MIAMI-DADE WATER AND SEWER DEPARTMENT
4200 Salzedo Street, Coral Gables, Florida 33146 • Tel: 305-669-3700 • Fax: 669-3788

SERVE • CONSERVE



October 20, 1998

Mr. A. A. Linero, P.E.
Administrator
New Source Review Section
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RE: FDEP Request for Information
Draft Permit No. 0250476-002-AC, PSD-FL-240
Central District Wastewater Treatment Plant
Miami, Florida

Dear Mr. Linero:

This letter is in response to comments provided by the Florida Department of Environmental Protection (FDEP) regarding the PSD Permit Application for proposed modifications to the above-referenced facility. Comments on the application were received from FDEP in a letter dated April 15, 1998. This letter is included in Attachment A. A signed P.E. Certification Statement is included in Attachment B along with a signed Responsible Official Certification Statement.

Our consultant, CH2M HILL has discussed these comments with Syed Arif, FDEP New Source Review Section, in order to obtain clarification and additional detail. Our responses to your comments reflect these discussions and are provided below:

***FDEP Comment No. 1*** – The response for the cost analysis for SCR technology for the Three 3,600 hp diesel engines includes cost of three SCR's. Please provide the cost analysis in $/ton removed if the three stacks are combined and a single SCR system is employed to reduce the NOx emissions to 12.1 lb/hr and 78.1 tons/yr.

***Response*** - In response to this comment and to a comment received from EPA for the Preston generators PSD application, additional evaluation of the appropriateness of selective catalytic reduction (SCR) emission control technology has been performed. A key element of this assessment is the fact that, in order for SCR technology to achieve effective reduction of NOx, the catalyst temperature must be at least 550°F. Based on the way this facility operates, there are prolonged periods of time when this will not be the case.

Approximate engine exhaust temperature information obtained from the equipment manufacturer (telephone conversation with Mike Thiel, Engine Systems Inc, on September 3, 1998), and

average engine operating loads monitored at the plant from September 1996 and September 1998 are provided in Attachment C. This information indicates that the 20E4 engine must be operating in the range of approximately 50 to 100 percent of full capacity in order for exhaust temperatures to exceed 550°F. While average 20E4 engine loads in 1996 and 1997 were 66 percent and 57 percent, respectively, monthly average loads ranged from less than 10 percent to greater than 95 percent. Based on information provided by the facility and the accuracy of the information provided by the manufacturer, it appears the exhaust temperatures from the 20E4 engines will be below 550°F up to approximately 50 percent of the time. Under these conditions, an SCR NOx emission control system on the 20E4 engines would not be beneficial for NOx reduction.

Cost estimates have been obtained from an SCR equipment manufacturer for a single system capable of treating the combined exhaust from all three diesel engines. The estimate and revised cost effectiveness tables are included in Attachment D. The revised tables should replace Tables 5-2 through 5-5 of the February 1998 application submittal. The cost effectiveness of using a single SCR system to control emissions of NOx from the diesel engines is estimated to be $3,800 per ton of NOx removed, taking into account the fact that the SCR will not be reducing NOx emissions at loads less than 50 percent. Three separate systems would be somewhat higher in price. For comparison, the cost effectiveness of using combustion modifications to control emissions of NOx from the diesel engines is estimated to be $31 per ton NOx removed.

Based on our evaluation, it appears that the use of SCR technology is not a technically feasible method of reducing NOx emissions from the 20E4 diesel engines when engine loading is less than 50 percent. When the use of SCR technology *is* technically feasible, the cost of NOx removal is relatively high at $3,800/ton of NOx removed. Based on this assessment, it does not appear that SCR technology meets the criteria for BACT emissions control for NOx emissions from these engines. Therefore, the use of SCR is rejected as BACT in favor of the combustion modifications previously proposed.

***FDEP Comment No. 2*** – Table 3-1 of the updated application lists a different emission value for CO at 25% load compared to the original application. Please explain the discrepancy.

***Response*** – Table 3-1 summarizes emissions from all three 20E4 engines. Both applications used the same power output-specific emission factor for CO of 1.45 g/bhp-hr. This factor, provided by EMD, applies to operation at 25% load (900 bhp). The original application (June 1997) showed emissions of 50.1 tons CO/year from all three 20E4 engines based on 21,750,000 kW-hr (31,320,000 bhp-hr) power output. This was in error because maximum power output from all three 20E4 engines operating continuous at 25% load is only 23,652,000 bhp-hr, which corresponds to 37.8 tons CO/year. Table 3-1 in the February 1998 application submittal is correct. See Attachment E for CO emissions calculations

***FDEP Comment No. 3*** – Please provide past actual emissions for criteria pollutants for the four Superior 16GTLB engines. Also, indicate the future potential emissions for the criteria pollutants for these units. What are the operating hour restrictions on these engines based on the current permit. Rule 62-212.300(3)(a)1 and 2 of the General Preconstruction Review mandates submittal of this information.

***Response*** – The Superior 16GTLB engines at this plant have been tested annually for emissions of NOx, using EPA Method 7E, as required by FDEP Operating Permit AO13-244408. All results have been submitted to the Southeast District Office. These engines are currently limited to 18.3 pounds per hour of NOx emissions; 6,800 hours per year of operation (each); and 27,200 hours per year of operation (total). According to the engine manufacturer, emissions of NOx from these engines while burning natural gas should not exceed 5.3 lb/hr.

A summary of past NOx stack test results is provided in Attachment F.

***FDEP Comment No. 4*** – Please indicate if any physical modifications will be done to the four Superior 16GTLB engines. If so, provide in detail what those modifications will be.

***Response*** – No physical modifications are proposed for the four 16GTLB Superior engines. The intent of the requested permit modification is to reduce allowable emissions of NOx to levels typically observed from these types of engines, and to increase operational flexiblity by eliminating limits on hours of operation.

MDWASD is requesting elimination of operating hour restrictions and any monitoring requirements from the permit application. Modeled emissions are based on potential emissions from these sources (continuous full-load operation of all 4 engines, each emitting 5.3 lb NOx/hr).

***FDEP Comment No. 5*** – In your air quality impact analysis section there was no table summarizing the cumulative PSD increment impact from all sources in the area on the PSD Class I Everglades National Park. You provided modeling results which show that you did a cumulative increment impact analysis and that these values are less than the PSD Class I NOx increment of 2.5 $\mu$g/m3. Please submit this summary table in order to complete the air quality impact analysis.

***Response*** – Tables summarizing maximum cumulative PSD NOx increment consumption and maximum predicted NOx concentrations in the Everglades National Park Class I area are provided in Attachment G.

***Request for Change to Application (Unsolicited)*** - Based on comments received from FDEP and EPA on applications submitted for other similar sources, the previously proposed annual power output and NOx emissions limitations (32,200,000 kW-hr/yr and 7.34 g/kW-hr, respectively) should be replaced with an equivalent heat input-based emissions limitation of 2.15 lbNOx/MMBTU. For the 20E4 engine, maximum NOx emissions of 2.15 lb/MMBTU occur at

full (100%) load. Emissions calculations provided in Attachment E indicate that this quantity of fuel consumption will result in the same amount of NOx emissions as the originally proposed power output limit.

At the request of Cleve Halladay, FDEP, a USGS map is included in Attachment H that shows the locations of refined modeling receptors. A diskette of ISC model input and output files is also enclosed with this letter.

If you have any questions about these responses, please call me at (305) 669-7668.

Sincerely,

R C Ready

Robert C. Ready, P.E.
Assistant Director
Treatment Facilities

c: Laxmana Tallam, FDEP/WPB
David Lindberg, CH2MHILL (w/o attachments)

cc: S. Arif, BAR
C. Halladay, BAR
SED
Dade Co.
EPA
NPS

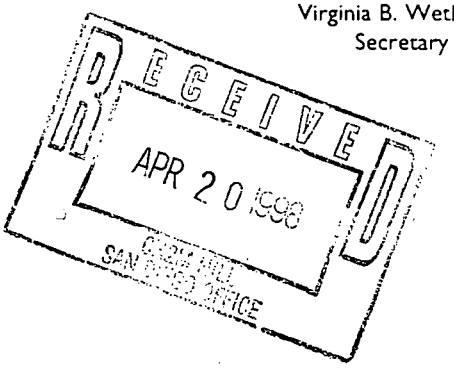
**ATTACHMENT A**
FDEP Request for Information Regarding Air Construction/Operation Permit Application
Draft Permit No. 0250476-002-AC, PSD-FL-240
Central District Wastewater Treatment Plant, Dade County

# Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary




April 15, 1998

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Robert C. Ready, P.E.
Assistant Director of Treatment Facility
Miami-Dade Water & Sewer Department
4200 Salzedo Street
Coral Gables, Florida 33146-0316

Re: DRAFT Permit No. 0250476-002-AC, PSD-FL-240
Central District Wastewater Treatment Plant

Dear Mr. Ready:

The Department has received your response to our August 21, 1997 incompleteness letter regarding air construction/operation permit for Three 3,600-horsepower (hp) Diesel Engine Driven Generator Sets. The response also includes a request for modification to your construction permit (AC13-81285) for Four Superior 16GTLB engines at your Central District Wastewater Treatment Plant. The updated application was received on March 16, 1998. The Department will combine the two projects under the same PSD permit and has therefore returned the fee of $4,500 that was included with the updated application. We will also coordinate with the District Office in issuing the PSD and the Title V operating permit simultaneously. In order to expedite the application, we need the additional information listed below:

1. The response for the cost analysis for SCR technology for the Three 3,600 hp diesel engines includes cost of three SCR's. Please provide the cost analysis in $/ton removed if the three stacks are combined and a single SCR system is employed to reduce the $NO_X$ emissions to 12.1 lb/hr and 78.1 tons/yr.

