Docket ID No. EPA-HQ-OAR-2013-0146

Table of Contents

[I. Summary 2](#_Toc422385754)

[II. Comments 2](#_Toc422385755)

[Overview of Comments on the Nitrogen Dioxide REA Planning Document 2](#_Toc422385756)

[Chapter 1: Introduction 3](#_Toc422385757)

[Chapter 2: Air Quality and Health Benchmark Comparisons 4](#_Toc422385758)

[Chapter 3: Human Exposure Assessment 6](#_Toc422385759)

[Chapter 4: Human Health Risk Assessment 8](#_Toc422385760)

[Chapter 5: Summary of Conclusions and Next Steps 9](#_Toc422385761)

[III. References 11](#_Toc422385762)

# I. Summary

On May 13, 2015, the United States (U.S.) Environmental Protection Agency (EPA) published in the *Federal Register* a notice of availability of the document entitled “Review of the Primary National Ambient Air Quality Standards for Nitrogen Dioxide: Risk and Exposure Assessment Planning Document”. (EPA-452/D-15-001). The Texas Commission on Environmental Quality (TCEQ) provides the following comments on this REA planning document.

# II. Comments

### Overview of Comments on the Nitrogen Dioxide REA Planning Document

In the following comments on the EPA’s REA planning document, the TCEQ will address nitrogen dioxide (NO2) health benchmarks for risk assessment, as well as air quality monitoring and air quality modeling used for the proposed exposure assessment. The conclusions are as follows:

* TCEQ agrees that the data on the health effects of NO2 have not substantially changed since the last REA. We also agree that there is evidence for a causal relationship between short-term NO2 exposure and respiratory effects in asthmatics. Data based on the effects of NO2 exposure measured during controlled human exposure studies can and should be used for a human health risk assessment. On the other hand, the uncertainties in the epidemiology studies (exposure measurement error, confounding, etc), makes these data unsuitable for deriving a risk assessment.
* The EPA proposes to obtain modeled concentrations at varying distances from a road to develop on-road simulation factors based on either road-side or away-from-road concentrations. The TCEQ is concerned that the influential factors (such as temporal variability, traffic flow, temperature and meterology) of the study areas used to derive these factors will not be the same for all areas of the country and should not be used to develop national factors.
* The TCEQ thinks that monitoring data obtained from the near-road NO2 monitoring network, designed to measure NO2 concentrations near heavily-trafficked roadways, will help address some of the uncertainties in previous assessments. In fact, monitoring data collected in Texas do not support a large difference in NO2 concentrations measured near roadways compared to concentrations measured farther away from those roads.
* The TCEQ urges the EPA to be cautious with the modeling used in their NO2 exposure assessment, and to carefully consider the uncertainties in the models. Each model and approach has individual and collective uncertainties. Results derived from certain models used to provide input into other models could confound results in the last model in the series. For example, it is not well known how uncertainty related to the use of MOVES, AERMOD, and finally APEX affects the results of studies and analyses that would be used to set the NAAQS. [EPA Motor Vehicle Emission Simulator (MOVES), American Meteorological Society/EPA Regulatory Model (AERMOD), Air Pollutants Exposure (APEX) model].
* The TCEQ thinks an updated exposure assessment may be warranted when enough data from recently deployed NO2 near-road monitors becomes available. If any significant updates are made to the air quality analysis and/or exposure assessment, it may be necessary to determine how or if these updates will affect the risk assessment.

