UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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MEMORANDUM

TO: Dean Wilson (MD-14)
Model Clearinghouse

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SUBJECT: Review of ASARCO Modeling Protocol

The Montana Air Quality Bureau (MAQB) has submitted the latest version of the ASARCO East Helena Lead SIP modeling protocol, which is dated December 4, 1990. A copy of this protocol was sent to Joe Tikvart on December 30, 1990. In this revised protocol, ASARCO has attempted to address the remainder of the outstanding issues regarding previously submitted modeling protocols, which Region VIII initially raised in its letter to the State of July 30, 1990 (the "initial 25 issues"). Also, in this protocol ASARCO has attempted to address the issues discussed during the October 24, 1990 meeting with EPA (Region VIII and Headquarters) and the MAQB. In addition, the MAQB, in their cover letter of December 11, 1990, has requested EPA's position on four items raised at the October 24, 1990 meeting with EPA.

This review of the above-referenced protocol will concentrate on three aspects: (1) the four issues discussed by the MAQB in their cover letter of December 11, 1990, (2) additional new issues that have surfaced as a direct result of ASARCO's latest revision to the protocol, and (3) outstanding issues remaining from the "initial 25 issues". This review incorporates the comments that you and Laurie Ostrand provided to us during a series of conference calls held during the weeks of January 21 and January 28, 1991, and the comments that you provided in draft form and by telephone on February 4, 1991. We appreciate your assistance in reviewing this latest modeling protocol, and request your review/concurrence with Region VIII's response to these various issues. Unless you notify us of additional concerns with this memorandum, or with the modeling protocol, before February 13, 1991, we will assume that this memorandum addresses the issues and concerns of EPA (Region VIII and Headquarters) and will transmit these comments to the State.

Items Discussed by the MAQB in their cover letter of December 11, 1990:

Item 1. The use of two surface wind sites for low level emissions.

Region VIII response:

The protocol appears to adequately address the use of two different 10 meter surface meteorological stations. The Kennedy Park site will be used for wind speed, wind direction for sources with stack and release heights less than 35 meters, and sigma theta measurements for stability calculation. When nighttime drainage winds last for 3 hours or more, and the drainage is between 150 and 210 degrees, the wind speed, wind direction and sigma theta measurements for stability from the Old Railroad site will be used for all types of sources which have stacks and release heights less than or equal to 35 m. However, Table 4 on page 44 of the protocol contains typographical errors. The two entries in the column labeled "stack height" for point sources need to read "(h<35)" rather than "(35<h)".

Item 2. The dual-boom data selection criteria for mid-stack level wind data.

Region VIII response:

The proposal in the December 4, 1990 protocol to use one-minute averages to compute wind direction from the 35 meter level of the zinc stack appears to be acceptable. If the wind is between, but not including, 164 and 344 degrees, the west boom will be used. Otherwise, the east boom will be used for that minute. If the west boom direction is 164 +/- 1 degree, or 344 +/- 1 degree, the boom from which the wind direction was selected from the previous minute will be used. Note that statement #4 on page 11 is in error when referring to sigma theta measurements. Sigma theta values for calculating stability should only be used when collected from the 10 meter level at either the Kennedy Park or Old Railroad sites; they do not need to be calculated from the 35 m level of the zinc stack.

Item 3. The sigma theta algorithm for converting one-minute data into hourly data.

Region VIII response:

EPA agrees with the methodology proposed in the protocol to convert its recorded one minute sigma theta averages to four 15-minute sigma theta averages, which are then computed using the root mean square average as per the EPA "Guideline on Air Quality Models". Note that this method is not the standard procedure of averaging all 3600 one-second values into four 15-minute averages. EPA agrees to allowing this deviation in this case due to the limited memory space in the two ASARCO 10 meter tower data loggers.

Item 4. The twenty meter minimum mixing depth.

Region VIII response:

EPA cannot approve the proposal in the December 4, 1990 protocol to use 20 meters as a minimum mixing height. The protocol does not provide technical justification for this "carte blanche" change to the model, other than to discuss small terrain features in and around the smelter. There is no discussion as to which meteorological conditions the substitute 20 meter mixing depth applies to. If it were to be applied to stable conditions (i.e. E and F stability), this would require a change in the ISC FORTRAN code which has 'unlimited' mixing of 10,000 meters built into the code. The effect of limiting a mixing height to 20 meters would cause the models to calculate large contributions from area and low level volume sources while causing stack plumes not to touch down, resulting in a zero contribution from stack emissions. Therefore, as stated in EPA's letter of November 6, 1990, it is EPA's position that mixing heights calculated from the RAMMET or MPRM meteorological preprocessor must be used in the analysis. If obvious discrepancies in the predicted dispersion modeling concentrations appear due to using the EPA guideline mixing height calculations, EPA may entertain a correction method. ASARCO would have to identify the days on which these discrepancies appear, and provide supporting information. Note that EPA is not giving blanket approval to the methodology proposed by ASARCO for correction of the mixing height calculations; the method to be used would be decided upon at the time that the discrepancies are presented to EPA.

