Dominion File 10/14

Memorandum To : Director, Division of Compliance

From : Director, Region VI

Subject : Fugitive Emissions from Coal Storage Piles at Hampton Roads Terminals

Reference : (a) Director, Region VI memo to the Director, Division of Compliance, dated December 27, 1983, Subject; New Coal Terminals in the Hampton Roads Area

Enclosures : (1) Discussion on Fugitive Emissions from Coal Storage Piles

(2) Calculations to Determine Fugitive Emissions from The Massey Coal Storage Pile based on Observed Hi-Vol concentrations and C Stability conditions

(3) Revision to Enclosure (2) using D Stability for the Observation on May 15, 1983

Date : September 22, 1983

Serial No. : 0503-83

The State Air Pollution Control Board issued the first of several coal terminal permits to the Massey Coal Terminal Corporation in September of 1980. Since that time five (5) additional applications for coal terminals have been received by Region VI. Of the five (5) applications four (4) permits have been issued, two (2) of which were subsequently cancelled by the applicant, and one is still being processed.

During this period EPA modified the formulae for estimating fugitive emissions for coal dumping and transferring operations. In addition, Region VI recommended, and the Richmond staff concurred, that the formula used for estimating fugitive emissions from coal storage piles in the first three permits should be replaced by a more appropriate formula. The rationale for this recommendation is contained in Enclosure (1). (Note: At that time EPA recognized the existance of several formulae for storage piles, but did not specify any particular one as being representative of coal storage piles.)

As the result of these changes and revisions, the estimated actual emissions, as well as the allowed emissions, for each coal facility issued a permit during that period were based on different emission factors. In order to rectify this inconsistency Region VI recommended in Reference (a) that certain revisions be made to the permits issued to Massey, Dominion and Higgerson & Buchanan in order to bring them all in line with the same basic emission estimates.

However, before Reference (a) was acted on EPA published Supplement 14 to AP-42 (effective May, 1983 and received on August 22, 1983), which further clouded the issue of fugitive emissions for coal storage piles. Section 8-24 of Supplement 14 recommended the formula $E=1.6U \frac{lbs}{hr/acre}$ for estimating fugitive emissions from coal storage piles at Western surface mines. A modification of this formula was the one recommended by Region VI and subsequently used by Patrick Coal Terminal. The proposed Virginia Port Authority terminal used the formula as is (E=1.6U lbs/acre/hr). However, Supplement 14 recommends that this formula only be used for Western surface coal mines and in Section 11.2 recommends that the formula E=1.7 (S/1.5)(365 - p/235)(f/15) lbs/acre-day be used for estimating emissions from other active storage piles. The latter formula was developed from tests on sand and gravel piles and is a general formula to be used for storage piles of various types of aggregate. As is indicated on page 11.2.3-5 of AP-42 "worse case emissions from storage pile areas occur under dry windy conditions". This fact has been borne out by numerous on-the-spot observations at Massey Coal Terminal. However, specific wind data is not a factor in the latter formula and use of the formula will result in the same emissions on a calm day as on a windy day, all other factors being equal. Therefore, Region VI believes that the formula E=1.7 (S/1.5)(365 - p/235)(f/15) should not be used for estimating short term emissions from coal storage piles.

In an attempt to get a better idea on emissions from a modern coal terminal, and specifically from coal storage piles, Region VI set up a Hi-Vol monitor on the roof of a maintenance building in the public housing area adjacent to the Massey Coal Terminal in Newport News. This monitor was operated on the same days as the other TSP monitors in the system plus an additional observation was made between each regular six day cycle. Terminal activity and hourly wind data also were recorded. Prior Liaison was established with the monitoring division in order that each filter paper would be subjected to a microscopic inspection to determine the degree of coal dust present. It also was determined that a more definitive figure on the amount of coal dust on the filter paper could be determined in the laboratory. This procedure was accomplished by incinerating a portion of the sample in order to determine the extent of the organics present and then subtracting from this figure the amount of organics not due to coal dust. It was decided that the amount of organics not due to coal dust could be approximated by analyzing the filter paper from the Hi-Vol monitor at the Virginia Schools which was only about 2.2 miles to the northeast. Since this laboratory analysis by incinerations was costly, it was decided to only analyze those observations which appeared to be more worthwhile (i.e., over 50% coal dust on filter paper, no rain, and wind out of the general direction of the coal terminal). Three dates were selected to be analyzed (May 15, June 27 and July 5) for the public housing monitor and two dates for the Virginia Schools monitor (May 30 and July 5). The average organic background on the Virginia Schools filter paper was determined to be .0235 gm for a 24 hour period. This figure of .0235 gm was subtracted from the total organics observed on the public housing monitor filter paper with the resultant organics assumed to be coal dust. The hourly wind was then analyzed to determine how long and at what velocity the wind was blowing from the terminal toward the Hi-Vol. Once this duration of time was established it was utilized to compute the volume of air taken in by the Hi-Vol during the same period of time. Using the weight of the coal dust on the paper and the volume of air taken in by the Hi-Vol during the time the wind was blowing in that direction the average downwind concentration of coal dust was calculated for the average wind during that period. An average downwind concentration was developed for each of the three days evaluated.

