July 17, 2006

Mine Concentrate Storage Building (CSB)
Prototype Dust Collector Test Project
Observation and Conclusions

Early in February 2006, a scaled down prototype cartridge type dust collector was installed in the mine CSB. The prototype arrangement consists of a dust collector/exhaust hood with 6 cartridge filters simulating a 6-row dust collector, fan arrangement with a manual outlet damper, ducting, and a compressor with an air dryer.

All of this equipment is located between the Zn & Pb stockpiles under Zn conveyor No. 10. Testing started February 13, 2006 and was terminated on July 15, 2006. The purpose of the testwork was the following:

A. To confirm applicability of dry filtration technology (cartridge type filters) considering the temperature variations, relative humidity and the nature of the dust in the CSB.
B. To establish a reasonable air to cloth ratio that would be required for a future full size dust collector installation.

Results for the test program are attached..

The design and operating specifications for the test system were as follows:

- System was capable to draw 3000 CFM at 10" WG SP.
- Filter media tested were - polyester spun bond cartridges with PTFE membrane.
  - polyester felt.

- Total filter cloth area per filter was 50 ft^2 (300 ft^2 total)
- Filter cleaning are done by pulsing compressed air (one filter at the time).

Test conclusions:

1. The major influence on differential pressure across the filter was relative humidity. When the relative humidity exceeded 99%, filters got water blinded which reduced air flow through to a minimum. During this test period, a relative humidity over 98% occurred only 88 hours or 2.5% of the total time (3,444 hrs.).

   A relative humidity of over 99% occurred only 40 hours or 1.1% of the time. Conservatively assuming that for an entire year, conditions are three times as bad:

   88 hrs x 2 = 176 hrs
   + 88 hrs
   264 hrs or 3% of the total time (8,760 hrs) rel. humidity will exceed 98%

   40 hrs x 2 = 80 hrs
   + 40 hrs
   120 hrs or 1.3% of the total time (8,760 hrs) rel humidity will exceed 99%

   After the relative humidity falls below 98% the filter recovers full flow.

2. The minimum recorded temperature was 16.9 deg F (-8.4 deg C) for a short period of time. No freezing of filter media was observed.
3. No dust build-up was observed on the catch screen below the filters.
4. Concentrate pile size has no influence on filter performance.
5. Ordinary felt polyester cartridges performed well but they were not exposed to high relative humidity. They would not recover as filter media with PTFE membrane. This is to be taken into consideration when selecting filter media for full scale project.
6. Air to cloth ratio for CSB dust control system sizing should be as low as possible because of weather condition and nature of dust in the building. While in some common dust control system applications air to cloth ratio could be up to 10:1, but in this case should not be more the 3.5:1 to 4.0:1 max i.e. one cartridge with 50 ft^2 cloth area will have a maximum design flow of 200 CFM/filter.
7. Dry filtration technology as tested is applicable for full scale CSB project bearing in mind that there will be a short period of time when flow will be restricted due to high relative humidity. This is the only viable technology available for the CSB application.

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M. Ridesic

Attachments:

- Mine CSB Prototype Dust Control System Start-up & Testing Procedure
- Mine CSB Temperature & Humidity Monitoring Data (dated July 13, 2006)