Additional New Issues Surfacing as a Direct Result of the Latest Revision to the Modeling Protocol:

1. Page 3 states that stacks greater than 35 meters will be modeled with the VALLEY model to address impacts in complex terrain. It is EPA's policy that all buoyant stack emissions be modeled as point sources with VALLEY or COMPLEX I for the complex terrain analysis, not just stacks greater than 35 meters. In the complex terrain analysis, only area and volume sources should be modeled with ISCLT or ISCST. Also, at this time there is no information available to EPA on the height of all stacks at ASARCO. It is EPA's understanding that this information is being obtained for the emission inventory work, and should be included in the March, 1991 report.

2. The second paragraph on page 4, along with Table 4, states that wind data from the 117 meter level will be used to model the stacks using the VALLEY and ISCLT models. This is incorrect. VALLEY and ISCLT modeling must use the same meteorological sites and observation levels as is described in Table 4 for the COMPLEX I and ISCST modeling. Page 4, and the top of Table 4, should be corrected.

3. The third paragraph on page 4 states that a second similar grid will be centered about 6 km southwest of the smelter for the VALLEY model. Figure 1a on page 24 also depicts this concept. This is incorrect. The smelter facility will have to remain near the center of the VALLEY grid system. To address a different receptor spacing with VALLEY, the GRID option in VALLEY is the correct method to employ.

4. The protocol states on page 5 that the highest nearby terrain feature is about 5470 feet MSL, 8.5 km from the blast furnace stack. This statement is misleading. Note that 6.5 km away, in Section 19, Range 2 West, Township 9 North, there is elevated terrain of 4640 feet MSL, which is above the highest expected blast furnace plume rise of 4630 feet (during stable conditions). There are other terrain features to the south of the plant which also exceed the final stable plume rise, and are closer than 8.5 km.

5. The postprocessor program described on page 5 for comparing VALLEY and ISCLT concentrations, or COMPLEX I and ISCST concentrations, in intermediate terrain must be reviewed and approved by EPA before it can be applied. Note that this evaluation of the concentrations at each receptor must be made for each of the wind speed, wind direction, and stability categories within the quarterly STAR deck.

6. The protocol states on pages 6, 7, 15, 16, and 17 that, "if it is clearly evident that the dispersion model results are inconsistent with the majority of the physical data (does not reconcile) and cannot be made consistent through justifiable modifications, the model which best represents physical reality will be used as the basis for control strategy development." This statement appears to be inconsistent with the agreement reached during the October 24, 1990 meeting and outlined in EPA's November 6, 1990 letter, and indicates that EPA needs to clarify its position on the use of dispersion modeling for the East Helena Lead SIP as follows:

> The EPA guideline dispersion models must first be utilized for all modeling runs through the reconciliation process, as per the "Protocol for Reconciling Differences Among Receptor and Dispersion Models" (EPA-450/4-87-008). During the reconciliation process, justified changes may be made in the emission inventory or the CMB analysis to help the dispersion and CMB models reconcile. Note, however, that as stated in the November 6, 1990 letter, the reconciliation process should not include changes to the dispersion model or changes to meteorological inputs to the model. (This does not preclude justifiable modifications to the input data which have been approved by EPA as part of the modeling protocol prior to the initial modeling.)
>
> As agreed to in EPA's letter of March 8, 1990, the initial reconciliation process should be performed using, as a minimum, data from the 3rd and 4th quarters of 1990; the data from the first two quarters of 1991 should then be used for "model verification". However, as stated in that letter, we believe that it is important, if at all possible within the schedule, to include ambient data from the first quarter in 1991 in the receptor modeling analysis and reconciliation process. Once the initial reconciliation effort is completed in the spring of 1991, the State and EPA can determine whether or not the models (dispersion and CMB) can be reconciled. At that point, we will discuss further whether a performance evaluation is necessary.

The inconsistent statements in the modeling protocol should be modified to reflect EPA's position, as is stated above and in EPA's letter of November 6, 1990.

7. Archived filters for the CMB analysis should be refrigerated, as stated on page 6. However, EPA also

recommends that the filters be stored in an air-tight condition, as well as refrigerated, to suppress lead oxidation.

