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September 8, 2010

Ms. Trina Vielhauer
Chief, Bureau of Air Regulation
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32301

RECEIVED
SEP 10 2010
BUREAU OF
AIR REGULATION

Re: Solid Waste Authority of Palm Beach County
Palm Beach Renewable Energy Facility No. 2
*Supplemental Air Quality Modeling Protocol for 1-hour NO₂ and SO₂ NAAQS (Revised
September 2010)*

0996234-017-AC

Dear Ms. Vielhauer:

The Solid Waste Authority of Palm Beach County (the Authority) is pleased to submit two copies of our revised *Supplemental Air Quality Modeling Protocol for 1-hour NO₂ and SO₂ NAAQS* for the Palm Beach Renewable Energy Facility No. 2. The protocol was requested in items 8, 10, and 11 of the Department's Request for Additional Information (RAI) dated June 15, 2010. The original protocol was provided to the Department on August 23, 2010. This revised protocol incorporates the Authority's recent decision to proceed with the use of SCR (Selective Catalytic Reduction) NO_x control technology into the design of Palm Beach Renewable Energy Facility No. 2, and in addition, reflects comments on the original protocol provided to us by the Department.

If you have any questions concerning the revised protocol, please do not hesitate to contact me at (914) 641-2646 or via e-mail at pdiosey@pirnie.com.

Very truly yours,

MALCOLM PIRNIE, INC.

Phyllis G. Diosey, Ph.D., QEP
Associate, Air Quality Services
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Attachments: Two (2) copies, *Supplemental Air Quality Modeling Protocol, Palm Beach County Renewable Energy Facility No. 2 (Revised September 2010)*.



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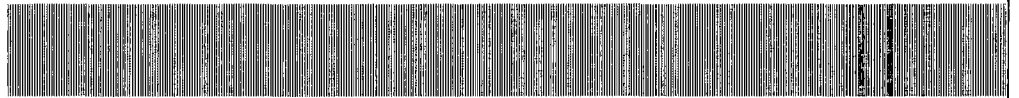
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BUREAU OF
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Supplemental Air Quality Modeling Protocol for 1-hour NO₂ and SO₂ NAAQS

Palm Beach Renewable Energy Facility No. 2



Report Prepared By:

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3582056
Revised September 2010

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1. Background

The Solid Waste Authority of Palm Beach County (the Authority) is planning to expand its waste processing capacity by constructing a mass burn waste-to-energy facility in West Palm Beach, Florida, adjacent to its existing renewable energy facility. The new facility, the Palm Beach Renewable Energy Facility No. 2 (Proposed Facility, PBREF2), will have a total facility throughput of 3,000 tpd of municipal solid waste (MSW). State-of-the-art emissions control systems will be included in the Proposed Facility to minimize air pollutant emissions. In addition, continuous emissions monitoring equipment will be used to ensure on-going compliance with state and federal air regulations.

The Authority's 1,320 acre campus (Palm Beach Renewable Energy Park, PBREP) includes the existing renewable energy facility (the North County Resource Recovery Facility (NCRRF)), a refuse-derived fuel (RDF) facility which has two identical MWC units, and a total nominal design capacity of 2,000 tons per day of MSW. The construction of the Proposed Facility will complement services that are being provided by the existing facilities at the PBREP, and will also serve to implement the Authority's 2006 Integrated Solid Waste Management Plan (ISWM Plan) to develop a system of programs and facilities to effectively and economically manage solid waste through source reduction, recycling, composting, combustion, and landfilling. The ISWM Plan also calls for the expanded combustion capacity in order to extend the life of the existing landfill beyond its currently anticipated lifespan.