### Chapter 1. Introduction

#### Section 1.3 Key Considerations in the Current Review

*1. “The evidence supports “a causal relationship between short-term NO2 exposure and respiratory effects” and the “strongest evidence is for effects on asthma exacerbation” (EPA 2015a, Table 1-1, pp. 1-19). Key supporting evidence for these conclusions comes from controlled human exposure studies of airway responsiveness and from epidemiologic studies of asthma-related hospital admissions, emergency department visits, and respiratory symptoms (EPA 2015a, section 1.5.1)” (EPA 2015b).*

TCEQ Comment:

Evidence that has become available since the last REA has not substantially changed our understanding of health effects related to NO2 exposure. The TCEQ thinks the information from controlled human studies should be weighted more heavily than information from the epidemiological studies in the risk assessment. As noted in previous comments by the TCEQ (EPA-HQ-ORD-2013-0232-0039), the TCEQ agrees that controlled human exposure and animal toxicological studies can provide direct evidence for health effects related to NO2 exposure. With regard to effects from short-term exposure to NO2, TCEQ agrees with the causal determination between short-term NO2 exposure and increased airway responsiveness in asthmatics for concentrations at or above the current 1-hour NAAQS of 100 ppb, based on evidence from controlled human and animal studies and to a limited extent, epidemiological studies. Evidence for causal associations between other respiratory effects and short-term exposure to NO2 concentrations is inconsistent, weak, or limited to high exposure concentrations.

*2. “The evidence “indicates there is likely to be a causal relationship between long-term NO2 exposure and respiratory effects” (US EPA 2015a, section 1.5.1, pp. 1-21 and 1-21) and the “strongest evidence is for effects on asthma development” (EPA 2015a, Table 1-1). Key supporting evidence comes from epidemiologic cohort studies reporting associations between long-term ambient NO2 concentrations (i.e., averaged over 1−10 years) and asthma incidence in children. Support for the biological plausibility of effects attributable to long-term exposures is provided by “a small body of experimental studies” (US EPA 2015a, Table 1-1)” (EPA 2015b).*

TCEQ Comment:

With regard to respiratory effects caused by long-term exposure to NO2, in the absence of more conclusive evidence from controlled exposure studies in humans or animals, TCEQ does not agree that the evidence indicates there is likely to be a causal relationship between long-term NO2 exposure and respiratory effects and that the strongest evidence is for effects on asthma development. EPA continues to use ecological epidemiology studies to support causal associations between NO2 exposure and certain health endpoints. Key uncertainties (exposure measurement error, confounding, etc) remain regarding the associations produced using this type of epidemiology study.

*3. “For all other health endpoints evaluated, the evidence is either “suggestive, but not sufficient, to infer a causal relationship” or “inadequate to infer a causal relationship” (US EPA 2015a, section 1.5.2)” (EPA 2015b).*

TCEQ Comment:

TCEQ agrees that available evidence do not support an association between NO2 exposure and other health endpoints.

### Chapter 2: Air Quality and Health Benchmark Comparisons

**General Comments:**

The TCEQ does not see the need to simulate a situation where NO2 concentrations “just meet” the existing annual and 1-hour standards in the REA. The effects of meeting the current standards are precisely represented by the current ambient NO2 concentrations, and the only outcome of generating a “just meets” situation is the inflation of perceived health effects of tightening the standards further.

The TCEQ has significant concerns with the EPA’s plan to develop factors to simulate on- and near-road ambient air concentrations based on information from the types of NO2 measurement and modeling research studies described in the REA planning document (EPA 2015b).

In the REA planning document, the EPA discusses approaches based on various new or existing studies to support the development of factors to simulate on-road concentrations from existing near-road monitor data. For example, the REA planning document references two new modeling studies that could inform the characterization of ambient NO2 concentrations around roadways in the current review (Thurman et al. 2013 and Kimbrough et al. 2013). The EPA proposes to obtain modeled concentrations at varying distances from a road to develop on-road simulation factors based on either road-side or away-from-road concentrations. In addition, the EPA would determine what it calls “influential meteorological and other factors” that could affect the relationship between road-side and away-from-road concentration, such as wind speed and direction, mixing heights, and the presence of stationary sources.

