Responses to Information and Data Request Number 2 from Herman Wong to Shell

B. Clarification to Shell's Response to First Information and Data Request dated 14 February 2011.

1. *There is still doubt about the quality of the peer-review for the Gryning and Batchvarova paper. The journal, International Journal of Environment and Pollution, was unknown to us until now. Neither EPA nor the University of Washington has subscriptions to the journal. The journal has a low impact factor and a couple of highly - respected academic researchers in pollutant dispersion we surveyed had never heard of this journal and were equally skeptical of its peer-review quality. Please provide substantive and convincing information about this journal's ability to provide a high standard of peer review.*

Response: No clarification necessary on this request.

2. *In order to accept this modeling methodology, we need a description of how all meteorological variables are prepared. The "mechanical description" is important information we need to have as soon as possible, especially as it relates to the empirical relationships for the mixing height and the vertical potential temperature gradient.*

Response. No clarification necessary on this request.

C. Second Information/Data Request

The following information and data request are based on R10's review of the "Evaluation of COARE-AERMOD Alternative Modeling Approach Support for Simulation of Shell Exploratory Drilling Sources in the Beaufort and Chukchi Seas" dated December 2010.

1. *On page 1, reference is made to Section 3.2.2.d.iv in the Appendix W of 40 CFR 51. This subsection is not found in Appendix W. Please clarify.*

Response: The referenced section of the Guideline is in error. The correct reference should have been 3.3.3.e.iv not as stated in the December report.

2. *On page 2, fourth bullet, "24-hour" should appear for clarity between "new" and "PM2.5 ".*

Response: The requested change will be made.

3. *The fifth bullet on page 3 states that shoreline fumigation is not critical because the model highest concentration impacts should occur at offshore locations. However, a cumulative impact analysis may be requested with receptor points located at both over water and terrestrial locations. What provisions has Shell made should R10 make this request as part of an ambient air quality impact analysis?*

Response: No clarification is necessary on this request

In Section 4.1 on page 5, three over water tracer gas experiments (i.e., Pismo, Beach, CA; Cameron, LA and Carpinteria, CA) are listed, described and used in the evaluation to satisfy Condition iv in Section 3.2.2.e of Appendix W. For the evaluations of OCD and/or CALPUFF, tracer

gas experiments from Ventura, CA and Oresund, Denmark/Sweden were also used. Please explain why these two experiments were not used in the evaluation of COARE.

Response. No clarification is necessary for this request.

4. *In the paragraph on the bottom of page 5 and carried over to page 6, it is states "...we adjusted the air-sea temperature difference to be at least as stable as indicated by the virtual temperature lapse rate" for Pismo Beach. Furthermore, the third bullet on page 8, implies that "...the air-sea temperature difference was based on the lapse rate applied from the surface to the temperature measurement height." We assume that this approach was also used in Cameron meteorological data. Please provide a sample calculation.*

Response: No clarification is necessary on this request.

5. *In the first bullet on Section 4.2.1, page 8, Shell states that COARE is insensitive to certain meteorological variables in the Arctic. If Shell is making a recommendation with respect to input data, please explain.*

Response: Shell is not making a recommendation. The purpose of this sentence is simply to explain why certain options within the COARE algorithm were not used in the model evaluation.

6. *Please clarify the sentence on page 10, second bullet that states "Plume rise is not applicable and these conditions do not occur in the current evaluation."*

Response: The tracer experiments being used in the evaluations of the COARE-AERMOD approach were releases of tracer gas from ships or platforms. The tracer gases were released at ambient conditions without appreciable momentum, thus neither momentum plume rise nor thermal plume rise was a factor in the experimental data.

7. *On page 10, first full paragraph, last two sentences, it states that a minimum mechanical mixing height is set at 25-m and the corresponding u% is 0.05 m/sec to avoid numerical problems. This 25-m height was employed in evaluation Case 1, Case 2, and Case 5 as detailed on page 11. However, evaluation Case 3 and Case 4 did not utilize a minimum height. We believe there is insufficient technical justification in the record to support a minimum mechanical mixing height.*

    a. *Please provide qualitative and quantitative technical justifications for the use of a 25-m minimum mechanical mixing height.*

Response: No clarification is necessary for this request.

    b. *Besides Case 3 and Case 4, please identify and discuss any other cases in which observed mechanical mixing heights could be used without a minimum mechanical mixing height, and the results and statistics would improve.*

