# Impact Assessment of Toxic Gas Dispersion and its Application in Onsite Emergency Planning

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*Abstract: The release of toxic gas poses a significant threat to both people and the surrounding environment. Among the various available software programs, ALOHA has been utilized to calculate the concentration of released ammonia.*

*ALOHA is specifically designed to model chemical releases for emergency responders and planners, allowing the modelling of diverse scenarios such as toxic gas clouds, Boiling Liquid Expanding Vapor Explosions (BLEVE), jet fires, vapor cloud explosions, and pool fires. Depending on the release scenario, ALOHA assesses the corresponding type of hazard. The program presents its estimation as a threat zone, delineating an area where hazards, including toxicity, flammability, thermal radiation, or damaging overpressure, surpass a user-specified level of concern.*

*Keywords: Hazard Identification, Risk Score, Impact Assessment, toxic gases, On-Site Emergency Plan, ALOHA.*

## Introduction

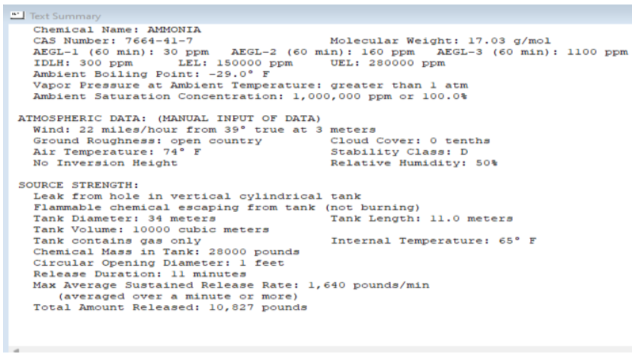
Fertilizers have played an essential role in agricultural production, supplying vital nutrients for crops, and their demand has increased over the years. India, being an agrarian country, is home to numerous small and marginal farmers, often facing challenges of low productivity and poor crop quality. The reliance on rain-fed crops cultivated on the same plot of land has led to a decline in soil fertility in many regions, prompting an increased usage of nitrogen fertilizers in the country.

To address these issues, the Indian government has implemented economic reforms to ensure the availability of fertilizers at affordable prices, aiming to boost agricultural productivity. The introduction of subsidies on specified fertilizers has not only supported farmers but also contributed to enhanced food security for the nation. Despite the heavy dependence of agriculture on fertilizers, the

*The IFFCO Phulpur Unit consistently endeavors to be the most energy-efficient consumer in the fertilizer industry. As part of a strategic plan for carbon reduction in 2006, the unit transitioned from naphtha feed to natural gas to reduce the carbon load. Subsequently, numerous energy conservation schemes have been identified and are planned for implementation in stages under the Energy Saving Project (ESP).*

## IDENTIFY, RESEARCH AND COLLECT IDEA

We conducted an impact assessment using the ALOHA software for the dispersion model of toxic gas in the fertilizer industry. In this process, we inputted all relevant values into the ALOHA software, calculating the worst-case scenario for chemicals and developing the on-site emergency plan.



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Text Summary
   Chemical Name: AMMONIA
   CAS Number: 7664-41-7                    Molecular Weight: 17.03 g/mol
   AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
   IDLH: 300 ppm      LEL: 150000 ppm      UEL: 280000 ppm
   Ambient Boiling Point: -29.0° F
   Vapor Pressure at Ambient Temperature: greater than 1 atm
   Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 22 miles/hour from 39° true at 3 meters
   Ground Roughness: open country           Cloud Cover: 0 tenths
   Air Temperature: 74° F                   Stability Class: D
   No Inversion Height                      Relative Humidity: 50%

 SOURCE STRENGTH:
   Leak from hole in vertical cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 34 meters                 Tank Length: 11.0 meters
   Tank Volume: 10000 cubic meters
   Tank contains gas only                   Internal Temperature: 65° F
   Chemical Mass in Tank: 28000 pounds
   Circular Opening Diameter: 1 feet
   Release Duration: 11 minutes
   Max Average Sustained Release Rate: 1,640 pounds/min
      (averaged over a minute or more)
   Total Amount Released: 10,827 pounds
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1.1 CHEMICAL PROPERTIES

government has successfully met almost all demands for chemical fertilizers.