The original modeling protocol, for the Proposed Facility was submitted and approved in 2009, and it included all applicable standards and criteria, including National Ambient Air Quality Standards (NAAQS), Florida Ambient Air Quality Standards (FAAQs), and Prevention of Significant Deterioration (PSD) increments (40 CFR Part 51.166) in effect at the time. This supplemental protocol describes the methodology that will be used in the air quality modeling analysis for demonstrating compliance with the new 1-hour nitrogen dioxide (NO₂) national ambient air quality standard as requested by Florida Department of Environmental Protection (FDEP) in their Request for Additional Information (RAI) dated June 15, 2010 (FDEP, 2010). This supplemental modeling analysis also addresses the newly promulgated 1-hour sulfur dioxide (SO₂) national ambient air quality standard (effective August 23, 2010) as requested by FDEP.

Specific project information can be found in the *Air Quality Modeling Report* (Malcolm Pirnie, 2010), and in addition, will reflect the Authority's recent decision to proceed with SCR (selective catalytic reduction) for the control of NO_x emissions. The information

provided in this supplemental protocol will focus on the additional information to be used in the modeling analyses for the 1-hour NO₂ and SO₂ standards. The protocol will follow recent regulatory guidance provide by the United States Environmental Protection Agency (USEPA) Office of Air Quality Planning and Standards (OAQPS) (USEPA, 2010a, b, c), and FDEP.

2. 1-hour NO₂ and SO₂ NAAQS

The new national ambient air quality standards for 1-hour NO₂ and SO₂ are shown in Table 2-1. For the 1-hour NO₂ standard, conversion from the ppb (parts per billion) standard to micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) was based upon guidance provided by USEPA (USEPA, 2010a). Conversion from ppb to $\mu\text{g}/\text{m}^3$ for the 1-hour SO₂ standard was based upon the conversion used for the 3-hour secondary NAAQS for SO₂.

Table 2-1.
1-Hour NO₂ and SO₂ NAAQS

Pollutant	NAAQS (ppb)	NAAQS ($\mu\text{g}/\text{m}^3$)
Nitrogen dioxide (NO ₂)	100 ¹	189
Sulfur dioxide (SO ₂)	75 ²	195

Notes:

¹ 40 CFR Parts 50 and 58

² 40 CFR Parts 50, 53, and 58

3. Modeling Methodology

The modeling will be performed using the most recent version of AERMOD (version 09292), and pre-processing programs, AERMAP (version 09040), and AERMET (version 06341) as was used for the PSD permit modeling, and was also recommended in the 1-hour NO₂ guidance memoranda from USEPA.

Following USEPA guidance (USEPA, 1990), the air quality analyses for both the 1-hour NO₂ and 1-hour SO₂ standards will consist of two distinct phases:

- a preliminary analysis to determine if facility emissions will result in a significant impact on ambient air quality, and
- a full impact, or multisource analysis that includes modeling emissions from the proposed source, other existing sources, and the emissions due to planned growth that accompanies the new source. A full impact analysis is required for any pollutant where the estimated pollutant concentration equals or exceeds the applicable significant impact level.

3.1. Meteorological Data

Five years of AERMOD-ready data provided by FDEP will be used for the analyses. The data from 2001 through 2005 is based on hourly surface data from Palm Beach International Airport and upper air data from Florida International University, Miami. Palm Beach International Airport, the nearest National Weather Service (NWS) station is approximately 6.9 miles southeast of the site. Information on the terrain and meteorological data used in the AERMOD set-up can be found in the original protocol.

3.2. Receptor Locations

The modeling for the 1-hour NO₂ and SO₂ standards will be performed using the same receptor grid locations as were used for the Class II modeling analysis; namely, receptors were placed on a Cartesian grid network designed to ensure that the maximum impact was captured. A fine 100 meter (m)-spaced grid was placed out to 3 kilometers (km). A coarser grid with 500-m spacing was placed from 3-km to 10-km, followed by a coarser 1,000-m spaced grid from 10-km out to 30-km. Receptors were also placed around the Proposed Facility fence line at a spacing of 50 meters. Because the public will have limited access within the fence lines of both the existing NCRRF and the Proposed

Facility (for example, at drop-off areas and at visitor centers), grid receptors within the fence line were also included in the model.