8. The emission inventory described on page 8 as "(c) a compliance year 1993 emission inventory of allowable daily lead emissions to demonstrate the adequacy of the control strategies" should include the effects of the Superfund remedial cleanup activity in the town of East Helena. It is not certain that cleanup activity will be completed by the compliance year, therefore the protocol should state that these emissions will be estimated and included in compliance year modeling.

9. The third paragraph on page 9 should state that ISCLT will also be included in Table 4, which describes the meteorological data sets.

10. The first sentence on page 11 and the first paragraph on this page refer to sigma theta measurements and calculations from the 35 meter level. Sigma theta for stability is only used in the modeling when it is collected from the 10 meter levels.

11. The fourth paragraph on page 11 states that "If when studying an individual day, it becomes apparent that the Great Falls surface temperature yields a mixing depth that causes significant over or underprediction, then Helena NWS surface temperature or on-site data may be substituted on a day-by-day basis. Such substitution will be supported with on-site temperature measurements and documentation on synoptic conditions." As stated earlier, any modification of mixing heights would require EPA approval on a day-by-day event basis. Note that EPA is not giving blanket approval to the methodology proposed by ASARCO for correction of the mixing height calculations; the method to be used would be decided upon at the time that the discrepancies are presented to EPA.

12. In the GEP Stack Height paragraph on page 12, the last two sentences should be replaced with the following: "The GEP stack height can be determined by using a formula presented in the stack height regulation, or by using appropriate field or fluid modeling studies, or by assuming the de minimis level of 65 meters. For this study, actual stack heights will be used for model reconciliation, and the lesser of the EPA-approved GEP stack height or actual stack height will be used for compliance modeling. To date, EPA has not approved the field study, completed to demonstrate GEP stack height of the blast furnace stack, as meeting the requirements of the 1985 stack height rules; therefore, ASARCO will either demonstrate that the previous field study

did meet the 1985 stack height rules, complete a fluid model or another field study to demonstrate the GEP stack height, or use the formula height or de minimis stack height of 65 meters."

13. On page 13, the second paragraph mentions "the highest C values". The variable "C" must be defined; Region VIII assumes that this means concentration. If this is true, then the second paragraph is correct.

14. On page 15, the second paragraph states that "The reconciliation process is an iterative process in which the two model results are compared, evaluated, modified and compared again until all possible modifications and corrections are made." The protocol should state that the term "modified" can only apply to CMB/filter analysis and emission inventory data, and not to the dispersion model itself.

15. The first paragraph on page 16 states that "whatever modifications are decided upon, technical justification will be provided". This is only acceptable before modeling starts and must have EPA approval prior to implementation. Modifications which would deviate from the "Guidelines on Air Quality Models" would require an Interim Procedures (performance evaluation) analysis.

16. In the first paragraph on page 17 it is stated, in reference to the initial base modeling case, that "If the (air quality) estimates are below the standard, compliance will have been demonstrated." This is not true. Ambient monitoring data takes precedence over modeling predictions. The continued monitored violations of the lead NAAQS in East Helena demonstrate that the area is not in compliance, therefore, this sentence must be deleted from the final protocol.

17. Table 3 on page 42 omits volume source point 13V - Dross Plant.

18. In a January 21, 1991 letter from TRC to John Coefield of the MAQB (see Attachment), corrections were listed to the previously-reported heights of the meteorological data stations on the zinc stack and the plant yard tower. These errors were discovered as a result of the December meteorological network audit. As a result, all references to the 117 meter level of the zinc stack should refer to 103 meters, and the plant yard upper temperature level should be 11 meters, rather than 8 meters. This requires corrections to pages 9, 10, Figures 3 and 4, and Table 4 of the protocol.

Remaining Issues from the "Initial 25 Issues":

EPA has reviewed the December 4, 1990 revised modeling protocol with respect to the 25 issues raised in EPA's letter of July 30, 1990. The following comments discuss the remainder of these 25 issues which were not properly addressed in the latest protocol, and which have not already been addressed in this memorandum. Note that each remaining issue from the July 30, 1990 letter is repeated for clarity.

Issue 1. "ASARCO's October 17, 1990 proposal to first model the complex terrain with the EPA VALLEY model using a quarterly STAR deck is acceptable. However, some additional information must be included in the protocol to assure that this effort will meet Region VIII requirements. The additional information is described below.