The TCEQ is concerned that the influential factors of the two study areas (Broward County, Florida and Las Vegas, Nevada) will not be the same for all areas of the country and should not be used to develop national factors. For example, traffic-emitted air pollutants can have significant temporal variability due to traffic activity patterns such as rush hour peaks, differences in weekend traffic flow, meteorology, and emission profiles that vary with temperature. These effects would not be captured by static exposure estimates based on parameters such as proximity to roadway, traffic intensity, and lane use.

The EPA is considering several approaches to develop simulation factors. One approach would assume that recent near-road ambient monitored NO2 concentration areas provide a reasonable approximation of on-road NO2 concentrations. In another approach, the EPA could develop a set of on-road simulation factors using information from one or more of the following sources: 1) ratios of on-road to away-from-road concentrations, based on available measurement data from research studies; 2) a statistical/fitted model using available measurement-based near-road transect study data; or 3) air quality model based on on- and near-road transect study concentrations.

The TCEQ would not dispute that traffic-related air pollutant concentrations are generally highest near major roadways and that it is costly to conduct the roadway and core-based statistical area monitoring necessary to obtain long-term on-road NO2 measurements. While modeled exposure metrics can be simple to generate, have minimal data requirements, and reduce monitoring costs, the TCEQ has continuing concerns related to modeled estimates of on- or near-road ambient NO2 concentrations and site-specific measurement studies that do not adequately represent on- and near-road ambient concentrations, and thinks that it is inappropriate to develop or apply one or more factors that would be used to estimate on-road concentrations nationally.

**Specific Comments:**

#### Section 2.1 Overview of the Assessment from the Last Review

*“At the time of the last review, EPA focused portions of the air quality analyses on characterizing NO2 concentrations occurring on roads and in near-road environments. According to the EPA analyses, mobile sources were the largest contributors to total annual NOX emissions in the United States (EPA 2008, section 2.2.1) and monitor-based research studies had demonstrated large gradients in ambient NO2 concentrations around major roadways, with higher concentrations occurring closer to roads and lower concentrations occurring farther away from those roads (EPA 2008, sections 2.5.3.2, 2.5.4). Because the ambient monitoring network present at the time of the last review was not designed to systematically measure NO2 concentrations near the most heavily trafficked roadways, the 2008 Risk and Exposure Assessment (REA) simulated ambient NO2 concentrations on-/near-roads using information from monitoring studies published in the scientific literature.” (EPA 2015b).*

TCEQ Comment:

The TCEQ thinks that monitoring data obtained from the near-road NO2 monitoring network, designed to measure NO2 concentrations near heavily-trafficked roadways, will help address some of the uncertainties in previous assessments. As described in Section 2.1.2 (EPA 2015b), many of the uncertainties in previous assessments were due to assumptions used to model predicted exposure concentrations. Actual monitoring data will help determine if inputs used in exposure models are accurate, and whether the predicted ambient concentrations reflect measured ambient concentrations. In fact, monitoring data collected in Texas do not support a large difference in NO2 concentrations measured near roadways compared to concentrations measured farther away from those roads. In the Houston and Dallas-Fort Worth-Arlington MSAs from January 2014 to April 2015, for example, the highest daily 1-hour maximum concentrations were measured at the Houston East site (located more than 200 meters from a large roadway) and the Fort Worth Northwest site (located over two miles from a large roadway).

##### Section 2.2.3 Preliminary Conclusions

*“Based on the information discussed above, we have a substantially improved body of information available in the current review to inform an updated characterization of 1-hour NO2 concentrations around roadways (section 2.2.1). In particular, data from recently deployed NO2 monitors near major roads, combined with new information from monitoring and modeling studies of NO2 concentration gradients around roads, will substantially improve our understanding of ambient NO2 concentrations in the on-road and near-road environments. This new information is expected to provide important perspective, beyond what is available from the last review, on the extent to which NO2 exposures on and near roads could have potentially important implications for public health. Therefore, we reach the preliminary conclusion that an updated analysis comparing ambient NO2 concentrations to health effect benchmarks is supported in the current review, with a particular focus on updating analyses of concentrations on and near major roadways” (EPA 2015b).*

TCEQ Comment:

TCEQ thinks that new information obtained from the recently deployed NO2 monitors could potentially reduce uncertainties regarding characterization of 1-hour NO2 concentrations around roadways, although it will still not provide information about on-road NO2 concentrations. Depending on the extent of the new monitoring data, an updated analysis comparing ambient NO2 concentrations to health effects benchmarks may be supported in the current review.

