1 - Confined and Contained  
 2 - Contained and uncontrolled  
 3 - Uncontrolled and uncontained

**Isolation and Protective Action Distance (PAD) for ammonia:**

|                        |  |
|------------------------|--|
| Small 100 ft.          | PAD: 550 ft. (day and night)           |
| Large 500 ft.          | PAD: Day = .5 miles; Night = 1.3 miles |
| Catastrophic 1,000 ft. | PAD: Track plume beyond 1.3 miles      |

**Acute Exposure Guideline Levels (AEGL):**

|                              |                    |
|------------------------------|--------------------|
| 10 Minutes: AEGL 2 = 220 PPM | AEGL 3 = 2,700 PPM |
| 30 Minutes: AEGL 2 = 220 PPM | AEGL 3 = 1,600 PPM |

**Flammability of confined NH<sub>3</sub> vapor with a 1,204°F ignition source:**  
 Caution - 10,000 PPM, move-out - 15,000 PPM, high risk - 40,000 PPM

**Evacuation to Safe Refuge or SIP**

- Movement Plan—move laterally and upwind to Safe Rally Point
- Secure the safe assembly area locations
- Setup Access Controls to and from the plant
- Head count—check in/check out

### 2. INITIAL RESPONSE - "CAN use SIMPLE"

**Size-up: CAN report Conditions-Actions-Needs**

**Conditions:** Hazard Zone Location? Nature of emergency? Level 1, 2, or 3? Size of Isolation Zone? Confined? Contained? Controlled?

**Actions:** Incident Commander? Command post location? Evacuation status? Rescue in progress? Life Safety in Isolation Zone? Status of emergency shut-down?

**Needs:** Rescue? Medical? Decon? Shut-down? Ventilation support? Downwind/downstream receptor management?

**Sources of ignition and fire suppression controls**

- Control utilities, ventilation, and sources of ignition
- Access to hydrants and FDCs for fire sprinkler system
- Firewall integrity, containment of fire, exposure protection

**Isolate the source of the leak and pump down the liquid**

- Identify upstream and downstream control points
- Avoid hydraulic shock - use situational awareness
- Avoid trapping liquid between valves with no relief valve
- Confine to hot zone, contain within system, and control leak source
- Confined and contain, e.g., close doors and/or tarp
- Control liquid upstream and/or downstream of leak

**Manage energy flow to the high and low sides**

- High side release - shutdown compressors and evaporators
- Low side release - use compressors and condensers to move liquid
- Reduce incoming heat - disable evaporators and defrost
- Use diffuser and/or pressure equalizer

**Pressurized ventilation using system or portable fans**

- Plan air flow - entry (upwind) and exhaust (downwind)
- Use fan to dilute or redirect vapor
- Engage portable fan to support rescue

**Life Safety and Engage Incident Action Plan**

- Assure life safety in Isolation Zone
- Public safety control of Protective Action Zone
- Eye-level wind movement: CAUTION for wind changes, eddies, backflow, and turbulence
- Engage site access control and air monitoring
- Assure containment of downstream environmental threat

### 3. SUSTAINED RESPONSE - "PLANS"

**Integrate command** with Facility Team - Senior Supervisor or Plant IC becomes Technical Support Liaison from the facility.

**Unify Command** with agencies having jurisdictional authority to address emergency services within the Protective Action Area and establish the Incident Command Leader of the Unified Command.

**Notify the community Emergency Services Director** if the incident requires regional resources.

**PRE ENTRY Hazard Zone readiness - ICS 215A**

- Develop a Situation Status Report and a Hazard Assessment (ASTI All-Hazards Response Guidebook pgs. 2-4 and 36-42.)
- Recognize escalating factors, e.g., ammonia vapor >10,000 PPM ignition sources and overpressure (approaching cut-out and/or PRV settings).
- Avoid hydraulic shock (hot gas mixing with cold liquid within the system) and be aware of possible hydrostatic pressure (trapped liquid).
- Assure adequate entry/exit locations, communications, and buddy-system alert signals.
- Utilize Hazmat Competence (Haz-Comp) to judge the level of PPE and risk vs. benefit consideration before doing a high-risk rapid entry rescue.
- Order adequate resources - double the number that are engaged, or triple if high-life threat exists.

