Commonwealth LNG

Cameron Parish, Louisiana

Evaluation of Compliance with the 1-hour NAAQS for NO_2

May 24, 2022

Conducted by:

Steven Klafka, P.E., BCEE

Wingra Engineering, S.C.

Madison, Wisconsin

1. Introduction

Wingra Engineering, S.C. was hired by the Sierra Club to conduct an air modeling impact analysis to determine if large emission sources were causing exceedences of the 1-hour nitrogen dioxide (NO_2) national ambient air quality standard (NAAQS) in Cameron Parish, Louisiana. This document describes the procedures and results for the evaluation of 926 individual sources of NO_2 located in Cameron Parish and adjacent parishes and county in Louisiana and Texas.

The dispersion modeling analysis predicted ambient air concentrations for comparison with the 1-hour NO_2 NAAQS. The modeling was performed using the most recent version of AERMOD, AERMET, and AERMINUTE, with data provided to the Sierra Club by regulatory air agencies and through other publicly-available sources. The analysis was conducted following all available USEPA guidance for evaluating source impacts on attainment of the 1-hour NO_2 NAAQS via aerial dispersion modeling. This guidance included: the AERMOD Implementation Guide; modeling guidance promulgated by USEPA in Appendix W to 40 CFR Part 51; USEPA's September 30, 2014 memorandum, Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard [1], USEPA's March 1, 2011 memorandum, Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS[2], and USEPA's June 28, 2010 memorandum, Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS[3].

To comply with the Prevention of Significant Deterioration (PSD) requirements of the Clean Air Act, TRC Environmental Corporation (TRC) conducted an air quality modeling study on behalf of the Commonwealth LNG liquefied natural gas facility in Cameron Parish, Louisiana.[4] Commonwealth LNG submitted that modeling report to the Louisiana Department of Environmental Quality (DEQ) in October 2021 as part of the PSD permit application. The enclosed modeling analysis updates that evaluation, and provides additional comments.

TRC conducted an analysis to determine if regional sources, including the proposed Commonwealth LNG project, complied with the 1-hour NAAQS for NO_2. The results of the 1-hour NO2 cumulative modeling results were presented in Table 6.2 of the TRC report. The analysis predicted exceedances of the NAAQS. TRC concluded that the Commonwealth project did not contribute significantly to the predicted NAAQS exceedences, so conducted no further evaluation of the predicted NAAQS exceedences.

---

[1] https://www.epa.gov/sites/production/files/2020-10/documents/no2_clarification_memo-20140930.pdf
[2] https://www.epa.gov/sites/production/files/2020-10/documents/additional_clarifications_appendixw_hourly-no2-naaqs_final_03-01-2011.pdf
[3] https://www.epa.gov/sites/production/files/2020-10/documents/clarificationmemo_appendixw_hourly-no2-naaqs_final_06-28-2010.pdf
[4] TRC Environmental Corporation, Class II Modeling Report in Support of Part 70 (Title V) Operating Permit and Prevention of Significant Deterioration Permit for Commonwealth LNG, Cameron, Louisiana, October 2021.

It should be noted that the TRC analysis for NAAQS compliance only considered receptor locations where the Commonwealth project was predicted to have a significant impact. Therefore, all locations where violations of the NAAQS may occur would not have been identified.

The enclosed modeling analysis used the same input files as the TRC analysis and were obtained from DEQ. It utilized the same information as accepted by DEQ for the PSD permit application for the Commonwealth LNG project. This information is as follows:

1. Latest version of AERMOD (v21112) with the regulatory default option in the rural mode;

2. Surface and upper-air meteorological data collected at the National Weather Service (NWS) station at the Lake Charles Regional Airport in Lake Charles, LA for the period 2015-2019 to generate AERMOD-ready meteorological data. These data were processed using the most recent version of AERMET (v21112);

3. A fixed background NO_2 concentration was obtained from the ambient monitoring station (Monitor ID 48-361-1001) located in West Orange, Texas.

4. Tier-2 Ambient Ratio Method (ARM2) method to predict the conversion of NO_x to NO_2; and,

5. Regional source inventory of 926 sources of NO_x emissions including the proposed Commonwealth LNG project.

The purpose of this new analysis was to determine the full extent of NAAQS exceedences in Cameron Parish as well as adjacent parishes and counties. For this reason, two change were made to the original modeling files:

1) the modeling domain was extended to the full 50-kilometer distance approved by USEPA for use by AERMOD. This new receptor grid was centered Commonwealth LNG facility.

2) the TRC modeling analysis removed approximately 400 acres of land around Commonwealth LNG from consideration for compliance with the NAAQS. While this land may be owned by the company, there was no description of a fence or other measures that would be employed to preclude public access to the property. Therefore, the updated modeling analysis included receptors on this property.

