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SHORT ABSTRACT

Abstract title: Planning for Jack Rabbit III Field Experiment Focussing on Anhydrous Ammonia

Name and Affiliation of the First Author: Steven Hanna, Hanna Consultants, Kennebunkport Maine USA

Email of first author: stevenrogershanna@gmail.com

Names and Affiliations of the Co-authors: Ronald Meris (US Defense Threat Reduction Agency), Sun McMasters (US Department of Homeland Security), Joseph Chang (Rand Corporation), Thomas Mazzola (Systems Planning and Analysis), Thomas Spicer (University of Arkansas), Simon Gant (UK Health and Safety Executive)

Abstract text

The series of Jack Rabbit field experiments, involving large (1 to 20 tons) releases of pressurized liquefied chlorine or anhydrous ammonia, is continuing. Jack Rabbit III will focus on anhydrous ammonia, building on experiences with Jack Rabbit I (10 trials with 1 or 2 tons of either chlorine or anhydrous ammonia) in 2010, and Jack Rabbit II (9 trials with 4 to 20 tons of chlorine) in 2015 and 2016.

This paper describes the initial planning of JR III, where laboratory studies, small-scale field studies, and full-scale field experiments will take place over the next four years. The research plan builds on knowledge gap documents presented at the HARMO20 Conference. The JR III laboratory studies are beginning soon and will look at uptake of ammonia by various substrates and vegetation. The full-scale studies will likely take place, as for Jack Rabbit I and II, at a remote large field site with minimal population density out to at least 50 km. This generally restricts the list of candidates to currently-operating DOD test sites such as Dugway Proving Ground. But, because several knowledge gaps concern effects of terrain and substrate types and vegetation, small-scale field studies are planned for hilly and/or vegetated sites. With reductions in release mass, the exclusion zone (hazard area) can be much smaller.

Motivation

The motivation for Jack Rabbit III is that, while anhydrous ammonia is being more widely used in the world, there are several unknowns regarding its emission, transport and dispersion, deposition, and re-evaporation. For example, the cloud density may initially be greater than that of air due to its cold temperature and due to tiny ammonia and water aerosols. The water aerosols are likely frozen and result from condensation of water vapor in cooled entrained ambient air. But, as the cloud moves downwind and warms, the aerosol evaporates, and the cloud may become buoyant. In addition, the deposition of anhydrous ammonia to vegetation and the substrate, and subsequent re-evaporation, are not well-known. Furthermore, JR III will address health effects of anhydrous ammonia, including applications of toxic load parameterizations.

As done in JR II, many experts in the international community are joining JR III planning groups. For example, a separate paper at this conference by Gant et al. describes an international model comparison exercise that uses trials from the Desert Tortoise and FLADIS ammonia field experiments. This should improve harmonization of models used for ammonia release scenarios.