**LIFE SAFETY and Logistics challenges**

- Utilize chemical monitoring to identify life safety concerns within the Isolation Zone and Protective Action Area.
- Assure that adequate back-up for Entry Team with readiness for decon and rehab.
- Position ventilation fans and back-up hose lines for rapid decon and lifeline support.
- Evacuation staging areas to be monitored for potential chemical vapor and smoke exposure.
- Evacuees supported with adequate protection from weather and personal care concerns, e.g. hydration and bathroom facilities.
- Logistical needs for PPE, decon, medical treatment/transport, air supply support, communications, technical support for critical high-risk rescue and system control.

**ACTION PLAN development using Hazmat Intelligence**

- Review the ICS 201 form and the Organizational Chart (back of this plan).
- Consider a Science Officer and/or Plans Section Chief - Hazard Assessment and IAP Objectives.
- Quick-Guide Hazmat Intelligence - See ASTI All-Hazards Response Guidebook pgs. 2-4 and 36-42.

**NO ENTRY until the following principles are addressed.**

- Conduct and IAP Command Team briefing; review hand signals, alert tones, and safety concerns (see sample on the back).
- Never enter a danger area without "Command" approval; never change an IAP task without IC approval.
- PPE readiness to escape IDLH and to enter with SCBA and hazmat over suit that addresses the predicted and monitored level of exposure, e.g. Level B <5,000 ppm.
- PPE protection concerns for -30°F to -80°F exposure within an aerosol or dense gas cloud; for flash fire threat within a dense gas cloud (10% to 28% concentrations).
- Avoid using water on aerosol streams or dense gas clouds when the residual effects are high life hazard, longer downwind impacts, and/or high system pressure.
- If you "feel the tingle" of ammonia vapor, your vapor barrier is failing - escape immediately.
- Do not put water on a liquid pool of ammonia - tarp and cover and absorb or suction the liquid puddles into safe storage tanks.

**SAFETY PLAN that is linked to the overall PLAN**

- Develop ICS 208 Site Safety and Control plan and review All-Hazards Response Guidebook pgs. 36-38.
- Plan to perform hazard assessments and update the safety plan prior to engaging additional IAP's and/or at a minimum of every 30 minutes.

For more information about trainings and Safety Days visit [www.ammonia-safety.com](http://www.ammonia-safety.com) or contact the main office at (831) 453-7102.

**Ammonia Safety and Training Institute**

**Take Command with the 30-Minute Plan**

- Establish Hazard Zone
- Set the Level of Concern
- Secure the Isolation Zone
- Set Life Safety Objective
- Engage Emergency Shutdown Plan

Save yourself, engage the team, and help others.  
 Act decisively to stop problems when they are small.

### 4. TERMINATE and "to RECOVER"

**Note:** This part of the 30-Minute Plan is available as a separate checklist with supporting Playbook information that engages the RECOVER acronym as follows:

- R**eview termination stipulations and regulatory orders
- E**valuate the situation status and develop a safety plan
- C**risis management team - Operations, Planning, Administrative (Legal, Finance, and Information Technology)
- O**verhaul, salvage, clean-up and restart plan
- V**erify status - customers, marketplace, investors, and stakeholders
- E**ducate the tripod; debrief, train, and improve
- R**eturn to business with celebrated success

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# ASTI Training and E-Planning