2. Modeling Results

2.1 1-hour NO_2 SIL and NAAQS

The significant impact level or SIL for NO_2 for the 1-hour averaging period is 7.5 µg/m^3. This is based on the average of the maximum 1-hour concentrations for each year using five years of meteorology.

The 1-hour NO_2 NAAQS takes the form of a three-year average of the 98th percentile of the annual distribution of daily maximum 1-hour concentrations, which cannot exceed 100 parts per billion (ppb).[5] Compliance with this standard was verified using USEPA's AERMOD air dispersion model, which produces air concentrations in units of µg/m^3. The 1-hour NO_2 NAAQS of 100 ppb equals 188 µg/m^3, and this is the value used for determining whether modeled impacts exceed the NAAQS. The 98th percentile of the annual distribution of daily maximum 1-hour concentrations corresponds to the eighth-highest value at each receptor for a given year.

2.2 Commonwealth LNG Facility and Comparison with the Significant Impact Level

The 1-hour average SIL for NO_2 is 7.5 µg/m^3. If emissions from the Commonwealth LNG facility are predicted to exceed the SIL, the facility is obligated to determine if its emissions combined with those from other regional sources comply with the NAAQS for NO_2. The 2021 analysis by TRC determined that the Commonwealth LNG facility exceeded the SIL so included a NAAQS compliance analysis.

The modeling for comparison with the SIL was updated for the enclosed analysis. The Commonwealth LNG facility was predicted to have a maximum 1-hour average impact of 37.7 µg/m^3. Since this exceeds the SIL, a NAAQS compliance analysis would be required.

Figure 1 shows the extent in which the Commonwealth LNG facility exceeds the 1-hour SIL of 7.5 µg/m^3 for NO_2. The SIL was predicted to be exceeded in both Cameron and Calcasieu Parishes. The maximum distance to a SIL exceedance is 40 km.

[5] USEPA, Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS, March 2, 2011.