##### Section 2.3.1.2 Initial Selection of Study Area

TCEQ thinks that the methods used to select a study area or multiple study areas should include as much newly available air monitoring data as possible to begin to reduce uncertainties associated with modeling exposure concentrations. EPA should include a detailed discussion of how and why the results apply to other areas of the country, including MSAs with populations of less than one million people.

### Chapter 3: Human Exposure Assessment

**General Comments:**

The TCEQ thinks there are many significant uncertainties and limitations with emission estimates and model predictions, and that the EPA should carefully consider these uncertainties if they undertake new risk and exposure assessments at this time. All models can be useful tools, and assuming they have been validated for the intended purpose, model results are only as good as the emissions and related data that goes into them. Individuals that conduct modeling or use model predictions must understand the assumptions used to develop the models and the uncertainty and limitations associated with model input and results. Unfortunately, some models are so complex that model sensitivity to various assumptions, conditions, parameters, or options is not obvious or easily evaluated.

The REA planning document discusses multiple models and their use, such as those used to estimate road emissions [EPA Motor Vehicle Emission Simulator (MOVES) model], conduct ambient air modeling [(American Meteorological Society (AMS)/United States Environmental Protection Agency (EPA) Regulatory Model (AERMOD)], and exposure assessment [Air Pollutants Exposure (APEX) model].

In addition, the Integrated Science Assessment discusses recent studies that explored hybrid application of models, such as land use regression (LUR) models and the Community MultiScale Air Quality (CMAQ) photochemical model. LUR models are used to fit concentrations measured at multiple sites using statistical models and land characteristics, traffic, and other data as independent variables, which then are used to predict pollutant concentrations at other locations. Photochemical model output from a grid-based CMAQ could be merged with AERMOD output to provide contributions from photochemical interactions, long-range (regional) transport, and details attributable to local-scale dispersion.

Each model and approach has individual and collective uncertainties. Results derived from certain models used to provide input into other models could confound results in the last model in the series. For example, it is not well known how uncertainty related to the use of MOVES, AERMOD, and finally APEX affects the results of studies and analyses that would be used to set the NAAQS.

Notwithstanding model limitations due to basic assumptions and validation against monitored data, the reliability of model results depends on an accurate emissions inventory. For example, development of the emissions inventory to determine impacts from mobile sources is complicated by influences such as road network geometry, traffic volume, temporal allocation factors, fleet mix, daily and seasonal meteorology, and pollutant specific emission factors. To develop the emissions inventory for the MOVES model, hourly traffic volume, fleet mix, and vehicle speed must be estimated for each road link. Usually, the annual average daily traffic (AADT) and average speed data for each link must be estimated using road counts and travel demand modeling with link-specific inputs including AADT, number of lanes, roadway type and location. Further, the average speed for each link may need to be refined for peak weekday and weekend traffic time periods. These hourly traffic flows must be derived for each link and vehicle class.

When AERMOD uses MOVES estimated emissions, it can provide spatially and temporally varying concentration estimates that could be used to examine relationships between traffic-related air pollutants and adverse health outcomes. However, over-predictions at certain hours are likely due to uncertainties in emissions carried over from the traffic model. In addition, the uncertainty increases if analysis is required near roads not defined as “major.” Estimating emissions from local roads is more challenging because of uncertainties in road locations, traffic activity and fleet distribution.