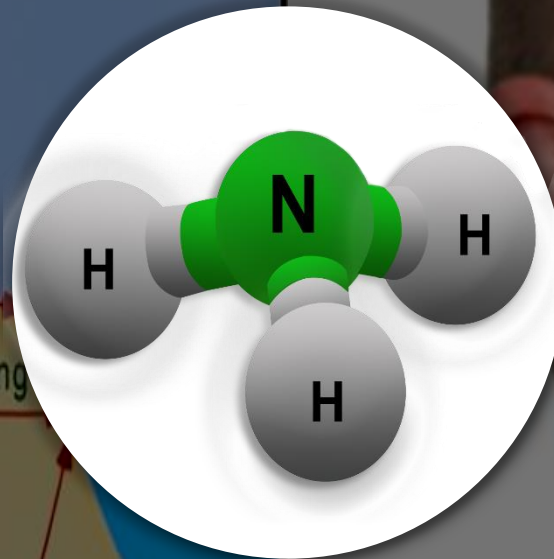
## Training

- Safety Days – U.S. Australia, and Canada – National Coalition
- EPA - RMP/CONOPS Tabletop Exercises
- 32 Hour – Live Training
- Asia Pacific 100, 200, and 300 Courses
- Building Associates for compliance training and Self-Sufficiency

## Emergency Planning

- EPA/FEMA Framework linked to the AHJ CONOPS
- Clipboard First Responder training for Discovery and Initial Response
- One Plan Integrated Contingency Plan Four Stages of Response
- Sustained Response Playbooks

# Challenges and Benefits of Ammonia



AMMONIA IS A VITAL PART OF EARTH'S LIFE CYCLE - JUST AS AIR AND WATER. IT'S A NATURAL PART OF OUR EXISTENCE..

THE MOST RECOGNIZABLE PROPERTY OF AMMONIA IS:

**THE SMELL**

AMMONIA'S STRONG, PUNGENT AND IRRITATING SMELL GIVES EARLY AND POSITIVE WARNING THAT AMMONIA IS PRESENT.



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Breath Through nose with short sniffs to smell odors.

Breathe clean air through the nose and exhale out the mouth to clear lungs.

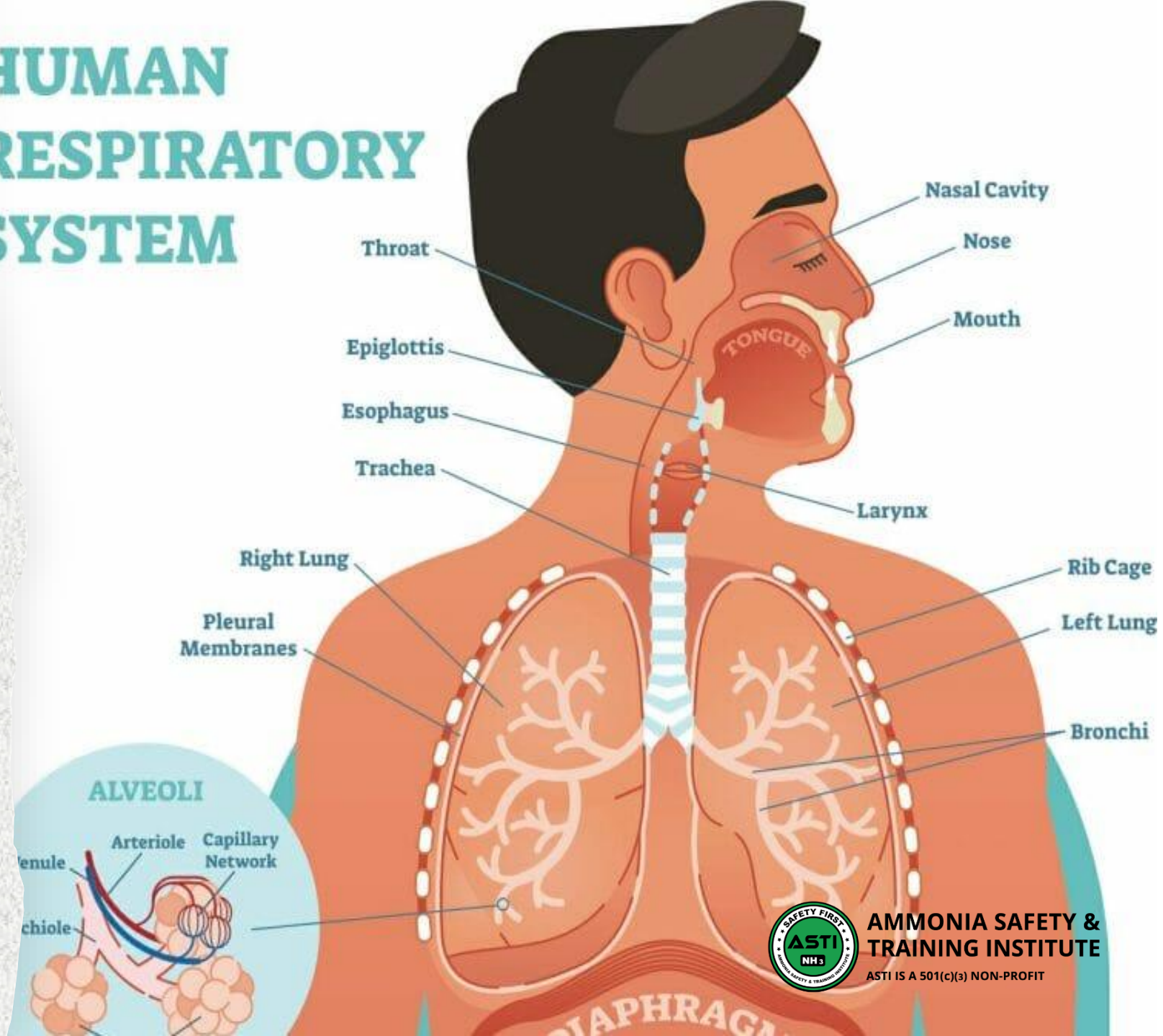
What's the procedure for escaping ammonia?