2. Table 3-1 of the updated application lists a different emission value for CO at 25% load compared to the original application. Please explain the discrepancy.

3. Please provide past actual emissions for criteria pollutants for the four Superior 16GTLB engines. Also, indicate the future potential emissions for the criteria pollutants for these units. What is the operating hour restrictions on these engines based on the current permit. Rule 62-212.300(3)(a)1 and 2 of the General Preconstruction Review mandates submittal of this information.

4. Please indicate if any physical modifications will be done to the four Superior 16GTLB engines. If so, provide in detail what those modifications will be.

5. In your air quality impact analysis section there was no table summarizing the cumulative PSD increment impact from all sources in the area on the PSD Class I Everglades National Park. You provided modeling results which show that you did a cumulative increment impact analysis and that these values are less than the PSD Class I $NO_X$ increment of 2.5 $ug/m^3$. Please submit this summary table in order to complete the air quality impact analysis.

If you have any questions, please call me or Cleve Holladay (meteorologist) at 850/488-1344.

Sincerely,

Syed Arif, P.E.
New Source Review Section

SA/a

cc: Mr. Brian Beals, EPA
Mr. John Bunyak, NPS
Mr. Isidore Goldman, SED
Mr. Patrick Wong, DERM
Mr. David Lindberg, P.E., CH2M-Hill

**ATTACHMENT B**
Responsible Official and P.E. Certification Statements
Central District Wastewater Treatment Plant, Dade County

Central District Wastewater Treatment Plant

**Owner/Authorized Representative or Responsible Official**

1. Name and Title of Owner/Authorized Representative or Responsible Official :

Name : Robert Ready, P.E.
Title : Director of Treatment Facilities

2. Owner or Authorized Representative or Responsible Official Mailing Address :

Organization/Firm : Miami-Dade Water &Sewer Department
Street Address : 4200 Salzedo Street
City : Coral Gables
State : FL Zip Code : 33146-0316

3. Owner/Authorized Representative or Responsible Official Telephone Numbers :

Telephone : (305)669-7668 Fax : (305)669-3753

4. Owner/Authorized Representative or Responsible Official Statement :

*I, the undersigned, am the ~~owner or authorized representative* of the non-Title V source addressed in this Application for Air Permit or the~~ responsible official, as defined in Rule 62-210.200, F.A.C., of the Title V source addressed in this application, ~~whichever is applicable.~~ I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions units.*

R C Ready 10-20-98

Signature Date

* Attach letter of authorization if not currently on file.

4. Professional Engineer Statement :

*I, the undersigned, hereby certify, except as particularly noted herein*, that :*

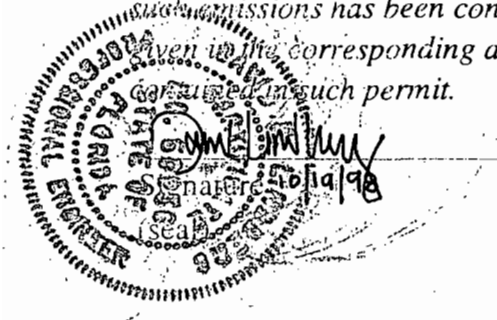
*(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollutant control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and*

*(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.*

*If the purpose of this application is to obtain a Title V source air operation permit (check here [ ] if so), I further certify that each emissions unit described in this Application for Air Permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance schedule is submitted with this application.*

*If the purpose of this application is to obtain an air construction permit for one or more proposed new or modified emissions units (check here [ ✓ ] if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.*

*If the purpose of this application is to obtain an initial air operation permit or operation permit revision for one or more newly constructed or modified emissions units (check here [ ] if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.*




Signature

19 October 1998
Date

**ATTACHMENT C**
Average 20E4 Engine Operating Loads – 1996 and 1997
Central District Wastewater Treatment Plant

**Central District WWTP**
**Power Production Summary**
**Miami-Dade Water and Sewer Department**

| | *Diesel Engines* | | | | | | | *Gas Engines* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Operating Hours | | | | | Average Load | | Operating Hours | | | | | | Average Load | |
| Date | Gen #1: EMD 20E4 | Gen #2: EMD 20E4 | Gen #3: EMD 20E4 | TOTAL | Power Output (kW-hr) | (kW) | % | Gen #1 | Gen #2 | Gen #3 | Gen #4 | TOTAL | Power Output (kW-hr) | (kW) | % |
| Sep-96 | 80 | 27 | 66 | 173 | 262,000 | 1,514 | 60% | 0 | 568 | 205 | 399 | 1,172 | 1,274,000 | 1,087 | 91% |
| Oct-96 | 40 | 22 | 33 | 95 | 140,000 | 1,474 | 58% | 0 | 542 | 286 | 564 | 1,392 | 1,540,000 | 1,106 | 92% |
| Nov-96 | 104 | 28 | 65 | 197 | 484,000 | 2,457 | 97% | 25 | 621 | 0 | 740 | 1,386 | 1,554,000 | 1,121 | 93% |
| Dec-96 | 170 | 97 | 176 | 443 | 754,000 | 1,702 | 67% | 516 | 87 | 417 | 141 | 1,161 | 1,274,000 | 1,097 | 91% |
| Jan-97 | 31 | 34 | 0 | 65 | 84,000 | 1,292 | 51% | 535 | 0 | 399 | 424 | 1,358 | 1,596,000 | 1,175 | 98% |
| Feb-97 | 9 | 113 | 0 | 122 | 152,000 | 1,246 | 49% | 250 | 0 | 524 | 469 | 1,243 | 1,288,000 | 1,036 | 86% |
| Mar-97 | 7 | 42 | 0 | 49 | 93,000 | 1,898 | 75% | 567 | 324 | 550 | 0 | 1,441 | 1,491,000 | 1,035 | 86% |
| Apr-97 | 65 | 36 | 9 | 110 | 241,000 | 2,191 | 86% | 275 | 554 | 2 | 378 | 1,209 | 1,295,000 | 1,071 | 89% |
| May-97 | 72 | 204 | 74 | 350 | 672,000 | 1,920 | 76% | 293 | 38 | 153 | 426 | 910 | 924,000 | 1,015 | 85% |
| Jun-97 | 139 | 60 | 120 | 319 | 533,000 | 1,671 | 66% | 505 | 29 | 28 | 531 | 1,093 | 1,183,000 | 1,082 | 90% |
| Jul-97 | 14 | 33 | 61 | 108 | 141,000 | 1,306 | 51% | 425 | 527 | 111 | 290 | 1,353 | 1,407,000 | 1,040 | 87% |
| Aug-97 | 9 | 85 | 51 | 145 | 224,000 | 1,545 | 61% | 632 | 530 | 196 | 9 | 1,367 | 1,456,000 | 1,065 | 89% |
| Sep-97 | 8 | 5 | 9 | 22 | 16,000 | 727 | 29% | 667 | 514 | 156 | 0 | 1,337 | 1,484,000 | 1,110 | 92% |
| Oct-97 | 41 | 2 | 56 | 99 | 170,000 | 1,717 | 68% | 374 | 570 | 20 | 371 | 1,335 | 1,414,000 | 1,059 | 88% |
| Nov-97 | 3 | 2 | 0 | 5 | 1,000 | 200 | 8% | 656 | 267 | 0 | 500 | 1,423 | 1,463,000 | 1,028 | 86% |
| **1997** | **568** | **713** | **556** | **1,837** | **3,081,000** | **1,677** | **66%** | **5,695** | **3,440** | **2,556** | **3,539** | **15,230** | **16,275,000** | **1,069** | **89%** |
| Dec-97 | 21 | 9 | 11 | 41 | 15,000 | 366 | 14% | 471 | 524 | 0 | 619 | 1,614 | 1,533,000 | 950 | 79% |
| Jan-98 | 15 | 10 | 1 | 26 | 35,000 | 1,346 | 53% | 291 | 250 | 28 | 223 | 792 | 1,561,000 | 1,971 | 164% |
| Feb-98 | 73 | 13 | 6 | 92 | 6,000 | 65 | 3% | 348 | 218 | 303 | 777 | 1,646 | 1,470,000 | 893 | 74% |
| Mar-98 | 29 | 12 | 26 | 67 | 238,000 | 3,552 | 140% | 452 | 4,432 | 264 | 323 | 5,471 | 1,442,000 | 264 | 22% |
| Apr-98 | 13 | 53 | 32 | 98 | 285,000 | 2,908 | 114% | 554 | 172 | 407 | 267 | 1,400 | 1,407,000 | 1,005 | 84% |
| May-98 | 20 | 10 | 0 | 30 | 7,000 | 233 | 9% | 532 | 589 | 314 | 0 | 1,435 | 1,505,000 | 1,049 | 87% |
| Jun-98 | 74 | 25 | 15 | 114 | 66,000 | 579 | 23% | 475 | 273 | 519 | 0 | 1,267 | 1,470,000 | 1,160 | 97% |
| Jul-98 | 42 | 9 | 50 | 101 | 139,000 | 1,376 | 54% | 529 | 545 | 307 | 0 | 1,381 | 1,421,000 | 1,029 | 86% |
| Aug-98 | 89 | 84 | 133 | 306 | 406,000 | 1,327 | 52% | 155 | 414 | 415 | 271 | 1,255 | 1,274,000 | 1,015 | 85% |
| Sep-98 | 72 | 17 | 156 | 245 | 451,000 | 1,841 | 72% | 153 | 100 | 374 | 432 | 1,059 | 1,169,000 | 1,104 | 92% |
| **1998** | **448** | **242** | **430** | **1,120** | **1,633,000** | **1,458** | **57%** | **3,489** | **7,517** | **2,931** | **2,912** | **17,320** | **14,252,000** | **823** | **69%** |

CH2MHILL SUBJECT 20E4 & 20F4B BY D. LINDBERG

EXHAUST TEMPS, SCR CATALYST SHEET NO. 1 of ____ DATE 9/3/98

TEMP RANGE. PROJECT NO. 148

According to Mike Thiel, ESI, exhaust temps decrease with load as follows: EMD did not provide written documentation...