## About Research Work

*The IFFCO Phulpur unit is dedicated to utilizing energy in the most efficient manner, with "Energy Conservation" being a major objective for IFFCO overall, and particularly for the Phulpur Unit. This commitment has allowed the Phulpur-I Naphtha-based Ammonia Plant, in operation since 1980, to maintain a high level of performance even after 35 years. The newer Phulpur-II Ammonia Plant, a Naphtha-based facility from the late nineties, has continuously enhanced its performance through various modifications and the adoption of optimal operating philosophies.*

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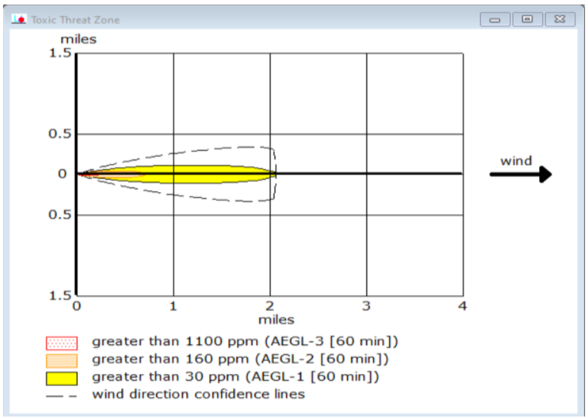
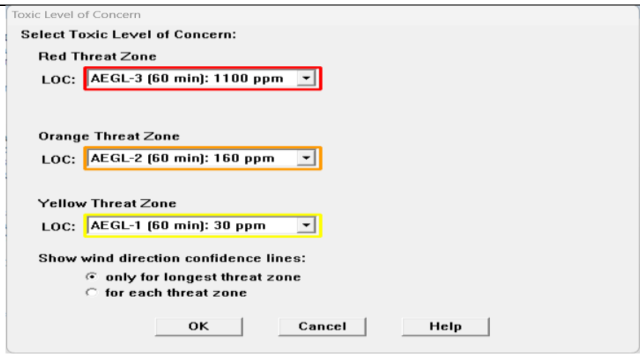
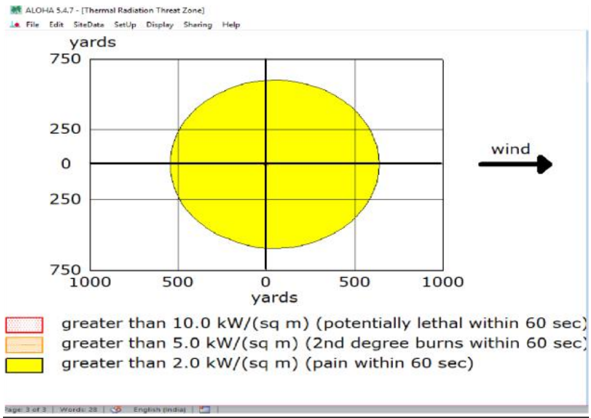
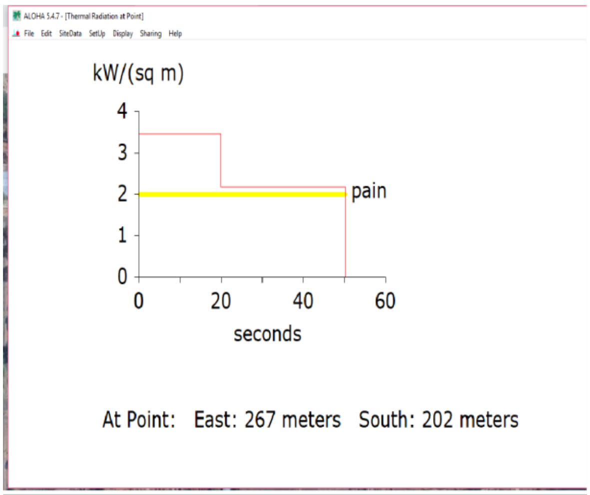



