Plaquemines LNG

Plaquemines Parish, Louisiana

Evaluation of Compliance with the 1-hour NAAQS for NO_2

May 25, 2022

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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 Plaquemines Parish, Louisiana. This document describes the procedures and results for the evaluation of 619 individual sources of NO_2 located in Plaquemines Parish and adjacent parishes in Louisiana.

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, Trinity Consultants (TC) prepared a PSD permit application and conducted an air quality modeling study on behalf of the Plaquemines LNG liquefied natural gas facility in Plaquemines Parish, Louisiana.[4] The PSD permit application was submitted to the Louisiana Department of Environmental Quality (DEQ) by Venture Global Plaquemines LNG, LLC. The enclosed modeling analysis updates the 2020 evaluation, and provides additional comments.

TC conducted an analysis to determine if regional sources, including the proposed Plaquemines LNG project, complied with the 1-hour NAAQS for NO_2. The results of the 1-hour NO_2 cumulative modeling results were presented in Table 5.3 of their report. The analysis predicted exceedances of the NAAQS. TC concluded that the Plaquemines LNG project did not contribute significantly to the predicted NAAQS exceedences, so conducted no further evaluation of the predicted NAAQS exceedences.

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[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] Trinity Consultants, Title V Permit Significant Modification and PSD Permit Modification Application for Venture Global Plaquemines LNG, LLC and Venture Global Gator Express, LLC, January 27, 2020.

It should be noted that the TC analysis for NAAQS compliance only considered receptor locations where the Plaquemines project was predicted to have a significant impact. Therefore, all locations where violations of the NAAQS may occur in the surrounding region were not identified.

The enclosed modeling analysis used the same input files as the TC analysis and were obtained from DEQ. It utilized the same information as accepted by DEQ for the PSD permit application for the Plaquemines LNG project. Since the TC modeling analysis was conducted in 2020, the most current versions of the AERMOD modeling system were used for the updated analysis.

A summary of modeling procedures is as follows:

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

2. Surface meteorological data collected at the National Weather Service (NWS) station at the New Orleans International Airport (Station No. 12916) for the period 2019-2021 to generate AERMOD-ready meteorological data. Upper air meteorological data were obtained from the Slidell, Louisiana station. 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 22-051-1001) located in Kenner, Louisiana.

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

5. Regional source inventory of 619 sources of NO_x emissions including the proposed Plaquemines LNG project.

The purpose of this new analysis was to: 1) determine the full extent of NAAQS exceedences in Plaquemines Parish as well as adjacent parishes and counties, and 2) evaluate the suitability of existing air quality monitoring stations. For this reason, two changes 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 Plaquemines LNG facility.

2) the TC modeling analysis removed approximately 1,200 acres of land around Plaquemines 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 average 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 Plaquemines 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 Plaquemines 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 2020 analysis by TC determined that the Plaquemines LNG facility exceeded the SIL so a NAAQS compliance analysis was conducted.

The modeling for comparison with the SIL was updated for the enclosed analysis. The Plaquemines LNG facility was predicted to have a maximum 1-hour average impact of 20.2 µg/m^3. Since this exceeds the SIL, a NAAQS compliance analysis would be required.

Figure 1 shows the extent in which the Plaquemines LNG facility exceeds the 1-hour SIL of 7.5 µg/m^3 for NO_2. The SIL was predicted to be exceeded in Acadiana, Jefferson, Lafourche, Plaquemines, and St. Bernard Parishes. The maximum distance to a SIL exceedance is 16 km. Boundaries of parishes in Louisiana are shown with black lines.