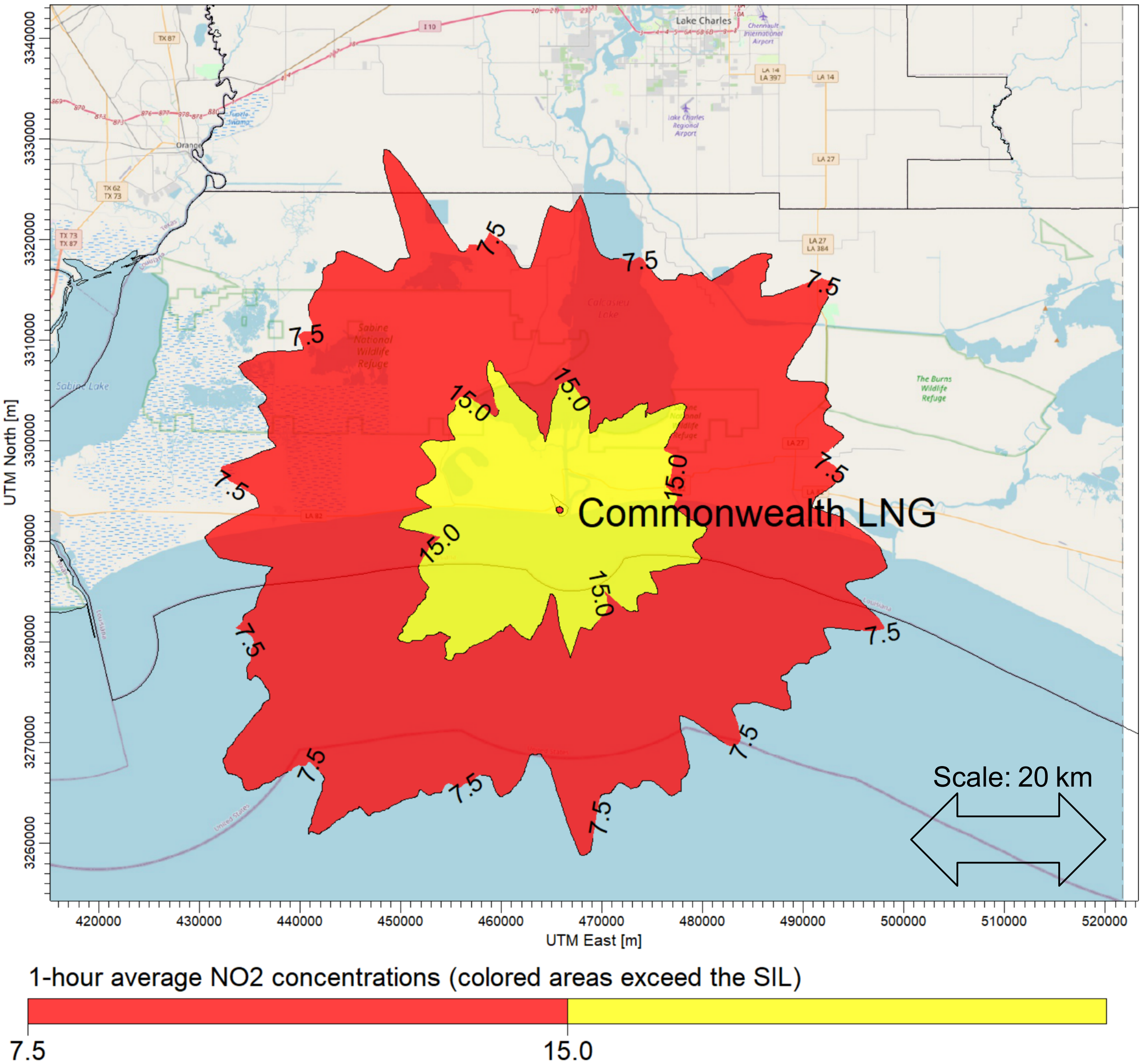

Figure 1 – Exceedences of the 1-hour Average NO_2 SIL by Commonwealth LNG

Table 1 provides the highest Cameron LNG concentrations which exceed the 1-hour SIL. These are the 5-year average of the 1-hour maximum concentrations for unique locations and hours.

Table 1 - Commonwealth LNG Maximum Impacts Exceeding 1-hour Average SIL of 7.5 µg/m³

X	Y	Average	NO_2 Concentration (µg/m³)
463766	3293009	1-HR	37.7
463666	3293009	1-HR	37.6
463766	3293109	1-HR	37.6
463866	3293009	1-HR	37.6
463866	3293109	1-HR	37.6
463666	3293109	1-HR	37.5
463566	3293009	1-HR	37.4
463966	3293109	1-HR	37.4
463966	3293009	1-HR	37.4
463566	3293109	1-HR	37.4

2.3 Compliance with the 1-hour NO_2 NAAQS

The TRC modeling analysis predicted a maximum impact of 229 µg/m³ including background. This exceeded the NAAQS of 188 µg/m³. The greatest distance to receptors exceeding the NAAQS was 39 kilometers.

After expanding the size of the receptor grid and number of receptors, the updated modeling analysis predicted a maximum impact of 1,537 µg/m³ including background. This again exceeded the NAAQS of 188 µg/m³. The greatest length of the area exceeding the NAAQS was 50 kilometers, the full extent of the modeling domain. NAAQS exceedences were predicted to occur in Cameron and Calcasieu Parishes in Louisiana, and in Orange and Jefferson Counties in Texas.

Figure 2 shows the full extent of predicted exceedances of the 1-hour NAAQS for NO_2. Boundaries of parishes in Louisiana and counties in Texas are show in black.