Answer: Sniff for threat;

Cover nose for short breaths while escaping  $\text{NH}_3$ .

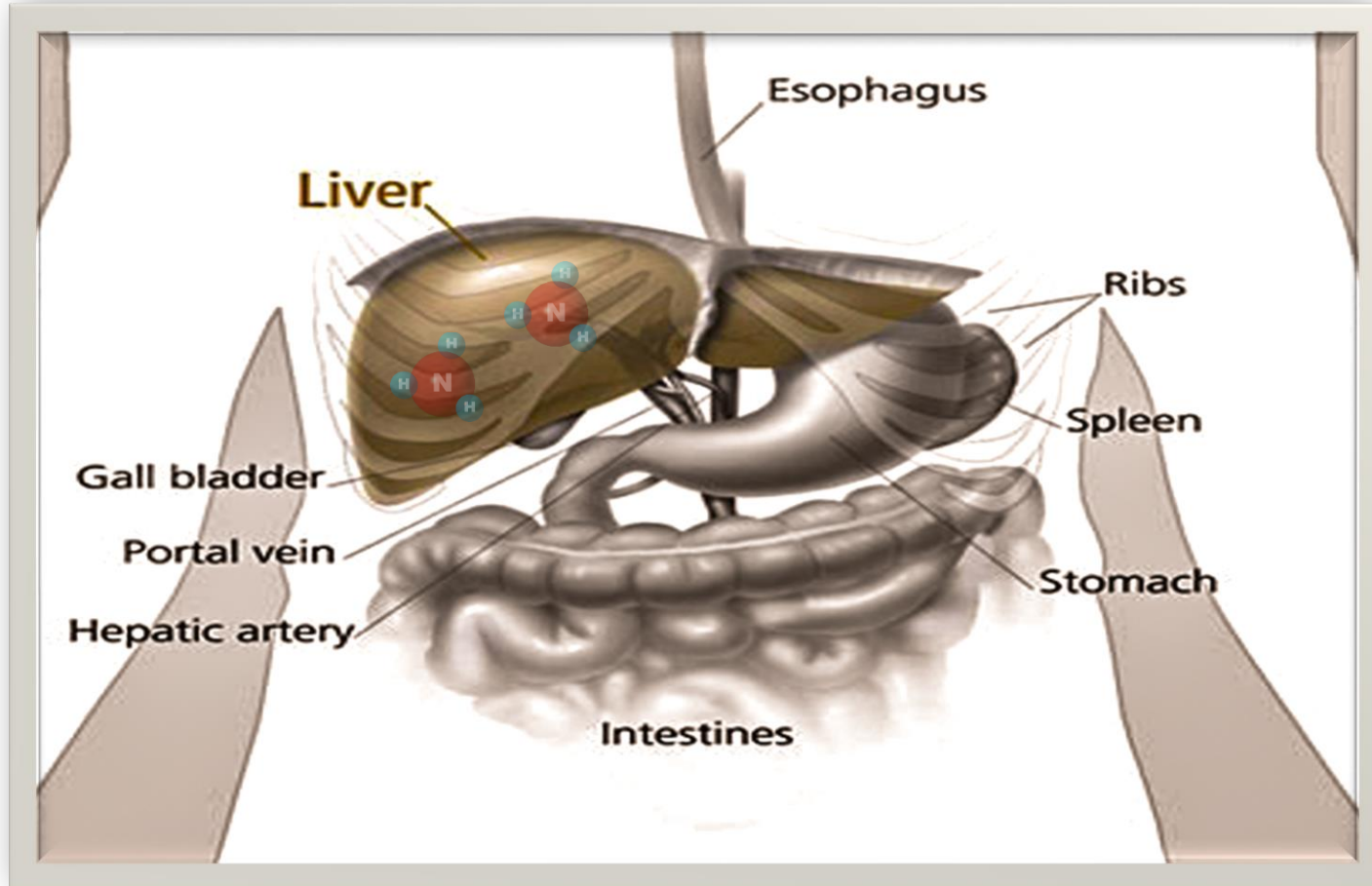
Move lateral and upwind to safe rally point (inside building or upwind outside).

