FLY ASH STORAGE CRITICAL FOR INCREASING USE

By Travis Collins

The recycling goal for coal burning utilities is 100% beneficial use of its coal combustion products. This is often a difficult standard to achieve. Fortunately, industry demand and need for fly ash in concrete has progressed over the last 40 years to the point that "concrete quality" fly ash is an integral product in the manufacture of most, if not all, concrete mixtures produced in the United States. As the demand and cost to use fly ash in concrete has increased, rightfully so have the quality control and supply expectations from the concrete industry risen as well. The recent closures of older generating stations coupled with the installation of various emissions-control methods on other units and the increase in renewable energy sources have all adversely affected the quality and quantity of available fly ash for use in concrete. Consequently, there is increased industry demand on the need for reliable supplies of fly ash for the concrete industry. Because fly ash is produced as a by-product and sold as a quality-assured, integral pozzolan in a concrete mixture, the idea of ash sometimes being available and sometimes not is unacceptable to concrete producers and design engineers. The seasonal nature of the concrete construction industry adds even more pressure during the peak demand months of summer and fall. With peak season demand pressure seemingly increasing every year, the issue of a dedicated fly ash storage in a market or lack thereof becomes a subject all stakeholders—utility, marketer, concrete producer, GC, design engineer, and state DOT—become familiar with when there is a temporary shortage.

Photo 1: National Minerals Corporation's terminal in Cohasset, MN, allows storage of ash produced during winter months for use in the summer construction season

THE CASE FOR STORAGE—EXAMPLE A: CLAY BOSWELL ENERGY CENTER—0 TO 100%

Minnesota Power's Clay Boswell Energy Center (BEC) is a 1025 MW plant located in Cohasset, MN, fueled by Powder River Basin coal. There are four coal-fired units at BEC, with Unit 3 being the second largest at 360 MW. In 2007-2009, Minnesota Power invested in a complete environmental retrofit of Unit 3 to install state-of-the-art emission-control equipment. This retrofit project was nationally recognized for its successful design, implementation, and level of emissions control. Part of this retrofit included segregation of Unit 3, dry collection, and the construction of a 2000 ton fly ash silo for Unit 3 fly ash.

Shortly after the retrofit was complete, technical representatives from National Minerals Corporation (NMC) in conjunction with Minnesota Power began sampling and testing the fly ash produced by Unit 3 to ascertain its characteristics with respect to ASTM C618 for use as a cement replacement. Over the course of 18 months, Minnesota Power and NMC worked together to modify the blend of two PRB coal sources and PAC and ammonia injection rates to find suitable levels for both the plant requirements as well as the effect on the fly ash chemistry.

Ultimately, BEC 3 fly ash has become a consistent, relied-upon Class C fly ash for the local ready mixed, precast, and concrete paving market in Minnesota with NMC cultivating a loyal customer base for 100% of the seasonal production within a 300 mile radius from the plant. However, being located near the Iron Range of Minnesota, the concrete construction season is only May to October, at best. This leaves 7 months of coal burning and fly ash production that could be stored and beneficially reused in concrete.

THE PLAN

After two seasons of successfully marketing BEC 3 fly ash to the concrete industry, representatives of Minnesota Power and NMC began discussing the next steps to further develop the marketing effort of this material to maximize both its beneficial use and revenue potential. NMC offered to purchase land nearby in the city-owned Cohasset Industrial Park and build a 10,000 ton capacity dedicated flat storage terminal for BEC 3 fly ash.

As the plan to build dedicated fly ash storage began to take shape, the saying "the devil is in the details" was very relevant, due to the uncertainty at the time due to the EPA trying to parse the definition of hazardous and non-hazardous as it relates to fly ash. As a result, this question was rightfully in the minds of the Minnesota Pollution Control Agency, the local governing and permitting body, and Minnesota Power. Even though Minnesota Power is committed to seeing encapsulated beneficial reuse of their CCPs, they needed assurance that NMC would be in compliance with all federal and local rulings pertaining to fly ash, storage, emissions, particulates, and groundwater concerns.

