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

RECEIVED

OCT 21 1998

**BUREAU OF
AIR REGULATION**

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

Mr. A. A. Linero, P.E.

Page 3

October 20, 1998

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 NO_x, 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 NO_x 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 NO_x from these engines while burning natural gas should not exceed 5.3 lb/hr.

A summary of past NO_x 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 NO_x to levels typically observed from these types of engines, and to increase operational flexibility 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 NO_x/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 NO_x increment of 2.5 μg/m³. Please submit this summary table in order to complete the air quality impact analysis.

Response – Tables summarizing maximum cumulative PSD NO_x increment consumption and maximum predicted NO_x 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 NO_x 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 lbNO_x/MMBTU. For the 20E4 engine, maximum NO_x emissions of 2.15 lb/MMBTU occur at

Mr. A. A. Linero, P.E.

Page 4

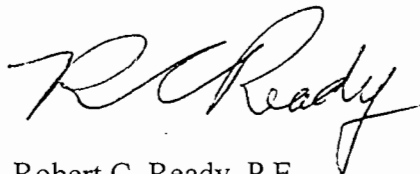
October 20, 1998

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,



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



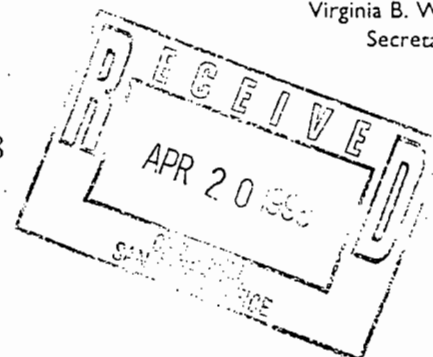
Department of Environmental Protection

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:

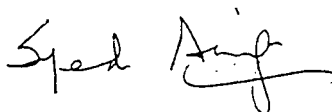
1. The response for the cost analysis for SCR technology for the Three 3,600 hp diesel engines includes cost of three SCR's. Please provide the cost analysis in \$/ton removed if the three stacks are combined and a single SCR system is employed to reduce the NO_x emissions to 12.1 lb/hr and 78.1 tons/yr.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

"Protect, Conserve and Manage Florida's Environment and Natural Resources"

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

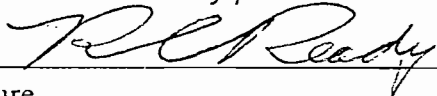
SA/a

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 :	
<p><i>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.</i></p>	
 Signature	<u>10-20-98</u> 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 :*

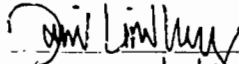
(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollutant control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions 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 10/19/98

(seal)

19 October 1998
Date

I. Part 6 - 1

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

<i>Diesel Engines</i>									<i>Gas Engines</i>							
Operating Hours					Average Load				Operating Hours					Average Load		
Date	Gen #1:	Gen #2:	Gen #3:	TOTAL	Power Output (kW- hr)			%	Gen #1	Gen #2	Gen #3	Gen #4	TOTAL	Power Output (kW- hr)		
	EMD 20E4	EMD 20E4	EMD 20E4		(kW)	(kW)	(kW)							(kW)	(kW)	(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	179	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%	