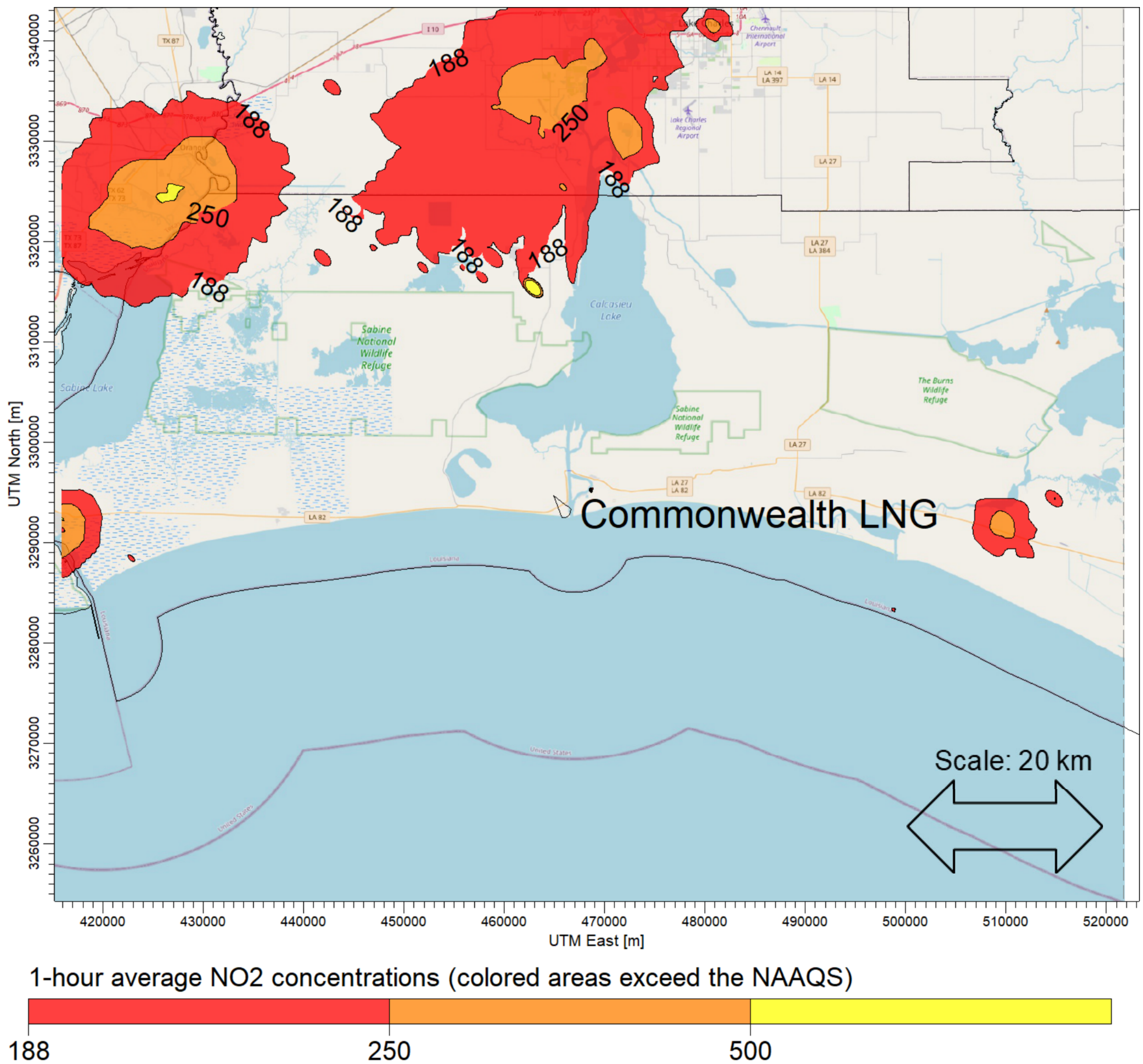

Figure 2 – NAAQS Exceedences by Commonwealth LNG and Regional Sources

2.4 Comparison of Modeling Results and Ambient Monitoring Sites

In the modeling domain there are two existing ambient monitoring sites for NO_2. These are the Westlake Site (Site ID # 22-019-0008) in Louisiana and West Orange Site (Site ID # 48-361-1001) in Texas.

Figure 3 shows the location of the two existing monitoring sites for NO_2 in relation to the areas where the updated modeling study predicted exceedences of the 1-hour NAAQS. The existing monitoring site in Louisiana is not located in the areas with predicted exceedences of the NAAQS. Additional monitors are needed to determine compliance with the NAAQS in these areas predicted to exceed the NAAQS.