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

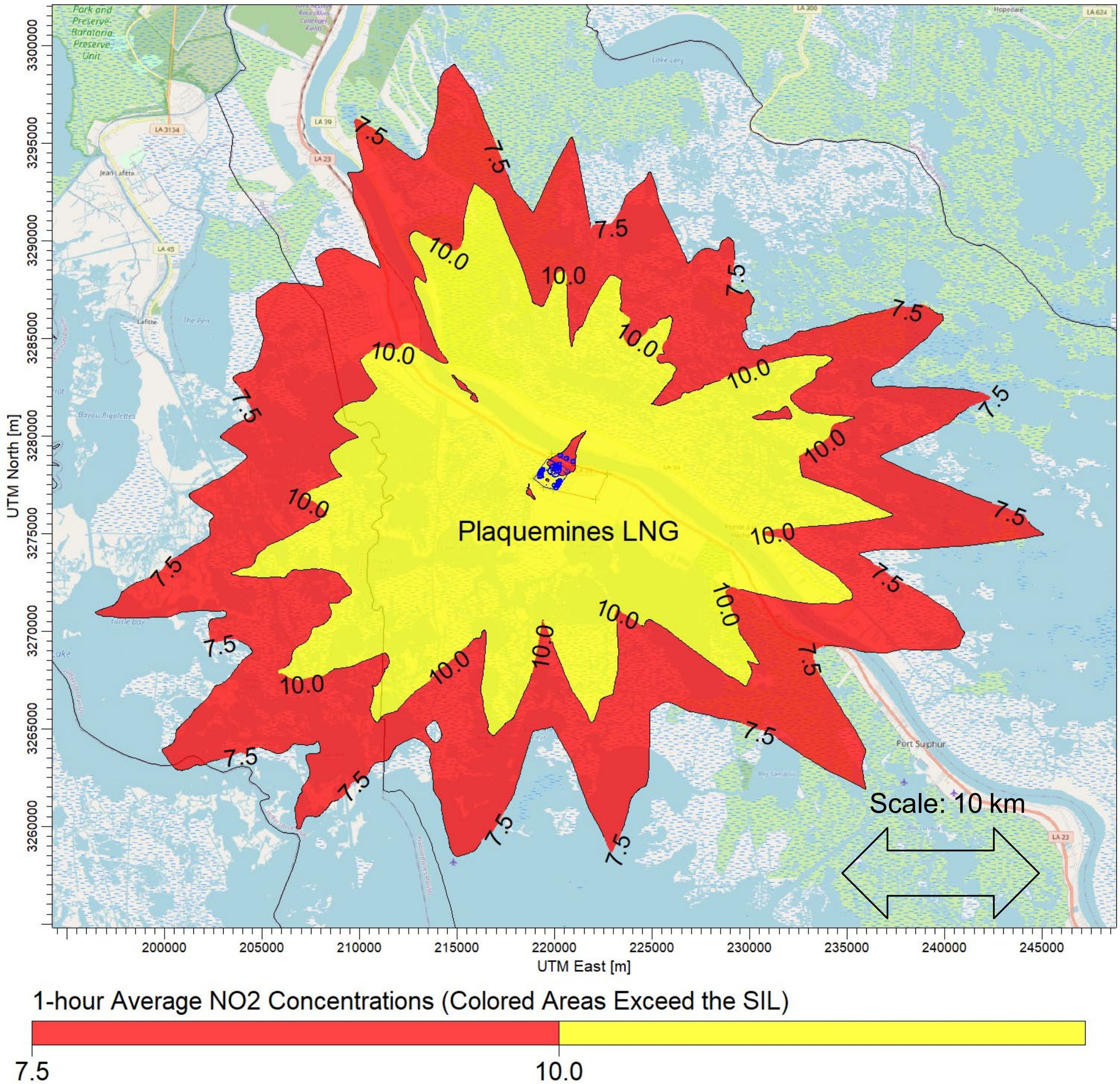

Figure 1 – Exceedences of 1-hour Average NO_2 SIL by Plaquemines LNG

Table 1 provides the highest Plaquemines 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 - Plaquemines LNG Maximum Impacts Exceeding 1-hour Average SIL of 7.5 μg/m³

X	Y	Average	NO_2 Concentration (μg/m³)
217879	3279044	1ST	20.2
217579	3275244	1ST	20.2
217979	3278944	1ST	20.2
217479	3275144	1ST	20.2
217779	3279044	1ST	20.2
217679	3275344	1ST	20.1
217579	3275144	1ST	20.1
217879	3278944	1ST	20.1
217579	3279244	1ST	20.1
217479	3275044	1ST	20.1

2.3 Compliance with the 1-hour NO_2 NAAQS

The TC modeling analysis predicted a maximum impact of 271.2 μg/m³ including background. This exceeded the NAAQS of 188 μg/m³.

