This report describes a commercial demonstration regarding the use of high-carbon fly ash in portland cement manufacture. The demonstration was carried out at Illinois Cement Company, located in LaSalle, Illinois using a high-carbon fly ash from Coffeen Power Station. The Coffeen Power Station is located in Coffeen, Illinois and uses coal from the Monterrey mine in Carlinville, Illinois.

Approximately 50 tons of fly ash with an approximate carbon content of 20% was used during this commercial-scale demonstration at Illinois Cement. The chemical composition of the fly ash and other raw materials (limestone and shale) limited the fly ash addition in the kiln feed to approximately 6%. During the demonstration, the kiln operation ran in a more efficient, stable, and predictable manner. As a result, the cement plant achieved fuel savings of approximately 3.9%, the production increased by approximately 9.7%, and several key processing parameters were improved.

The evaluation of clinkers and the cement samples collected before, during, and after the demonstration showed them to be equivalent to commercial quality. Microscopical and analytical examination of clinkers confirmed the presence and normal distribution of the major clinker phases. Cement produced during the demonstration tested as per the ASTM C 150 specification, performed similarly to that of cements produced before and after the demonstration.
EXECUTIVE SUMMARY

The objective of the project was to demonstrate on a commercial scale, the use of high-carbon Illinois coal fly ash as a raw feed component and a fuel supplement in the manufacture of portland cement. During our 1999 ICCI project, this concept was successfully proved on both the laboratory and pilot scales.

This commercial scale demonstration involved the participation of Illinois Cement, located in LaSalle, Illinois, using high carbon fly ash from the Coffeen Power Station, located in Coffeen, Illinois.

Previously, fly ash from Meridosia Power Station had been considered for use in the demonstration. However, the fly ash from Meridosia is ponded and is available only in wet form. Although our studies on its dryability showed that the ponded ash could be easily dried under ambient conditions, drying of the volume of fly ash needed for the commercial demonstration was not cost-effective. Therefore, the plan to use the Meridosia ash for the demonstration was abandoned.

The Coffeen Power Station produces a high carbon fly ash, which is available in a dry form. Coffeen Power Station uses Illinois coal from the Monterrey mine near Carlinville, Illinois.

Prior to the demonstration, fly ash samples from Coffeen were analyzed to determine composition and fuel value to optimize their use in the raw feed of Illinois Cement. Results confirmed that the fly ash was an appropriate choice for making cement clinker.

Approximately 50 tons of high-carbon fly ash was transported by pneumatic trucks from Coffeen to Illinois Cement. The ash was blended with the other raw materials (limestone and shale) at Illinois Cement. The target composition of the kiln feed, and the chemical composition of the fly ash, limestone, and shale limited the fly ash concentration in the kiln feed to approximately 6%.

The demonstration run realized several benefits. The kiln operated in a more efficient, stable, and predictable manner. As a result, the cement plant achieved an approximate fuel savings of 3.9% and clinker production increased by approximately 9.7%. During the demonstration, several key processing, operational, and environmental parameters were observed and their improvements were documented.

Samples of clinker and cement were collected before, during, and after the demonstration burn for compositional and physical evaluation. The clinkers were evaluated using analytical techniques to determine their phase composition. Microscopical examination was carried out to observe the presence and distribution of the major clinker phases.

Cements produced during the demonstration were compared with those produced before and after the demonstration in accordance with tests described in ASTM Specification C 150. The data confirmed that the cement produced from the demonstration had properties comparable to those of the normally produced cements. Additionally, the
alkali content of the demonstration cement was reduced by approximately 20%, compared to that of the normally produced cement.

Thus, the interrelated material, operational, fuel, emission, and product benefits realized from the demonstration trial run confirmed the beneficial use of high carbon fly ash in the manufacture of portland cement. The demonstration has clearly shown the benefits of using high carbon fly ash from Illinois coal in the manufacture of portland cement. Utilizing this technology, cement plants located in Illinois and electric utilities that burn Illinois coal can gain a competitive advantage.