Florida Power & Light Company, P.O. Box 088801, North Palm Beach, FL 33408-8801

FPL

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MAY 1? 1993

Division of Air
Resources Management

May 19, 1993

FPL-JEN-DER-170-93-17

Mr. Hamilton S. Oven, Jr. PE.
Florida Department of Environmental Regulation
2600 Blair Stone Rd Room 612
Tallahassee, FL 32399

Re: **Martin CG/CC Project**
**PA 89-27 Modification Request**
**Response to your Letter Dated April 19, 1993**

Dear Mr. Oven:

In response to your letter dated April 19, 1993, FPL submits the following responses to the comments of the Department concerning our February 2, 1993, request for modification of the Site Certification for the Martin CG/CC Project. The following responses also reflect the additional discussions we had with the Department's staff on May 12, 1993. The actual Department comments have been repeated prior to FPL's response in order to provide a complete and coherent picture.

1.) Tables 2-7 and 2-8 of the original PSD application (SCA section 10.1.5) list emissions based on continuous operation (8760 hrs/yr) for the auxiliary boiler and the diesel generator. The PSD permit itself is silent regarding the quantity of emissions (TPY) for these sources. For the emergency diesel generator, a continuous operation of 8760 hrs/yr will cause an emission increase of over 40 TPY of $NO_x$. This may subject this source to PSD regulations which requires a BACT determination for this pollutant.

**RESPONSE: FPL hereby withdraws its request for unlimited operation of the auxiliary boiler and emergency diesel generator and now proposes to limit operation of these sources to circumstances consistent with the current Site Certification. Specifically, FPL requests that the current condition in the Site Certification (II.A.7) and the corresponding condition of the PSD permit (Specific condition 7) be revised to read as follows:**

**"Auxiliary Steam Boiler and Diesel Generator shall operate only during start-up and shutdown, periodic maintenance testing and for emergency power generation. $NO_x$ emissions for the auxiliary steam boiler shall not exceed 0.3 lb/MMBtu for natural**

**gas firing or for oil firing. $NO_x$ emissions for the diesel generator shall not exceed 15.0 grams/hp-hr."**

**The phrase "periodic maintenance testing" is currently in the Site Certification condition but is not in the PSD permit condition. The auxiliary boiler and emergency diesel generator are each expected to operate no more than 400 hours per year under these circumstances. Since there is now no request by FPL for increased hours of operation of these sources, no new BACT determination should be required.**

2.) General Electric (GE) should provide a technical explanation of why dry low $NO_x$ combustors are not able to meet the emission limits during the initial periods of a "cold start." The explanation should include laboratory data as a verification. Furthermore, GE should indicate whether the same problem exists with the other models of Frame 7 combustion turbines.

**RESPONSE: The GE Dry Low $NO_x$ (DLN II) combustion system is capable of starting, loading and producing 25 ppm $NO_x$ emission in less than 20 minutes in a simple cycle configuration (CT only). However, the combined cycle configuration (CT, HRSG, & ST) at Martin Unit 3 & 4 imposes certain constraints on the DLN II system during "cold start" and will require a substantially longer start-up phase as compared to the simple cycle configuration.**

**DLN II has three modes of operation: 1.) Diffusion firing (start up, 0 to 50 % load), 2.) Lean lean (transition, 20 to 100 % load) and 3.) Pre mix (low $NO_x$, 50 to 100 % load). This overlap of load in the three modes of operation allows for the optimization of emissions during field testing which will be conducted after initial firing of the combustion turbine (CT). Also the "cold start-up" procedures for Units 3 & 4 will be refined after the field testing. During a unit start-up (CT, HRSG, & ST) the control system moves the CT through the three modes of operation identified above in accordance with standard operating procedures to minimize emissions. A simple cycle CT can achieve this "cold start" in minutes since there are no large metal components downstream of the exhaust.**

**At the Martin Site, two large metal components are downstream of the CT. First is the heat recovery steam generator (HRSG) which will be exposed to the 1,200 F exhaust gas produced by the CT. The HRSG is comprised of heavy, thick-wall components which must be heated up gradually to avoid unacceptable thermal stresses. Secondly, as the HRSG heats up, it begins to produce large quantities of hot steam. The steam turbine (ST) is also a large, thick, metal structure which must also be heated up slowly to avoid unacceptable thermal stresses. These two constraints require the CT to remain in the diffusion firing and lean-lean modes at low load to allow the HRSG and ST to warm up. It is this procedure that produces elevated exhaust emissions for the additional two hours of a cold start-up. Even though very few "cold starts" are expected for the new Martin units, FPL**