3.3. Source Data

Sources of NO₂ and SO₂ emissions at the Proposed Facility include the MWC units (MWC emissions are exhausted from a tall stack which contains three identical flues, one for each of the three identical MWC units), one (1) 250 kW diesel-fired emergency generator, and two (2) 250 HP diesel-fired fire water pumps (one unit is back-up). Following guidance from FDEP, routine testing and emergency operation will be excluded from consideration in the 1-hour NO₂ and SO₂ NAAQS modeling analyses since the units will meet the federal definition of emergency units (see, for example, 40CFR93: NESHAPS for Reciprocating Internal Combustion Engines); namely,

1. The units will be used solely in the event of an emergency when the other units onsite would not be operating.
2. Testing and maintenance of the emergency units will be limited to 100 hours per year, and each routine test period will be approximately 30 minutes long, such that the 1-hour standard would not apply.
3. Under true emergency conditions, the emergency units will be operated as long as needed, but no longer than necessary.

Therefore, the modeling for the 1-hour NO₂ and SO₂ NAAQS will consider the emissions of the three MWC combustion units. As described in the Air Quality Modeling Report, the three identical MWC flues will be adjacent to each other within an outer concrete shell; and will be modeled as a single merged stack with an equivalent diameter following regulatory guidance.

3.4. Operating Scenario

Under the present design, NO_x emissions will be controlled using SCR technology. A worst-case load analysis will be performed and the scenario that results in the highest 1-hour impact will be used for comparison to the SILs. Note that with SCR control, the exhaust temperature will increase to 315 deg. F; all other stack parameters will be the same as reported in the *Air Quality Modeling Report*. The short-term NO₂ emission rates will be based on an in-stack NO_x concentration of 50 ppm.

3.5. Preliminary (Significant Impact) Analysis

The preliminary analysis uses the concept of a significant impact level (SIL) to screen for the need for further analysis. The SIL is used to determine if a source has the potential to cause or contribute to an exceedance of an ambient air quality standard. If the maximum modeled impact for a given pollutant and averaging time is below the applicable SIL, then no further analysis is required. If the maximum predicted impacts equals or exceeds a SIL, then a full impact analysis that includes the Proposed Facility along with other nearby sources and background concentration may be performed for that pollutant for compliance with the standard.

USEPA has developed SILs for a number of pollutants and averaging times (see Table 3-1). The SILs for PM, CO, annual NO₂ and 3-hour, 24-hour, and annual SO₂ were evaluated in the *Air Quality Modeling Report* (Malcolm Pirnie, 2010), and it was demonstrated that the maximum impacts from the Proposed Facility were well below the significance levels for these pollutants and averaging times.

The current analysis will look at the impacts for comparison to the newly promulgated 1-hour NO₂ and SO₂ standards. In the case of the new 1-hour NO₂ standard, USEPA has recently provided an interim SIL (USEPA, 2010b). According to this guidance, the recommended SIL for the 1-hour NO₂ standard is 4 ppb. Using the recommended conversion to a mass-based value (USEPA, 2010a), and rounding to a whole number following the convention of the other Class II SILs, the 1-hour NO₂ SIL is 8 µg/m³. USEPA has noted that the interim 1-hour NO₂ SIL is a *non-binding* interim value which may change once formally promulgated; however, FDEP has indicated that while each project is assessed “case-by-case,” FDEP is inclined to use this value in modeling analyses, based on their experience with recent projects. USEPA also recently recommended a *non-binding* interim value for the SIL of 3 ppb for the 1-hour SO₂ NAAQS (USEPA, 2010c). Assuming a conversion based on the 3-hour secondary standard for SO₂ (the closest averaging time to the 1-hour standard), the 1-hour SIL for SO₂ would be 8 µg/m³.

