



North Carolina Department of Environment and Natural Resources

DIVISION OF AIR QUALITY

Michael F. Easley, Governor

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August 21, 2002

Mr. Stephen G. Zemba, Ph.D., P.E.
Ms. Laura C. Green, Ph.D., D.A.B.T.
Cambridge Environmental, Inc.
58 Charles Street
Cambridge, Massachusetts 02141

Subject: Response to Comment on the Draft Salisbury Air Quality Monitoring Study

Dear Mr. Zemba and Ms. Green:

Thank you for your July 12, 2002 memorandum in which you provided comment on the reported estimates of hydrogen sulfide (H₂S) emissions from the APAC hot-mix asphalt (HMA) plant. For several reasons you felt that the H₂S emission estimates produced from our monitoring survey were unreliable and should not appear in the final version of the subject report. After review of your comments and our discussion with the manufacturer of the H₂S monitor, we feel that the data should still be presented as preliminary estimates in the final report. However, we do recognize value in other points that you made and will incorporate these as changes in the final report. One of these points is to present the estimated H₂S data to one significant figure, considering that the nature of the procedures and ensuing data was an order-of-magnitude estimate of H₂S emissions from hot-mix asphalt plants. Below is our response to each individual comment in the order that you raised.

1. Sulfur dioxide (SO₂) concentration. We stand corrected on the dryer exhaust gas SO₂ concentration calculation based on the EPA emission factor; the correct value is 2 parts per million (ppm) as you indicated, and not 0.002 ppm as presented in the Draft Report. However, based on in-house data collected by the manufacturer, RAE Systems (telephone 408.752.0723), a 2 ppm SO₂ concentration would have negligible effect on the H₂S level measured by the monitor.
2. Possibility of inferences with other gases. The RAE H₂S monitor has been tested for interferences with sixteen gases, a few more than the ten you indicated (see http://www.raesystems.com/pdf/TN-114_Sensor_Specs.pdf). According to the monitor manufacturer, no major interference effects from asphalt fumes are expected from the relatively low levels quantified in the EPA speciation profile for a wide range of compounds (volatile organic compounds [VOCs], semi-VOCs, and criteria pollutants). As you indicated, there could be hundreds of compounds in asphalt fumes. However, the H₂S monitor manufacturer's data in combination with other available data for asphalt fumes show that:

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- A. High levels of polar organic compounds (alcohols, ketones, and amines) give a negative response (i.e., a low bias); however, the EPA data indicates the relative absence of polar compounds. Other organic compounds in asphalt fumes quantified by EPA have no effect (e.g., toluene) or are at sub-ppm levels -- too low to cause interference.
 - B. Likewise, methyl mercaptan causes interference at 100 ppm, but the Associated Asphalt test data show that methyl mercaptan was below the practical detection limit of 4 ppm.
3. Non-condensing conditions. Discussion with the monitor manufacturer revealed that the non-condensing specification for humidity is primarily for long-term instrument protection. The approximate moisture and dew point conditions at the storage tank exhaust and the dryer / mixer exhaust were 5% H₂O / 90 °F and 20% H₂O / 140 °F, respectively (see Associated Asphalt H₂S Emission Test Report). Given the monitoring survey characteristics (moisture-related conditions, gas temperature, pollutants' concentrations, sampling configuration, duplicate measurements and stable monitor readings), the H₂S monitor manufacturer vouched for the integrity of the storage tank data (90 ppm H₂S) and judged only a 10% shift in response at the dryer / mixer due to the estimated temperature of 140 °F. This suggests a lower concentration at the dryer / mixer than originally reported (6 ppm - (10% of 6) = 5.4 ppm), reducing the emission rate from the reported value of 0.75 lb/hr to 0.68 lb/hr (rounded to one significant figure, 0.7 lb/hr).
 4. Significant figures. We agree with your point to present the estimated H₂S data to one significant figure, considering that the nature of the procedures and ensuing data was an order-of-magnitude estimate of H₂S emissions.
 5. Storage tank emission calculation. Your comments were: (1) The emission calculation was performed assuming that the volumetric displacement of gas through tank vents was equal to the volume of liquid asphalt pumped into the storage tank (181 gallon per minute x 0.1337 gal/ft³ = 24 ft³/minute); (2) The tank vapors were at the same temperature as the liquid asphalt in the tank (assumed 300 °F); and (3) the emission calculation should be made with consistent units at appropriate conditions (flowrate and concentration at the same conditions).