**is continuing to work on minimizing the duration of "cold start" time. The combination of steam turbine heater blankets (which keep the ST warm when the HRSG is offline) and the steam by-pass around the ST (used during start-up and ST trips) coupled with the adjustability inherent in the DLN II system will result in minimizing the amount of time required to achieve the low $NO_x$ pre mix firing mode.**

3.) The pollutants subject to PSD review include: $SO_2$, $NO_x$, and PM. Why were only $NO_x$ emissions values revised?

**RESPONSE: FPL's original request addressed only those pollutants ($NO_x$) for which emission limits for the auxiliary boiler and emergency diesel generator were included in the Site Certification and PSD permit and which needed to be revised, based on design refinements. Generally $SO_2$ and PM only change if the quality of the fuel changes and no change in fuel quality is proposed. The auxiliary boiler and diesel generator have only a $NO_x$ emission limit in the permits; $SO_2$ will continue to be controlled by restricting the sulfur in the fuel.**

4.) As originally permitted, the auxiliary boilers and the diesel generator would only be operated during the periods of start-up and shut-down. Because of this, we agreed that emissions from these two sources could simply be added to the big sources in the original modeling study. However, if the operational restrictions are to be removed, the auxiliary boiler and diesel generators should be considered as separate sources.

**RESPONSE: As stated in the response to comment 1, FPL is hereby revising its request regarding the operational limits for the auxiliary boiler and emergency diesel generator to that which is currently consistent with the Site Certification. Collocation of these sources with the CT emission sources, as the department originally accepted, should therefore remain appropriate for modeling purpose.**

5.) The stack parameters for both sources have been revised. The revised stack heights and exit velocities are much lower than the permitted ones (stack height on the boiler lowered from 18.3 m to 12.8 m and on the generator from 7.6 m to 3.8 m). The screen model shows the impact from the revised parameters are much higher than the permitted ones. Further modeling study is required. What are the stack parameters for the auxiliary boiler when oil is burned? For the CT/HRSG stack, when the stack parameters are being changed, modeling study should be done to prove no larger impact than the permitted one. Use the highest emission rate including the excess emission in "Cold Start."

**RESPONSE: As stated in the response to comment 1, FPL is hereby revising its request for unlimited operation of the auxiliary boiler and emergency diesel generator. Any changes in the impact associated with these two sources should be insignificant, even taking into**

account the revised stack parameters, because both the auxiliary boiler and emergency diesel generator will be smaller and have lower emission rates (lb/hr) than those previously modeled. Therefore, no additional modeling should be necessary.

The stack parameters for the auxiliary boiler when firing oil are not expected to be significantly different than when firing natural gas.

FPL's modeling and impact assessment done during the licensing process was based on 100 percent firing of 0.5 percent sulfur oil in all four Martin CG/CC Units (3-6). This scenario resulted in worst case overall emissions. FPL recently used the SCREEN model to estimate the impact associated with the changes of the CT/HRSG stack parameters for Units 3 & 4. That SCREEN modeling, contained in Attachment A, shows only a 1 percent increase in ground level concentration when compared to the modeling analysis for Units 3 & 4 with the original stack parameters when firing oil under worst case ambient temperature (40 F) scenario. This increase is not considered to be significant. The predicted values will also be well below the ambient air quality standards. While the revised modeling for gas is higher than the original modeling for gas, the gas scenario is still less than the worst case oil-firing scenario previously modeled. Therefore further detailed modeling is not warranted.

The impact of the requested additional two hours of "cold start" emissions on the maximum concentrations modeled in the Site Certification Application for the ultimate site capacity (Martin Units 3-6) has also been evaluated. A conservative "ratioing" technique using the highest values previously modeled was utilized. It was assumed that there would be 12 "cold starts" per year which last longer than the 2 hours allowed by 17-210.700(1) F.A.C.

For $NO_x$, the increase in emissions resulting from this assumption for Units 3 & 4 would be more than offset by the elimination from immediate consideration of Units 5 & 6, which will need to be reanalyzed at a later time. Thus, by ratioing, ambient impacts would be less than previously presented.