# HUMAN RESPIRATORY SYSTEM





# Breathing NH<sub>3</sub>



Total production by body –  
**17,000** mg/day

CONTINUOUSLY BREATHING  
25 PPM = **379** MG/DAY

**LIVER CAN PROCESS**  
**130,000** MG/DAY,  
EXPELLED DURING  
EXHALATION AND AS UREA



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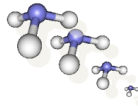
Asphyxiation  
>2,500 ppm

Eye injury  
> 700 ppm

Skin Burn  
> 10,000 ppm

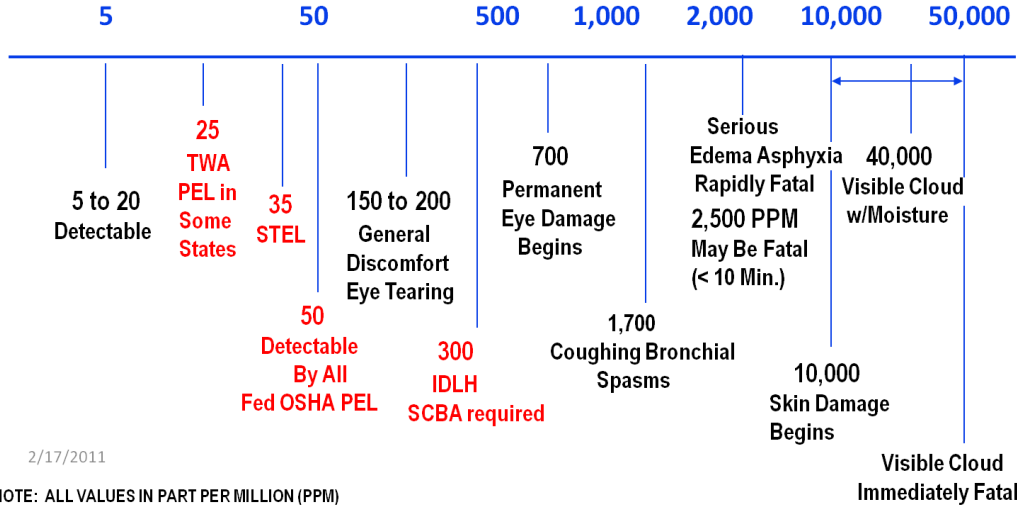
Freezing  
25°F – 18.5°F

Ingestion  
pH – 11.6



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**RULE OF FIVES**



2/17/2011  
NOTE: ALL VALUES IN PART PER MILLION (PPM)

