



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

DEC 22 2015

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Model Clearinghouse Review of the Use of the Ambient Ratio Method 2 (ARM2)
Default AERMOD Option for Hankook Tires Facility NO₂ Ambient Impact
Analysis

FROM: George Bridgers, Model Clearinghouse Director *George M. Bridgers*
Air Quality Modeling Group, C439-01

Chris Owen, Physical Scientist *Chris C. Owen*
Air Quality Modeling Group, C439-01

TO: Todd Rinck, Chief
Air Data and Analysis Section, Region 4

Stanley Krivo, Environmental Scientist
Air Data and Analysis Section, Region 4

INTRODUCTION

In response to your November 20, 2015 concurrence request memorandum, the Model Clearinghouse has reviewed Region 4's position on the proposed use of the Ambient Ratio Method 2 (ARM2) technique for the Hankook Tires facility project in Clarksville, TN. The ARM2 technique would be used as a Tier 2 approach to determine NO/NO₂ speciation in lieu the default Tier 2 approach, ARM, which assumes a fixed amount of conversion. As noted in your memorandum, the facility and the ambient environment in the area of the facility appear to have several features that make it appropriate for the usage of ARM2, as outlined in the September 20, 2014 EPA clarification memorandum (U. S. EPA, 2014). Mainly that the NO₂/NO_x in-stack ratio (ISR) is likely to be well below 0.2. Additionally, the background ozone is not high enough to cause concern for excessive NO-to-NO₂ conversion, which would cause ambient NO₂/NO_x ratios to increase rapidly. Therefore, the use of ARM2 should be appropriate in the required ambient impact assessment for this specific application.

MODEL CLEARINGHOUSE RESPONSE

The Model Clearinghouse concurs with Region 4's position that ARM2 is an appropriate technique for modeling NO₂ impacts from the Hankook Tires facility project. We agree that the

facility meets the requirements for the usage of ARM2 set forth in the September 20, 2014 EPA clarification memorandum. The ARM2 technique can be used to model a variety of sources, provided that they meet certain minimum criteria to insure that the model results are appropriately conservative relative to a more refined Tier 3 technique (i.e., the Ozone Limiting Method, or OLM, and the Plume Volume Molar Ratio Method, or PVMRM). As noted in your memorandum, a review of the EPA's NO₂/NO_x ISR Database was conducted for natural gas boilers to determine representative ISR from reported similar sources. The database contained 42 natural gas fired boilers, which had a maximum ISR for natural gas fired boilers of 0.1579. Based on the information provided to date, we believe the minimum ambient NO₂/NO_x ratio of 0.20 is appropriately conservative for this proposed Hankook Tires facility project.

First, we note that use of the ARM2 technique meets the 5 criteria of condition 3 for accepting an alternative model as outlined in section 3.2.2(e) of Appendix W. Specifically:

- i. ARM2 has been peer reviewed (Podrez, 2015);
- ii. ARM2 is applicable to the problem on a theoretical basis when an appropriate minimum ambient ratio is considered;
- iii. The databases necessary to perform an analysis with ARM2 are identical to those that are required for those that are required to run AERMOD in general and are thus available and adequate;
- iv. Appropriate model performance evaluations have been performed (Podrez, 2015; U. S. EPA, 2014); and,
- v. A protocol for application of ARM2 was submitted to the appropriate reviewing authorities.

Second, U. S. EPA, 2014, which provides guidance on the application of the ARM2 technique, outlined several considerations that should be taken into account when applying ARM2. These recommendations included evaluations of the maximum NO_x impacts, considerations of the background NO₂, an evaluation of the source's NO₂/NO_x ISR, and an accounting of the background ozone. The context of these recommendations was a comparison of source impacts as determined by ARM2 (using a minimum ambient ratio of 0.2) against the impacts determined by PVMRM using the recommended default ISR of 0.5 when no reliable information is available for a source. The 2014 clarification memorandum suggested that minimum ambient NO₂/NO_x ratios from the Tier 3 methods (OLM and PVMRM) are driven by the source's ISR. As such, the default ARM2, with a minimum ambient ratio 0.2, corresponds to a source with an ISR of 0.2 rather than the ISR of 0.5 recommended as the default ISR. When a source is expected to have an ISR less than 0.2, as is the case with Hankook Tires facility, then the current implementation of ARM2, with a minimum ambient ratio of 0.2, should be appropriately conservative relative to a Tier 3 equivalent modeling demonstration. In this case, an alternative model request based on AERMOD 14134 would need to only provide an adequate demonstration of the source's ISR as well as any other sources in the immediate vicinity (see discussion of ISR of nearby sources in U. S. EPA, 2014).

An additional point related to ARM2 alternative model approval requests that is not specific to this Hankook Tire facility project is that the EPA has proposed regulatory changes to the *Guideline on Air Quality Models* (Appendix W to Part 51), including a new version of

AERMOD, since U. S. EPA, 2014 was issued.. If promulgated, the new version of AERMOD and Appendix W would include ARM2 as a regulatory default option, requiring no alternative model approval. As proposed, the ARM2 option in AERMOD would have a default minimum ambient NO₂/NO_x ratio of 0.5, to match the proposed recommended default ISRs for OLM and PVMRM. Based on the Appendix W proposal, an ARM2 alternative model request proposing to use a minimum ambient NO₂/NO_x ratio of 0.5 should not need any additional justification. However, it should be emphasized that if a source is known or suspected to have ISRs greater than this proposed regulatory default, then the higher ratio should be considered in any impact analysis. If the OLM and PVMRM approaches were to be used for such a source, the stacks with higher ratios should not model at the lower default ISR. Similarly, the use of ARM2 should not ignore the implications of having sources with ISR greater than 0.5.

REFERENCES

U. S. EPA, 2014, “Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO₂ National Ambient Air Quality Standard”, U.S. EPA, Research Triangle Park, NC.

Podrez, M., 2015, An update to the ambient ratio method for 1-h NO₂ air quality standards dispersion modeling. *Atm. Env.*, 103, 163-170.

cc: Richard Wayland, C304-02
Anna Wood, C504-01
Tyler Fox, C439-01
Raj Rao, C504-01
EPA Air Program Managers
EPA Regional Modeling Contacts