For CO, both the 1-hour and 8-hour worst case conditions were considered and these maximum values are still well below the significance values ( 2000 ug/m$^3$ and 500 ug/m$^3$ for the 1-hour and 8-hour averaging times), and therefore, there should be no need for further modeling.

For VOC, the "cold start" emissions are relatively small and since no modeling was originally perform, no comparison is possible.

As was indicated in our meeting, the emergency diesel generator will be tested and made operational by May 22, 1993, so that it may be available to provide emergency backup power once hydrogen is loaded into the generators. The auxiliary boilers will be tested and readied for operation beginning June 1, 1993 in order to supply steam for the startup of the steam turbines later that month.

FPL recognizes the heavy workload of the Department but respectfully requests that the Department work quickly with FPL to bring this matter to conclusion since Units 3 & 4 are scheduled soon to undergo initial start-up and field testing. Also, FPL has not received any questions on its request to modify the associated PSD permit and assumes that the permit can be revised as requested.

If you or the Department's staff have any questions regarding these responses, please call Dan MacDougall at (407) 625-7661.

Sincerely,

Wayne C. Ondler / DSR

Wayne C. Ondler
Environmental Licensing Project Manager
Environmental Affairs

cc: Clair Fancy DER/TAL
Preston Lewis DER/TAL
Teresa Heron DER/TAL

**FPL MARTIN CG/CC PROJECT**

**REQUEST FOR MODIFICATION OF CERTIFICATION**

**RESPONSE TO FDER QUESTIONS**

**ATTACHMENT A**

**MAY 1993**

FPL MARTIN
SUMMARY OF SCREEN MODELLING
ORIGINAL vs FINAL DESIGN

STACK PARAMETERS

| | ORIGINAL @ 40oF | | FINAL @ 40oF | |
|---|---|---|---|---|
| | GAS | OIL | GAS | OIL |
| H (ft) | 213.3 | 213.3 | 213.3 | 213.3 |
| D(ft) | 20 | 20 | 18 | 18 |
| Vs(ft/s) | 61 | 61.7 | 68.1 | 76.2 |
| Ts(oF) | 280 | 280 | 209 | 275 |
| METRIC | | | | |
| H (M) | 65 | 65 | 65 | 65 |
| D(M) | 6.1 | 6.1 | 5.5 | 5.5 |
| Vs(m/s) | 18.6 | 18.8 | 20.8 | 23.2 |
| Ts(oK) | 411 | 411 | 371 | 408 |

MODELLING SUMMARY @ 1g/s

| | | | | |
|---|---|---|---|---|
| MAX CONC. (ug/m3) | 0.6565 | 0.6504 | 0.8884 | 0.6574 |
| DISTANCE TO MAX(M) | 1209 | 1212 | 1103 | 1205 |

| | NAT GAS | OIL |
|---|---|---|
| MAX CONCENTRATION % DIFF. | 35.3 | 1.1 |
| DISTANCE TO MAX DIFFERENCE (M) | −106 | −7 |

*** SCREEN-1.2 MODEL RUN ***
*** VERSION DATED 91/10 ***

ORIGINAL ***** FPL MARTIN ***** NAT. GAS *****

SIMPLE TERRAIN INPUTS:

| | | |
|---|---|---|
| SOURCE TYPE | = | POINT |
| EMISSION RATE (G/S) | = | 1.000 |
| STACK HEIGHT (M) | = | 65.00 |
| STK INSIDE DIAM (M) | = | 6.10 |
| STK EXIT VELOCITY (M/S) | = | 18.6000 |
| STK GAS EXIT TEMP (K) | = | 411.00 |
| AMBIENT AIR TEMP (K) | = | 277.00 |
| RECEPTOR HEIGHT (M) | = | .00 |
| IOPT (1=URB,2=RUR) | = | 2 |
| BUILDING HEIGHT (M) | = | .00 |
| MIN HORIZ BLDG DIM (M) | = | .00 |
| MAX HORIZ BLDG DIM (M) | = | .00 |

***************************************
*** SUMMARY OF SCREEN MODEL RESULTS ***
***************************************

| CALCULATION PROCEDURE | MAX CONC (UG/M**3) | DIST TO MAX (M) | TERRAIN HT (M) |
|---|---|---|---|
| SIMPLE TERRAIN | .6565 | 1209. | 0. |

*******************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
*******************************************************

BUOY. FLUX = 553.18 M**4/S**3; MOM. FLUX = 2169.02 M**4/S**2.