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

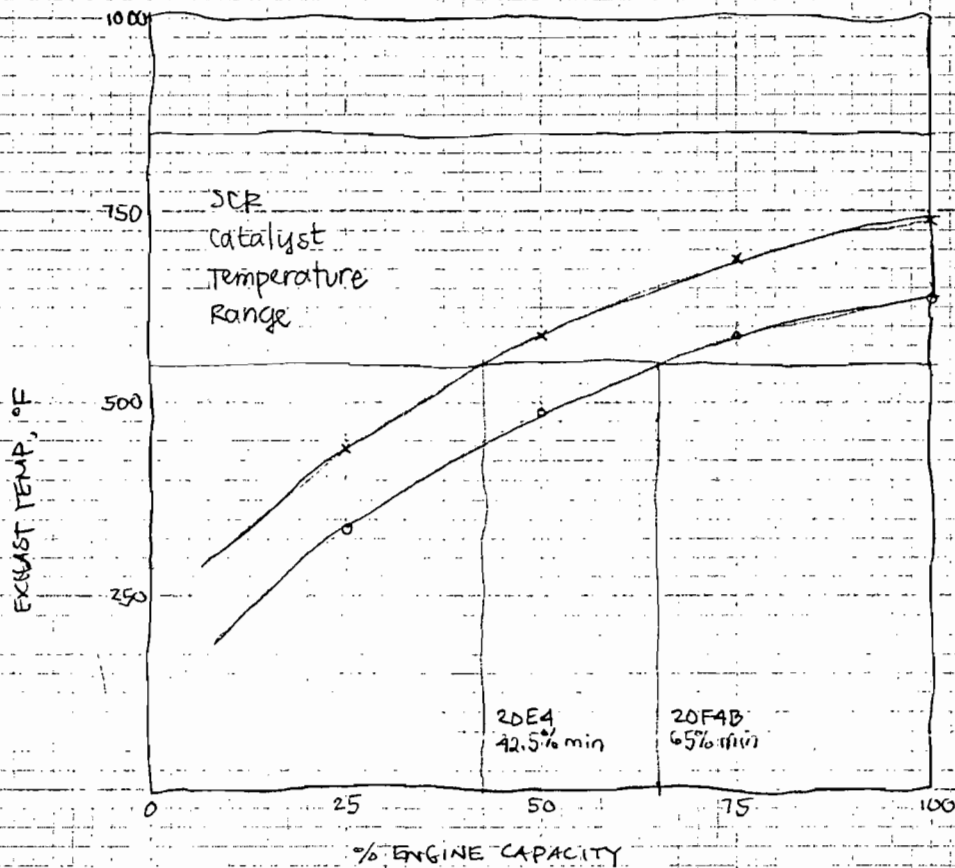
20F4B EXHAUST TEMPS:

100% load	435°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)

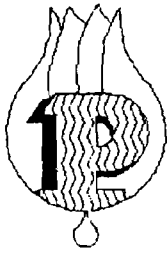
20E4 EXHAUST TEMPS:

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



o 20F4B
x 20E4

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

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

RE: SCR Pricing for Diesel Gen Sets
Your Reference: Miami - Dade County Water & Sewer
Peerless Reference: PMC-1967

Dear Mr. Lindberg,

I apologize for the delay in getting you this information. We will need more detailed design data 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)
<u>Central District</u> 20E4 (3)	\$450K
<u>Preston WTP</u> 20E4 (3) 20F4B (3)	\$450K \$550K
<u>Orr WTP</u> 20F4B (4)	\$780K

The budget ($\pm 20\%$) 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.

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**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

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

RE: SCR Pricing for Diesel Gen Sets**Your Reference: Miami - Dade County Water & Sewer****Peerless Reference: 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
<u>Central District</u>			
20E4	23 ea.	\$165K ea.	6 Systems \$1.1M
16G4A	18 ea.	\$150K ea.	
<u>Preston WTP</u>			
20E4	23 ea.	\$165K ea.	6 Systems \$1.35M
20F4B	48 ea.	\$200K ea.	
<u>Orr WTP</u>			
20F4B	48 ea.	\$200K ea.	4 Systems \$1M

The budget ($\pm 20\%$) 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 H₂O. 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\1988\CH2MHILL.FAX

This message is intended only for the use of the individual or entity to which it is addressed, and may contain information that is privileged, confidential, and exempt from disclosure under applicable law. If the reader of this message is not the intended recipient, or the employee or agent responsible for delivering the message to the intended recipient, you are hereby notified that any dissemination, distribution, or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately at the above telephone number. Thank you.