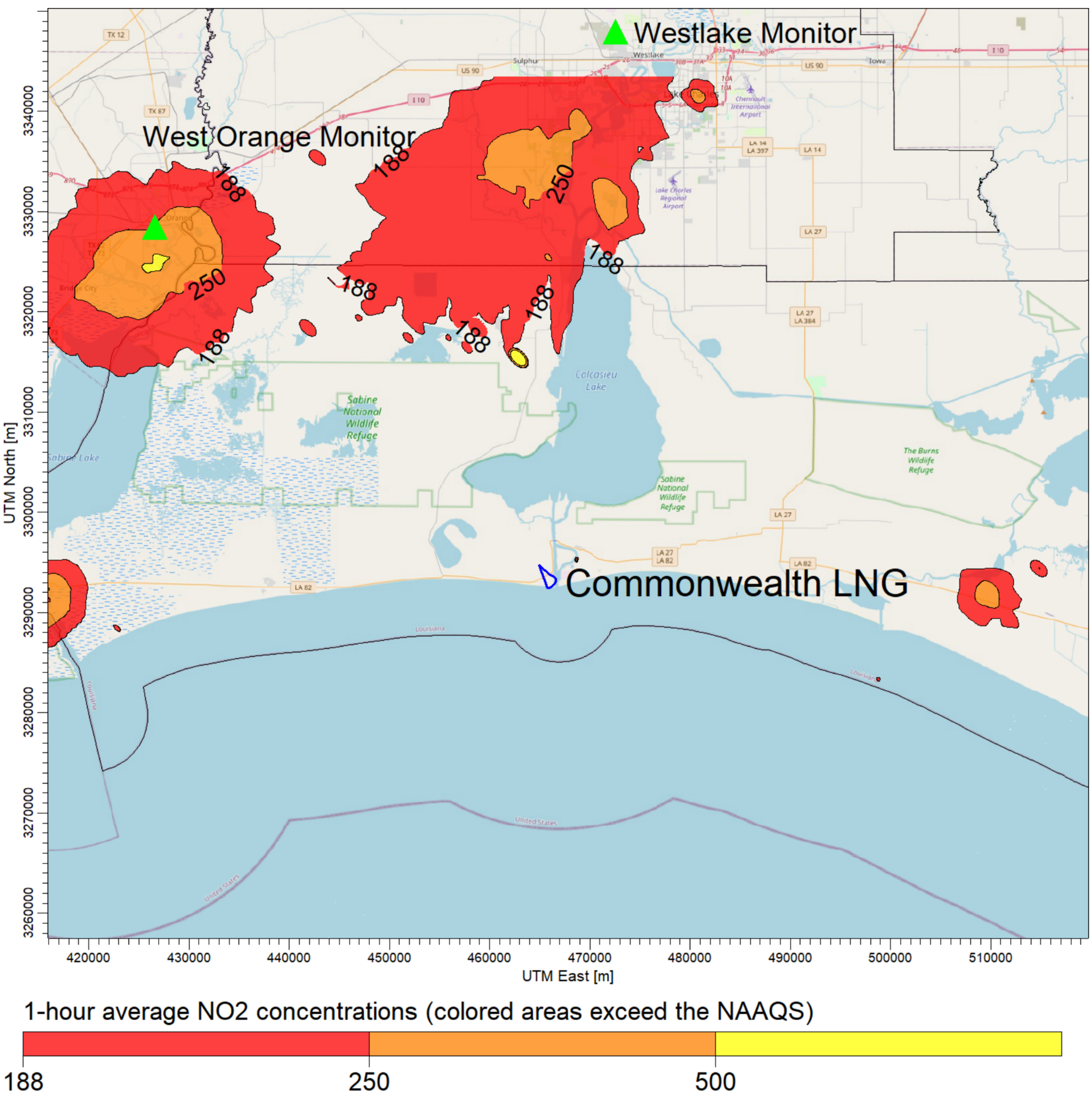

Figure 3 - NO_2 Monitor Locations and Predicted NAAQS Exceedences

Figure 4 shows the location of the two existing monitoring sites for NO_2 in relation to the areas where the updated modeling study predicted exceedences of the 1-hour NAAQS. To evaluate the environmental justice (EJ) impacts of the NAAQS exceedences, the base map for this figure provides the percent people of color in each census tract. The gradations of people of color in the population of each census tract are 0-20% (lightest shade), 20-40%, 40-60%, 60-80%, 80-100% (darkest shade). The existing monitor site in Louisiana is not located in census tracts with a higher percentage of people of color. Additional monitors are needed to determine compliance with the NAAQS in these areas and evaluate EJ impacts.

