AP42 Section:	11.3
Background Chapter	4
Reference:	36
Title:	Written communication from R. Maner, Boral Bricks, Columbus, GA, to Boral Bricks Environmental Distribution, September 12, 1996.

Exhibit G (36)

BORAL BRICKS

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MEMORANDUM

To: Boral Bricks Environmental Distribution

From: Robert Maner, Environmental Manager R. Maner

Re: Emission Estimating Techniques for Pneumatic Devices

Date: September 12, 1996

I have considered several potential approaches to estimate emissions from pneumatic collection devices for Title V applications, other air operating permit applications, and air quality fee assessments. To my knowledge, Boral Bricks possesses no actual stack test data from a pneumatic collection device in operation at one of our plants. In my review, I have tried to determine the most accurate approach to estimate actual and potential emissions from these devices. Observations on several potential methods are described below.

A common method to calculate emissions from pneumatic devices is to use a manufacturer's guaranteed efficiency. Guaranteed control efficiencies are usually derived from tests executed in a laboratory setting. Test conditions of these exercises usually include a well defined particle size distribution and inlet concentration. In addition, the performance of a dust collector is closely correlated to the inlet grain loading and particle size distribution. For dust collector applications in our plants, these factors are unknown or variable which means applying the guaranteed control efficiency to estimate emissions may be inappropriate. Also, it is likely that a large percentage of our dust loading is PM_{10}, or less than ten microns in diameter. Dust collectors become notably less effective as the mean diameter of the controlled media decreases. Finally, an emission estimate using a control efficiency also requires an estimate of the fugitive dust emitted from a process when all process material does not flow to the control device. In some cases, an emission factor from AP-42 may be available but may be inaccurate. In other cases, no emission factor may exist which would create even further uncertainty.

The draft section of AP-42 for the brick industry also contains an emission factor grinding and screening emissions controlled by a fabric filters based on a clay throughput. This factor was based on a set of test results from a General Shale plant in Tennessee and a Belden Brick plant in Ohio. Although this emission factor is derived from useful information, I believe that the performance of a fabric filter is only loosely proportional to the throughput of the emission points it controls. In addition, it is difficult to determine an accurate throughput in many instances when a fabric filter has several pick-up points and those points are equipped with return belts.

Considering these observations, I believe a more accurate approach is an estimate based on an assumed an exhaust grain loading coupled with the design or actual flow rate. Several wood products companies have used a similar approach to successfully estimate emissions from baghouses and cyclones. With proper maintenance and consistent operating conditions, an exhaust concentration may be the most consistent variable of the unit's operation. In addition, separate emission factors for PM and PM_{10} can be derived with proper information to reflect the dust collector's actual performance although it is likely that the most significant portion of emissions is PM_{10}. Although Boral Bricks does not have any specific fabric filter source test data available, an appropriate emission factor can be determined by compiling fabric filter outlet data from the stack tests completed on fabric filters at other brick plant operations. To the best of my knowledge, dust collectors on the grinding and screening operations at General Shale and Belden Brick are the only fabric filters to be tested in brick plant operations, excluding kiln applications.` Source test data from these tests are compiled in the following table:

Fabric Filter Outlet Particulate Emissions in Brick Plant Applications								
	Test Runs					Average		Maximum
	General Shale			Belden Brick		Factor		Factor
	1	2	3	1	2	Average	St. Dev.	Avg. + 2SD
	gr/dscf	gr/dscf	gr/dscf	gr/dscf	gr/dscf	gr/dscf	gr/dscf	gr/dscf
PM > PM_{10}	9.16E-04	2.76E-04	1.23E-03	9.6E-04	6.1E-04	7.98E-04	3.66E-04	N/A
PM_{10}	3.52E-03	1.36E-03	1.23E-03	2.4E-04	2.0E-04	**1.31E-03**	1.35E-03	**4.0E-03**
Total PM	4.44E-03	1.64E-03	2.46E-03	1.20E-03	8.10E-04	**2.11E-03**	1.44E-03	**5.0E-03**

Figure 1: Compilation of Dust Collector Outlet Data and Derived Emission Factors

In order to estimate emissions for *compliance* purposes, *maximum* anticipated emissions should be calculated. For this situation, a conservative emissions estimate can be made using a maximum emission factor and the design flow rate. The maximum emission factor suggested in the table above is derived from the average plus two standard deviations of the results of five total test runs at both plants. Statistics suggest that the average plus to standard deviations should give a 95% confidence interval. The emission factor shown is based on standard conditions while designs are normally based on actual flows. Actual pressures are normally atmospheric while normal operating temperatures exceed 68°F, making the factor even more conservative. Sample calculation of a dust collector with a design flow rate of 15,500 actual cubic feet per minute is shown below.