Our response: The Associated H₂S testing verified that the volumetric displacement of gas through tank vents was equal to the volume of liquid asphalt pumped into the storage tank. The invoice of the liquid asphalt purchased in Winston Salem by APAC for this survey reflected that the shipment was loaded with 5970 gallons of liquid asphalt initially at 325 °F (invoice specifications referenced a density of 8.653 lbs/gal at 60 °F with a net weight of 51,660 lbs) plus 30 gallons of anti-strip for a total of 6000 gallons. Eighty minutes after being loaded the tank was pumped empty in a period of 33 minutes. Revised calculations were made (see Calculations Attachment) using available data for temperature and moisture from the Associated Asphalt Emission Report. Given this report, EPA's test reports, and our technical judgment, the revised calculations are based

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on liquid asphalt unloading temperature of 280 °F and vapor temperature at the sampling location of 140 °F. The Associated report provides measured gas temperatures averaging 140 °F for railcar unloading, conditions comparable to APAC's truck unloading. The revised calculations show that H₂S estimated emission is 0.010 lb/hr, slightly less than the reported 0.012 lb/hr.

In summary, the intended purpose of our monitoring survey at APAC was merely to collect *preliminary estimates* of the H₂S emissions data in a timely and low-cost manner in order to fill the data gap on HMA H₂S emissions. Our purpose was not to formally quantify emissions. Accordingly, the report presents and clearly caveats the information as *preliminary estimates*. Having approved the test plan and audited the testing at Associated's terminal adjacent to APAC, we were well aware of the details and costs of performing formal H₂S emission test measurements with EPA Method 15. However, the 2400 ppm H₂S levels measured during storage tank filling at Associated in early September prompted DAQ to conduct a monitoring survey the following month to obtain order-of-magnitude information. We feel that our monitoring survey was successful in collecting *preliminary estimates* of HMA H₂S levels and in illustrating the need for obtaining more authoritative data from industry-sponsored tests using formal EPA emission test procedures. Such testing would eliminate the issues in which DAQ and you tend to disagree, those being estimates and technical judgments for gas flowrate, temperature, moisture level, as well as non-controversial concentration measurements.

If you have any questions or comments, please contact me at (919) 715-2694 or Steve.Schliesser@ncmail.net.

Sincerely,

Steve Schliesser, QEP
Environmental Engineer

Attachment

cc:

Andy Jones, APAC President

Lori Cherry

Lee Daniel

ATTACHMENT**Truck Unloading Calculations**

Revised calculations:

1. APAC Invoice from Coastal Refining: 5970 gal LA @60 °F + 30 gal anti-strip = 6000 gal total
LA = liquid asphalt
2. Storage tank filling: 6000 gal @60 °F x 1.092 = 6552 gal @ 280 °F
1.092 = expansion coefficient between 60 °F and 280 °F per ASTM D 1250
3. 6552 gal / 33 minutes = 199 gpm x 0.13371 ft³/gal = 26.5 ft³/min @ 280 °F
4. 26.5 ft³/min @ 280 °F = 21.5 ft³/min @ 140 °F
5. 21.5 ft³/min x 90 ppm H₂S (both at @ 140 °F) = 0.0102 lb/hr H₂S (rounded to 0.01 lb/hr)
6. Weight: 5970 gal LA @ 8.653 lbs/gal @60 °F = 51,660 lbs

Original calculations:

1. APAC Invoice from Coastal Refining: 5970 gal LA
2. Storage tank filling: 5970 gal / 33 minutes = 181 gpm x 0.13371 ft³/gal = 24.2 ft³/min
3. 24.2 ft³/min x 90 ppm H₂S (both at @ 140 °F) = 0.012 lb/hr H₂S