After expanding the size of the receptor grid and number of receptors, the updated modeling analysis predicted a maximum impact of 3,692.8 μg/m³ including background. This again exceeded the NAAQS of 188 μg/m³. The greatest length of the area exceeding the NAAQS was 49 kilometers, the full extent of the modeling domain. NAAQS exceedences were predicted to occur in Acadiana, Jefferson, Lafourche, Plaquemines, and St. Bernard Parishes in Louisiana.

Figure 2 shows the full extent of predicted exceedances of the 1-hour NAAQS for NO_2. Boundaries of parishes in Louisiana are shown with black lines.

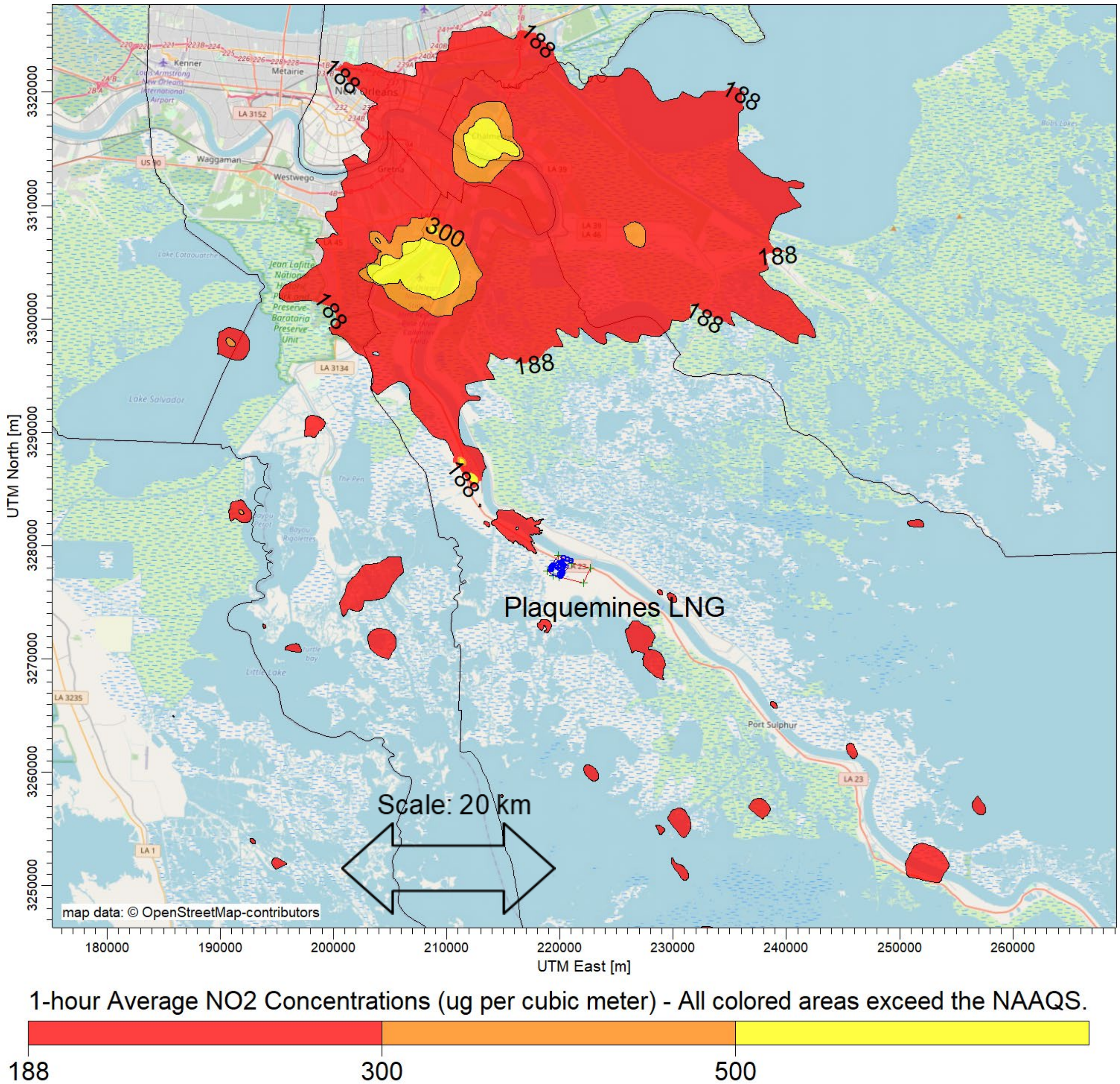

Figure 2 – NAAQS Exceedences by Plaquemines LNG and Regional Sources

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 located in New Orleans metropolitan area north of the areas where exceedences of the NAAQS are predicted. These are the Kenner Site (Site ID #220511001) and I-610 Site (Site ID #220710021).

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. Existing monitoring sites for NO_2 are not located in the areas with predicted exceedences of the NAAQS. Additional monitors are needed to determine compliance with the NAAQS in these areas.