Although construction was off-site and was designed and funded by National Minerals Corporation, Minnesota Power's

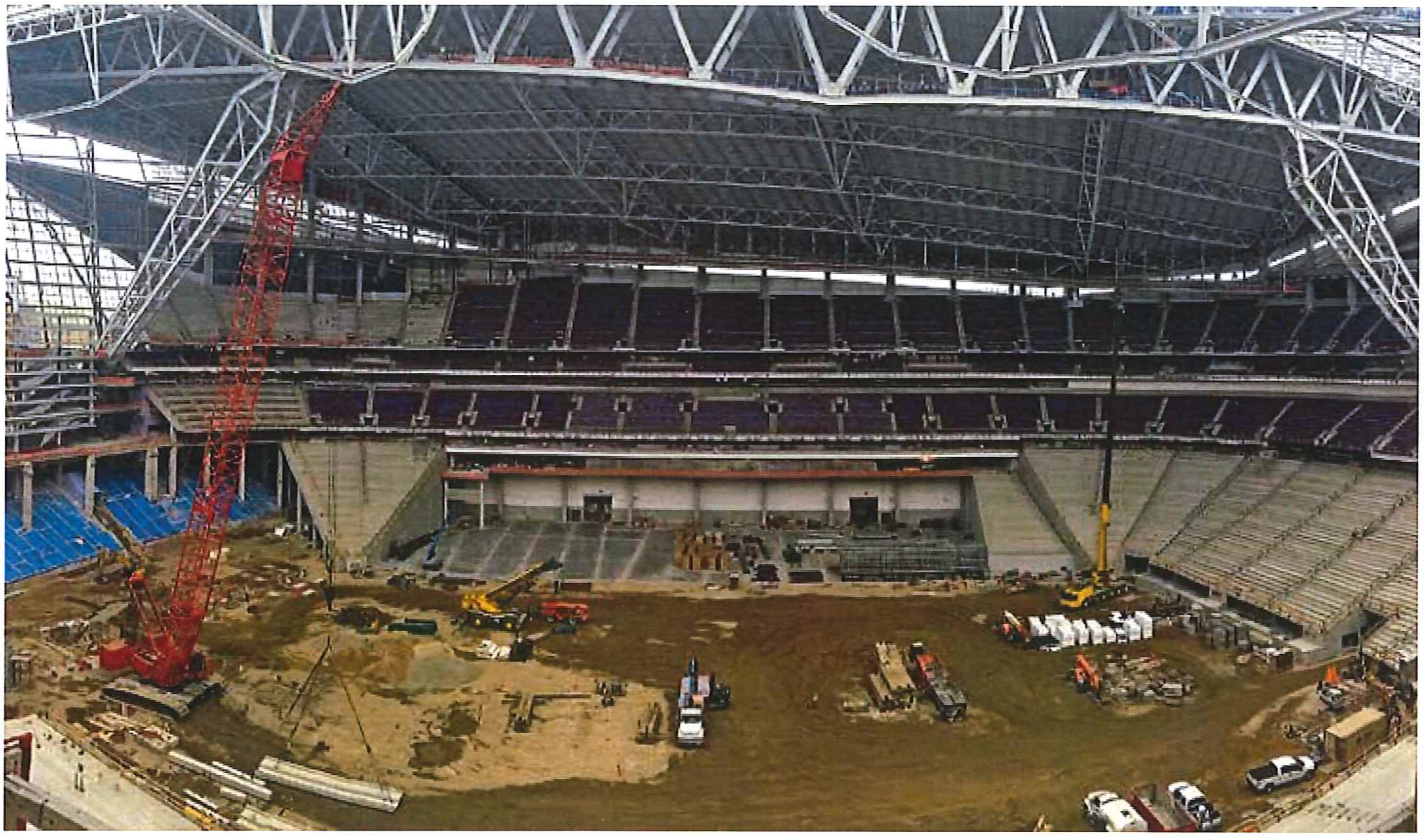

Photo 2: Construction of the $1.1 billion U.S. Bank Stadium depended on a reliable supply of fly ash for its concrete components

Photo 3: More than 5000 structural precast concrete elements with 28-day minimum strength of 10,000 psi were required for construction of U.S. Bank Stadium

environmental engineering representatives and fuels staff were very involved and helpful to make sure that all state, local, and federal thresholds and permits pertaining to solid waste storage standards were met. They also recognized the long-term benefits a storage building would provide for Boswell Unit 3 fly ash, not to mention the positive economic impact on the city of Cohasset, population 2500. Ultimately, a storage terminal was permitted, constructed, and commissioned in time to store the winter production of BEC 3.