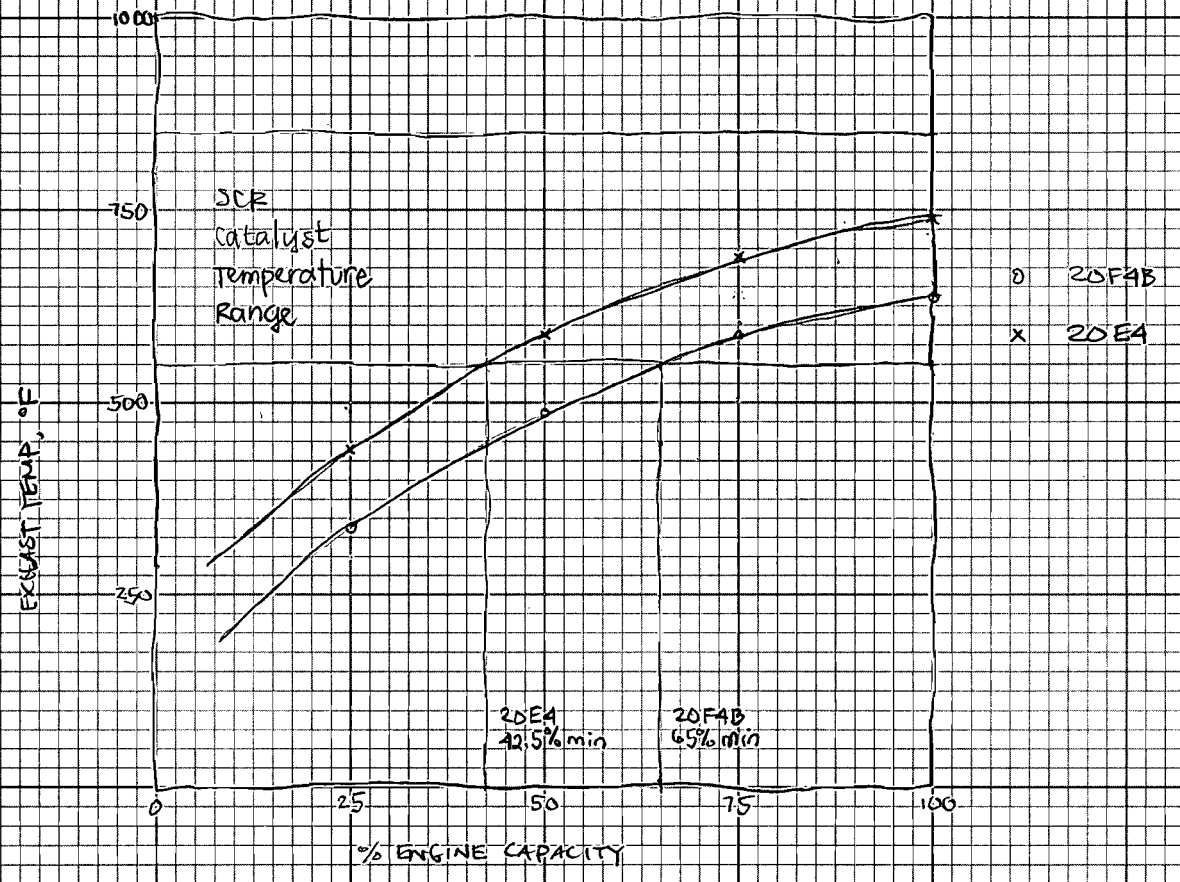
## 20F4B EXHAUST TEMPS

| | | | | |
|---|---|---|---|---|
| 100% load | 635°F | | | |
| 75% load | 635°F | − 50°F | ≅ | 585°F |
| 50% load | 635°F | − 150°F | ≅ | 485°F |
| 25% load | 635°F | − 300°F | ≅ | 335°F |

from EMD (verbal)

## 20E4 EXHAUST TEMPS

| | | | | |
|---|---|---|---|---|
| 100% load | 735°F | | | |
| 75% load | 735°F | − 50°F | ≅ | 685°F |
| 50% load | 735°F | − 150°F | ≅ | 585°F |
| 25% load | 735°F | − 300°F | ≅ | 435°F |



**ATTACHMENT D**
Revised Cost Effectiveness Determination
Central District Wastewater Treatment Plant

**PEERLESS MFG. CO.** FACSIMILE MESSAGE
2819 Walnut Hill Lane • Dallas, Texas 75229 • (214) 357-6181 • FAX: (214) 351-0194

**TO:** CH2MHILL
**ATTN:** Mr. David Lindberg
**FAX:** (619) 687-0111
**RE:** **SCR Pricing for Diesel Gen Sets**
**Your Reference: Miami - Dade County Water & Sewer**
**Peerless Reference: PMC-1967**

**DATE:** June 8, 1998
**PAGES:** One (1)
**CC:** PJB/TTS/PMC-1967

Dear Mr. Lindberg,

I apologize for the delay in getting you this information. We will need more detailed design dat to "firm up" our pricing and sizing.

Below is a table that summarizes the pricing for the various SCR systems. I do not have good estimates for installation, but I assume it to be between 20-35% of contract price.

| | Budget SCR Price (excluding tank) |
|---|---|
| Central District<br>20E4 (3) | $450K |
| Preston WTP<br>20E4 (3)<br>20F4B (3) | $450K<br>$550K |
| Orr WTP<br>20F4B (4) | $780K |

The budget (± 20%) price includes catalyst, reactor (external insulation by others), Ammonia Flow Control Unit (AFCU), Ammonia Injection Grid (AIG). We will adjust sizing/pricing upon more detail design/information.

The preliminary size of the bigger reactors (20F4B) is approximately 36'w x 44'h x 12'd. This dimension does not include room for future catalyst. If you have any questions or need any additional information, please call.

Best Regards,

Tim T. Shippy
Sales Engineer
SCR Systems Division
**PEERLESS MFG. CO.**

J:\SCR\SALES\QUOTES\1968\CH26-8.FAX

**PEERLESS MFG. CO.** FACSIMILE MESSAGE
2819 Walnut Hill Lane • Dallas, Texas 75229 • (214) 357-6181 • FAX: (214) 351-0194

**TO:** CH2MHILL
**ATTN:** Mr. David Lindberg
**FAX:** (619) 687-0111
**RE:** **SCR Pricing for Diesel Gen Sets**
**Your Reference: Miami - Dade County Water & Sewer**
**Peerless Reference: PMC-1967**

**DATE:** September 24, 1997
**PAGES:** One (1)
**CC:** PJB/TTS/PMC-1967

Dear Mr. Lindberg,

Below is a table that summarizes the pricing for the various SCR systems. I do not have good estimates for installation, but I assume it to be between 20-35% of contract price.

| | Anhydrous Ammonia Consumption @ 100% Load (lbs/hr) - Estimate | Budget SCR Price per engine (excluding tank) | Price including $NH_3$ Storage Tanks & inst. and vaporizer |
|---|---|---|---|
| Central District<br>20E4<br>16G4A | <br>23 ea.<br>18 ea. | <br>$165K ea.<br>$150K ea. | 6 Systems<br>$1.1M |
| Preston WTP<br>20E4<br>20F4B | <br>23 ea.<br>48 ea. | <br>$165K ea.<br>$200K ea. | 6 Systems<br>$1.35M |
| Orr WTP<br>20F4B | <br>48 ea. | <br>$200K ea. | 4 Systems<br>$1M |

The budget (±20%) price includes catalyst, reactor (external insulation by others) with transition ducting, Ammonia Flow Control Unit (AFCU), Ammonia Injection Grid (AIG). Tanks are included in final column pricing. The tank is sized to hold about 15,000 gallons $H_2O$. It will feed all units. We will adjust sizing/pricing upon more detail design/information.

The preliminary size of the bigger reactors (20F4B) is approximately 9'w x 11'h x 12'd. This dimension does not include room for future catalyst. If you have any questions or need any additional information, please call.

