



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

APR 28 2016

**MEMORANDUM**

OFFICE OF  
AIR QUALITY PLANNING  
AND STANDARDS

SUBJECT: Model Clearinghouse Review of the Use of the Ambient Ratio Method 2 (ARM2)  
Default AERMOD Option for Indorama Facility NO<sub>2</sub> Ambient Impact Analysis

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**INTRODUCTION**

In response to your April 27, 2016 concurrence request memorandum, the Model Clearinghouse has reviewed Region 6's position on the proposed use of the Ambient Ratio Method 2 (ARM2) technique for the Indorama facility project in Westlake, Louisiana. The ARM2 technique would be used as a Tier 2 approach to determine NO/NO<sub>2</sub> 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 30, 2014 EPA clarification memorandum (U.S. EPA, 2014). Mainly that the facility full conversion NO<sub>2</sub> impacts are well below the threshold values given in the 2014 clarification memo (150-200 ppb). Additionally, the background ozone is not high enough to cause concern for excessive conversion of NO to NO<sub>2</sub>, which would cause ambient NO<sub>2</sub>/NO<sub>x</sub> 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 6's position that ARM2 is an appropriate technique for modeling NO<sub>2</sub> impacts from the Indorama facility project. We agree that the facility meets the requirements for the usage of ARM2 set forth in the September 30, 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 NO<sub>2</sub>/NO<sub>x</sub> 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. ISR information for the other on-site emission sources was not readily available in EPA's ISR Database. Based on the information provided to date, including the percentage of the Indorama facility's short-term emissions accounted for by the boilers (> 60%) and the anticipated ISR for the boilers (< 0.20), we believe the minimum ambient NO<sub>2</sub>/NO<sub>x</sub> ratio of 0.50 is appropriately conservative for this proposed Indorama 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<sub>x</sub> impacts, considerations of the background NO<sub>2</sub>, an evaluation of the source's NO<sub>2</sub>/NO<sub>x</sub> 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. This comparison showed that ARM2 would predict ambient impacts that are appropriately conservative regardless of the ISR of the primary source if the source's total conversion modeled NO<sub>x</sub> impacts were below a threshold of 150-200 ppb. In the case of the proposed Indorama facility, the full conversion impacts are well below this threshold (i.e., design value of 68 ppb) so the implementation of ARM2 should be appropriately conservative. Therefore, the alternative model request based on AERMOD 15181 needs only to demonstrate that the Tier 1, full conversion, impacts are less than the 150-200 ppb threshold with no additional requirement to document the source's ISR, though it is preferred. Indorama did provide additional ISR information and chose a conservative minimum ambient ratio of 0.5 based on ISRs anticipated for the facility's emission sources.

An additional point related to ARM2 alternative model approval requests that is not specific to this Indorama 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 NO<sub>2</sub>/NO<sub>x</sub> 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 NO<sub>2</sub>/NO<sub>x</sub> 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 NO<sub>2</sub> 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 NO<sub>2</sub> air quality standards dispersion modeling. *Atm. Env.*, 103, 163-170.

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