*** FULL METEOROLOGY ***

*************************************
*** SCREEN AUTOMATED DISTANCES ***
*************************************

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES **

| DIST (M) | CONC (UG/M**3) | STAB | U10M (M/S) | USTK (M/S) | MIX HT (M) | PLUME HT (M) | SIGMA Y (M) | SIGMA Z (M) | DWASH |
|---|---|---|---|---|---|---|---|---|---|
| 1000. | .5198 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 265.8 | 482.8 | NO |
| 1100. | .6250 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 286.9 | 582.3 | NO |
| 1200. | .6564 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 307.6 | 693.0 | NO |
| 1300. | .6434 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 328.0 | 814.8 | NO |
| 1400. | .6137 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 348.1 | 947.8 | NO |
| 1500. | .5829 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 367.3 | 1091.9 | NO |
| 1600. | .5613 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 381.6 | 1245.9 | NO |
| 1700. | .5410 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 395.9 | 1411.7 | NO |
| 1800. | .5219 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 410.4 | 1589.3 | NO |
| 1900. | .5040 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 424.9 | 1778.7 | NO |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2000. | .4873 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 439.5 | 1979.9 | NO |
| 2100. | .4716 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 454.2 | 2192.9 | NO |
| 2200. | .4568 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 468.9 | 2417.7 | NO |
| 2300. | .4429 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 483.6 | 2654.4 | NO |
| 2400. | .4297 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 498.4 | 2903.1 | NO |
| 2500. | .4174 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 513.2 | 3163.7 | NO |
| 2600. | .4057 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 527.9 | 3436.3 | NO |
| 2700. | .3947 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 542.7 | 3721.0 | NO |
| 2800. | .3842 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 557.5 | 4017.8 | NO |
| 2900. | .3743 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 572.2 | 4326.7 | NO |
| 3000. | .3649 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 587.0 | 4647.8 | NO |
| 3500. | .3243 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 660.5 | 5000.0 | NO |
| 4000. | .2922 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 569.3 | 544.3 | NO |
| 4500. | .2993 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 622.9 | 608.3 | NO |
| 5000. | .2946 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 676.4 | 674.0 | NO |
| 5500. | .2834 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 729.6 | 741.1 | NO |
| 6000. | .2694 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 782.5 | 809.4 | NO |
| 6500. | .2548 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 835.0 | 878.7 | NO |
| 7000. | .2408 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 887.3 | 948.8 | NO |
| 7500. | .2279 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 939.1 | 1019.7 | NO |
| 8000. | .2161 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 990.7 | 1091.3 | NO |
| 8500. | .2056 | 2 | 2.0 | 2.3 | 816.9 | 815.9 | 1041.9 | 1163.6 | NO |
| 9000. | .2042 | 3 | 2.0 | 2.4 | 775.9 | 774.9 | 773.8 | 499.2 | NO |
| 9500. | .2063 | 3 | 2.0 | 2.4 | 775.9 | 774.9 | 809.4 | 520.5 | NO |
| 10000. | .2068 | 3 | 2.0 | 2.4 | 775.9 | 774.9 | 844.8 | 541.7 | NO |
| 15000. | .1755 | 3 | 2.0 | 2.4 | 775.9 | 774.9 | 1192.4 | 755.6 | NO |
| 20000. | .1957 | 5 | 1.0 | 1.9 | 5000.0 | 257.5 | 754.3 | 122.4 | NO |
| 25000. | .1993 | 5 | 1.0 | 1.9 | 5000.0 | 257.5 | 917.3 | 131.0 | NO |
| 30000. | .1977 | 5 | 1.0 | 1.9 | 5000.0 | 257.5 | 1075.9 | 138.7 | NO |
| 40000. | .1877 | 5 | 1.0 | 1.9 | 5000.0 | 257.5 | 1382.8 | 152.1 | NO |
| 50000. | .1706 | 5 | 1.0 | 1.9 | 5000.0 | 257.5 | 1678.6 | 161.2 | NO |

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1000. M:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1209. | .6565 | 1 | 2.0 | 2.3 | 816.9 | 815.9 | 309.2 | 702.3 | NO |

