



ENVIRONMENTAL & COAL TECHNOLOGY

PROJECT FACTS

UNIVERSITY OF KENTUCKY
CENTER FOR APPLIED ENERGY RESEARCH

AMMONIATED FLY ASH

PARTICIPANTS

University of Kentucky
Center for Applied Energy
Research
Boral Material Techn.
ISG Resources
LaFarge North America
Southern Company Serv.

SPONSORS

US Department of
Energy

PROJECT VALUE

DOE Cost: \$149,815
Prime Contractor Cost
Share: \$90,511
Partner Cost Share:
\$60,000

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Objective

The goal of this project was to develop practical guidelines for handling and using ammoniated fly ash in concrete, in order to prevent a decrease in the use of fly ash for this application. The objective was to determine the amount of ammonia that is released, over the short- and long-term, from concrete that contains ammoniated fly ash.

Background

The Clean Air Act Amendments of 1990 require large reductions in NO_x emissions from coal-fired electric utility boilers. This will require ammonia injection, such as in selective catalytic reduction (SCR), in many power plants, resulting in ammonia deposition on fly ash. The presence of ammonia could create a barrier to fly ash utilization in concrete because of odor concerns. Although there have been limited studies of ammonia emission from concrete, little is known about the quantity of ammonia emitted during mixing and curing, and the kinetics of ammonia release. This is manifested as widely varying opinions within the concrete and ash marketing industry regarding the maximum acceptable levels of ammonia in fly ash. Therefore, practical guidelines for using ammoniated fly ash are needed in advance of the installation of many more SCR systems.

Conclusion

Ammonia release from mortar and concrete during mixing, placement, and curing was measured. Short-term levels in the air were found to be noticeable; however longterm effects were minimal. Work initially focused on laboratory mortar experiments to develop fundamental data on ammonia diffusion characteristics. Larger-scale laboratory experiments were then conducted to study ammonia emission from concrete containing ammoniated fly ash. The final phase comprised monitoring ammonia emissions from large concrete slabs. The data indicated that only 10 - 20% of the initial ammonia diffused from the concrete during 30-40 minutes of mixing, depending on the mix proportions and batch size. When placing concrete in an enclosed space, with negligible ventilation, it is recommended that the ammonia concentration in the concrete mix water should not exceed 110 mg NH₃/L, if the NIOSH exposure limit of 25 ppm in the air is not to be exceeded. If even a modicum of ventilation is present, then the maximum ammonia concentration in the concrete water would be approximately 170 mg/L. Long-term experiments indicated that ammonia diffusion from concrete was relatively slow, with greater than 50% of the initial ammonia content remaining in a concrete slab after 1 month. In general, during the mixing and placement of ammonia-laden concrete, no safety concerns were encountered. After one to two days, the ammonia level decreases to a point where it cannot be smelled. The only location where the ammonia concentration attained high levels (i.e. > 25 ppm in the air) was within the concrete mixing drum.

These findings are being distributed throughout the industry. The other project participants represent some of the country's largest ash marketers and a major utility; and will include these recommendations during interactions with cement companies. It is further hoped that the information will be used to adopt standards for use of ammoniated fly ash.