1.2 TOXIC LEVEL OF CONCERN

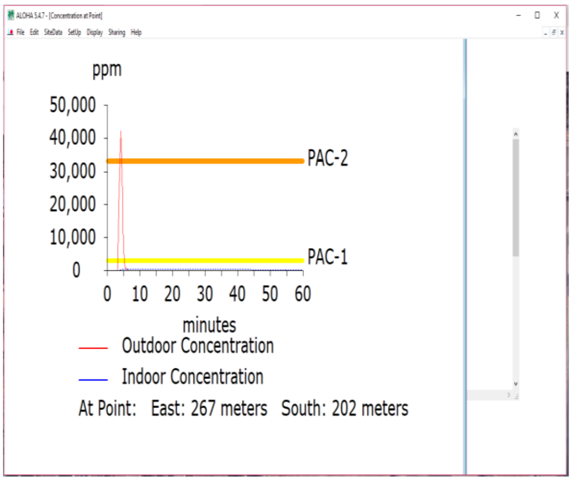



1.6 THERMAL RADIATION THREAT ZONE

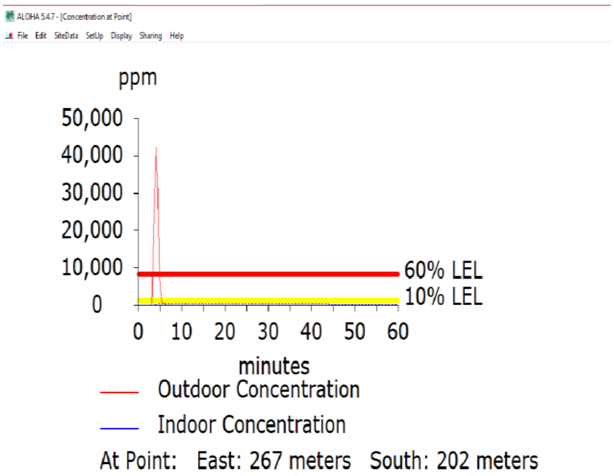



1.7 OVERPRESSURE THERMAL RADIATION (CHEMICAL BURNING AS JET FIRE)

1.3 TOXIC AREA OF VAPOUR CLOUD



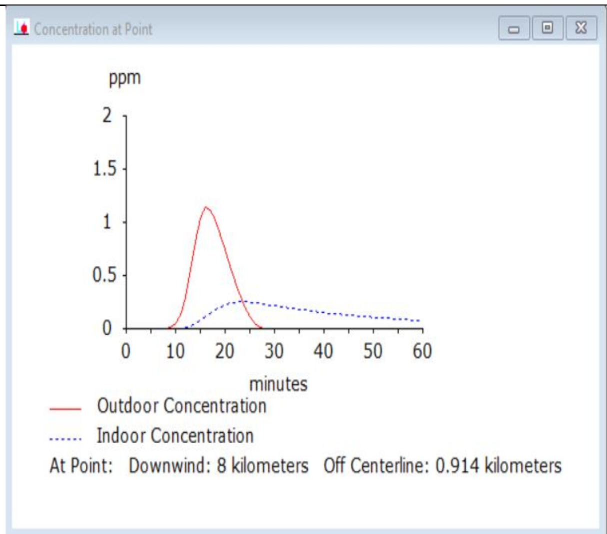

1.4 CONCENTRATION AT EACH POINT OF AMMONIA




1.5 FLAMABLE AREA VAPOR CLOUD

## CONCLUSION

The presented study has demonstrated the hazards and risks inherent in the fertilizer industry. Primary hazards include exposure to various chemicals (e.g., xylene, benzene, toluene, CO), high temperatures, fire, mechanical hazards, slips and falls, noise, and low light conditions that can impair vision. To mitigate these hazards, several measures are essential, such as continuous risk assessment in the fertilizer industry to identify potential dangers, proper training for workers, efficient and effective




1.8 CONCENTRATION AT POINT

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use of Personal Protective Equipment (PPE), and periodic medical examinations for the early detection and management of health risks harmful to workers. Immediate action is imperative to control these hazards, preserving workers' health and promoting overall safety.

In conclusion, the study underscores the necessity of assessing risks in the fertilizer industry. Utilizing the ALOHA software, we identified workplace hazards and associated risks, providing insights into the actual hazards and their values within the premises. Subsequently, we recommended control measures and techniques to ensure the safety and well-being of workers, contributing to an overall improvement in working conditions within the fertilizer industry.

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