DIST = DISTANCE FROM THE SOURCE
CONC = MAXIMUM GROUND LEVEL CONCENTRATION
STAB = ATMOSPHERIC STABILITY CLASS (1=A, 2=B, 3=C, 4=D, 5=E, 6=F)
U10M = WIND SPEED AT THE 10-M LEVEL
USTK = WIND SPEED AT STACK HEIGHT
MIX HT = MIXING HEIGHT
PLUME HT= PLUME CENTERLINE HEIGHT
SIGMA Y = LATERAL DISPERSION PARAMETER
SIGMA Z = VERTICAL DISPERSION PARAMETER
DWASH = BUILDING DOWNWASH:
DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

***********************************
*** END OF SCREEN MODEL OUTPUT ***
***********************************

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1300. | .8197 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 315.4 | 809.8 | NO |
| 1400. | .7840 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 330.3 | 941.4 | NO |
| 1500. | .7500 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 345.3 | 1084.7 | NO |
| 1600. | .7186 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 360.4 | 1239.6 | NO |
| 1700. | .6896 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 375.6 | 1406.2 | NO |
| 1800. | .6627 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 390.8 | 1584.4 | NO |
| 1900. | .6378 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 406.0 | 1774.3 | NO |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2000. | .6147 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 421.3 | 1975.9 | NO |
| 2100. | .5932 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 436.6 | 2189.3 | NO |
| 2200. | .5731 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 451.9 | 2414.4 | NO |
| 2300. | .5544 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 467.1 | 2651.5 | NO |
| 2400. | .5369 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 482.4 | 2900.4 | NO |
| 2500. | .5204 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 497.6 | 3161.2 | NO |
| 2600. | .5050 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 512.9 | 3434.0 | NO |
| 2700. | .4904 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 528.0 | 3718.9 | NO |
| 2800. | .4768 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 543.2 | 4015.8 | NO |
| 2900. | .4638 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 558.4 | 4324.9 | NO |
| 3000. | .4516 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 573.5 | 4646.1 | NO |
| 3500. | .4187 | 2 | 2.0 | 2.3 | 675.6 | 674.6 | 500.1 | 465.8 | NO |
| 4000. | .4214 | 2 | 2.0 | 2.3 | 675.6 | 674.6 | 555.3 | 529.7 | NO |
| 4500. | .4060 | 2 | 2.0 | 2.3 | 675.6 | 674.6 | 610.2 | 595.2 | NO |
| 5000. | .3828 | 2 | 2.0 | 2.3 | 675.6 | 674.6 | 664.7 | 662.3 | NO |
| 5500. | .3581 | 2 | 2.0 | 2.3 | 675.6 | 674.6 | 718.8 | 730.4 | NO |
| 6000. | .3346 | 2 | 2.0 | 2.3 | 675.6 | 674.6 | 772.4 | 799.6 | NO |
| 6500. | .3135 | 2 | 2.0 | 2.3 | 675.6 | 674.6 | 825.6 | 869.7 | NO |
| 7000. | .2948 | 2 | 2.0 | 2.3 | 675.6 | 674.6 | 878.4 | 940.5 | NO |
| 7500. | .2974 | 3 | 2.0 | 2.4 | 642.4 | 641.4 | 655.7 | 419.8 | NO |
| 8000. | .2998 | 3 | 2.0 | 2.4 | 642.4 | 641.4 | 692.2 | 441.4 | NO |
| 8500. | .2992 | 3 | 2.0 | 2.4 | 642.4 | 641.4 | 728.5 | 463.2 | NO |
| 9000. | .2964 | 3 | 2.0 | 2.4 | 642.4 | 641.4 | 764.7 | 485.0 | NO |
| 9500. | .2918 | 3 | 2.0 | 2.4 | 642.4 | 641.4 | 800.7 | 506.8 | NO |
| 10000. | .2861 | 3 | 2.0 | 2.4 | 642.4 | 641.4 | 836.5 | 528.6 | NO |
| 15000. | .2329 | 5 | 1.0 | 1.9 | 5000.0 | 236.4 | 585.4 | 107.4 | NO |
| 20000. | .2609 | 5 | 1.0 | 1.9 | 5000.0 | 236.4 | 753.9 | 119.8 | NO |
| 25000. | .2585 | 5 | 1.0 | 1.9 | 5000.0 | 236.4 | 917.0 | 128.6 | NO |
| 30000. | .2509 | 5 | 1.0 | 1.9 | 5000.0 | 236.4 | 1075.7 | 136.4 | NO |
| 40000. | .2303 | 5 | 1.0 | 1.9 | 5000.0 | 236.4 | 1382.6 | 150.1 | NO |
| 50000. | .2055 | 5 | 1.0 | 1.9 | 5000.0 | 236.4 | 1678.4 | 159.3 | NO |