NMC chose to build a 20,000 ft², poured-in-place concrete and steel structure, with a concrete floor and a screw conveyor for the loading of trucks. Winter fly ash is hauled in NMC trucks to the Cohasset terminal and pneumatically conveyed into the building. A 6000+ CFM dust collector assures particulate matter emissions far below state and federal thresholds.

WIN-WIN-WIN SOLUTION

It is not often when you can truly present a win-win-win scenario. Minnesota Power is benefitting from the marketing of 100% of Unit 3 fly ash by eliminating the costs associated with landfilling, seeing annual revenues grow through the sales of fly ash year-round and is meeting the company vision of moving Energy Forward through pursuing beneficial reuse opportunities of its CCPs, among other renewable power and recycling initiatives.

As a marketer, building and maintaining dedicated ash storage enables NMC to provide a continuity of supply to its customer base throughout the year. As unplanned outages occur or other unforeseen issues at the power plant happen, NMC is able to assure an uninterrupted supply of fly ash to important concrete projects around the state of Minnesota.

With the closure of older coal-fired plants in this region and the abundant supply of wind energy, historical supply volumes from local power plants are not as easy to predict, causing issues in maintaining a consistent source of fly ash for many concrete producers. Short-notice material changes create havoc with ready mix producers, especially with high-performance, high-strength concrete projects—such as bridge decks, parking ramps, high-rise construction, and main-line concrete paving—where the mixture designs, lab results, and field performance of the concrete are tested and accepted based on the results of a specific set of materials.

U.S. BANK STADIUM

The $1.1 billion U.S. Bank Stadium construction project—home of the 2018 Super Bowl in downtown Minneapolis, MN—fit the definition of a high-performance concrete project where the expectations on all of the concrete materials selected could not be compromised or deviated. BEC 3 fly ash was selected to replace 25% of the cement in all of the precast concrete. The 5000+ structural precast elements (including stadia risers, beams, columns, and walls) for the stadium were produced and erected by Wells Concrete. The production and erection schedule was carefully orchestrated over the course of 2 years. All of the precast mixture designs required a 28-day minimum strength of 10,000 psi. Once the project started, changing materials and thus causing a delay in the project was not an option. Having the ability to guarantee a continuity of supply (that is, a storage terminal) of a consistent source of fly ash despite several scheduled plant outages throughout the project enabled NMC to be the chosen supplier with BEC 3 fly ash to this significant local project—not bad for the market credibility of a material that was still relatively new at the time in the local concrete market.

NOTHING NEW UNDER THE SUN

The idea of building off-site flat storage for fly ash is not a new one in the industry. National Minerals Corporation is one of the ash marketing pioneers that commercialized this concept in 1985 with the construction of a 35,000 ton dedicated flat storage, bulk fly ash terminal located in Eagan, MN. These original buildings were constructed using precast double Ts, incidentally also supplied by Wells Concrete. Although the terminal is under different ownership, the buildings are still in service for the fly ash sources they were initially constructed for over 30 years ago. NMC also constructed a 12,000 ton onsite storage terminal for WE Energies at Pleasant Prairie in 1988 that is still paying dividends for the utility, the current marketer, and ultimately the local concrete industry.

The recent experience and the positive economic impact of building dedicated storage at the Clay Boswell Energy Center is a good example of a utility and a marketer working together to achieve the mutual goal of 100% use of a CCP. NMC has since supplemented the storage building in Cohasset with a 12,000 ton fly ash terminal in Hastings, MN, to further service the off-season production of Minnesota Power and provide a reliable ash supply to their Minneapolis-St. Paul customer base for this material. ❖

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