**Table 3-1
Class II Significant Impact Levels**

Pollutant	Averaging Time	Class II Significant Impact Levels (µg/m ³)
Nitrogen dioxide (NO ₂)	Annual	1
	1-hour	8 (interim - proposed)
Sulfur dioxide (SO ₂)	Annual	1
	24-hour	5
	3-hour	25
	1-hour	8 (interim - proposed)

Pollutant	Averaging Time	Class II Significant Impact Levels ($\mu\text{g}/\text{m}^3$)
Particulate matter < 10 μm (PM ₁₀)	Annual	1
	24-hour	5
Carbon monoxide (CO)	8-hour	500
	1-hour	2,000

Sources: 40 CFR 51.165, USEPA/OAQPS Memoranda (2010b), USEPA/OAQPS Memoranda (USEPA, 2010c).

A preliminary analysis will be performed using AERMOD to determine if predicted 1-hour impacts of NO₂ and SO₂ are below the 1-hour SILs identified in Table 3-1. Following the recent USEPA guidance for the 1-hour standards, the highest of the 5-year average of the maximum modeled 1-hour NO₂ and SO₂ concentrations predicted at each receptor will be compared to the 1-hour SILs. If the highest of the 5-year average of the maximum modeled 1-hour NO₂ or SO₂ impact is below their respective SIL, no further analysis will be performed for that pollutant. If the highest of the 5-year average of the maximum modeled 1-hour NO₂ or SO₂ impact is equal to or exceeds its respective SIL, then a full impact analysis may be required for that pollutant.

3.6. Full Impact Analysis

In the event that a full impact analysis is required, and depending upon the pollutant (NO₂ and/or SO₂), an inventory of sources will be requested from FDEP out to approximately 50 km beyond the significant impact area (SIA). The inventory(ies) will be reviewed and modified as necessary for the appropriate short-term emission rates and operating parameters based on readily available sources, such as the air permitting website of the FDEP. Prior to inclusion in the multisource modeling, the inventories will be screened using the 20D Method (for short-term analyses) (NCDNRCD, 1985). Inventory sources remaining after using this method may be further screened out using conventional screening techniques (e.g., identifying a significant concentration in the vicinity of the source), or will be included in the final inventory modeling.

The receptor locations in the full impact analysis will be limited to those receptor locations where the SIL is equaled or exceeded. This will allow for the identification of any potential exceedances caused by or contributed to by the Proposed Facility, while keeping the size of the data files within reason. In the event that the full impact analysis for either NO₂ or SO₂ indicates a potential modeled exceedance, the determination as to whether the Proposed Facility may potentially cause or contribute to this modeled exceedance may be determined both spatially (at locations where the SIL is exceeded) and temporally (at the time of a potential modeled exceedance in terms of year, month, day, and hour) as recommended by USEPA. If the modeling indicates that there is no exceedance of a standard where the Proposed Facility is determined to be significant

(both spatially and temporally), then the Proposed Facility will be assumed not cause or contribute to an exceedance of a standard.

4. Modeling for 1-Hour NO₂ NAAQS

Following recent USEPA guidance, if the maximum predicted impacts (highest of the 5-year average of the maximum modeled 1-hour NO₂ concentrations) are below the proposed SIL (Table 3-1), then the facility impacts will be deemed insignificant, and no further analysis will be performed for the 1-hour NO₂ standard. If the proposed SIL is equaled or exceeded, then a full multisource analysis may be performed. The multisource NO₂ analysis would use the inventory of sources provided by FDEP, screened as previously discussed.

Modeling for compliance with the 1-hour NO₂ NAAQS will use the recommended three (3) tier screening approach. Initially, Tier 1/Tier 2 (Ambient Ratio Method, NO₂/NO_x = 0.75) will be used. If necessary, Tier 3, which accounts for the chemical reactions that convert NO to NO₂ in the presence of ozone, and additionally, allows for the use of site-specific ozone data, will be used.

4.1. NO₂/NO_x Ratios (for Tier 3)

The typical in-stack ratio for mass burn waste-to-energy combustion units is 0.05 (NO₂ to NO_x)¹. The ambient equilibrium NO₂/NO_x ratio will be set to 0.9, the default equilibrium ratio within the PVMRM mode.