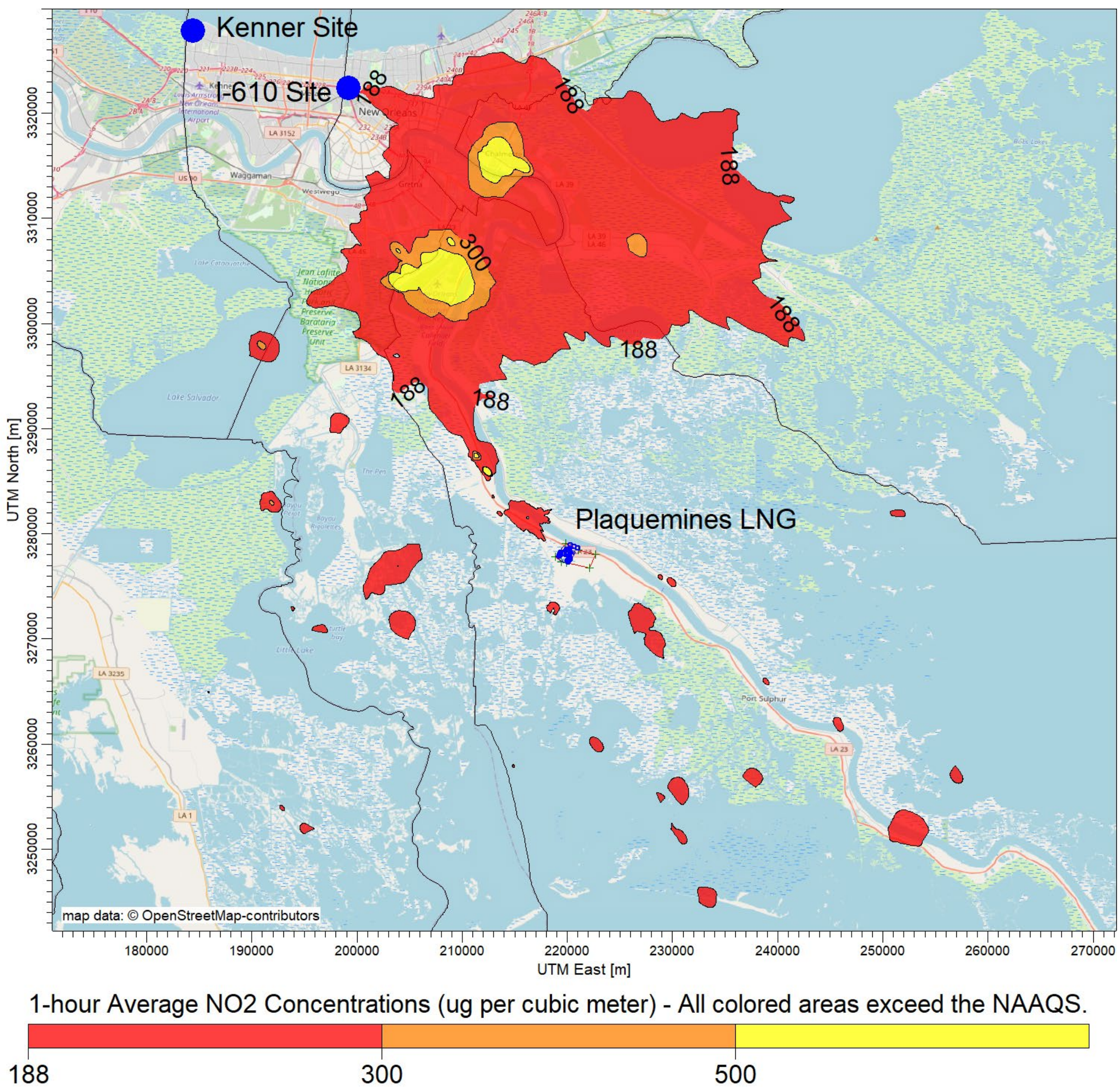

Figure 3 – NO_2 Monitor Locations and Predicted NAAQS Exceedences

Figure 4 shows the location of the two existing monitoring sites for NO2 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). Existing monitor sites are 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.