Once the average downwind concentration was determined, an overall emission rate could be estimated for the terminal as a whole by assuming the entire terminal to be a surface area source and using the Gaussian distribution formula. Daily observation of the terminal revealed that on the days in question, while the wind was blowing toward the monitor, there were no significant coal handling operations in progress and that the terminal emissions were primarily from the coal storage pile.

Enclosure (2) contains the calculations for the three days evaluated. The size of the Massey coal storage area is 30 acres and the outer extremities of the piles bear 230° T clockwise through 270° T. The center of the area is approximately 1,780 feet (542.9m) from the monitor. In accordance with the procedure outlined in Turner's Workbook (page 39) the coal pile was considered a square surface area source with each side equal to 348.4 meters. (30 acres = 121,406 M^2; $\sqrt{121,406}$ = 348.4.) A virtual point for a constructed source was determined to be 613.86M upwind at C stability. Note: for this evaluation a class C stability was assumed for all three days. Under these conditions and Turner's procedures the constructed source would be 1156.8 meters upwind from the monitor at ground level. At this point one could solve for the horizontal and vertical dispersion coefficients by using Figures 3-2 and 3-3 in Turner's Workbook or by utilizing the approximations in EPA Project Report No. 3311 which developed the formulae for emissions from Western Surface Mines. Enclosure (2) utilizes the latter approximations. (Note: Region VI worked it both ways and there's no significant difference.)

Once the horizontal and vertical dispersion coefficients have been determined the only unknown in the formula $C=Q\div(\pi)(U)(\sigma y)(\sigma z)$ is the "Q". Therefore, since we know the concentration and wind on the days in question, it is an easy matter to solve for the emission rate (Q) on that day. Having calculated the estimated emission rate for each of the three days analyzed, Region VI then compared these rates to the emissions calculated using the various emission formulae. This comparison is included on the bottom of page five of Enclosure (2).

As noted in this comparison emission rates based on the formula E=1.7 (S/1.5)(365 - p/235)(f/15) from Section 11.2 of AP-42 resulted in the same very low rate each day even though actual observations indicated considerable differences in the daily rates and much higher rates. The formula E=1.6U from Section 8.24 of AP-42 used with Western surface mine storage piles appeared to overestimate the rate while the Region VI modification of this formula E=.8U appeared to underestimate the rate. On the other hand, the formula E=1.1U indicated good correlation with the observed rates.

As indicated earlier, the observed rates developed in Enclosure (2) were based on using C stability dispersion coefficients. More recently Region VI checked with National Weather Service concerning actual stability conditions on the days in question and learned that, while stability conditions were predominantly C on the June 27 and July 5, on May 15 the stability condition was D. Enclosure (3) recalculates the emission rate on May 15 based on D stability, the observed wind and the recorded Hi-Vol concentration. The change from C stability to D stability reduces the calculated emission rate from 39.8 gm/sec to 27.4 gm/sec. It also upsets the excellent correlation indicated in Enclosure (2) when all calculations were based on C stability. Using actual stability conditions as observed the best correlation now appears to be described by the formula E=.9U. (Ironically enough this not too unlike the arbitrarily modified formula (E=.8U) previously used by Region VI.)

In summary, it appears to Region VI that the formula given in Section 11.2 of AP-42 for fugitive emissions from wind errosion of active storage piles is inappropriate for short duration periods (24 hours or less). In fact, on the same page in AP-42 where the formula is given there is statement to the effect that the worse case condition for storage pile emission is a dry windy day. Therefore, unless the wind is prominent in the emission formula, a worse case condition cannot be calculated by use of the formula E=1.7 (S/1.5)(365 - p/235)(f/15). In section 8.24 of AP-42 the formula for emissions from Western surface mine coal storage pile uses wind as the primary factor, but warns that the formula should not be used for other type facilities or even different geographical locations. The validity of this warning is amply demonstrated in the comparison on page five of Enclosure (2) where the emissions estimated by using the formula E=1.6U are approximately 50% in excess of the observed rates. However, using the Hampton Roads location with the type of coal normally exported from this port, and the methodology described in the report that developed the E=1.6U formula, a more appropriate formula (E=.9U) was developed.

While it is realized that the use of only one monitor, coupled with approximations on distances and the many assumptions used in the evaluation, leave a lot to be desired insofar as a scientifically conducted emission test is concerned, it is never-the-less the opinion of Region VI that the formula $E=.9U \frac{lbs}{hr/acre}$ best describes the short term emissions from coal storage piles at terminals in the Hampton Roads area and it's use for this purpose is hereby recommended.

Ramon P. Minx
Director, Region VI

John Salop
Acting

RPM/JS/LWH/cf

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The following pages contain the Optical Character Recognition text of the preceding scanned images.

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