VDZ International Congress

26-28 September 2018

Dusseldorf, Germany.

The VDZ International Conference is held every four years and attended by cement industry executives as well as scientists, engineers, and technology suppliers. VDZ (Verein Deutscher Zementwerke e.V.) is the economic, scientific, and technical association for the German cement industry.

Two of PEC Consulting's members attended the conference: Francisco Benavides, Principal Consultant, and Mohammed Dimah, Process Consultant, as part of PEC Consulting's ongoing effort to keep up to date with technological development in the cement industry as well as general industry trends.

The 2018 congress focused specifically on the development of sustainable production and utilization of cementitious construction materials. Also, many of the papers presented targeted on improving the effect that the industry has on the environment, particularly on the emission of pollutants to the atmosphere.

The VDZ presented a very interesting paper on the utilization of alternative fuels in the cement industry. At this time, Germany has reached a substitution rate of 60%; while the European Union in general has a substitution rate of 40%. This achievement of sustainability, utilizing the waste of some industrial operations as a fuel source for another industry, indicates the opportunity that exists to conserve the earth's natural resources. The VDZ research in this area of sustainability is paying off. Several papers were presented by cement companies with information on co-processing projects, such as CIMPOR, Duna-Drava Cement (Heidelberg) and Lafarge Holcim. Implementation of co-processing with RDF (Refuse Derived Fuel) required significant modifications to the process, but with an attractive payback in fuel savings.

On the front, to reduce CO_2 emissions, LC_3 technology has captured much interest. LC_3 comes from "Limestone Calcined Clay Cement". It basically consists of replacing clinker with calcined clay acting as a pozzolanic substitute to clinker. In average, the cement industry contributes approximately 7% of the CO_2 generated. In some countries, the relative generation of CO_2 from cement is significantly hovering around 15% and Vietnam closer to 25%.

In general, the focus of the industry in the foreseeable future is to increase efficiency, replace as much as possible natural resources with recycled materials, both as raw materials and fuels, and minimize emissions in particular CO_2. Following is a recap from presentations on these various aspects.

<u>ENERGY CONSERVATION</u>

- Heidelberg presented information on the installation of a waste heat power generation at their Fieni Plant. The facility generates up to 17 MWh net. The project was in part subsidized by the European Fund for Regional Development. An ORC system was acquired

for this project. This paper is an excellent reference for performance data on an organic Rankine cycle waste heat recovery project.

ALTERNATIVE FUELS

- The VDZ presented a paper on the current substitution rates of alternative fuels in the cement industry in Germany and the EU-28. As of 2016, substitution in Germany exceeds 60% and overall in the EU 40%. The paper presents the fractions of SRF – solid recovered fuels – being utilized. It also describes trials which have been made to research factors, such as flame shape, temperature profiles, particle size, satellite burners and other factors which would allow the amount of SRF that can be burned at the kiln firing hood.
- CIMPOR presented a paper on their experience over the past years in co-processing – utilizing RDF – refuse derived fuels – as a substitute to fossil fuels. The RDF is received as collected and is processed at the plants which include drying down from 40% moisture. The drying is done on a belt utilizing vent gases from the clinker cooler. Of particular interest is the fact that the RDF is not processed prior to arriving at the plants.
- The LH paper on their plant at Lägerdorf is of interest in describing the utilization of a TKIS step-combustor to burn as-received RDF at the calciner, receiving materials up to 250mm dimension, and moisture up to 30%.

CO_2 REDUCTION

- LC_3 stands for Limestone Calcined Clay Cement and it is an undertaking for CO_2 emission reduction by using alternative cementitious materials. There is a global consciousness of the importance of maintaining global temperature in check. This paper focuses on the production of calcined clay as a pozzolanic partial replacement of clinker in the manufacture of cement. The LC_3 program has studied clays from around the world analyzing suitability. Many countries that have natural puzzolans from volcanic ash readily available, already have norms for significant replacement levels of clinker in cement manufacture. Where natural puzzolans are not readily available, calcining clay is a substitute that produces less CO_2 emissions than clinker. European standards are already in place and should be emulated in other regions. There is a great potential for sustainability for the cement industry to increase the utilization of supplementing cementitious materials (SCMs).
- SINOMA and CBMA presented a paper on the status of measures in China to decrease CO_2 generation in China. China has reached a peak cement consumption of 1.7t/capita and this high demand is now expected to start decreasing. Cement manufacture currently accounts for 15% of China's total energy consumption and for 15% of total CO_2 emissions. However, China has been for years increasing the level of clinker substitution. Clinker factor is now around 60%. Also, the utilization of waste for fuel and raw materials is around 800 million t/y based on a cement output of 2.3 billion tons. WHR co-generation is also the highest in the world.

CONTROL OF AIR EMISSIONS

- Heidelberg presented a status of NO_x abatement in the German cement industry. The presentation discusses primary and secondary measures in place and an outlook going forward. The primary measures are the traditional ways of preventing NO_x generation such

as flame cooling, low NO_x burners, addition of mineralizers, staged combustion and process optimization. The secondary measures being SNCR, SCR, and SCR combined with other forms of abatements.

Current BAT emission levels are:

NO_x : < 200 – 450 mg/Nm^3

NH_3 Slip : < 30 – 50 mg/Nm^3

By 2019, the allowances for plants utilizing co-incineration of waste is <200 mg/Nm^3, combined with an NHz limit of 30 mg/Nm^3. Primary measures are not sufficient to reach these levels of emissions. Therefore, Heidelberg has been installing SNCR and various versions of SCR at their plants in Germany.

The outlook is that more SCR systems will be installed to meet regulations.

This paper by Dr. Bernd Haegermann should be studied by any cement company considering the installation of some form of SCR controls to take advantage of the experience by the German cement industry.

The other topic of discussion related to mercury abatement. The VDZ presented a paper indicating cause and effect on sources of mercury and the most common methods of capture ahead of the stack. Careful selection of raw materials and fuels, if it can be helped, is obviously the way to prevent mercury in the first place. The current practice of dust shuttling is commonly accepted as BAT. The paper presents detailed statistical analysis of mercury concentrations detected in various sources of feed materials to cement plants as well as in the various types of cements produced.

An interesting finding was in the cement mill operation that there was no perceptible Hg emissions from the mill stack with the introduction of either fly ash or CKD into the mill feed, therefore demonstrating the ability of Hg capture with dust shuttling.

DIGITALIZATION

Decisions based on data versus decisions based on personal prejudice, real time optimizer versus fuzzy logic, failure detection and true automation through artificial intelligence were the primary topics discussed. The industry is heading towards big data analytics. Collection of data through sensors and real time analysis, coupled with mobile connectivity and training of personnel are necessary for implementation: measure-analyze-control.