Best Regards,

Tim T. Shippy
Sales Engineer
SCR Systems Division
**PEERLESS MFG. CO.**

J:\SCR\SALES\QUOTES\1968\CH2MHILL.FAX

**Table 1**
**Total Capital Cost Estimates**
**Central District WWTP Standby Generators**
**Miami-Dade Water and Sewer Department**

| | Retarded Timing + Aftercoolers | SCR |
|---|---|---|
| **Direct costs** | | |
| Purchased equipment cost (PEC) | | |
| Control devices, auxilary equip, instrumentation[1,2] | $ 33,103 | $ 650,000 |
| Two Extractive NOx and O2 CEMS Systems[3] | $ - | $ 160,300 |
| Sales Taxes (3% of PEC) | $ 993 | $ 24,309 |
| Freight (5% of PEC) | $ 1,655 | $ 40,515 |
| Direct installation cost[4] | $ 14,897 | $ 292,500 |
| **Total direct cost** | **$ 50,648** | **$ 1,167,624** |
| **Indirect costs** | | |
| Indirect installation costs[5] | $ 10,924 | $ 214,500 |
| Contingencies[6] | $ 6,621 | $ 130,000 |
| **Total indirect cost** | **$ 17,545** | **$ 344,500** |
| **TOTAL CAPITAL COST** | **$ 68,193** | **$ 1,512,124** |

1 Includes catalyst, reactor (external installation by others) with transition ducting, ammonia flow control unit, ammonia injection grid, and a 15,000 gallon anhydrous ammonia tank.
2 20E4 SCR system ($450,000) and one 15,000 gallon ammonia tanks ($200,000).
3 Estimate obtained from EPA CEMS Cost Manual, version 3.0 for extractive CEMS at an existing plant with NOx and O2 monitors ($148,300) and fuel flow meters ($4,000 each engine).
4 Direct installation cost assumed equal to 45% of PEC, and includes foundation and supports, handling and erection, electrical, piping, insulation for ductwork, and painting.
5 Indirect installation cost assumed equal to 33% of PEC and include engineering, construction and field expenses, contractors fees, start-up costs, performance testing, model study, and technician training.
6 Contingency costs assumed equal to 20% of PEC and include equipment redesign and modifications, cost escalations, and delays in start-up.

**Table 2**
**Total Annual Cost Estimates**
**Central District WWTP Standby Generators**
**Miami-Dade Water and Sewer Department**

| | Cost | Unit | Retarded Timing + Aftercoolers | SCR |
|---|---|---|---|---|
| **Total Operating Hours (all 3 engines)** | | | 12,880 | 12,871 |
| **Direct annual costs** | | | | |
| Utilities | | | | |
| Electricity @ 20 kW[1] | $ 0.06 | kW-hr | $ - | $ 15,445 |
| Diesel fuel[2] | $ 0.77 | gallon | $ (13,591) | $ 9,767 |
| Natural Gas | $ 0.40 | therm | $ - | $ - |
| Anhydrous ammonia @ 48 lb/hr each | $ 275.00 | ton | $ - | $ 84,949 |
| Operating labor | | | | |
| Operating labor[3] | $ 30.39 | hr | $ - | $ 66,369 |
| Supervising labor[4] | | | $ - | $ 9,955 |
| Maintenance[5] | | | $ 811 | $ 15,917 |
| CEM O&M | | | $ - | $ 14,800 |
| CEM Annual RATA | | | $ - | $ 12,000 |
| CEM Quarterly CGAs | | | $ - | $ 5,600 |
| CEM Recordkeeping | | | $ - | $ 10,600 |
| CEM Annual Review and Update | | | $ - | $ 10,200 |
| Annual compliance test (two engines) | | | $ 3,500 | $ - |
| Catalyst replacement[6] | | | $ - | $ 242,433 |
| Catalyst disposal[7] | $ 0.15 | lb | $ - | $ 1,412 |
| **Total direct annual costs** | | | **$ (9,280)** | **$ 499,448** |
| **Indirect annual costs** | | | | |
| Overhead[8] | | | $ 487 | $ 9,550 |
| Property tax[9] | | | $ 682 | $ 15,121 |
| Insurance[10] | | | $ 682 | $ 15,121 |
| Administrative charges[11] | | | $ 1,364 | $ 30,242 |
| Capital recovery[12] | 0.15582009 | | $ 10,626 | $ 235,619 |
| CEM Capital recovery | 0.15582 | | $ - | $ 46,600 |
| **Total indirect annual costs** | | | **$ 13,840** | **$ 352,255** |
| **TOTAL ANNUAL COST** | | | **$ 4,561** | **$ 851,702** |

1 Vaporizer and instrumentation electrical requirement, 12,871 total hours of operation.
2 Anticipated change in fuel consumption is 0.7% decrease for retarded timing + aftercoolers and 0.5% increase for SCR. hours of operation, and BSFC = 0.383 lb/bhp-hr.
3 Assumes 3 hrs per 8 hr shift for SCR (6 hrs/day). No labor for IR.
4 Supervisor labor is 15% of operator labor.
5 Maintenance costs are 10% of purchased equipment costs, prorated by the number of hours of operation.
6 Catalyst replacement every 8760 hours of operation per engine.
7 Assume catalyst density 100 lb/cf. Total weight = (12880/8760)(4 modules/engine)(1600 lb/module) = 9410 lb
8 Overhead charge rate is 60% of maintenance costs.
9 Property tax is estimated to be 1% of total capital costs.
10 Insurance is estimated to be 1% of total capital costs.
11 Administrative costs are estimated to be 1% of total capital costs.
12 Capital recovery cost applied to add-on control technology only, and is calculated at an interest rate of 9% for a lifetime of 10 years (excludes CEM).

**Table 3**
**Cost Effectiveness Comparison**
**Central District WWTP Standby Generators**
**Miami-Dade Water and Sewer Department**

| | | Retarded Timing + Aftercoolers | SCR |
|---|---|---|---|
| **NOx Emissions** | | | |
| Uncontrolled | tons/yr | 520 | 520 |
| Control Efficiency | % | 28% | 85% |
| Reduction | tons/yr | 146 | 442 |
| Controlled | tons/yr | 375 | 78 |
| **Total annual cost** | $000/yr | $ 4.6 | $ 852 |
| **COST EFFECTIVENESS ($/ton NOx reduction)** | | **$ 31** | **$ 1,927** |

Note: the cost effectiveness of SCR shown assumes this technology operates 100% of the time. Actual engine operating load information indicate that exhaust temperatures may be below the minimum temperature required for SCR operation up to 50% of the time. Under these conditions, the cost effectiveness of SCR could be as high as $3,800/ton NOx removed.

**Table 4**
**Controlled and Uncontrolled NOx Emissions**
**Central District WWTP Standby Generators**
**Miami-Dade Water and Sewer Department**

| Control Technology | Reference | Uncontrolled Emissions | | | Controlled Emissions | | | |
|---|---|---|---|---|---|---|---|---|
| | | Factor (g/bhp-hr) | lb/hr | tons/yr | Efficiency | Factor (g/bhp-hr) | lb/hr | tons/yr |
| Retarded Timing + Aftercoolers | EMD | 10.19 | 80.8 | 520 | 28% | 7.3 | 58.2 | 375 |
| SCR | EMD | 10.19 | 80.8 | 520 | 85% | 1.5 | 12.1 | 78.0 |

1 Annual emissions based on 12,880 hrs/yr operation all generators at full load (32,200,000 kW-hrs/yr).

| **20-645F4B** | | % Load | BSFC (lb/bhp-hr) | gal/hr |
|---|---|---|---|---|
| Prime Mover Power Output (bhp): | 3,600 | 100% | 0.383 | 194 |
| Generator Capacity (kW): | 2,500 | 75% | 0.392 | 149 |
| Total power output (bhp-hr): | 46,368,000 | 50% | 0.425 | 108 |
| Total power output (kW-hr): | 32,200,000 | 25% | 0.479 | 61 |
| Total operation (hrs/yr): | 12,880 | | | |

**Type of CEMS**

- [x] Extractive
- [ ] InSitu
- [ ] FTIR

**Plant Type**

- [ ] New
- [x] Existing

**Sampling Lines**

- [ ] Before Control
- [x] After Control

**Monitors**

| | Before Control | After Control |
|---|---|---|
| NOx | [ ] | [x] |
| SO2 | [ ] | [ ] |
| CO | [ ] | [ ] |
| HCl | [ ] | [ ] |
| THC | [ ] | [ ] |
| O2 | [ ] | [x] |
| CO2 | [ ] | [ ] |
| Opacity | [ ] | [ ] |
| PM | [ ] | [ ] |
| Flow | [ ] | [ ] |

| Task | Corporate and facility labor costs | Consultant and test team costs | Other direct costs | Total Costs |
|---|---|---|---|---|
| Planning | $ 2,200 | $ 0 | $ 400 | $ 2,500 |
| Select Equipment | $ 10,400 | $ 0 | $ 2,000 | $ 12,300 |
| Provide support facilities | $ 0 | $ 0 | $ 10,600 | $ 10,600 |
| Purchase CEMS | $ 0 | $ 0 | $ 87,500 | $ 87,500 |
| Install & Check CEMS | $ 2,800 | $ 0 | $ 8,200 | $ 11,000 |
| Performance Spec Tests | $ 2,400 | $ 5,800 | $ 600 | $ 8,800 |
| Prepare QA/QC Plan | $ 2,400 | $ 12,400 | $ 700 | $ 15,500 |
| **Total First Costs** | **$ 20,100** | **$ 18,300** | **$ 109,900** | **$ 148,300** |
| | | | | |
| Operation & Maintenance | $ 5,900 | $ 0 | $ 1,500 | $ 7,400 |
| Annual RATA | $ 800 | $ 5,200 | $ 0 | $ 6,000 |
| PM Monitor RCA | $ 0 | $ 0 | $ 0 | $ 0 |
| Quarterly CGAs | $ 1,500 | $ 0 | $ 1,300 | $ 2,800 |
| Record Keeping | $ 5,200 | $ 0 | $ 200 | $ 5,300 |
| Annual Review & Update | $ 2,300 | $ 0 | $ 2,800 | $ 5,100 |
| Capital Recovery | | | | $ 21,100 |
| **Total Annual Costs** | **$ 15,700** | **$ 5,200** | **$ 5,700** | **$ 47,700** |