**Ammonia 7664-41-7 (Final) - Expressed in PPM**

|               | 10 min | 30 min | 60 min | 4 hr | 8 hr |
|---------------|--------|--------|--------|------|------|
| <b>AEGL 1</b> | 30     | 30     | 30     | 30   | 30   |
| <b>AEGL 2</b> | 220    | 220    | 160    | 110  | 110  |
| <b>AEGL 3</b> | 2,700  | 1,600  | 1,100  | 550  | 390  |



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# NIOSH Respirators

NIOSH 23C  
Cartridge APR



NIOSH 14G  
Canister Gas Mask



Emergency Escape  
Breathing App.





# FIRST RESPONDER CLIPBOARD

## AMMONIA RESPONSE CONOPS



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## EMERGENCY SYSTEM CONTROL



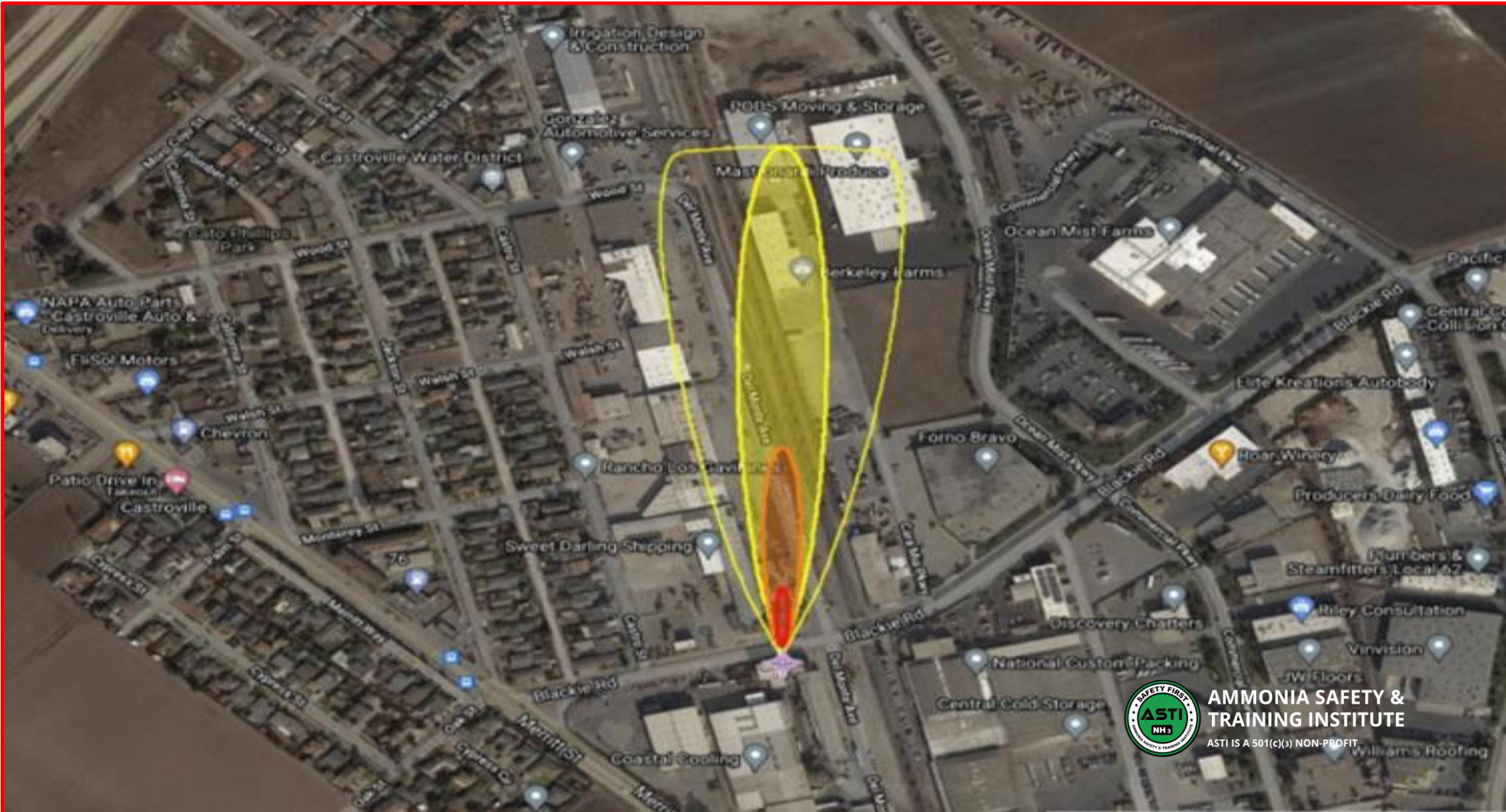
The Control Box includes emergency ventilation, shut down of ammonia pumps, shut down of the compressor, and master kill switch for all power except the ventilation fans.