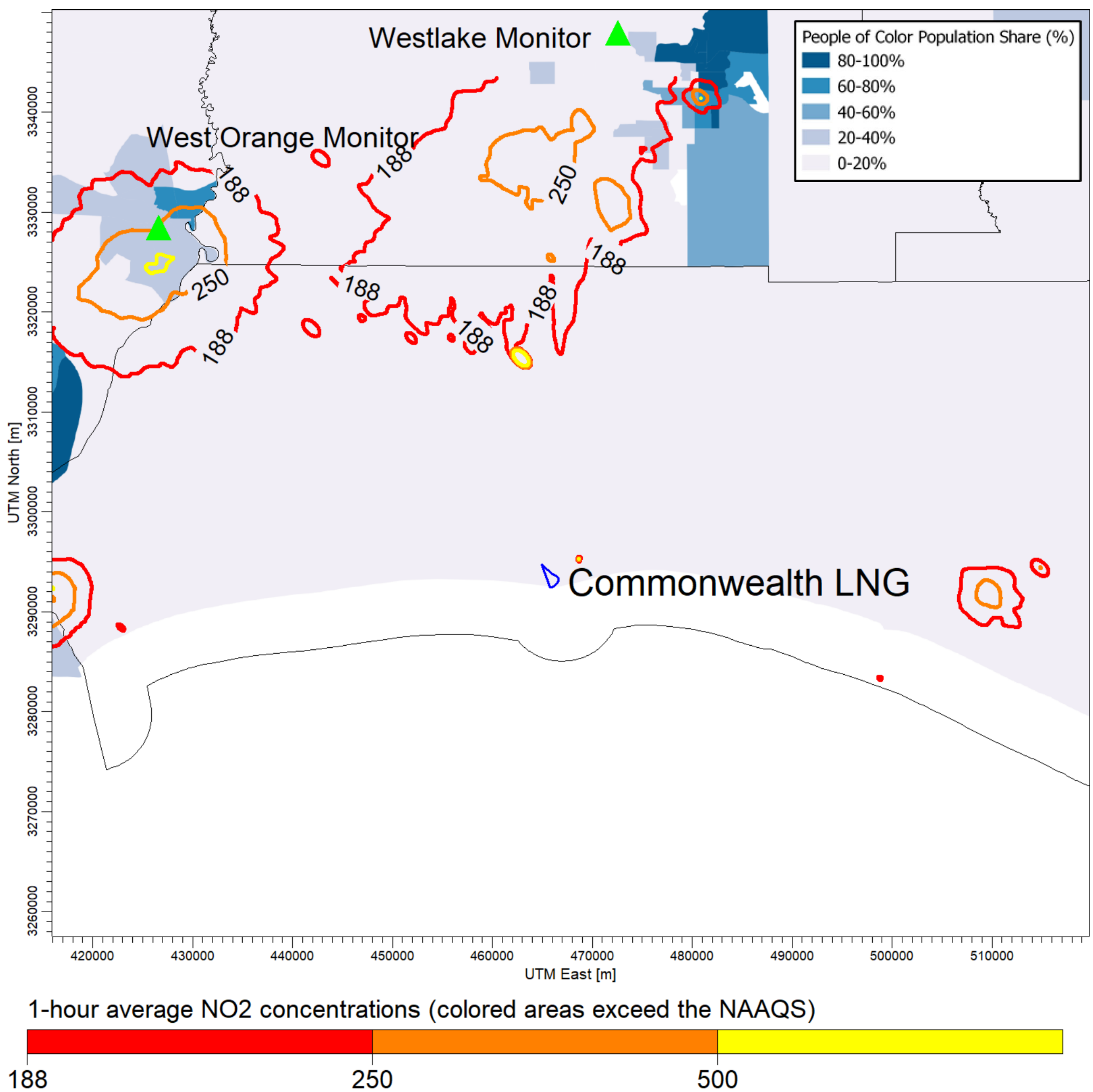

Figure 4 – NO_2 Monitor Locations, Predicted NAAQS Exceedences & People of Color

Figure 5 shows the location of the two existing monitoring sites for NO_2 in relation to the areas where the updated modeling study predicted exceedences of the 1-hour NAAQS. To evaluate the EJ impacts of the NAAQS exceedences, the base map for this figure provides the income levels of residents in each census tract in increments of $25,000 per year. Existing monitor sites are not located in lowest income census tracts. Additional monitors are needed to determine compliance with the NAAQS in the lowest income areas and evaluate EJ impacts.