| Task | Corporate and facility labor costs | Consultant and test team costs | Other direct costs | Total Costs |
|---|---|---|---|---|
| I. Planning | | | | |
| A. Review regulations | $202 | | | $202 |
| B. Resolve questions | $386 | | $287 | $673 |
| C. Review drawings | $210 | | | $210 |
| D. Inspect source | $176 | | $76 | $252 |
| E. Define specific constraints | $504 | | | $504 |
| F. Write engineering report | $672 | | | $672 |
| Total | $2,150 | | $363 | $2,513 |
| | | | | |
| II. Select Equipment | | | | |
| A. Decide on Approach | $252 | | | $252 |
| B. Write specifications | $1,669 | | | $1,669 |
| C. Identify potential bidders | $420 | | | $420 |
| D. Write RFPs & Guarantees | $1,210 | | | $1,210 |
| E. Copy & Mail RFPs | $147 | | $80 | $227 |
| F. Respond to bidder's questions | $344 | | $50 | $394 |
| G. Review and evaluate proposals | $2,505 | | $320 | $2,825 |
| H. Select winners | $168 | | | $168 |
| I. Negotiate contracts | $1,029 | | | $1,029 |
| J. Management | $2,621 | | $1,500 | $4,121 |
| Total | $10,364 | | $1,950 | $12,315 |
| | | | | |
| III. Provide support facilities | | | | |
| A. Sampling ports | | | $365 | $365 |
| B. Utilities | | | $1,200 | $1,200 |
| C. Platforms & ladders | | | $0 | $0 |
| D. Instrument room | | | $9,000 | $9,000 |
| Total | | | $10,565 | $10,565 |
| | | | | |
| IV. Purchase CEMS | | | | |
| A. Opacity equipment | | | $0 | $0 |
| B. Buy gas CEMS equipment | | | $16,300 | $16,300 |
| C. Buy D.A.S. | | | $17,000 | $17,000 |
| D. Buy sampling systems | | | $44,000 | $44,000 |

| Task | Corporate and facility labor costs | Consultant and test team costs | Other direct costs | Total Costs |
|---|---|---|---|---|
| E. Buy flow monitors | | | $0 | $0 |
| F. Fabrication | | | $10,240 | $10,240 |
| G. Buy PM Monitor | | | $0 | $0 |
| Total | | | $87,540 | $87,540 |
| | | | | |
| V. Install & Check CEMS | | | | |
| A. Install CEMS | $2,117 | | | $2,117 |
| B. Start up equipment | $403 | | $6,457 | $6,860 |
| C. Resolve problems | $151 | | $1,760 | $1,911 |
| D. Calibrations | $121 | | | $121 |
| Total | $2,792 | | $8,217 | $11,009 |
| | | | | |
| VI. Performance Spec Tests | | | | |
| A. Select test contractor | $672 | | $50 | $722 |
| B. Pretest meeting with ctr & agency | $570 | $285 | $295 | $1,150 |
| C. Drift tests per EPA specs | $536 | | $150 | $686 |
| D. CEMS PST | $437 | $4,558 | $90 | $5,085 |
| E. Write PST test report | | $976 | | $976 |
| F. Review report & send to agency | $141 | | | $141 |
| Total | $2,356 | $5,819 | $585 | $8,759 |
| | | | | |
| VII. Prepare QA/QC Plan | | | | |
| A. Review needs & requirements | $151 | | | $151 |
| B. Hire consultant | $571 | | $50 | $621 |
| C. On site meeting | $533 | $2,669 | $293 | $3,494 |
| D. Write draft plan | | $5,757 | | $5,757 |
| E. Review & comment on draft | $323 | | | $323 |
| F. Write final plan | | $1,625 | | $1,625 |
| G. Get agency approval of plan | $128 | | | $128 |
| H. Kick-off meeting @ plant | $693 | $2,393 | $364 | $3,450 |
| Total | $2,398 | $12,444 | $707 | $15,549 |
| | | | | |
| VIII. Operation & Maintenance | | | | |
| A. Daily checks of COMS/PM | $0 | | | $0 |

| Task | Corporate and facility labor costs | Consultant and test team costs | Other direct costs | Total Costs |
|---|---|---|---|---|
| B. Daily checks of CEMS | $3,226 | | | $3,226 |
| C. Weekly checks of PM Monitors | $0 | | | $0 |
| D. Weekly checks of CEMS | $1,799 | | | $1,799 |
| E. Quarterly checks of COMS/PM | $0 | | $0 | $0 |
| F. Monthly checks of CEMS | $882 | | $1,500 | $2,382 |
| Total | $5,907 | | $1,500 | $7,407 |
| | | | | |
| IX. Annual RATA | | | | |
| A. Pretest preparation | $302 | | | $302 |
| B. Hire testing team | $84 | | | $84 |
| C. Notify agency | $42 | | | $42 |
| D. Do RATA | $252 | $4,204 | | $4,456 |
| E. Take corrective action | $30 | $126 | | $156 |
| F. Retest | $28 | $151 | | $179 |
| G. Write report | | $682 | | $682 |
| H. Certify & send report to agency | $84 | | | $84 |
| Total | $823 | $5,163 | | $5,986 |
| | | | | |
| X. PM Monitor RCA | | | | |
| A. Pretest preparation | $0 | | | $0 |
| B. Hire testing team | $0 | | | $0 |
| C. Notify agency | $0 | | | $0 |
| D. Do RCA | $0 | $0 | | $0 |
| E. Recalibration calculations | $0 | $0 | | $0 |
| F. Write report | | $0 | $0 | $0 |
| G. Certify & send report to agency | $0 | | | $0 |
| Total | $0 | $0 | $0 | $0 |
| | | | | |
| XI. Periodic QA Checks | | | | |
| A. Notify agency | $126 | | | $126 |
| B. Conduct CGAs, PM ACA, and/or FTIR Spe | $544 | | $1,125 | $1,669 |
| C. Take corrective action | $197 | | | $197 |
| D. Retest | $106 | | $113 | $218 |
| E. Write report | $544 | | $45 | $589 |

| Task | Corporate and facility labor costs | Consultant and test team costs | Other direct costs | Total Costs |
|---|---|---|---|---|
| Total | $1,517 | | $1,283 | $2,800 |
| | | | | |
| XII. Record Keeping | | | | |
| A. Daily reduction | $4,032 | | | $4,032 |
| B. Monthly reduction | $857 | | | $857 |
| C. Quarterly emissions report | $286 | | $160 | $446 |
| Total | $5,174 | | $160 | $5,334 |
| | | | | |
| XIII. Annual Review & Update | | | | |
| A. Meeting with plant technicians | $773 | | $260 | $1,033 |
| B. Update QA plan | $504 | | $50 | $554 |
| C. Update equipment inventory | $343 | | $1,630 | $1,973 |
| D. Training | $693 | | $848 | $1,541 |
| Total | $2,313 | | $2,788 | $5,101 |

**ATTACHMENT E**
Emissions Calculations
EMD 20-645E4 Engine (all pollutants, all loads)
Central District Wastewater Treatment Plant

CH2MHILL SUBJECT: CENTRAL DISTRICT WWTP — CO EMISSIONS FROM EMD 20E4 ENGINE

BY D. LINDBERG

SHEET NO. 1 of 1 DATE 5/9/98

PROJECT NO. 139633.AP

Per EMD : 1.45 g CO / bhp-hr

Annual Power Output @ 25% load

= (25%)(3,600 bhp)(3 engines)(8,760 hrs/yr)

= 23,652,000 bhp-hr/yr

Proposed Annual Power Output Limitation (Previously)

= (32,200,000 kW-hr/yr)(3,600 bhp / 2500 kW)

= 46,368,000 bhp-hr/yr

⇒ 3 Engines can operate continuous (8760 hrs/yr) at 25% load without exceeding proposed power output limitation. (Engines cannot generate 43,368,000 bhp-hr if operated @ 25% load for 1 year).

