



## Florida Department of Transportation Research

### Identification of Potential Concerns Associated with FDOT Use of Ammoniated Fly Ash

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Each year, the U.S. burns over a million tons of coal to generate electricity, producing large amounts of atmospheric pollutants, such as fly ash and flue gases. Pollution controls now capture much of this material; however, the tons of recovered fly ash must be disposed of without environmental damage. Fortunately, the physical and chemical properties of fly ash make it useful in construction in cement and concrete as well as in other fields. Several European countries use 100% of their fly ash in this way.

The U.S. Department of Energy encourages increased use of fly ash. However, ammonia can occur in significant amounts in fly ash, and this has raised health and safety concerns for those who work with this ammoniated fly ash (AFA). In this project, University of Florida researchers investigated concerns about AFA use. The team was charged by the Florida Department of Transportation (FDOT) to recommend limits on ammonia in fly ash used as an admixture in concrete, focusing on worker health and safety, chronic exposure concerns, and nuisance odors.

As a health hazard, ammonia is corrosive to skin, eyes, and lungs. The odor at 20 ppm is offensive, but exposure to 300 ppm is life-threatening. Ammonia can explode in confined spaces, given an ignition source. Therefore, general worker exposure limits for ammonia are required. The National Institute of Occupational Safety and Health (NIOSH), for example, recommended a limit of 25 ppm for an eight-hour workday and 35 ppm for any 15-minute exposure.

Researchers conducted the project in two phases. In Phase I, they studied the origins of AFA, use among state departments of transportation (DOT), regulatory framework, environmental aspects, and potential worker hazards. This work suggested that ammonia exposure could occur in plausible settings, and studies were initiated to determine appropriate thresholds of ammonia in AFA that FDOT can establish for different uses.

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For more information, visit <http://www.dot.state.fl.us/research-center>



*Every year, many tons of ammoniated fly ash are generated by industrial coal burning.*

State DOTs were surveyed about current use of coal fly ash, awareness of AFA use in concrete, and experience with AFA. Any DOT-sponsored studies were requested; however, no DOT had formally investigated AFA or established ammonia limits.

Laboratory experiments produced mass transfer rates of ammonia/ammonium from AFA-amended concrete into various media. Calculated mass transfer and diffusion coefficients were used to model realistic scenarios that could result in worker exposure to ammonia. Scenarios included construction of an outdoor concrete slab, roadway or bridge deck, placement of concrete in a form with high walls, ready-mix concrete truck, and placement of concrete inside a building.

The researchers made recommendations for FDOT use of AFA based on project research and extensive consultations. This project was the first to fully explore the use of AFA in transportation construction. It supplies valuable information to FDOT and fly ash suppliers, and most importantly, advances worker safety in transportation.