The Effect of Ettringite Formation on The Expansion Properties of A Compacted Spray Dryer Ash Fill

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ABSTRACT

Efforts by electric utilities to reduce the environmental impacts of sulfur emissions from coal burning power plants have led to a number of changes in the way exhaust gasses are being processed. In the most widely used methods for treating oxides of sulfur, calcium is reacted with the sulfur to produce a solid that can then be collected before the exhaust gasses are discharged into the atmosphere. The solid collected is then typically disposed of in a controlled landfill. In recent years, a substantial body of data on the physical properties of these flue gas desulfurization (FGD) products has been generated. Samples of compacted FGD tested at various time intervals clearly show that the behavior of the material in an engineered structure changes with time. Much of this behavior change has been attributed to the formation of minerals comprised of varying proportions of the FGD constituents. Both strength and stiffness are typically equal to or greater than those found in most naturally occurring soils so identifying beneficial uses in lieu of landfilling has been a goal of both generators and regulators. One popular use in recent years has been in structural fills, particularly when sources of select fill are not abundant nearby. One concern in compacted FGD fills that might be used to support structures is that the formation of ettringite and other ettringite-like minerals will result in volume expansion (swell) leading to structural damage.

In this paper, the results of a series of laboratory performed to correlate swelling with ettringite formation are presented. A spray dryer ash was compacted according to ASTM Standard procedures (ASTM D698) and allowed free access to water over an extended period of time. Volume change was recorded while X-ray diffraction and scanning electron microscopy were used to measure changes in the mineralogical composition of the ash. After several days the formation of ettringite-like minerals was apparent. Swelling, however was minimal.