CO Emissions

$$\left(\frac{1.45\ g\ CO}{bhp\text{-}hr}\right)\left(\frac{23,652,000\ bhp\text{-}hr}{yr}\right)\left(\frac{lb}{454\ g}\right)\left(\frac{ton}{2000\ lb}\right)$$

$$= \boxed{37.77\ \frac{tons\ CO}{yr} \quad @\ 25\%\ load}$$

**NOx Emissions Calculations**
**Central District Wastewater Treatment Plant**

| Source | NOx Emissions tons/yr | Permit | lb/hr | Emission Factors lb/bhp-hr | g/bhp-hr | lb/MMBTU |
|---|---|---|---|---|---|---|
| | | *Current Emissions Inventory* | | | | |
| 16GTLB Superior Engines | 248.9 | AO13-244408 | 18.3 | 0.0104 | 4.72 | |
| Worthington SDR Blower (1996 &1997) | 1.8 | AO13-177237 | 23.0 | 0.0242 | 10.99 | |
| Worthington CC Blowers (1996 &1997) | 44.0 | AO13-177237 | 12.6 | 0.0308 | 13.98 | |
| Flares | 15.3 | | | | | |
| **Subtotal** | **310.0** | **PSD Major Source** | | | | |
| PSD Major Source Threshold | 250.0 | | | | | |
| | | *Emissions Increase/Decrease* | | | | |
| 16GTLB Superior Engines | -156.0 | | 5.3 | | | |
| Worthington SDR Blower | -1.8 | forfeit | | | | |
| Worthington CC Blowers (2) | 11.3 | | 12.6 | 0.0308 | 13.98 | na |
| Flares | 0.0 | | | | | |
| Standby Generators (20E4) | 375.2 | | 58.2 | 0.0162 | ***7.34*** | 2.15 |
| **Total Emissions Increase** | **228.7** | **Significant Net Emissions Increase** | | | | |
| Significant Net Emissions Increase | 40.0 | | | | | |

**Proposed Emissions**

| Source | NOx Emissions tons/yr | | Monitoring Frequency | Restrictions | |
|---|---|---|---|---|---|
| 16GTLB Superior Engines | 92.9 | | na | none | |
| Worthington CC Blowers (2) | 0.0 | | na | removed June 1998 | |
| Flares | 15.3 | | na | none | |
| Standby Generators (20E4) | 375.2 | ***BACTed*** | daily | 2,525,000 | gallons 0.05 w |
| Central District WWTP | 483.4 | | | | |
| PSD Major Source | 250.0 | | | | |

**EMD Model 20-645E4**
**Central District Wastewater Treatment Plant (3)**
**Miami-Dade Water and Sewer Department**

| | | 36 API Fuel Consumption | | | NOx Emissions (uncontrolled) | | | | NOx Emissions (controlled)[1] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| bhp | % load | lb/bhp-hr | lb/hr | MMBTU/hr | g/hr | lb/hr | lb/MMBTU | g/bhp-hr | g/hr | lb/hr | lb/MMBTU | g/bhp-hr |
| 3958 | 110% | 0.383 | 1516 | 29.7 | 40,052 | 88.2 | 2.97 | 10.12 | 28,837 | 63.5 | 2.14 | 7.29 |
| 3603 | 100% | 0.383 | 1380 | 27.1 | 36,716 | 80.9 | 2.99 | 10.19 | 26,436 | 58.2 | 2.15 | 7.34 |
| 2705 | 75% | 0.392 | 1060 | 20.8 | 23,589 | 52.0 | 2.50 | 8.72 | 16,984 | 37.4 | 1.80 | 6.28 |
| 1801 | 50% | 0.425 | 765 | 15.0 | 18,366 | 40.5 | 2.69 | 10.20 | 13,224 | 29.1 | 1.94 | 7.34 |
| 891 | 25% | 0.515 | 459 | 9.0 | 9,381 | 20.7 | 2.30 | 10.53 | 6,754 | 14.9 | 1.65 | 7.58 |

36 deg API 7.043 lb/gal
19620 BTU/lb (HHV)

1 NOx emissions reduction through combustion modifications (timing adjustment and turbocharger aftercoolers): 28%

**EMD Model 20-645E4**
**Fuel Use and NOx Emissions Calculations**
**Central District Wastewater Treatment Plant (3)**

| Engine Load | Fuel Consumption (lb/hr) | (gal/hr) | (MMBTU/hr) |
|---|---|---|---|
| 110 % load (3958 bhp) | 0.383 lb fuel/bhp-hr * 3958 bhp = 1,516 lb/hr | 1,516 lb/hr * gal 36-deg API/7.043 lb = 215.2 gal/hr | 1,516 lb/hr * 0.0196 MMBTU/lb = 29.7 MMBTU/hr |
| 100 % load (3603 bhp) | 0.383 lb fuel/bhp-hr * 3603 bhp = 1,380 lb/hr | 1,380 lb/hr * gal 36-deg API/7.043 lb = 195.9 gal/hr | 1,380 lb/hr * 0.0196 MMBTU/lb = 27.1 MMBTU/hr |
| 75 % load (2705 bhp) | 0.392 lb fuel/bhp-hr * 2705 bhp = 1,060 lb/hr | 1,060 lb/hr * gal 36-deg API/7.043 lb = 150.6 gal/hr | 1,060 lb/hr * 0.0196 MMBTU/lb = 20.8 MMBTU/hr |
| 50 % load (1801 bhp) | 0.425 lb fuel/bhp-hr * 1801 bhp = 765 lb/hr | 765 lb/hr * gal 36-deg API/7.043 lb = 108.7 gal/hr | 765 lb/hr * 0.0196 MMBTU/lb = 15.0 MMBTU/hr |
| 25 % load (891 bhp) | 0.515 lb fuel/bhp-hr * 891 bhp = 459 lb/hr | 459 lb/hr * gal 36-deg API/7.043 lb = 65.2 gal/hr | 459 lb/hr * 0.0196 MMBTU/lb = 9.0 MMBTU/hr |

| Engine Load | NOx Emissions - Uncontrolled (lb/MMBTU) | NOx Emissions - Controlled (lb/MMBTU) |
|---|---|---|
| 110 % load (3958 bhp) | 10.12 g/bhp-hr * 3958 bhp * lb/454g * hr/29.7 MMBTU = 2.97 lb/MMBTU | 7.29 g/bhp-hr * 3958 bhp * lb/454g * hr/29.7 MMBTU = 2.14 |
| 100 % load (3603 bhp) | 10.19 g/bhp-hr * 3603 bhp * lb/454g * hr/27.1 MMBTU = 2.99 lb/MMBTU | 7.34 g/bhp-hr * 3603 bhp * lb/454g * hr/27.1 MMBTU = 2.15 |
| 75 % load (2705 bhp) | 8.72 g/bhp-hr * 2705 bhp * lb/454g * hr/20.8 MMBTU = 2.50 lb/MMBTU | 6.28 g/bhp-hr * 2705 bhp * lb/454g * hr/20.8 MMBTU = 1.80 |
| 50 % load (1801 bhp) | 10.20 g/bhp-hr * 1801 bhp * lb/454g * hr/15.0 MMBTU = 2.69 lb/MMBTU | 7.34 g/bhp-hr * 1801 bhp * lb/454g * hr/15.0 MMBTU = 1.94 |
| 25 % load (891 bhp) | 10.53 g/bhp-hr * 891 bhp * lb/454g * hr/9.0 MMBTU = 2.30 lb/MMBTU | 7.58 g/bhp-hr * 891 bhp * lb/454g * hr/9.0 MMBTU = 1.65 lb |

| Engine Load | NOx Emissions Equivalent Hours of Operation |
|---|---|
| 110 % load (3958 bhp) | 2525000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/29.7 MMBTU = 11,731 hrs/yr |
| 100 % load (3603 bhp) | 2525000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/27.1 MMBTU = 12,887 hrs/yr |
| 75 % load (2705 bhp) | 2525000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/20.8 MMBTU = 16,771 hrs/yr |
| 50 % load (1801 bhp) | 2525000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/15.0 MMBTU = 23,234 hrs/yr |
| 25 % load (891 bhp) | 1712000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/9.0 MMBTU = 26,277 hrs/yr - 3 engines @ 25% load operating continuous. |

| | (tons/yr) |
|---|---|
| @ 2.15 lb/MMBTU | 2.15 lb NOx/MMBTU * 0.0196 MMBTU/lb fuel * 7.043 lb/gal * 2525000 gal/yr = 375.2 tons NOx/yr |
| Annual Fuel Consumption | 2,525,000 gallons |

**EMD Model 20-645E4**
**Emissions Calculations - All Pollutants - Based on information provided by EMD**
**Central District Wastewater Treatment Plant (3)**

