Clean Coal Technology By-Products: An Overview

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Abstract

In response to meeting the requirements of the 1990 Clean Air Act and its precursors, many coal-burning electrical utilities have installed or retrofitted combustion or scrubbing systems designed to reduce the emissions of atmospheric pollutants, most notably the oxides of sulfur and nitrogen. While for the most part this has been successful for the primary goal of reducing air emissions, it has been accompanied by an unfortunate significant increase in the amount of solid by-products produced by these plants. According to ACAA statistics for 2003, by-products from plants with SO_x control systems account for nearly a third of the total CCPs produced in the United States. At the same time, these by-products have very different physical and chemical characteristics from the more familiar pulverized coal fly ash and bottom ash that have a major impact on the forms of utilization that are possible.

This paper provides a comparative overview of the various forms of solid CCPs produced by SOx emission control systems on electrical utility power plants. These CCPs include: wet flue gas desulfurization (FGD) scrubber material from inhibited oxidation systems (sulfite); wet FGD scrubber material from forced air oxidation systems (FGD gypsum); dry FGD scrubber material (spray driers); fluidized bed combustion ash (AFBC, PFBC); and sorbent injection system ash (LIMB, LIFAC).

While these by-products are produced by vastly different emission control technologies, there are underlying similarities in their reactivities in the presence of water that are driven by a common base of mineral compositions derived from sulfated calcium-rich sorbents (limestone) and aluminosilicate-rich ash derived from clay and shales in the coal. This chemical cocktail of components frequently leads to similarities in reactivity, including a self-cementing property via a sequence of sulfo- and silico-pozzolanic reactions that occur without the need for added portland cement. This paper is part of a series that examines the properties of these less well-known emission control CCPs in relation to potential beneficial uses that could reduce the costs and environmental impact of disposal.

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