<u>Maximum Short-Term Emissions:</u>

= [Design Air Flow Rate (cf/min) x Emission Factor (gr/cf) x Conversion Factor]

PM Emissions:

$$= \frac{15{,}500\ ft^3}{\cancel{min}} \times \frac{0.0050\ \cancel{gr}}{ft^3} \times \frac{60\ lb\ \cancel{min}}{7006.3\ \cancel{gr}\ hr}$$

= **0.66 lb/hr**

PM_{10} Emissions:

$$= \frac{15{,}500\ ft^3}{\cancel{min}} \times \frac{0.0040\ \cancel{gr}}{ft^3} \times \frac{60\ lb\ \cancel{min}}{7006.3\ \cancel{gr}\ hr}$$

= **0.53 lb/hr**

Figure 2: Sample Calculation of a Short-term Maximum Emissions for a Fabric Filter at 15,500 acfm

If an estimate *long-term actual* emissions is required, as for air quality fees, the a*verage* emission factor used with the dust collectors actual flow rate and hours of operations are probably more appropriate. The average emission factor from the average of the five test runs above could be used or rounded up slightly to maintain simplicity and maintain a conservative estimate.

If the dust collector exhausts inside an enclosed structure, an appropriate building removal efficiency should also be applied. I am comfortable using a building removal efficiency of 90% considering some of the other conservative assumptions that have been applied.

I am also aware that some cyclones are in operation at our brick plants. As I recall, some cyclones are used to control dust in some sand coating areas and also in some sawdust preparation areas as well. To my knowledge, no data exists for any of these applications at brick plants. In the absence of any site specific approach that may be more accurate, I would base emissions estimates on emission factors from section 10.4, *Woodworking Waste Collection Operations*, published in the 4th edition of AP-42. This section suggests an average emission factor of 0.055 gr/scf for cyclones controlling sanderdust and an emission factor of 0.03 gr/scf for other applications. Using this information as a only a rule of thumb accompanied by some engineering logic, I would apply the 0.055 gr/scf sanderdust emission factor to those cyclones controlling dust emitted from periodic processes such as mixing of surface coatings and the application of surface coatings to brick columns. I suggest the 0.03 gr/scf factor for those cyclones used in the pneumatic handling of sawdust. Again, these are only rough estimates, loosely based on actual data coupled with engineering judgement. At some point, a refined estimate may be developed based on the designed carrying velocity of specific systems in addition to a particle size distribution of the controlled media and the design specifications of the control device. However, the outlined approach should be sufficient for estimates.

The following table summarizes suggested emissions factors for pneumatic devices.

Summary of Suggested Emission Factors for Pneumatic Control Devices				
Application	**Average, PM**	**Average, PM_{10}**	**Maximum, PM**	**Maximum, PM_{10}**
Fabric Filter, clay/sand	0.0025 gr/scf	0.0020 gr/scf	0.0050 gr/scf	0.0040 gr/scf
Cyclone, Sand/Coatings	0.0550 gr/scf	assume PM = PM_{10}	0.0550 gr/scf	assume PM = PM_{10}
Cyclone, Sawdust	0.0300 gr/scf	assume PM = PM_{10}	0.0300 gr/scf	assume PM = PM_{10}
Structure Removal	90%	90%	90%	90%

Figure 3: Summary of Emission Factors for Pneumatic Control Devices

These factors should provide somewhat representative estimates of actual and maximum emissions if site specific information is not available. As Boral Bricks works towards stream lining environmental affairs, emissions of from the pneumatic devices discussed should be estimated using this approach until better information becomes available. Please note that if additional data becomes available on emissions from dust collectors in operation at brick plants, emission factors should be revised appropriately.