| | | |
|---|---|---|
| **CO** | | tons CO/yr = gal/yr * lb fuel/gal * MMBTU/lb fuel* lb CO/hr * hr/MMBTU * ton/2000 lb |
| 100 % load (3,603 bhp) | 4.05 lb CO/hr | tons CO/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 4.05lb CO/hr * hr/27.07MMBTU * ton/2000 lb = 26.1 tons CO/yr |
| 75 % load (2,705 bhp) | 2.50 lb CO/hr | tons CO/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 2.50lb CO/hr * hr/20.80MMBTU * ton/2000 lb = 21.0 tons CO/yr |
| 50 % load (1,801 bhp) | 2.34 lb CO/hr | tons CO/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 2.34lb CO/hr * hr/15.02MMBTU * ton/2000 lb = 27.2 tons CO/yr |
| 25 % load (891 bhp) | 2.85 lb CO/hr | tons CO/yr = 1712000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 2.85lb CO/hr * hr/9.00MMBTU * ton/2000 lb = 37.4 tons CO/yr |
| **NOx (controlled)** | | tons NOx/yr = gal/yr * lb fuel/gal * MMBTU/lb fuel* lb NOx/MMBTU * ton/2000 lb |
| 100 % load (3,603 bhp) | 2.15 lb NOx/MMBTU | tons NOx/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 2.15lb NOx/MMBTU * ton/2000 lb = 375 tons NOx/yr |
| 75 % load (2,705 bhp) | 1.80 lb NOx/MMBTU | tons NOx/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 1.80lb NOx/MMBTU * ton/2000 lb = 314 tons NOx/yr |
| 50 % load (1,801 bhp) | 1.94 lb NOx/MMBTU | tons NOx/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 1.94lb NOx/MMBTU * ton/2000 lb = 338 tons NOx/yr |
| 25 % load (891 bhp) | 1.65 lb NOx/MMBTU | tons NOx/yr = 1712000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 1.65lb NOx/MMBTU * ton/2000 lb = 195 tons NOx/yr |
| **SO2 (0.05 weight % fuel sulfur content)** | | tons SO2/yr = gal/yr * lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb |
| 100 % load (3,603 bhp) | 0.05 weight % S | tons SO2/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 8.9 tons SO2/yr |
| 75 % load (2,705 bhp) | 0.05 weight % S | tons SO2/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 8.9 tons SO2/yr |
| 50 % load (1,801 bhp) | 0.05 weight % S | tons SO2/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 8.9 tons SO2/yr |
| 25 % load (891 bhp) | 0.05 weight % S | tons SO2/yr = 1712000 gal/yr * 7.043lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 6.0 tons SO2/yr |
| **PM-10 (controlled)** | | tons PM-10/yr = gal/yr * lb fuel/gal * MMBTU/lb fuel* lb PM-10/MMBTU * ton/2000 lb |
| 100 % load (3,603 bhp) | 0.057 lb PM-10/MMBTU | tons PM-10/yr = 2525000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.057 lb PM-10/MMBTU * ton/2000 lb = 10.0 tons PM-10/yr |
| 75 % load (2,705 bhp) | 0.057 lb PM-10/MMBTU | tons PM-10/yr = 2525000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.057 lb PM-10/MMBTU * ton/2000 lb = 10.0 tons PM-10/yr |
| 50 % load (1,801 bhp) | 0.057 lb PM-10/MMBTU | tons PM-10/yr = 2525000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.057 lb PM-10/MMBTU * ton/2000 lb = 10.0 tons PM-10/yr |
| 25 % load (891 bhp) | 0.057 lb PM-10/MMBTU | tons PM-10/yr = 1712000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.057 lb PM-10/MMBTU * ton/2000 lb = 6.8 tons PM-10/yr |
| **NMHC** | | tons NMHC/yr = gal/yr * lb fuel/gal * MMBTU/lb fuel* lb NMHC/MMBTU * ton/2000 lb |
| 100 % load (3,603 bhp) | 0.08 lb NMHC/MMBTU | tons NMHC/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.080 lb NMHC/MMBTU * ton/2000 lb = 14.0 tons NMHC/yr |
| 75 % load (2,705 bhp) | 0.08 lb NMHC/MMBTU | tons NMHC/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.080 lb NMHC/MMBTU * ton/2000 lb = 14.0 tons NMHC/yr |
| 50 % load (1,801 bhp) | 0.08 lb NMHC/MMBTU | tons NMHC/yr = 2525000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.080 lb NMHC/MMBTU * ton/2000 lb = 14.0 tons NMHC/yr |
| 25 % load (891 bhp) | 0.08 lb NMHC/MMBTU | tons NMHC/yr = 1712000 gal/yr * 7.043lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.080 lb NMHC/MMBTU * ton/2000 lb = 9.5 tons NMHC/yr |

**ATTACHMENT F**
Superior 16GTLB Historic Test Results and Potential Emissions
Central District Wastewater Treatment Plant

**Superior 16GTLB Engines**
**Central District Wastewater Treatment Plant**

| | | |
|---|---|---|
| Engine Power (bhp): | 1,760 | Fuel Star 7000 Electronic Air-to-Fuel Ratio Controller |
| Output Capacity (kW): | 1,200 | Woodward 701 Governor |
| Gas Consumption (scfm): | 310 | =(7450 BTU/bhp-hr)(1760 bhp)(scf/700 btu) |
| Exhaust Volume (scfm): | 240,000 | based on air-to-fuel ratio of 13.3:1 |

| | | Superior Engine | | | |
|---|---|---|---|---|---|
| **Year** | **Units** | **No. 1** | **No. 2** | **No. 3** | **No. 4** |
| 1992 | lb/hr | nd | nd | nd | nd |
| 1993 | lb/hr | nd | nd | nd | nd |
| 1994 | lb/hr | 10.70 | 2.66 | 2.50 | 17.12 |
| 1995 | lb/hr | 4.66 | 2.19 | 3.95 | 4.03 |
| 1996 | lb/hr | 1.70 | 3.55 | 5.08 | 2.63 |
| 1997 | lb/hr | 10.43 | 6.66 | 9.86 | 8.27 |
| Average | lb/hr | 6.87 | 3.77 | 5.35 | 8.01 |
| Maximum | lb/hr | 10.70 | 6.66 | 9.86 | 17.12 |
| Std Deviation | lb/hr | 4.43 | 2.01 | 3.19 | 6.53 |
| Superior Data | lb/hr | 5.29 | 5.29 | 5.29 | 5.29 |
| Current Limits | lb/hr | 18.3 | 18.3 | 18.3 | 18.3 |

**Equivalent Emissions**

| | Pollutant | lb/hr | ppmv | tons/yr NOx (ea) | tons/yr NOx (total) |
|---|---|---|---|---|---|
| Superior | NOx (as $NO_2$) | 5.29 | 172 | 23.2 | 92.6 |
| Current Limits | NOx (as $NO_2$) | 18.3 | 595 | 80.2 | 248.9 |

**ATTACHMENT G**
Revised Analysis of PSD Class I Increment Consumption
Central District Wastewater Treatment Plant

**Summary of Maximum Predicted PSD Class I Increment Consumption - $NO_2$**
**Central District WWTP**
**Miami-Dade Water and Sewer Department**

| | Maximum Predicted Offsite Concentration (µg/m3) | | | | |
|---|---|---|---|---|---|
| | **1987** | **1988** | **1989** | **1990** | **1991** |
| Maximum Predicted Impact | 0.54 | 0.53 | 0.43 | 0.74 | 0.63 |
| PSD Increment | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Distance (m) to Max | 34668 | 34668 | 34668 | 34668 | 34668 |

$Q_s$ = 10.81 g/s $NO_x$ standby generators
$Q_s$ = 2.67 g/s $NO_x$ superior engines - horizontal exhaust
Concentration $NO_2$ = 0.75*Concentration $NO_x$

* PM10 emissions do not exceed PSD significant emission rates.

**Summary of Maximum Predicted NO2 Concentrations (Annual Average) in the Everglades National Park Class I Area**
**Central District WWTP**
**Miami-Dade Water and Sewer Department**

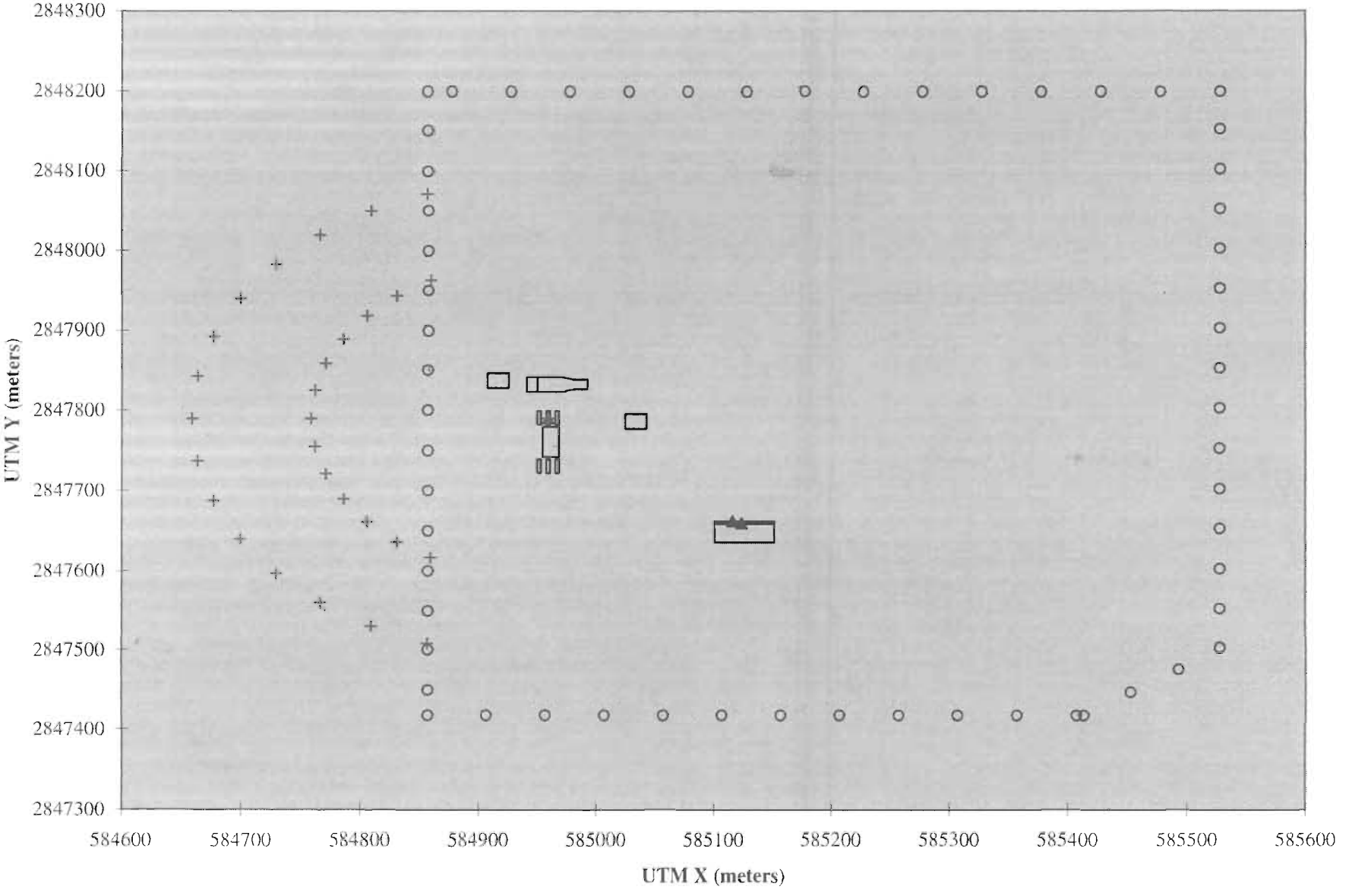
| | Maximum Predicted Offsite Concentration (µg/m3) | | | | |
|---|---|---|---|---|---|
| | **1987** | **1988** | **1989** | **1990** | **1991** |
| Maximum Predicted Impact | 3.29 | 3.35 | 2.75 | 4.18 | 3.93 |
| 1197 Background - Key Biscayne | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| Maximum Predicted Concentration | 15.3 | 15.4 | 14.8 | 16.2 | 15.9 |
| NAAQS | 100.00 | 100.00 | 100.00 | 100.00 | 101.00 |
| Distance (m) to Max | 39967 | 34668 | 34668 | 34668 | 34668 |

$Q_s$ = 10.81g/s NOx standby generators
$Q_s$ = 2.67 g/s NOx superior engines - horizontal
$Q_s$ = 0.00 g/s NOx diesel blower engines removed
Concentration $NO_2$ = 0.75*Concentration $NO_x$

* PM10 emissions do not exceed significant emission rates.