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1000. M:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1103. | .8884 | 1 | 2.0 | 2.3 | 675.6 | 674.6 | 276.0 | 579.0 | NO |

DIST = DISTANCE FROM THE SOURCE
CONC = MAXIMUM GROUND LEVEL CONCENTRATION
STAB = ATMOSPHERIC STABILITY CLASS (1=A, 2=B, 3=C, 4=D, 5=E, 6=F)
U10M = WIND SPEED AT THE 10-M LEVEL
USTK = WIND SPEED AT STACK HEIGHT
MIX HT = MIXING HEIGHT
PLUME HT= PLUME CENTERLINE HEIGHT
SIGMA Y = LATERAL DISPERSION PARAMETER
SIGMA Z = VERTICAL DISPERSION PARAMETER
DWASH = BUILDING DOWNWASH:
DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

***********************************
*** END OF SCREEN MODEL OUTPUT ***
***********************************

04-26-93
05:49:19

*** SCREEN-1.2 MODEL RUN ***
*** VERSION DATED 91/10 ***

FINAL DESIGN ***** FPL MARTIN ***** OIL *****

SIMPLE TERRAIN INPUTS:

```
   SOURCE TYPE              =    POINT
   EMISSION RATE (G/S)      =    1.000
   STACK HEIGHT (M)         =    65.00
   STK INSIDE DIAM (M)      =     5.50
   STK EXIT VELOCITY (M/S)= 23.2000
   STK GAS EXIT TEMP (K)    =   408.00
   AMBIENT AIR TEMP (K)     =   277.00
   RECEPTOR HEIGHT (M)      =      .00
   IOPT (1=URB,2=RUR)       =    2
   BUILDING HEIGHT (M)      =      .00
   MIN HORIZ BLDG DIM (M)   =      .00
   MAX HORIZ BLDG DIM (M)   =      .00
```

***************************************
*** SUMMARY OF SCREEN MODEL RESULTS ***
***************************************

| CALCULATION PROCEDURE | MAX CONC (UG/M**3) | DIST TO MAX (M) | TERRAIN HT (M) |
|---|---|---|---|
| SIMPLE TERRAIN | .6574 | 1208. | 0. |

***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************

BUOY. FLUX = 552.40 M**4/S**3; MOM. FLUX = 2763.51 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
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*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES **

| DIST (M) | CONC (UG/M**3) | STAB | U10M (M/S) | USTK (M/S) | MIX HT (M) | PLUME HT (M) | SIGMA Y (M) | SIGMA Z (M) | DWASH |
|---|---|---|---|---|---|---|---|---|---|
| 1000. | .5210 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 265.8 | 482.7 | NO |
| 1100. | .6261 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 286.8 | 582.3 | NO |
| 1200. | .6572 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 307.5 | 693.0 | NO |
| 1300. | .6441 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 327.9 | 814.7 | NO |
| 1400. | .6143 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 348.1 | 947.8 | NO |
| 1500. | .5835 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 367.2 | 1091.9 | NO |
| 1600. | .5619 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 381.5 | 1245.9 | NO |
| 1700. | .5415 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 395.8 | 1411.7 | NO |
| 1800. | .5224 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 410.3 | 1589.3 | NO |
| 1900. | .5045 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 424.8 | 1778.7 | NO |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2000. | .4878 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 439.5 | 1979.9 | NO |
| 2100. | .4720 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 454.1 | 2192.8 | NO |
| 2200. | .4572 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 468.8 | 2417.7 | NO |
| 2300. | .4433 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 483.6 | 2654.4 | NO |
| 2400. | .4301 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 498.3 | 2903.1 | NO |
| 2500. | .4178 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 513.1 | 3163.7 | NO |
| 2600. | .4061 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 527.9 | 3436.3 | NO |
| 2700. | .3950 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 542.6 | 3721.0 | NO |
| 2800. | .3846 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 557.4 | 4017.8 | NO |
| 2900. | .3746 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 572.2 | 4326.7 | NO |
| 3000. | .3652 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 586.9 | 4647.8 | NO |
| 3500. | .3246 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 660.4 | 5000.0 | NO |
| 4000. | .2927 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 569.2 | 544.2 | NO |
| 4500. | .2997 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 622.9 | 608.2 | NO |
| 5000. | .2950 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 676.3 | 673.9 | NO |
| 5500. | .2837 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 729.5 | 741.1 | NO |
| 6000. | .2697 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 782.4 | 809.3 | NO |
| 6500. | .2550 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 835.0 | 878.6 | NO |
| 7000. | .2410 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 887.2 | 948.8 | NO |
| 7500. | .2280 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 939.1 | 1019.7 | NO |
| 8000. | .2163 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 990.6 | 1091.3 | NO |
| 8500. | .2057 | 2 | 2.0 | 2.3 | 816.3 | 815.3 | 1041.8 | 1163.5 | NO |
| 9000. | .2046 | 3 | 2.0 | 2.4 | 775.3 | 774.3 | 773.8 | 499.2 | NO |
| 9500. | .2066 | 3 | 2.0 | 2.4 | 775.3 | 774.3 | 809.3 | 520.4 | NO |
| 10000. | .2071 | 3 | 2.0 | 2.4 | 775.3 | 774.3 | 844.8 | 541.7 | NO |
| 15000. | .1756 | 3 | 2.0 | 2.4 | 775.3 | 774.3 | 1192.4 | 755.5 | NO |
| 20000. | .1959 | 5 | 1.0 | 1.9 | 5000.0 | 257.4 | 754.3 | 122.3 | NO |
| 25000. | .1995 | 5 | 1.0 | 1.9 | 5000.0 | 257.4 | 917.3 | 131.0 | NO |
| 30000. | .1979 | 5 | 1.0 | 1.9 | 5000.0 | 257.4 | 1075.9 | 138.7 | NO |
| 40000. | .1878 | 5 | 1.0 | 1.9 | 5000.0 | 257.4 | 1382.8 | 152.1 | NO |
| 50000. | .1708 | 5 | 1.0 | 1.9 | 5000.0 | 257.4 | 1678.6 | 161.2 | NO |

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1000. M:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1208. | .6574 | 1 | 2.0 | 2.3 | 816.3 | 815.3 | 309.0 | 701.1 | NO |

DIST = DISTANCE FROM THE SOURCE
CONC = MAXIMUM GROUND LEVEL CONCENTRATION
STAB = ATMOSPHERIC STABILITY CLASS (1=A, 2=B, 3=C, 4=D, 5=E, 6=F)
U10M = WIND SPEED AT THE 10-M LEVEL
USTK = WIND SPEED AT STACK HEIGHT
MIX HT = MIXING HEIGHT
PLUME HT= PLUME CENTERLINE HEIGHT
SIGMA Y = LATERAL DISPERSION PARAMETER
SIGMA Z = VERTICAL DISPERSION PARAMETER
DWASH = BUILDING DOWNWASH:
DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

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*** END OF SCREEN MODEL OUTPUT ***
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# EXCESS EMISSION REQUEST

# FOR CT COLD STARTS

**FLORIDA POWER & LIGHT COMPANY**

**MARTIN CG/CC PROJECT**

**JANUARY, 1993**

Baseloading rating

# EXCESS EMISSION REQUEST FOR CT COLD STARTS

Florida Power & Light Company (FPL) obtained certification to construct and operate multiple combined-cycle (CC) units in several phases at the existing 11,300 acre Martin site pursuant to the Florida Electric Power Plant Siting Act, Chapter 403, Part II, Florida Statutes, in February, 1991. A PSD permit for the Project was issued on June 3, 1991. Detailed information about the Martin CG/CC Project is contained in the 8 volume Site Certification Application filed in December 1989, as amended.

The new units, (identified as Martin Units 3 & 4 (Phase I) and Units 5 & 6 (Phase II preliminary approval)) are capable of firing natural gas, No. 2 fuel oil, and coal derived gas. Units 3 & 4 are now under construction, with commercial operation scheduled to begin between November, 1993 and April, 1994. Each unit consists of two combustion turbines (CT), two heat recovery steam generator (HRSG), and one steam turbine (ST). Each CT/HRSG will exhaust to an individual stack.