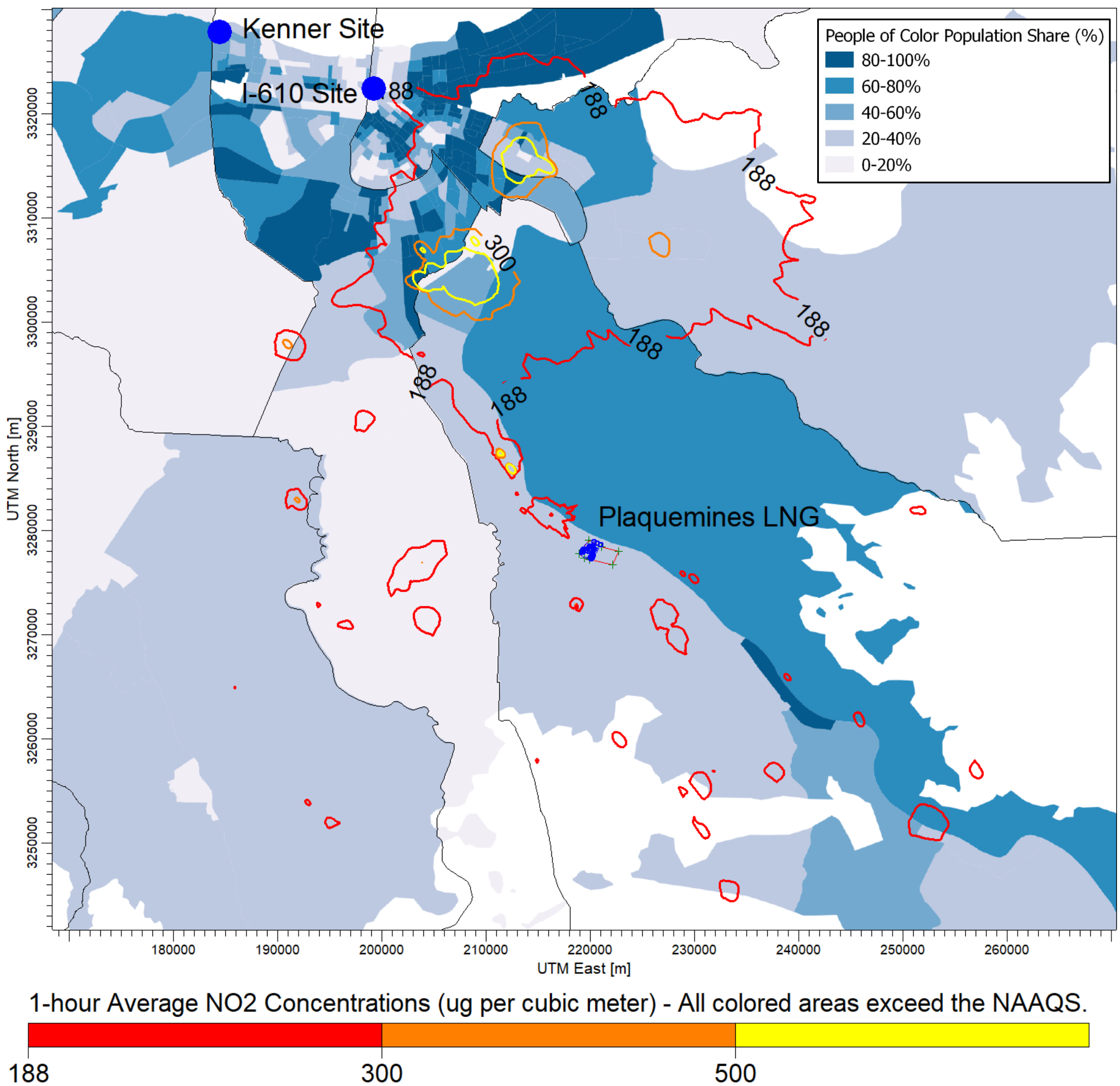

Figure 4 – NO_2 Monitor Locations, Predicted NAAQS Exceedences & People of Color

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 located in higher income census tracts but not those with low-income households. Additional monitors are needed to determine compliance with the NAAQS in these areas and evaluate EJ impacts.