One method of modeling in complex terrain is to use VALLEY for the point sources and the ISCLT model for the area and volume sources. The ISCLT model must be executed in the flat terrain mode for these sources with receptors at the distances corresponding to the area of concern (the distance and direction to plume impaction) identified in the VALLEY complex terrain analysis. Intermediate terrain, impacted by the stack emissions will be modeled by both VALLEY and ISCLT for each of the STAR deck stabilities and wind speed categories, and the higher of the two predicted concentrations will be the value used as the correct concentration for that receptor. Therefore, the total lead concentration in the intermediate terrain is the higher of ISCLT or VALLEY point source impact plus the ISCLT area and volume source impacts at the specific receptors. The guidance for application for intermediate terrain is found in the "Guidelines on Air Quality Models" (EPA 450/2-78-027R) on page 5-4 Section 5.2.1. In addition, the intermediate terrain concentrations from both models is best handled by a post processor. This post processor must be deemed satisfactory by Region VIII prior to its use.

Another method of modeling in the complex terrain is to use the EPA COMPLEX 1 model for point sources and the ISCST model for area and volume sources. COMPLEX 1 does not allow the use of quarterly STAR deck meteorological data. Therefore, when running COMPLEX 1 and ISCST, ASARCO must use hourly meteorological data. Complex terrain impacts from area and volume sources, which cannot be analyzed with COMPLEX 1, as proposed by ASARCO, must be modeled with ISCST. It requires that

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the ISCST model be run in a flat terrain mode for the area and volume sources with receptors at the distances corresponding to the area of concern (the distance and direction to plume impaction) identified in complex terrain. To address the intermediate terrain impacted by the stack emissions, both ISCST and COMPLEX 1 will have to be run on an hourly basis and the higher of the two predicted concentrations used as the concentration for that receptor.

It is indicated in ASARCO'S response to Issue #1 that if the dispersion model and CMB cannot be reconciled, the CMB/filter analysis will be used to determine compliance. This is an incorrect application of reconciliation. Before defaulting to CMB only, a performance evaluation needs to be completed to demonstrate that dispersion modeling is not appropriate in this particular situation.

Reconciliation, without a performance evaluation, is not allowed for the changing of meteorological data or the dispersion model inputs, which are not part of the regulatory default option in the "Guidelines on Air Quality Models." The application of non-regulatory default options renders the model as nonguideline, and requires a performance evaluation in accordance with the "Interim Procedures for Evaluating Air Quality Models (Revised)," EPA 450/4-84-023."

Region VIII response based on 12/4/90 protocol:

When using a quarterly STAR deck, the VALLEY model is to be used for all buoyant point sources. ISCLT will be used for all area and volume sources. Asarco's concept to model only stacks greater than 35 meters with VALLEY is incorrect. All buoyant point sources are to be modeled with VALLEY. The receptor grid described for VALLEY is incorrect. In order to locate a receptor on the location of the highest concentration, the GRID value in VALLEY needs to be adjusted. The center of the VALLEY grid should not be moved away from the smelter. Figure 1a on page 24 is incorrect. The proposed concept for a second grid 6 km southeast of the smelter is incorrect. On page 5 of the December 4, 1990 protocol, the discussion regarding the second level complex terrain screening is incorrect. All buoyant point sources must be modeled with COMPLEX I. All volume and area sources must be modeled with ISCST.

Finally, the discussion of the complex terrain modeling on pages 3 and 4 of the protocol is extremely ambiguous. For example, it states on page 3 that "for the four stacks with heights above 35 meters, the concentration from VALLEY will

be used to assess compliance for all receptors above plume top". This statement is incorrect. VALLEY is only being used to predict impact from buoyant point sources. For these receptors above plume top, concentrations from VALLEY plus area and volume source impacts from ISCLT must be used to assess compliance. This discussion in the protocol must be rewritten to explicitly state how the VALLEY and ISCLT models, and the COMPLEX I and ISCST models, will be used.

Issue 5. "Discrete receptors are a valid technique with COMPLEX I. ASARCO must describe the COMPLEX I discrete receptor grid and how it will interface with the ISCST receptor grid. The information provided to date needs more explanation. Additionally, ASARCO also needs to describe how the VALLEY receptors, which are radial, will interface with the rectangular receptor network used in the rest of the analysis."

Region VIII response based upon 12/4/90 protocol:

The Complex I and ISCST receptor grids for the complex terrain analysis should reflect the new corrections to the VALLEY and ISCLT grid as referred to in Issue 1, above.

Issue 25B "Region VIII does not agree with the ASARCO response. ASARCO will have to place receptors at locations considered ambient air; where access is not precluded to the public. (See attached EPA Ambient Air Package)."

Region VIII response based on the 12/4/90 protocol:

The protocol does not provide the appropriate receptor density on ASARCO plant property where public access is not precluded (Figure 1b on page 25). The receptor density for the town of East Helena is correct and this same density should be applied to the ambient air on Asarco property where the public has access.

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