In addition, dispersion modeling can be subject to errors related to simplifying assumptions such as meteorology, downwash, downwind dispersion, topography, deposition, or transformation of NO to form NO2. The REA notes that the AERMOD modeling system has had eight major update cycles since the last NO2 REA was conducted, and that these updates include major revisions to the NO2 chemistry options used to estimate NO/NO2 partitioning (i.e., the Ozone Limiting Method [OLM] and the Plume Volume Molar Ratio Method [PVMRM]), which have resulted in more accurate estimates of NO2 concentrations from stationary and mobile sources in certain situations.

However, the OLM and PVMRM model options require emission-specific input data, and these data have their own uncertainties associated with them. For example, both model options require in-stack NO2-to-NOx ratios for sources being modeled. Data are still lacking for reasonable in-stack NO2-to-NOx ratios to be used with these model options. The EPA’s current guidance for these model options is geared towards regulatory permit modeling, and consequently, suggest conservative default options. Relying on conservative choices can result in overestimated concentrations. Therefore, while AERMOD may be able to provide concentrations and time patterns of on-road and near-road pollutant concentrations, it may not provide representative information critical for the APEX model or exposure and health risk estimates.

In addition, monitored measurements of air pollutant concentrations also have uncertainties related to issues such as spatial extent of traffic-related air pollution and interaction with ozone and nearby mobile and stationary sources; the measurement method or instrument; and whether the measurement captures actual air pollutant exposures or could be a surrogate for it. Although the sub-daily modeled exposure metrics may have greater uncertainty than daily or longer-term averages, few passive or mobile monitoring methods exist that can measure exposures with a time resolution below daily averages. Collecting limited high resolution measurements for comparison with model predictions is one approach to help identify potential contributors to the modeling uncertainty.

Lastly, it will be difficult to associate in-vehicle concentrations with health end points in an epidemiological study due to uncertainty and limitations related to:

* Accurate in-vehicle exposures, estimates for inside-to-outside ratios, and knowledge of on-road pollutant concentration.
* Estimated air exchange rates - these rates vary with vehicle speed and can be highly variable, even for the same vehicle.
* Simultaneous measurement of inside and roadway concentrations under different ventilation conditions needed to develop and measure attenuation factors and loss rates.
* Assuming in-vehicle concentrations are a predictable function of on-road concentrations with losses reflected by some pollutant-specific attenuation factor.

Based on the listed concerns, the TCEQ urges the EPA to carefully consider the uncertainties and limitations of modeled information to confirm causal associations between in-vehicle pollutants and adverse health outcomes.

### Chapter 4: Human Health Risk Assessment

With respect to a risk assessment based on controlled human exposure studies, EPA reaches the preliminary conclusion that a quantitative risk assessment based on information from controlled human exposure studies is not supported by the evidence in the current review.

With respect to an updated epidemiology-based risk assessment that estimates respiratory-related endpoints attributable to short-term NO2 exposures, EPA concludes that an updated assessment would be subject to uncertainties that are essentially the same as those identified in the 2008 REA (EPA 2008). EPA reaches the preliminary conclusion that such an updated epidemiology-based risk assessment in the current review would not appreciably reduce uncertainties and limitations from the assessment conducted in the last review and would be unlikely to substantially improve our understanding of NO2-attributable health risks or increase our confidence in risk estimates beyond the assessment from the last review.

With respect to an updated epidemiology-based risk assessment that estimates respiratory-related endpoints attributable to long-term NO2 exposures, EPA concludes that such a risk assessment would not substantially add to our understanding of NO2-attributable health risks and would therefore be of limited value in informing decisions in the current review.