As stated above, Units 3 & 4 have been previously permitted but recent information, design refinements, and field verification have necessitated FPL to request a revision of the Site Certification and PSD permit. Specifically this package addresses FPL's request for clarification that the startup period for these units includes an additional two hours, (for a total of 4 hours). A "cold start" is when the steam turbine is at approximately ambient temperature.

FPL selected the CT which incorporated best available controls within its design and normal operation while using clean fuels such as natural gas and No. 2 fuel oil with the low potential for airborne emissions as compared to other units. The CT's selected for Units 3 & 4 are the General Electric (GE) model 7001F/A, advanced design with dry low NOx combustors (DLN II). Units 3 & 4 will be GE's first field application of this technology.

The use of dry low NOx combustors when firing natural gas eliminates wet injection and consumption of large volumes of water for NOx control. The DLN II combustors are still under development and have not been field tested in a CT. However, lab data has indicated that the DLN II combustor will not be able to meet the Project's permitted emission limits for several pollutants during the initial periods of a "cold start". The excess emissions are due to the fact that the CT's during a "cold start" must hold loads at low levels to allow the ST to warm up before engaging the premix option of the DLN II combustor (ie. 25 ppm NOx) on natural gas and of steam injection on oil.

A "cold start" using a DLN II combustor in combined cycle configuration presents a new and unique situation. Unlike CT's which use a traditional burner design to control NOx, the DLN II combustors are unable to control the CT exhaust temperature to the HRSG and ultimately the steam turbine when firing natural gas. The absence of exhaust temperature controls could result in significant

to Establish best O.P.

thermal stress on the back end equipment. The thermal stress damages and substantially reduces the operational life of the equipment. The DLN II combustor when fired on No. 2 fuel oil, is also unable to meet the permitted emission limits for certain pollutants during a "cold start". The DLN II combustor alters the typical flame pattern in the CT which results in the flame being unstable at low loads. The flame instability therefore restricts the amount of steam that can be injected without extinguishing the flame. For flame stability the unit needs to be at approximately 25% load before steam injection is initiated. The exact load level which will provide flame stabilization will be determined during field testing.

FPL and GE have spent a great deal of time and money to try and reduce the thermal stress and the corresponding "excess emissions". The HRSG's were redesigned at a cost of $5 million to tolerate higher exhaust temperatures than are typically encountered. FPL and GE have also been working together to develop a ST temperature maintenance system. The ST temperature maintenance system is designed to keep the ST warm longer between periods of operation. The cost of the ST temperature maintenance system is approximately $300,000 of capital cost. FPL and GE are also developing a "dynamic model" which predicts the performance/operating characteristics of the ST. This model will allow the start-up curve to be revised to the maximum extent possible, thereby minimizing the time required to start a cold CT.

During CT "cold starts", FPL will utilize the design refinements identified above in addition to best operational practices. Best operational practices for "cold start" are currently under development and it is anticipated that the operational practices will be verified during initial field testing of the CT's which is scheduled for late 1993.

The combustion turbines are each expected to be cold started 6 times per year (12 times per unit). The "cold start" will require approximately 4 hours for the initial firing of a CT per unit to reach a sufficiently high temperature that will not damage the back end equipment. The second CT in the unit will only take approximately 2 hours to be at operational load. FPL is therefore seeking a modification of the conditions, in both the site certification order and the PSD permit, to clarify the operating conditions for cold startup of the CTs to allow 4 hours total to meet permitted emission limits.

# AIR EMISSION ESTIMATE FOR CT COLD START

| Combustion Turbine Running Time (hours) | Actual Emissions[1] (lb/hr) per CT | | | | | |
|---|---|---|---|---|---|---|
| | NOx | CO | VOC | PM/$PM_{10}$ | Pb | $SO_2$ |
| 2 - 3 | 370 | 1180 | 90 | IN COMPLIANCE | | |
| 3 - 4 | 500 | 810 | 60 | | | |
| 4 - | IN COMPLIANCE<br>$\leq$ 177[2] | $\leq$ 94.3[2] | $\leq$ 3[2] | $\leq$ 18[2] | neg.[2] | $\leq$ 91.5[2] |

1. This data is based on latest laboratory combustion testing of an ongoing program. Some variation in these data is to be expected, however at this time (Jan, 1993) the information presented is the best estimate of cold-start-up emissions.
2. Site Certification PA 89-27 and PSD-FL-146 permitted values

AIREMCT.DRW