4.2. Background Ozone Concentrations (for Tier 3)

In the event that Tier 3 is used, hourly ozone data from a nearby representative monitoring stations for the same years as the meteorological data used in the model (2001 to 2005), requested from FDEP, will be used in both preliminary and full impact analyses. The ozone data provided by FDEP were collected at a number of stations within Palm Beach County. The primary ozone monitoring station used was located at the Royal Palm WWTP (980 Crestwood Blvd N) and was the closest monitor to Proposed Facility. The other monitoring stations were used to replace extended periods of missing data. Procedures for filling in missing hourly ozone data are described in Attachment A of this protocol.

¹ E-mail from M. Hergott (Martin GmbH) to A. Chattopadhyay, Sept. 2, 2010.

4.3. Background NO₂ Concentrations

While USEPA has proposed a “first-tier assumption” of adding the overall highest hourly background NO₂ concentration from a representative monitor to the modeled design value at those receptors above the SIL, it also considered the use of further refinement through temporal pairing of modeled and monitored background values. In the event that the use the overall highest hourly NO₂ concentration from a representative monitoring station is too conservative, hourly NO₂ background data (for the same five years of meteorological data used for the modeling, 2001 to 2005) may also be used in order to refine the NAAQS analysis both spatially and temporally. Hourly NO₂ data from Palm Beach County (Belvedere Rd site, Monitor No. 099-1004) was provided by FDEP. This station is approximately 10 kilometers south-southeast of the project site and is on the northern border of Palm Beach International Airport. A review of area around this monitoring station shows that it is surrounded by a number of NO_x-emitting facilities including the Proposed Facility. Therefore, monitored concentrations at this location are considered to be representative of the project site. In the event of missing hourly NO₂ data, procedures will be followed to fill in gaps in the hourly NO₂ data. These procedures are summarized in Attachment B of this protocol.

From a review of the hourly NO₂ background data provided by FDEP, NO₂ concentrations appear to be trending downward from 2001 to 2009, probably associated with increased NO_x control regulations for both stationary and mobile sources. Therefore, use of this earlier NO₂ background data (i.e., 2001 through 2005) should provide somewhat conservative impacts when added to the modeled concentrations from the Proposed Facility and the inventory sources.

4.4. Comparison to 1-hour NO₂ NAAQS

The 1-hour NO₂ standard is in the form of the 98th percentile of the annual distribution of the daily maximum 1-hour concentration averaged over the 5 years of meteorological data used for the analysis. In the modeling analysis, this is interpreted as the average of the 8th highest daily maximum 1-hour concentrations at every receptor averaged over the 5 years of meteorological data. The AERMOD program does not currently have the capability to perform the necessary post-processing to provide this form of output, and USEPA is currently in the process of developing and testing post-processing program needed to process the AERMOD output for this format. If needed, post-processing will be performed following USEPA guidance. A number of software vendors have developed 1-hour NO₂ post-processing capability as part of their model software package. Post-processing for comparison to the statistical form of the 1-hour NO₂ standard may also use this post-processing software (BREEZE software). This post-processing software was designed to follow USEPA guidance provided in their 1-hour NO₂ modeling notice (USEPA, 2010a).

5. Modeling for 1-Hour SO₂ NAAQS

Following recent USEPA guidance, if the maximum predicted impacts (highest of the 5-year average of the maximum modeled 1-hour SO₂ concentrations) are below the proposed SIL (Table 3-1), then the facility impacts will be deemed insignificant, and no further analysis will be performed for the 1-hour SO₂ standard. If the proposed SIL is equaled or exceeded, then a full multisource analysis may be performed. The multisource SO₂ analysis would use the inventory of sources provided by FDEP.

5.1. Comparison to the 1-Hour SO₂ Standard

The 1-hour SO₂ standard is in the form of the 99th percentile of the annual distribution of the daily maximum 1-hour concentrations. In the modeling analysis, this is represented as the 4th highest daily maximum 1-hour concentration at each receptor averaged over the five years of meteorological data. Until USEPA provides the necessary post-processing software for the 1-hour SO₂ standard, post-processing of the AERMOD output results will be performed using procedures adapted from those outlined by USEPA in their 1-hour NO₂ modeling notice (USEPA, 2010a). Commercial software (BREEZE software) developed to process the 1-hour SO₂ model output may also be used.

