

Ammonia Port Preparedness and Emergency Response



Science and
Technology

SUPPORTING AMMONIA ENERGY OPERATIONS AT U.S. PORTS

There are 16 critical infrastructure sectors whose assets are considered so vital to the United States that their incapacitation or destruction would have a debilitating effect on national security, the economy, or public health. The chemical sector and the transportation sector are two of them. The Maritime Transportation System is a part of the transportation sector and consists of approximately 95,000 miles of coastline, 361 ports, and more than 25,000 miles of waterways that move people and goods to, from, and on the water.

Ammonia is one of the world's most valued commodities. The annual global production of ammonia is over 220 million tons, with 70–80% used in agriculture as fertilizer. Today, as ammonia emerges as a global energy source, its storage, use, and transport will increase. The direct use of ammonia as a fuel has been embraced by the shipping industry. The U.S. chemical industry is also exploring the use of ammonia as a more efficient and safer method to transport large amounts of hydrogen over long distances.

While the use of ammonia as a maritime fuel and hydrogen carrier are exciting innovations, the resulting large-scale storage and handling of ammonia at U.S. ports and the co-location of ammonia production facilities increases the risk of a large-scale release of this toxic inhalation chemical. To ensure the U.S. ammonia industry and commerce via U.S. ports continue to thrive, the Ammonia Port Preparedness and Emergency Response (AmPPER) Project seeks to provide risk mitigation technology and expedient protective measures to minimize the impacts of potential large-scale releases.

THE PROJECT

The U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T) Chemical Security Analysis Center (CSAC) was established in 2006 and is tasked by Congress to conduct studies, analyses, and research to assess and address domestic chemical security events. In support of the S&T's Community and Infrastructure Resilience Program, CSAC is conducting AmPPER. The project will provide an understanding of the current ammonia landscape at U.S. ports, characterize the hazards associated with a large-scale release of ammonia, assess potential mitigation technologies, and provide science-based recommendations.

THE APPROACH

An ammonia energy landscape analysis will be conducted to characterize the increase in ammonia storage and transport at major U.S. ports now and in the future. Based on the ammonia storage and transfer infrastructure being envisioned for U.S. ports, potential large-scale releases will be modeled to characterize and bound the potential risks and hazards from such releases. Laboratory and chamber tests will be designed based on the bounding factors determined in the modeling. Chamber tests will be used to characterize water spray technologies as a potential mitigation measure. Laboratory experiments will examine efficacies of expedient protective measures that might be employed by community members needing to shelter in place during an ammonia release, and port workers needing to utilize air-purifying escape respirators to enable safe escape.



THE IMPACT

Through AmPPER, S&T will provide critical information to support life-saving mitigation strategies for the U.S. chemical industry and U.S. ports. It will facilitate the safe adoption of ammonia as a maritime commodity and fuel and support U.S. industry's efforts to produce and transport ammonia as a hydrogen carrier. Through data-driven mitigation recommendations, S&T can support U.S. ports in embracing protective technologies in the event of a catastrophic ammonia release. Ultimately, these efforts contribute to the safety and security of ports and their surrounding communities, protecting both employees and nearby residents by improving planning, preparedness, response, and mitigation to an intentional or unintentional catastrophic ammonia release.