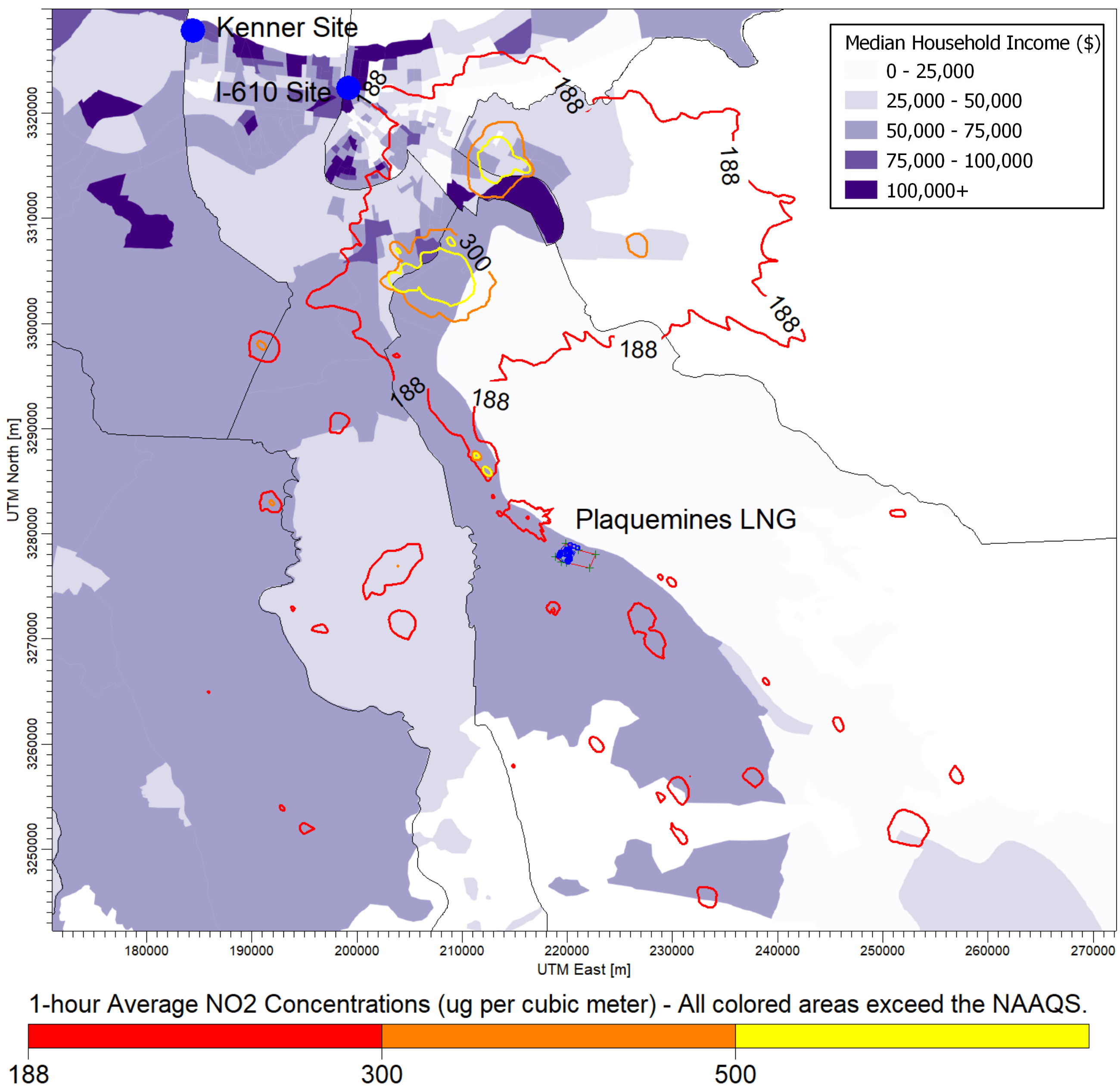

Figure 5 - NO_2 Monitor Locations, Predicted NAAQS Exceedences & Household Income Levels

2.5 Conservative Modeling Assumptions

The modeling results presented in the report may under-estimate NO_2 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 Plaquemines 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 Plaquemines 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 2020 modeling report, TC did not conduct 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 2019-21 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.

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[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. Plaquemines LNG and Plaquemines Parish are located in UTM Zone 16.

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] It was determined that land use around the Plaquemine LNG facility was 3.4% urban which included low, medium and high intensity development land use categories. Therefore, rural dispersion coefficients were used for the updated modeling analysis.

In its 2020 modeling report, TC did not evaluate the use of urban vs rural dispersion coefficients.

4.2 Emission Rates and Source Parameters

The emissions and stack parameters for the 619 sources included in the modeling analysis are summarized in the 2020 modeling report submitted by TC to DEQ. Procedures for assembling the regional source inventory, as well as all modeling procedures, were described in the 2020 modeling report submitted by TC to DEQ.

4.3 Downwash

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

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[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.

4.4 Receptors

Three receptor grids were employed:

1. A 100-meter Cartesian receptor grid centered on Plaquemines LNG and extending out 5 kilometers.
2. A 500-meter Cartesian receptor grid centered on Plaquemines LNG and extending out 10 kilometers.