Response: Clarification is needed here for what EPA is requesting. Is the term "other cases" meant to refer to Cases 1, 2 and 5? Is EPA asking Shell to identify and discuss which of the cases 1, 2 and 5 could be run without a minimum mechanical mixing height and show improved model performance over the case evaluated with the minimum of 25 m?

c. *Please identify and discuss any other mechanical height options for use in Cases 1, 3, and 5. One possibility is 10 meters, the lowest resolvable height of the Kipp & Zonen MTP 5-P temperature profiler at Endeavor Island.*

Response: Does EPA mean Cases 1, 2, and 5 rather than 1, 3, and 5?

d. *If we believe a different minimum mechanical mixing height or no minimum height is more appropriate and defensible based on your responses, we may request Shell to generate the applicable evaluation cases including the use of those listed on page 11, if appropriate.*

Response: Is there a request here? This appears to be an informational statement by EPA.

e. *Please provide a frequency distribution of available measured representative mechanical mixing height data focusing on the lowest 10-m and 25-m.*

Response: Clarification is needed here for what EPA is requesting. It is unclear what EPA is referring to when they say "available measured representative mechanical mixing height data". Is EPA referring to data available at the sites of the experiments in Louisiana and California? We are unaware of any additional representative mixing height data for the times of these experiments.

f. *Please provide a frequency distribution of available predicted mechanical mixing height data focusing on the lowest 10-m and 25-m.*

Response: Clarification is needed here. Predicted mechanical mixing heights can be calculated anywhere from meteorological data. It is unclear what EPA is requesting. The request suggests EPA is asking for us to calculate mixing heights for the times and locations of the three experiments and prepare a statistical distribution of these values. Please provide a more specific request for the dates, times and locations that EPA would like Shell to provide predicted mixing heights and provide clarification on what is meant by a statistical distribution in this context.

g. *Please confirm that there is no minimum convective mixing height.*

Response: No clarification is necessary for this request.

8. *On page 10, fourth bullet, six variables are listed but not used in the evaluation simulations. Please explain the relevance for this listing.*

Response: The variables are listed for completeness of the record explaining why these variables appear in the model files. No clarification is necessary on this request.

9. *On page 11, first paragraph, explain the differences in the five cases with respect to the measured and calculated meteorological variable used to generate surface file and profile file.*

Response: No clarification is necessary on this request.

10. *On page 15, third bullet,*

a. *Since it always better to use site specific or representative meteorological data, please explain in further detail the sentence "An estimate of the mechanical mixing height based on the friction velocity, as in AERMET, was a better alternative than using the observed mixing height from the field studies."*

Response: The mixing height data in these experiments were not documented, so the source of the data is unclear.

b. *The predicted mixing height was compared to the mixing height from what station?*

Response: The station was not documents and is unknown.

c. *Please provide the equation referred to in the last sentence.*

Response: No clarification is necessary on this request.

11. *Please confirm that Case 1 in the December 2010 evaluation document has been selected by Shell and will be used in its over water modeling analysis.*

Response: No clarification is necessary on this request.

12. *Please provide a CD containing the evaluation files including all input and output files, spreadsheets, code...etc.*

Response: A CD has been provided to EPA with the requested information.

13. *Shell has completed an alternative model demonstration under Section 3.2.2.e in Appendix W of 40 CFR 51 and intends to use the model in its project specific ambient air quality impact analysis. R10 will public notice of the use of the model as well as make the all relevant materials available to the public for review and comment. To facilitate public understanding, Shell is requested to provide a glossary of terms that includes at a minimum, the below technical terms and/or acronyms. It is suggested that the glossary include a write definition in layman terms followed by a formula, if appropriate.*

    The terms and/or acronyms include:

    Absolute humidity
    Bulk Richardson number
    COARE bulk air-sea flux
    Convective mixing height
    Convective velocity scale
    Cool skin
    Critical Richardson number
    Dew point
    Empirical relationships
    Friction velocity or u%
    Marine boundary layer
    Monin-Obukhov length
    Relative humidity
    Sea surface temperature
    Shoreline fumigation
    Similarity theory

Skin temperature
Stable boundary layer height
Stable mixing height
Surface energy fluxes
Surface Rossby number
Surface roughness length
Vertical potential temperature gradient
Virtual potential lapse temperature
Virtual temperature
Warm layer
Well-developed or deep sea
Wet bulb temperature

Response: No clarification is necessary on this request.