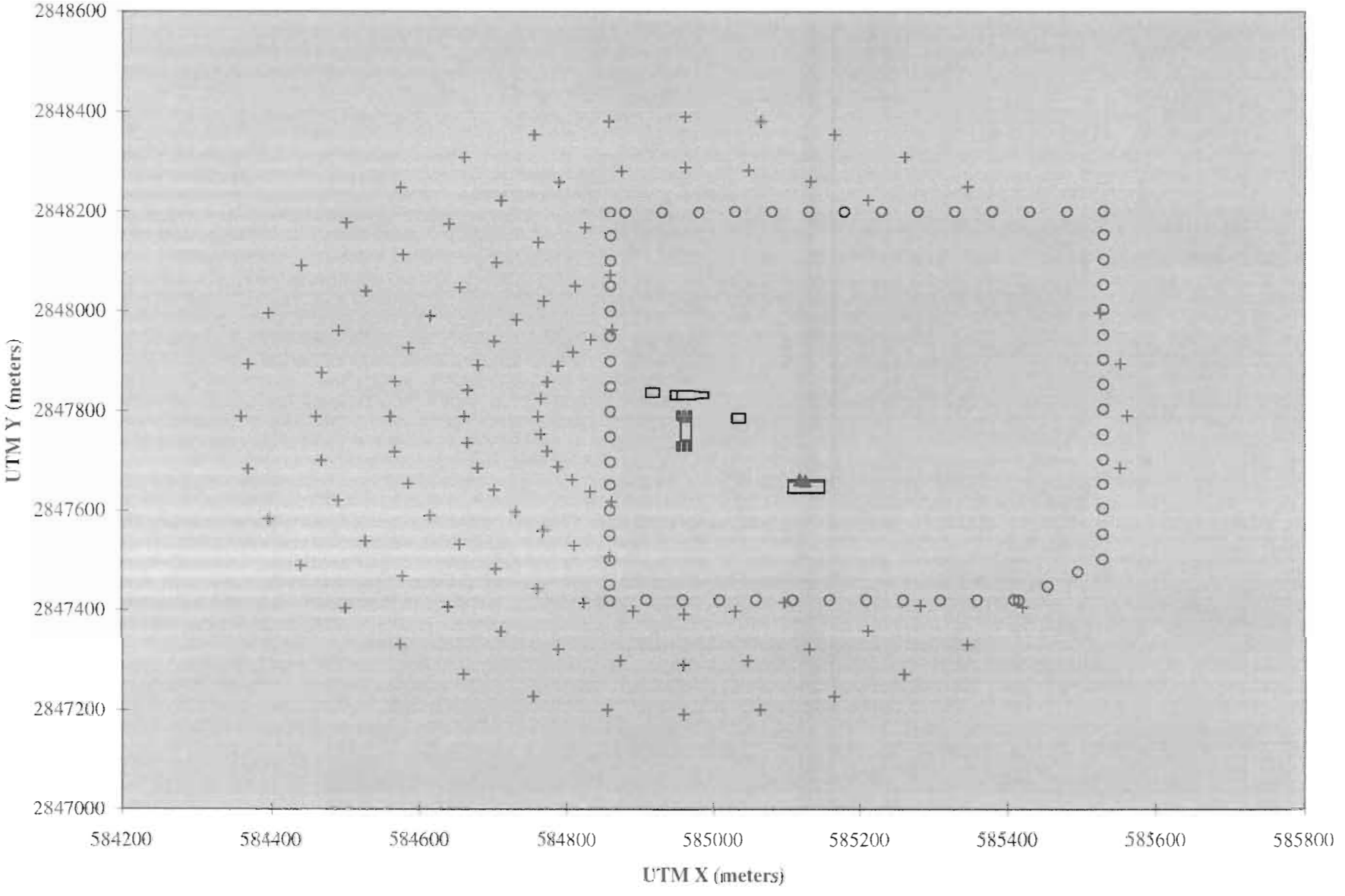
**ATTACHMENT H**
USGS Map Sections Showing Refined Model Receptor Locations
Central District Wastewater Treatment Plant

ISC Modeling Receptor Locations
Central District WWTP



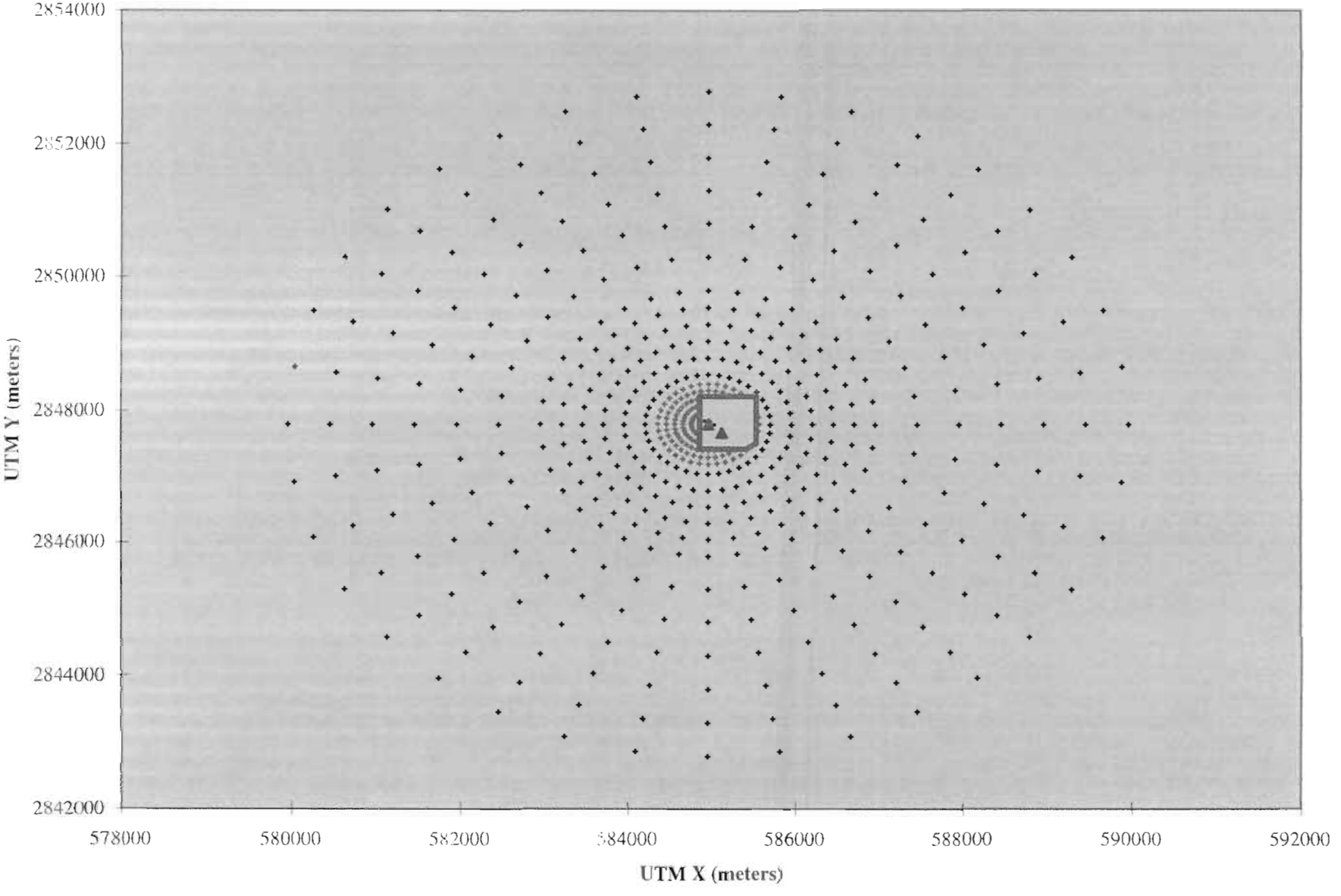

cdpsdno2 Chart4

ISC Modeling Receptor Locations
Central District WWTP




cdpsdno2 Chart4

ISC Modeling Receptor Locations
Central District WWTP




cdpsdno2 Chart4