Preliminary Comments on the REA Planning Document from Dr. H. Christopher Frey

This review focuses on Chapter 4: Plan for the Current Health Risk and Exposure Assessment, on pages 4-1 to 4-30, with a focus on exposure assessment.

The key points from this review are:

- Please explain why there are no plans for exposure assessment scenarios at levels of air quality below the current standard.
- How will the dispersion modeling approach be "supplemented and informed" by air quality monitoring measurements?
- Why use a linear ramp (Equation 4-2).
- Will (and if so, how) will transport time be accounted for with regard to modeled concentration?
- Page 4-19 – there seems to be some ambiguity between the concept of a design value versus a decision to look at annual data. The rationale here is not stated.
- Figure 4-6: the R2 values do not imply that hourly data are correlated from one year to the next – this needs to be clearly communicated. The meaning of R2 here, as an indicator of similarity in the frequency distributions from one year to another, should be communicated carefully.
- There are some detailed comments on Equations 4-1 to 4-4 and regarding the hour-day-month specific factors. The latter are not clear.

Page 3-9: the new algorithm for resting metabolic rate should be documented, perhaps in an appendix, in the 1st draft HREA unless it is documented elsewhere in a report that can be provided to CASAC (e.g., the documentation of the expected Spring 2017 release of the APEX update). Similarly, updates to the algorithm using V_E (if different) should also be documented.

Page 4-3, the decision to evaluate potential risk associated with air quality adjusted to just meeting the existing SO2 standard (and recent unadjusted air quality) seems appropriate if the question is whether the current standard protects public health with an adequate margin of safety. What about other levels less than the current standard?

Page 4-6: "we are proposing to use the model-based approach to estimate ambient air concentrations in each study area, supplemented and informed by available local ambient monitor measurements." Please explain more clearly how the model-based approach will be "supplemented and informed by" measurements.

Page 4-6 – it would help to say what cities are included in these counties. More broadly, the choice of only four study areas needs discussion, as noted by other panelists.

Page 4-13: "Calculate an average distribution of hour-day-month specific factors using measured values" not clear what is meant by "hour-day-month specific factors." Does this mean factors that are specific to each hour for a given day for a given month? If so, the sample size would be very small. Or does this mean one factor for hour of day, another factor for day of month, and another factor for month of year? Or other?

Page 4-13: "Instances of where ambient air measurements are missing likely occur at times where concentrations are relatively low…" Explain why this is.

Equation 4-1. I finally figured this out, but the nomenclature is confusing. Nomenclature such as this would be more clear:

$C_{i,h,d,m}$ = estimated concentration for the ith 5 minute interval (I =1,12) in the hth hour for the dth day in the mth month. [or could just be $C_{i,h}$]

$C_{max,h,d,m}$ = maximum 5 minute average concentration in the hth hour for the dth day in the mth month. [or could just be $C_{max,h}$]

$C_{ave,h,d,m}$ = hourly average concentration in the hth hour for the dth day in the mth month. [or could just be $C_{max,h}$]

i = index for 5 consecutive non-overlapping 5 minute periods in an hour, from 1 to 12.

Thus, Equation (4-1) would become:

$$C_{i,h,d,m} = \frac{\left(12 \times C_{ave,h,d,m}\right) - C_{max,h,d,m}}{11}$$

Or possibly:

$$C_{i,h} = \frac{\left(12 \times C_{ave,h}\right) - C_{max,h}}{11}$$

And so on for the other equations.

Page 4-15: Is there some underlying reason to use a linear ramp? This text just describes the linear ramp but does not offer a reason/rationale for it.

Page 4-16: "Because there is improved representation of 5-minute concentration variability based on the number of measurements in this data set." This is not clear – improved compared to what and in what way?

Equation (4-3) is unclear. For example, n is not defined. Could be more clear, perhaps something such as this:

$$C_{est,h} = \frac{\left(12 \times C_{ave,h}\right) - \sum_{i=1}^{n-m} C_{i,h}}{12 - (n - m)}$$

Where

$C_{i,h}$ = concentration for the ith *measured* 5 minute interval (I =1,m) in the hth hour

$C_{est,h}$ = estimated 5 minute average concentration in the hth hour, applicable to each of the n-m 5-minute periods that were not measured.

$C_{ave,h}$ = hourly average concentration in the hth hour for the dth day in the mth month. [or could just be $C_{max,h}$]

m = number of measured 5 minute periods in hour h (must be 11 or fewer).

n = number of 5 minute periods in hour h (12).

Page 4-17:

"would" → "will"

"perspective" is vague and unclear → "quantification of"?

Text could address how factors such as complex terrain, built environment, and chemical reactivity and deposition of SO_2 will be addressed. What is known about validation of AERMOD for application to SO_2?

Page 4-18:
"can be" → will be?
"we would need to" → we will?

Equation 4-4: define the units as applicable.

Page 4-19: mention that the temporal pattern from one 5-min period to another at a monitor will be delayed compared to the pattern at the emission source because of transport time. For example, for a wind speed of 2 m/s, an air parcel would be transported 600 meters. Thus, a change in emission rate would manifest as a change in concentration 5 minutes later at a distance of 600 meters, 10 minutes later at a distance of 1,200 meters, and so on. At one hour, the air parcel would be 7.2 km from the source, which would likely still be within the study region. Thus, at a wind speed of 2 m/s, it is likely that the maximum 5 hour concentration would be misclassified by one hour compared to the timing of the emissions that lead to such a peak. Or, to put this another way, simulated emissions at hour h would lead to downwind air concentration at hour h+1 at a distance of 7.2 km to 14.4 km. Does this matter to the exposure assessment? If so, how much? For sources that emit approximately continuously, exposure concentration errors would have less error than for sources with more pronounced short-term temporal variation. Perhaps it can be argued that industrial sources that are the main sources of SO2 would be operating approximately continuously. More information about the load or emissions profile over time would be helpful.

Section 4.1.3.4 – page 4-19: as noted earlier, please explain the purpose of "air quality adjusted to just meet the existing primary SO2 standard, as well as for recent (unadjusted) air quality." Why not also look at air quality below the existing standard?

Same paragraph – design values are based on three years of averaging, but it is not clear that this text is using the term design value correctly. In a five year period, there would be three design values, assuming that the three year average rolls from one year to the next. Thus, there would not be a low concentration "year" but a low concentration 3-year average. Or explain why annual averages are used instead of three year averages, and be careful to clarify the choice of design value as a basis for assessing high or low concentrations in a given year. Please clarify. An example would help.

Page 4-20: Table 4-1 does not show adjustment factors. Need to explain more specifically how an adjustment factor can be inferred from data given in Table 4-1.

Figure 4-6: I think this makes sense from the perspective of evaluating whether two data sets are similarly distributed. However, it should be acknowledged in the text that the data are not actually paired this way. The data in both years have been sorted and the sorted values have been paired to assess whether the distributions are similar from one year to another. This does not imply that the data are correlated. The linear fit and R2 are indications of similarity of the hourly distributions but do not imply that data in one year are correlated with data in another year. Some readers are likely to

misinterpret the very high R2 values to mean that hourly data in one year are highly correlated to data in the same hour of a different year, which is of course not valid.

Page 4-23: It would help to either state values of a, P, and k or, if these values (and distributions) have been developed and reported elsewhere, cite references for the values (and distributions) to be used. Or otherwise give more insight as the basis of these.

Page 4-28: a comparison of APEX model results (for PM2.5) based on using the Markov-chain clustering (MCC) algorithm, diversity and autocorrelation approach, and random resample is given by Che et al. (2014) (Risk Analysis, 34(12):2066-2079).