Unintended Effects of NOx Emission Control Strategies on Unburned Carbon and CCP Marketability

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Summary

The American Coal Ash Association (ACAA) is a resource conservation and recovery association, representing producers of coal combustion products (CCPs), CCP marketers, coal companies, and suppliers of ash-related equipment and services. ACAA's mission is to advance the management and use of CCPs in ways that are technically sound, commercially competitive and environmentally safe.

In 1994, the base year for this analysis, a total of 89.0 million tons of CCPs was produced. Excluding the 15.5 million tons of flue gas desulfurization (FGD) material, coal-burning electric utilities in the USA produced 73.4 million tons of fly ash, bottom ash, and boiler slag. Out of this total, 21.1 million tons (28.8 percent) was beneficially used.

The benefits of using, in lieu of disposing, 21.1 million tons of CCPs during 1994 were substantial. Principal benefits included: preserving about 20 million yd^3 of landfill space; using fly ash to displace portland cement in concrete, thereby effectively avoiding about 4.7 million tons of CO_2 emissions, plus related environmental impacts, from the cement industry; and creating economic benefits estimated conservatively at $1 billion.

The historical growth in beneficial use of CCPs is a trend that can be expected to continue, barring changes in combustion that might serve to impair their marketability. This trend results primarily from the recognition of fly ash by specifiers and producers of concrete as a high quality engineering material with specifications for purchase and testing developed by the American Society for Testing and Materials (ASTM). Technical data is readily available from marketers, national organizations, libraries and other sources to verify that fly ash improves the physical characteristics and performance of concrete.

One of the most frequently pledged activities in the Climate Challenge Program between the

U.S. Department of Energy (DOE) and the electric utilities is the increased use of CCPs, particularly fly ash, to displace portland cement in cement and concrete applications. The corresponding incremental reduction in CO_2 emissions is nearly two million tons in the year 2000.

One of the few factors that has acted to slow or reverse these positive trends has been the increasing pressures for utilities to reduce nitrogen oxide (NO_x) emissions and the subsequent selection of NO_x reduction strategies. ACAA recently conducted a confidential survey of coal-burning electric utilities requesting specific responses on the impact of NO_x reduction strategies on fly ash for use in cement and concrete. The responses to ACAA's questionnaire show that no less than 700,000 tons of fly ash that could have been marketed for use in concrete was disposed during 1995 as a result of NO_x reduction strategies. Because ACAA did not receive responses from all utilities, it can reasonably be assumed that the actual decrease in marketable fly ash during 1995 was significantly more than 700,000 tons. Several reviewers of a summary of the questionnaire responses suggested that because the full impact of Phase I NO_x reduction is not yet known, and because the number of boiler units affected by Phase 2 implementation could be much greater than in Phase I, the decreased tonnage of marketable fly ash could be an order of magnitude higher than indicated by ACAA's questionnaire results. Furthermore, several respondents indicated that their fly ash had been marginally unacceptable for use in concrete prior to the implementation of NO_x reduction strategies, but subsequent to implementation the fly ash was so far beyond the range of quality parameters (primarily due to residual carbon content) required for concrete use that efforts to beneficiate the fly ash would be either ineffective or prohibitively expensive.

EPA's proposed NO_x regulations pose at least two concerns regarding the subsequent marketability of CCPs. Higher and more variable levels of unburned carbon could limit fly ash use in displacing portland cement in concrete applications. Also, because ammonia frequently is injected to enhance electrostatic precipitator performance, especially in conjunction with low-NO_x burner installations, residual ammonia concentrations in fly ash could affect sales. The quantity of fly ash that could be affected would be substantial. Under Option 1, an additional 5.0 million tons of fly ash would potentially be affected by changes in NO_x control technologies. Under Options 2 and 2-80, the potentially affected quantity of fly ash rises to nearly 11 million tons. While the portion of this "at risk" amount that is now or that might be beneficially used is not known exactly, it is nevertheless reasonable to anticipate substantial losses in CCP marketability.

If "at risk" CCPs in the range of 5 to 11 million tons could not be beneficially used, then economic costs could be high. Economic costs just to the electric utilities could be up to $125 to $275 million per year. Additionally, for the CCP marketer, economic costs could be up to $100 to $220 million per year. Further, for the purchasers of CCPs and/or society at large,

economic costs could be up to $125 to $275 million per year.

It appears as though EPA did not quantify the loss of CCP sales and the attendant environmental and economic impacts. However, those impacts could be substantial. Looking only at the potential economic costs to the electric utilities, we saw that 5 to 11 million tons of "at-risk" CCPs could amount to as much as $125 to $275 million per year. This is potentially more than the entire cost estimated by EPA of $143 million which presumably excluded costs of lost CCP sales. Hence, the per-ton cost estimated by EPA ($172 per ton of NO_x removed) may only be about half of the full cost to the utilities. Including the potential costs to marketers of CCPs, purchasers of CCPs, and/or society at large would further highlight the underestimate of costs created by EPA's exclusion of these impacts.

ACAA is also concerned that the *cumulative* effects of multiple rulemakings could serve to impact the beneficial use of CCPs much more than any individual rulemaking action. ACAA urges EPA to consider the use of "life cycle assessment" (LCA) to evaluate the impact on CCPs of this and future related rulemakings.