MEMORANDUM

To: Steve Schliesser

From: Stephen G. Zemba, Ph.D., P.E. and Laura C. Green, Ph.D., D.A.B.T.

Subject: Comments on the Draft Study Report *Salisbury Air Quality Monitoring Study*

Date: July 12, 2002

We write to comment on an aspect of the Draft Report of the *Salisbury Air Quality Monitoring Study* (April 30, 2002). In particular, we focus on the reported estimates of hydrogen sulfide emissions from the APAC hot-mix asphalt plant. For several reasons, we feel that the estimates are unreliable, and, absent additional testing, should not appear in the final version of the Report. Allow us please to explain.

As you know, in an attempt to (1) identify, and (2) quantify hydrogen sulfide concentrations in four emission sources at APAC, the investigators used a measuring device "not designed for use under source test conditions (Draft Report, p. 19)." This device is an electrochemical monitor (the MultiRAE PLUS model, made by RAE Systems) that responds to both hydrogen sulfide and to other, interfering compounds, some of which, such as sulfur dioxide, are expected to be present in the stack gases at issue. The Draft Report (p. 19) acknowledges the potential interference by sulfur dioxide (SO_2), but incorrectly estimates, by a factor of 1,000, the magnitude of the potential for this interference. The stack-gas concentration of SO_2 estimated from the U.S. EPA's AP-42 emission factor is 2 ppm, and not 0.002 ppm, as stated in the text of the Draft Report. The corrected calculation of 2 ppm from the emission factor of 0.0034 lb SO_2/ton asphalt and a stack gas flow rate of 24,000 scfm is as follows:

$$\frac{0.0034\ \text{lb SO}_2}{\text{ton asphalt}} \times \frac{180\ \text{tons asphalt}}{\text{hour}} \times \frac{\text{min}}{24{,}000\ \text{ft}^3} \times \frac{\text{ft}^3}{0.02831\ \text{m}^3} \times \frac{\text{hour}}{60\ \text{min}} \times \frac{453{,}600\ \text{mg}}{\text{lb}} = 6.8\ \text{mg/m}^3$$

At standard temperature and pressure, the SO_2 concentration of 6.8 mg/m^3 is equal to a volume ratio of 2 ppm.

There may also be interferences with other gases. The H_2S electrochemical method has been tested for interferences with only about ten different gaseous species. Stack-gas from a combustion source such as an asphalt plant contains hundreds of different chemicals, and there may be dozens present at ppm levels for which potential interferences have not been tested. Some interfering gases will enhance the device's signal, while others will diminish it, so that not even the direction of the overall bias, let alone the degree, can be known from the data at hand.

Cambridge Environmental Inc

58 Charles Street Cambridge, Massachusetts 02141
617-225-0810 FAX: 617-225-0813 www.CambridgeEnvironmental.com

The MultiRAE meter is not an instrument designed for stack-gas measurements. Its specifications state that it can be used over a wide range of **non-condensing conditions**. The stack-gas of an asphalt plant typically contains a 20% or greater concentration of water vapor (which can remain in the vapor phase at stack-gas temperatures). The Draft Report states that H_2S measurements taken downstream of the baghouse were collected at ambient temperature (p. 20). If so, water vapor had to condense from the sampled stack-gas, since saturated air at 70°F can hold at most about 2.5% water vapor. The Draft Report does not state that any measures were taken to condense water out of the stack-gas. If the stack-gas was sampled directly by the MultiRAE meter, as the Report implies, then the instrument was operated in a manner that invalidated any measurements with respect to the instrument's design capabilities.

The issue of water condensation may transcend the stack-gas measurements. Although one would not expect to find high concentrations of water vapor in the air space of the asphalt cement storage tank, the vapors are maintained at roughly 300°F in the heated tank, and it is possible that water vapor could be present at levels greater than the ambient saturation point. The U.S. EPA found such high water vapor concentrations to be present in storage silo vapors. Thus, the 90 ppm H_2S concentration reported for the APAC facility asphalt cement tank may also be unreliable.

Overall, the results to date do not reveal, even to one significant figure, the concentration of hydrogen sulfide in the gas streams analyzed at APAC — yet the Draft Report provides an estimate to *two* significant figures, reporting (page 61), "Preliminary data indicate that H_2S emission rates of 0.76 lb/hr are released from the APAC hot mix asphalt plant . . ." Since the estimate is not even good to one significant figure, the implied precision is inappropriate. Of this estimated emission from the APAC facility, 99% (0.75 lb/hr) is estimated to emanate from the stack of the dryer/mixer; but since the concentration of H_2S in this stack has not been measured accurately, the *actual* emission rate (which is simply the concentration times the flow rate) cannot be known. Similarly, it cannot be said whether or not (page 61) "the H_2S TPER guideline of 0.52 lb/hr" has in fact been exceeded by emissions from the APAC facility.

Another, technical error has been made in the Draft Report in calculating emission rates from refilling liquid asphalt storage tanks. In estimating the rate of hydrogen sulfide (H_2S) emissions during storage tank refilling, the assumption was made that the volumetric displacement of air through tank vents was equal to the volume of liquid asphalt pumped into the storage tank. As described on p. 20 of the Draft Report, the liquid pumping rate of 181 gal/min corresponds to a volumetric flowrate of 24 ft^3/min. This flowrate of 24 ft^3/min is then considered at "standard" temperature in the calculations described in Table 13 (p. 45). However, since the storage tanks are heated to maintain a liquid asphalt temperature of about 300°F, the vapors in the tank are presumably at the same temperature. Therefore, the 24 ft^3/min effluence of vapor occurs at a

temperature of 300°F. Corrected to a standard temperature of 68°F, the flowrate at standard temperature is 16.8 ft^3/min, and thus the emission rates for storage tank filling in Table 13 should be reduced to 70% of the stated values.

Thank you for allowing us to consider this issue with you. Best regards.

Cambridge Environmental Inc

58 Charles Street Cambridge, Massachusetts 02141
617-225-0810 FAX: 617-225-0813 www.CambridgeEnvironmental.com