A solenoid for shut down of the King Valve is also a control measure that is offered.



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ASTI NH3

ASTI NH3

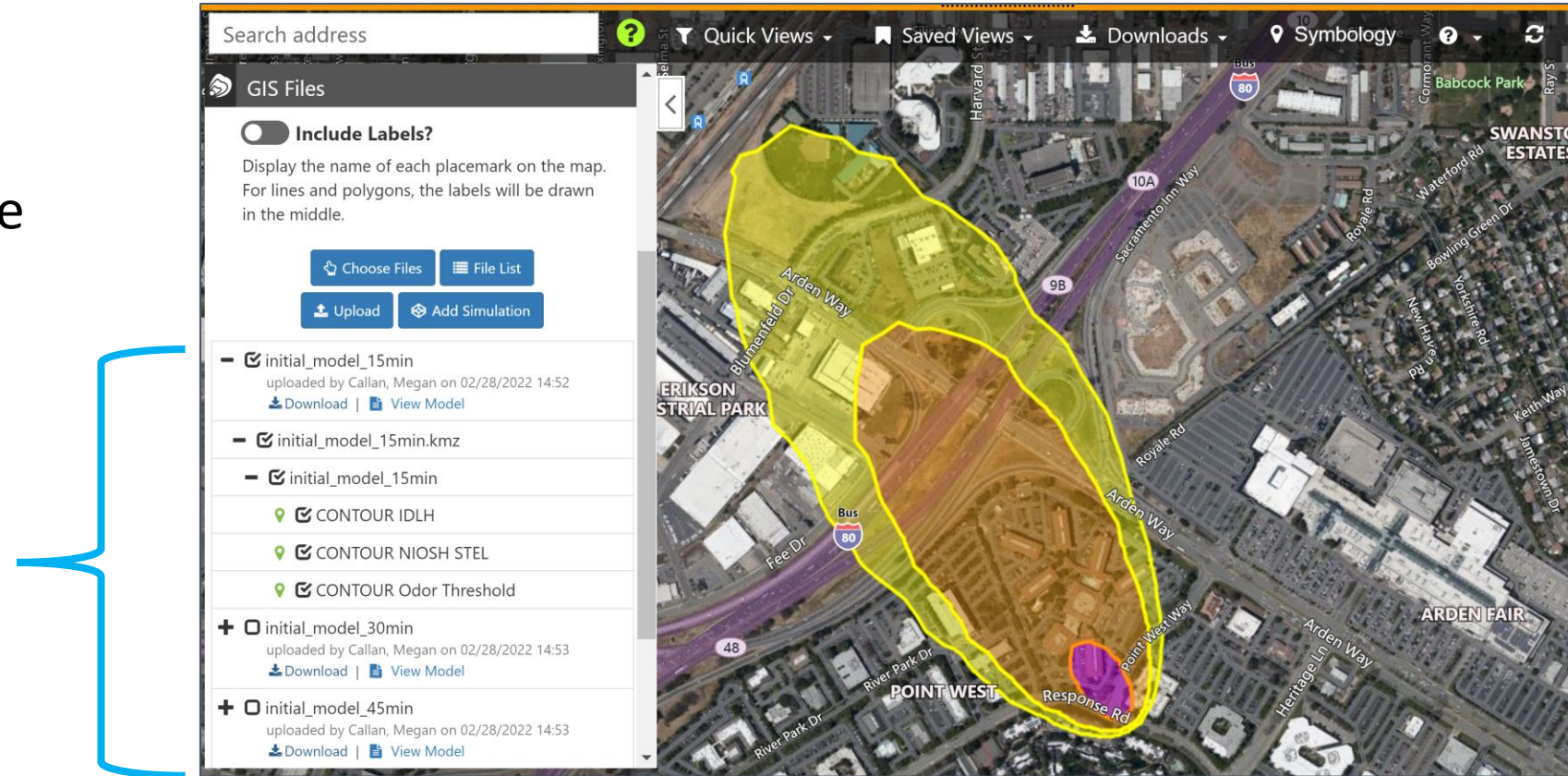


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# ChemResponder Action 7 – View your IMAAC Products

- Modeling files are pushed directly to the event map
- The user can customize the layering for their model viewing



Discovery

Initial Response

Sustained Response

Termination

## About Ammonia

Ammonia is a chemical that occurs naturally in the environment. It is an efficient and natural refrigerant used to support safe food storage, and as a fertilizer that is essential in growing crops. Ammonia is used as a household cleaner, and industrially to treat water and control air pollutants.

Ammonia is hazardous; however, people can live and work safely around it. Electricity, natural gas, and gasoline are examples of other hazardous materials that people have learned to live and work safely around.

Some basic things about ammonia:

- ▼ Ammonia is a colorless liquid or gas.
- ▼ Ammonia has a strong, pungent odor.



Wet baby diapers produce the ammonia odor.

- ▼ Initially a high concentration of ammonia may be visible as a white cloud. It will turn into invisible vapor as it travels downwind, away from the leak, and rise toward the upper atmosphere where it breaks down harmlessly.