If a full impact analysis is performed, the modeled 1-hour SO₂ impacts may be combined initially with the maximum 1-hour SO₂ concentration from the previous three (3) years from the nearest representative monitoring station for comparison to the standard. Further refinement may also be applied both spatially and temporally using available hourly SO₂ monitoring data from a nearby representative monitoring station as discussed above for NO₂.

6. Documentation

The results of the analysis will be documented in a report that describes the analysis and provides the modeling results and conclusions of the analyses. Copies of the model input and output files in electronic format will also be provided to FDEP for their review.

7. References

FDEP, 2010. *Request for Additional Information. DEP File No. 0990234-017-AC (PSD-FL-413.* Florida Department of Environmental Protection. Letter dated June 15, 2010.

Malcolm Pirnie, 2010. *Air Quality Modeling Report. Palm Beach Renewable Energy Facility No. 2.* Submitted as Appendix F of the PSD Permit Application. April 2010.

NCDNRCD, 1985. *Screening Threshold Method for PSD Modeling.* North Carolina Department of Natural Resources and Community Development. Division of Environmental Management.

USEPA, 1990. *New Source Review Workshop Manual – Prevention of Significant Deterioration and Nonattainment Area Permitting – DRAFT.* Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

USEPA, 2010a. *Notice Regarding Modeling for New Hourly NO₂ NAAQS.* Office of Air Quality Planning and Standards (OAQPS), Air Quality Modeling Group (AQMG). February 25, 2010.

USEPA, 2010b. *Guidance Concerning the Implementation of the 1-hour NO₂ NAAQS for the Prevention of Significant Deterioration Program.* Office of Air Quality Planning and Standards (OAQPS). Memorandum from Stephen D. Page to Regional Air Division Directors dated June 29, 2010.

USEPA, 2010c. *Guidance Concerning the Implementation of the 1-hour SO₂ NAAQS for the Prevention of Significant Deterioration Program.* Office of Air Quality Planning and Standards (OAQPS). Memorandum from Stephen D. Page to Regional Air Division Directors dated August 23, 2010.

Attachment A: Methodology for Filling in Missing Hourly Ozone Data

If the Plume Volume Molar Ratio Method (PVMMR) mode of AERMOD is used for estimating the 1-hour NO₂ concentrations under Tier 3, ambient ozone concentrations from the monitoring station at Royal Palm WWTP (980 Crestwood Blvd N, the monitoring site nearest to the project site) during the 2001-2005 period modeled in the PSD analysis will be used to represent hourly background ozone levels.

These hourly ozone data are used within the PVMMR option of AERMOD in order to simulate the atmospheric chemistry of ozone reacting with nitric oxide (NO) emitted from the stack to form NO₂. The model disperses the initial NO_x emissions (which are mostly NO), each hour of the day over each year of meteorological data (e.g., 8,760 hours a day in a 365-day year). AERMOD allows replacement of any missing data in the ozone data file using a single value or to import an ozone data file where the missing hourly ozone concentrations have already been filled. In order to more realistically predict downwind NO₂ concentrations based on the ozone diurnal pattern, missing hours of ambient ozone concentration will be filled using the hourly background O₃ data according to the following procedures.