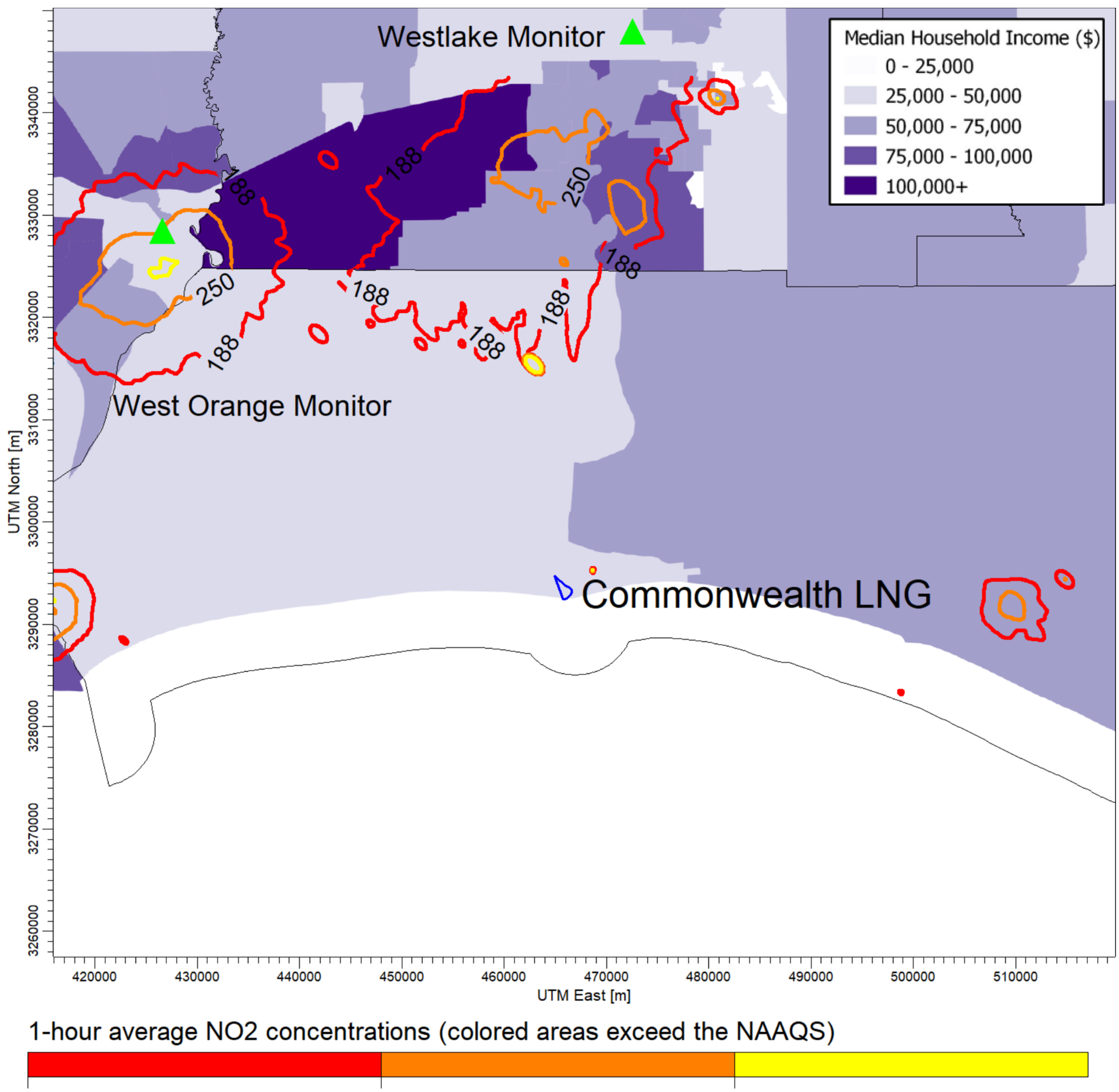

Figure 5 - NO_2 Monitor Locations, Predicted NAAQS Exceedences & Household Income Levels

2.5 Conservative Modeling Assumptions

The modeling results presented in the report may under-estimate NO2 concentrations for the following reasons:

1) The inventory of regional emission sources included substitutions for rates and stack parameters if these were missing or considered inappropriate. These substitutions may underestimate the air quality impact of these sources.

2) The 50-kilometer receptor grid was centered on the Commonwealth LNG facility. Emission sources are located throughout this grid and may individually be culpable for NAAQS exceedences. The receptor grid would need to be centered on each source to fully determine if the source is capable of exceeding the NAAQS.

3) The downwash effect of buildings and structures was evaluated only for the proposed Commonwealth LNG project. It was not considered for the other regional sources. The consideration of downwash may increase in the predicted impacts of the regional sources.

3. Modeling Methodology

3.1 Air Dispersion Model

The modeling analysis used the most recent version of USEPA's AERMOD program, v. 21112. AERMOD, as available from the Support Center for Regulatory Atmospheric Modeling (SCRAM) website, was used in conjunction with a third-party modeling software program, *AERMOD View*, sold by Lakes Environmental Software.

3.2 Control Options

The AERMOD model was run with the following control options:

- 1-hour average air concentrations
- Regulatory defaults

In its October 2021 modeling report, TRC conducted an evaluation to determine if the modeled facility was located in a rural or urban setting using USEPA's methodology outlined in Section 7.2.3 of the Guideline on Air Quality Models.[6] For urban sources, the URBANOPT option is used in conjunction with the urban population from an appropriate nearby city and a default surface roughness of 1.0 meter. Methods described in Section 4.1 were used to determine whether rural or urban dispersion coefficients were appropriate for the modeling analysis.

3.3 Output Options

The AERMOD analysis was based on recent meteorological data. The modeling analysis was conducted using sequential meteorological data from the 2015-19 period. Consistent with USEPA's guidance for evaluation compliance with the NO_2 NAAQS, AERMOD was used to provide a table of eighth-high 1-hour NO_2 impacts concentrations consistent with the form of the 1-hour SO_2 NAAQS.

Please refer to Section 2.0 for the modeling results.

[6] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005.

4. Model Inputs

4.1 Geographical Inputs

The air dispersion modeling analysis used a coordinate system for identifying the geographical location of emission sources and receptors. These geographical locations are used to determine local characteristics (such as land use and elevation), and also to ascertain source to receptor distances and relationships.

The Universal Transverse Mercator (UTM) NAD83 coordinate system was used for identifying the easting (x) and northing (y) coordinates of the modeled sources and receptors. Commonwealth LNG and Cameron Parish are located in UTM Zone 15.