TCEQ Comment:

The TCEQ agrees with the EPA that evidence made available since the last REA has not substantially changed our understanding of health effects related to NO2 exposure. The TCEQ thinks that the information from controlled human studies should be weighted more heavily than epidemiological studies used in the risk assessment. As noted in previous comments by the TCEQ (EPA-HQ-ORD-2013-0232-0039), the TCEQ agrees that controlled human exposure and animal toxicological studies can provide direct evidence for health effects related to NO2 exposure. Coherence between experimental and epidemiological studies can address uncertainties within the collective body of evidence. However, EPA repeatedly uses epidemiology study results as evidence of a causal association between certain health endpoints and NO2 exposure, even in the absence of experimental evidence. With a notable lack of experimental evidence and mechanistic data, there is significant uncertainty in the interpretation of certain realms of evidence, especially epidemiologic studies. Nevertheless, EPA uses information from epidemiologic studies, but not controlled human exposure studies, to conduct a quantitative risk assessment and uses information from controlled human exposure studies to determine human health benchmarks. TCEQ thinks that the epidemiology data should not be the basis for the health effects used in the NO2 risk assessment.

With respect to respiratory effects associated with long-term exposure to NO2, the TCEQ has significant concerns regarding the current risk assessment evaluating respiratory-related endpoints attributable to long-term NO2 exposures. As stated previously, in the absence of more conclusive evidence from controlled exposure studies in humans or animals, TCEQ does not agree that “evidence indicates there is likely to be a causal relationship between long-term NO2 exposure and respiratory effects and the strongest evidence is for effects on asthma development.” However, EPA continues to use ecological epidemiology studies to support causal associations between NO2 exposure and certain health endpoints. Key uncertainties remain regarding this procedure. The TCEQ thinks that the EPA should seriously assess the accuracy of the current risk assessment and associated analyses for long-term NO2 exposure and respiratory-related endpoints, given the significant uncertainties associated with the epidemiology studies used to conduct the risk assessment. That data should not be used to conduct a quantitative risk assessment.

### Chapter 5: Summary of Conclusions and Next Steps

Overall, the TCEQ thinks that an updated exposure assessment may be warranted given the availability of data from recently deployed NO2 near-road monitors. However, compounding uncertainties involved in the exposure modeling could make this assessment difficult to interpret. An updated risk assessment and analysis of benchmark concentrations (and any other associated analyses) may be impacted by the results of an updated exposure assessment and should not be ruled out at this time. If an updated risk assessment is completed, it should focus on the data derived from the controlled human studies, and should not emphasize the data from the epidemiology studies because of the uncertainties inherent in those studies.

**Section 5.1. Summary of Primary Conclusions**

*“Air quality comparison to health benchmarks: New information from the NO2 monitoring network and from available research studies has the potential to substantially improve our understanding of NO2 concentrations around major roads in the current review. Staff concludes that updated analyses comparing ambient NO2 concentrations (i.e., as surrogates for potential exposure concentrations) to health effect benchmarks would better characterize a key uncertainty from the last review (i.e., uncertainty in ambient NO2 concentrations on- or near-roads).” (EPA 2015b)*

TCEQ Comment:

TCEQ agrees with the EPA that new information from the recently deployed NO2 monitoring network and from available research studies has the potential to improve our understanding of NO2 concentrations around major roadways. An updated air quality analysis comparing actual monitored NO2 concentrations, as opposed to modeled NO2 concentrations, to health effect benchmarks would better characterize risk for individuals exposed to NO2 around major roadways.

“*Exposure assessment: While modeling tools have been updated since the last review, staff reaches the preliminary conclusion that an updated exposure assessment would be warranted only if the air quality assessment discussed in Chapter 2 indicates the potential for NO2 exposures that could be of public health concern (i.e., based on comparisons of ambient NO2 concentrations with health effect benchmarks). If the air quality assessment indicates little potential for such exposures, including on or near major roads, staff reaches the preliminary conclusion that an updated assessment of population exposures would be of limited use in informing decisions in the current review.” (EPA 2015b)*

TCEQ Comment:

The TCEQ thinks an updated exposure assessment may be warranted given the availability of data from recently deployed NO2 near-road monitors. If predicted NO2 concentrations from the previous assessment are significantly higher than actual monitored NO2 concentrations, the previous exposure assessment may have significantly over-estimated exposure and subsequent risk. Alternatively, if predicted NO2 concentrations are significantly lower than actual monitored concentrations, the previous exposure assessment may have under-estimated exposure and subsequent risk. However, as stated above, the uncertainties in the models required to assess exposure based on monitored concentrations, can be compounded and lead to results that are difficult to interpret.