1. If three or fewer consecutive hours of ambient ozone concentrations are missing, linear interpolation will be used to fill in the missing concentrations based on the previous and subsequent hour concentrations from the same day as follows:
 - a. If only one value (A_n) is missing, then A_n = arithmetic mean of A_{n-1} and A_{n+1} , where A_{n-1} is the previous concentration and A_{n+1} is the subsequent concentration.
 - b. If A_n and A_{n+1} (two values) are missing, then $A_n = A_{n-1} * 0.67 + A_{n+2} * 0.33$ and $A_{n+1} = A_{n-1} * 0.33 + A_{n+2} * 0.67$.
 - c. If A_{n-1} , A_n and A_{n+1} (three values) are missing, then $A_{n-1} = A_{n-2} * 0.75 + A_{n+2} * 0.25$, $A_n = A_{n-2} * 0.5 + A_{n+2} * 0.5$, $A_{n+1} = A_{n-2} * 0.25 + A_{n+2} * 0.75$.
2. If four or more consecutive hours of ambient ozone concentrations are missing, then substitution for each missing concentration will be filled by concentrations from another nearby alternate monitor from the same hours that were missing. [Alternate ozone data from a nearby waste water treatment plant in Palm Beach County (Monitor #120992004) was used for the years 2001, 2002, 2003 and up to

August 4th, 2004. After August 4th, 2004, available ozone data from the Lantana monitor (Monitor #120990020) was used as the replacement data source for periods of four or more hours.]

3. If there are four or more consecutive hours of missing ambient ozone data for both the main and alternate monitoring stations, then data for the same hours from the previous day prior to the missing data or following day of the missing data, whichever period contains the higher ambient monitoring concentrations will be used to replace the missing hours.

Attachment B: Methodology for Filling In Missing Hourly NO₂ Background Data

If pairing impacts and background concentrations spatially and temporally, hourly ambient monitored NO₂ concentrations will be combined with the predicted NO₂ impacts from the multi-source analysis in order to estimate the total predicted 1-hour NO₂ concentrations. Background ambient NO₂ concentrations from the monitoring station in Palm Beach County (Belvedere Rd site, Monitor No. 099-1004), during the 2001-2005 period used in the air quality analysis were obtained from FDEP.

Missing hours of ambient NO₂ concentration will be filled using a method similar to the methodology described in Attachment A for ozone data. The methodology is based on the following procedures.

1. If three or fewer consecutive hours of ambient NO₂ concentrations are missing, linear interpolation will be used to fill in the missing concentrations based on the previous and subsequent hour concentrations from the same day as follows:
 - a. If only one value (A_n) is missing, then A_n = arithmetic mean of A_{n-1} and A_{n+1} , where A_{n-1} is the previous concentration and A_{n+1} is the subsequent concentration.
 - b. If A_n and A_{n+1} (two values) are missing, then $A_n = A_{n-1} * 0.67 + A_{n+2} * 0.33$ and $A_{n+1} = A_{n-1} * 0.33 + A_{n+2} * 0.67$.
 - c. If A_{n-1} , A_n and A_{n+1} (three values) are missing, then $A_{n-1} = A_{n-2} * 0.75 + A_{n+2} * 0.25$, $A_n = A_{n-2} * 0.5 + A_{n+2} * 0.5$, $A_{n+1} = A_{n-2} * 0.25 + A_{n+2} * 0.75$.
2. If four or more consecutive hours of ambient NO₂ concentrations are missing, then other substitution methods will be applied to fill in the missing values:
 - a. If four to ten missing values are present in a row, subjective substitution methods were used while accounting for both the hours prior to and after the period of missing data.
 - b. If ten or more values in a continuous period are missing, the filled concentrations are derived from either the specific hours of the day missing using the seasonal diurnal maximum of monitored NO₂ values

from the same year for which the data is missing. The concentration values from both the period prior to and after the missing data will be reviewed to determine if seasonal or maximum diurnal values are appropriate for the filling process. The only exception to this method occurred for the autumn season from 2004 where no monitoring concentrations were reported. NO₂ values from a bordering year would be used. In this case, monitoring concentrations from the previous autumn (2003) was used for data replacement since the following year (2005) had more periods of missing data.

In the case of SO₂, should the first tier assumption of using the overall highest hourly SO₂ background concentration from a representative monitoring station be too conservative, a similar procedure may be followed if representative hourly SO₂ monitoring data is used for the SO₂ background for comparison to the 1-hour standard.