The facility was evaluated to determine if it should be modeled using the rural or urban dispersion coefficient option in AERMOD. A GIS was used to determine whether rural or urban dispersion coefficients apply to a site. Land use within a three-kilometer radius circle surrounding the facility was considered. USEPA guidance states that urban dispersion coefficients are used if more than 50% of the area within 3 kilometers has urban land uses. Otherwise, rural dispersion coefficients are appropriate.[7]

The October 2021 modeling report, TRC evaluated the use of urban vs rural dispersion coefficients. It concluded that rural coefficients were appropriate. A similar approach with rural dispersion coefficients was used for the analysis presented in this report.

4.2 Emission Rates and Source Parameters

The emissions and stack parameters for the 926 sources included in the modeling analysis are summarized in the October 2021 modeling report submitted by TRC to DEQ. Non-Commonwealth source information was obtained by TRC from the DEQ Emissions Reporting and Inventory Center.[8] Additionally, stack parameters for major sources in Texas were obtained by TRC through a Public Information Request to the Texas Commission of Environmental Quality. Procedures for assembling the regional source inventory, as well as all modeling procedures, were described in the October 2021 modeling report submitted by TRC to DEQ.

4.3 Downwash

[7] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005, Section 7.2.3.

[8] https://business.deq.louisiana.gov/Eric/EricHome

The downwash effect of buildings and structures was considered for only the proposed Commonwealth LNG project. Downwash effects for other regional sources was not considered.

4.4 Receptors

Three receptor grids were employed:

1. A 100-meter Cartesian receptor grid centered on Commonwealth LNG and extending out 5 kilometers.
2. A 500-meter Cartesian receptor grid centered on Commonwealth LNG and extending out 10 kilometers.
3. A 1,000-meter Cartesian receptor grid centered on Commonwealth LNG and extending out 50 kilometers. 50 kilometers is the maximum distance accepted by USEPA for the use of the AERMOD dispersion model.[9]

A flagpole height of 1.5 meters was not used for all modeled receptors.

Elevations for receptors were obtained from National Elevation Dataset (NED) GeoTiff data. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. These elevations were extracted from 1 arc-second (30 meter) resolution NED files. The USEPA software program AERMAP v. 18081 is used for these tasks.

4.5 Meteorological Data

The same meteorological data used for the October 2021 TRC modeling analysis was used for the updated modeling analysis presented in this report. Surface and upper-air meteorological data collected at the National Weather Service (NWS) station at the Lake Charles Regional Airport in Lake Charles, LA for the period 2015-2019 to generate AERMOD-ready meteorological data. These data were processed using the most recent version of AERMET (v. 21112).

Procedures used for processing of the meteorological data would have been evaluated and approved by DEQ as part of the PSD air permit application review process.

4.5.1 Surface Meteorology

Surface meteorology was obtained for Lake Charles Regional Airport in Lake Charles located approximately 41 km northeast the Commonwealth LNG project.

---

[9] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, Section A.1.(1), November 9, 2005.

4.5.2 Upper Air Data

Upper-air data are collected by a "weather balloon" that is released twice per day at selected locations. As the balloon is released, it rises through the atmosphere, and radios the data back to the surface. The measuring and transmitting device is known as either a radiosonde, or rawindsonde. Data collected and radioed back include: air pressure, height, temperature, dew point, wind speed, and wind direction. The upper air data are processed through AERMET Stage 1, which performs data extraction and quality control checks.

Concurrent 2015-2019 upper air data from twice-daily radiosonde measurements obtained at the most representative location were used. This location was the Lake Charles Regional Airport measurement station.

4.5.3 AERSURFACE

AERSURFACE is a program that extracts surface roughness, albedo, and daytime Bowen ratio for an area surrounding a given location. AERSURFACE uses land use and land cover (LULC) data in the U.S. Geological Survey's National Land Cover Dataset to extract the necessary micrometeorological data. The current version of AERSURFACE v. 20060. It was used by TRC with National Land Cover Database for 2016 including land cover, canopy and impervious surfaces.

4.5.4 Data Review

Missing meteorological data were not filled as the data file met USEPA's 90% data completeness requirement.[10] The AERMOD output file shows there were 1.0% missing data across the entire 2015-19 meteorological period.

5. Background NO_2 Concentrations

A fixed 1-hour average background NO_2 concentration was obtained from the ambient monitoring station (Monitor ID 48-361-1001) located in West Orange, Texas.

6. Reporting

All files from the programs used for this modeling analysis are available to regulatory agencies.

---

[10] USEPA, Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-05, February 2000, Section 5.3.2, pp. 5-4 to 5-5.