

Comments on SAMI Final Report

Generally, the report is easy to read and understand. It should be reviewed carefully to correct grammar and spelling. Specific comments are listed below.

Page 20, section on NH₃: The report mentions that it is not known whether the SAMI inventory over- or underestimates NH₃ emissions. The most critical inventory is that for the base years because all future years are derived from them. The atmospheric modeling of NH₄ wet deposition (which is the result of NH₃ gas and NH₄ aerosol dissolved in precipitation) found that modeled levels of NH₄ in precipitation were biased high when compared to observations, whereas modeled levels of sulfate and nitrate were more reasonable. This is unlikely to have occurred unless atmospheric levels of NH₃ were too high. Therefore, it is reasonable to conclude that NH₃ emissions in the base year inventories were *probably* too high and subsequent future year inventories are likewise affected. The model evaluation results, however, cannot be used to indicate a *quantitative* estimate of the NH₃ emissions bias. This is because NH₃/NH₄ also deposits directly (“dry deposition”) as a gas or particle, and levels in precipitation are the result of a balance between the amount deposited by dry deposition and the amount left behind in gaseous and particulate form. Large uncertainties exist in a model’s ability to simulate dry deposition. Thus, the influence of model dry deposition bias on precipitation scavenging of NH₃/NH₄ cannot be determined. Additional evidence for NH₃ being too high is found when comparing NH₄ to SO₄ ratios (in particles) from the model with those determined from recent PM_{2.5} measurements. Data indicate that, in the Southeast in summer, sulfate is not completely neutralized by NH₄. However, SAMI’s modeling indicated that the PM_{2.5} sulfate was closer to neutral (i.e., too much NH₄). This is consistent with the SAMI inventory having NH₃ emissions that are biased high. The report would benefit from providing this information so the reader can decide how much weight to give subsequent arguments involving ammonia.

Page 20 – The following text describes the importance of ammonia to air quality (“Ammonia is significant in the development of fine particulate, it is also a significant contributor to the overall nitrogen deposition. To begin to understand this contribution SAMI assessed the total nitrogen emissions as Nitrogen from both the NO_x sources and the NH₃ sources”). One other point that might be made here is that ammonia tends to neutralize acidic aerosols, cloud droplets and raindrops. The efficiency with which hygroscopic aerosols, cloud droplets and raindrops convert SO₂ gas to sulfate aerosol is strongly affected by the acidity of the aerosol or drop. Thus, the presence of ammonia in the atmosphere influences the formation of sulfate aerosol. An overly neutralized atmosphere, caused by too much NH₃, will more rapidly convert SO₂ to sulfate. This, in turn, introduces error into computed source-receptor relationships involving SO₂ and sulfate, possibly shortening the distances between sources of SO₂ and their impacts on PM_{2.5}.

Page 23 – The following text is in error (“Light energy is transmitted through the atmosphere as electromagnetic waves called photons”) Light has a dual character. Under some conditions it exhibits the characteristics of waves. Under other conditions it

exhibits characteristics consistent with particles. The small “particles” of light are called photons. Electromagnetic waves are not called photons as implied by the text as written.

Page 24, section “What Causes Haze?” – The following statement is incorrect (“Organic particles in rural areas are primarily emitted by vegetation.”) Vegetation does not emit organic particles. Instead, organic gases, primarily terpenes, are converted photochemically into organic compounds with lower vapor pressures which, consequently, condense into aerosols.

Page 24 – “Ammonia gas causes a smelly haze.” Please explain what this means. “Smelly haze” is not standard terminology. How can haze have an odor?

Page 27, second ¶ under “Methods” section – “Only a fraction of the total organic particles are captured on the filter. To account for the unmeasured organic mass, IMPROVE multiplies the measured organic mass by a factor of 1.4 to report total organic mass.” This is incorrect. The correction factor is not used because the filter collection fails to capture some of the mass. The correction factor is applied because the laboratory analytical technique (called “TOR” or thermo-optical reflectance) that is used only determines the amount of elemental and organic *carbon*, and does not provide information on the elements other than carbon that compose the organic compounds.

Page 27, third ¶ under “Methods” – The extra mass is often assumed to be caused by condensed water on the aerosols, not water vapor.