- ▼ Ammonia does not cause damage to the ozone or contribute to climate change.

## Plan for Hazards Possible in Your Community

Create the following emergency plans:

- ▼ Emergency Alert and 9-1-1 Notification Plan
- ▼ Fire Control and Escape Plan
- ▼ Shelter-in-Place Plan
- ▼ Medical Plan—CPR and First Aid
- ▼ Emergency Escape and Evacuation Plan
- ▼ Storm Mitigations and Shelter Plan



## For More Information



Ammonia Safety and Training Institute  
PO Box 1578  
Watsonville, CA 95076  
Phone: (831) 761-2935  
[www.ammonia-safety.com](http://www.ammonia-safety.com)

Agency for Toxic Substance and Disease Registry  
Phone: 1 (888) 422-8737  
[www.atsdr.cdc.gov/](http://www.atsdr.cdc.gov/)

Materials Safety Data Sheet: Search *MSDS* for *Anhydrous Ammonia*.

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# Living near Anhydrous AMMONIA





## Neighborhood Debriefing



## Governmental & Community Concerns



# ASTI Tripod Building Accomplishments



- **Critical Task Guidance** – Best Practices by ASTI and IIAR
- **CRADA** – Chemical Security Analysis Center Water Proximate Releases
- **Quarterly Newsletter** – linking to a Learning Management System
- **ASTI Tech Forum** – Currently analyzing the Effingham Incident
- **National and International Coalition** to perform Safety Day Training
- **10 Ammonia Fuels NDAs** – 5 in the U.S. and 5 internationally