3. A 1,000-meter Cartesian receptor grid centered on Plaquemines LNG and extending out 50 kilometers. 50 kilometers is the maximum distance accepted by USEPA for the use of the AERMOD dispersion model.[8]

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 meteorological data for the updated modeling analysis was obtained from the same weather stations used for the 2020 TC modeling analysis. 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 meteorological data collected at the National Weather Service (NWS) station at the New Orleans International Airport for the period 2019-2021 was used to generate AERMOD-ready meteorological data.

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.

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[8] 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.

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 2019-2021 upper air data from twice-daily radiosonde measurements obtained at the most representative location were used. Upper air data were obtained from the Slidell, Louisiana 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 including land cover, canopy and impervious surfaces. The current version of AERSURFACE v. 20060. It was assumed that annual moisture was average and there was no snow cover during the winter months.

4.5.4 Data Review

Missing meteorological data were not filled as the data file met USEPA's 90% data completeness requirement.[9] The AERMOD output file shows there were 0.79% missing data across the entire 2019-21 meteorological period.

5. Background NO_2 Concentrations

Similar to the 2020 modeling report submitted by TC to DEQ, a fixed background NO2 concentration was obtained from the ambient monitoring station (Monitor ID 22-051-1001) located in Kenner, Louisiana.

6. Reporting

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

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[9] 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.