“*Risk assessment based on information from controlled human exposure studies: Based on the evidence assessed in the 2nd draft ISA, staff reaches the preliminary conclusion that available studies do not provide information to support the identification of an NO2 exposure-response relationship with relevant health endpoints and at relevant NO2 concentrations. Therefore, as in the last review, staff reaches the preliminary conclusion that the available evidence in the current review is not sufficient to support a risk assessment based on exposure-response information from controlled human exposure studies.”* *(EPA 2015b)*

TCEQ Comment:

The TCEQ agrees with the EPA that evidence made available since the last REA has not substantially changed our understanding of health effects related to NO2 exposure and an updated risk assessment based on information from controlled human exposure studies may have limited value. However, if any updates are made to the air quality analysis and/or exposure assessment, it may be necessary to determine how or if these updates will affect the risk assessment.

“*Risk assessment based on information from epidemiologic studies of health effects associated with long-term NO2 exposure: Key U.S. epidemiology studies of long-term NO2 and asthma incidence do not present analyses with co-pollutant models that include highly correlated traffic-related pollutants. A risk assessment quantifying the development of asthma attributable to long-term NO2 exposures would be subject to considerable uncertainty due to the inability to distinguish the contributions of NO2 from the contributions of other pollutants. Therefore, we reach the preliminary conclusion that such a risk assessment would be of limited value in informing decisions in the current review.” (EPA 2015b)*

TCEQ Comment:

With respect to respiratory effects associated with long-term exposure to NO2, the TCEQ has significant concerns regarding the current risk assessment evaluating respiratory-related endpoints attributable to long-term NO2 exposures. As stated previously, in the absence of more conclusive evidence from controlled exposure studies in humans or animals, TCEQ does not agree that “evidence indicates there is likely to be a causal relationship between long-term NO2 exposure and respiratory effects and strongest evidence is for effects on asthma development.” However, EPA continues to use ecological epidemiology studies to support causal associations between NO2 exposure and certain health endpoints. Key uncertainties (exposure measurement error, confounding, etc) remain regarding this procedure. The TCEQ thinks that the EPA should seriously assess the accuracy of the current risk assessment and associated analyses for long-term NO2 exposure and respiratory-related endpoints, given the significant uncertainties associated with the epidemiology studies used to conduct the risk assessment. That data should not be used to conduct a quantitative risk assessment.

# III. References

Kimbrough E.S., Bauldauf R.W., and N. Watkins. **2013**. “Seasonal and diurnal analysis of NO2 concentrations from a long-duration study conducted in Las Vegas, Nevada”. *JAWMA*. 3(8)934-942.

Thurman J., Bailey C., Watkins N., Baldauf R., and R. Brode. **2013**. “Use of AERMOD for NO2 Near-road Monitoring Implementation”. A&WMA Guideline on Air Quality Models: The Path Forward. March 19, 2013, Control # 44.

US EPA. **2015a**. "Review of the Primary National Ambient Air Quality Standards for Nitrogen Dioxide: Risk and Exposure Assessment Planning Document". Office of Air Quality Planning and Standards, Health and Environmental Impacts Division. EPA-452/D–15-001. May.

US EPA. **2015b**. "Integrated Science Assessment for Oxides of Nitrogen – Health Criteria (Second External Review Draft)". National Center for Environmental Assessment (NCEA). EPA/600/R–14/006. January.