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, auxiliary 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

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

	20-645F4B	%	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

Extractive	<input checked="" type="checkbox"/>
InSitu	<input type="checkbox"/>
FTIR	<input type="checkbox"/>

Plant Type

New	<input type="checkbox"/>
Existing	<input checked="" type="checkbox"/>

Sampling Lines

Before Control	<input type="checkbox"/>
After Control	<input checked="" type="checkbox"/>

Monitors

	Before Control	After Control
NOx	<input type="checkbox"/>	<input checked="" type="checkbox"/>
SO2	<input type="checkbox"/>	<input type="checkbox"/>
CO	<input type="checkbox"/>	<input type="checkbox"/>
HCl	<input type="checkbox"/>	<input type="checkbox"/>
THC	<input type="checkbox"/>	<input type="checkbox"/>
O2	<input type="checkbox"/>	<input checked="" type="checkbox"/>
CO2	<input type="checkbox"/>	<input type="checkbox"/>
Opacity	<input type="checkbox"/>	<input type="checkbox"/>
PM	<input type="checkbox"/>	<input type="checkbox"/>
Flow	<input type="checkbox"/>	<input type="checkbox"/>

Task	labor costs	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

BEST AVAILABLE COPY

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 Spec	\$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

Per EMD : 1.45 g CO / bhp-hr

Annual Power Output @ 25% load

$$= (25\%)(3,600 \text{ bhp})(3 \text{ engines})(8,760 \text{ hrs/yr})$$

$$= 23,652,000 \text{ bhp-hr/yr}$$

Proposed Annual Power Output Limitation

$$= (32,200,000 \text{ kW-hr/yr})(3,600 \text{ bhp} / 2500 \text{ kW})$$

Previously

$$= 46,368,000 \text{ bhp-hr/yr}$$

⇒ 3 Engines can operate continuous (8760 hrs/yr) at 25% load without exceeding proposed power output limitation. (Engines cannot generate 46,368,000 bhp-hr if operated @ 25% load for 1 year).

CO EMISSIONS

$$\left(\frac{1.45 \text{ g CO}}{\text{bhp-hr}} \right) \left(\frac{23,652,000 \text{ bhp-hr}}{\text{yr}} \right) \left(\frac{1 \text{ lb}}{454 \text{ g}} \right) \left(\frac{\text{ton}}{2000 \text{ lb}} \right)$$

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

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

<u>Source</u>	<u>NOx Emissions</u>			<u>Emission Factors</u>		
	<u>tons/yr</u>	<u>Permit</u>	<u>lb/hr</u>	<u>lb/bhp-hr</u>	<u>g/bhp-hr</u>	<u>lb/MMBTU</u>
<i>Current Emissions Inventory</i>						
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				
<u>PSD Major Source Threshold</u>	<u>250.0</u>					
<i>Emissions Increase/Decrease</i>						
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				
<u>Significant Net Emissions Increase</u>	<u>40.0</u>					

Proposed Emissions

<u>Source</u>	<u>NOx Emissions</u> <u>tons/yr</u>	<u>Monitoring</u> <u>Frequency</u>	<u>Restrictions</u>
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	<i>BACTed</i>	2,525,000 gallons 0.05 w
Central District WWTP	483.4		
<u>PSD Major Source</u>	<u>250.0</u>		

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

<u>bhp</u>	<u>% load</u>	<u>36 API Fuel Consumption</u>			<u>NOx Emissions (uncontrolled)</u>				<u>NOx Emissions (controlled)¹</u>			
		<u>lb/bhp-hr</u>	<u>lb/hr</u>	<u>MMBTU/hr</u>	<u>g/hr</u>	<u>lb/hr</u>	<u>lb/MMBTU</u>	<u>g/bhp-hr</u>	<u>g/hr</u>	<u>lb/hr</u>	<u>lb/MMBTU</u>	<u>g/bhp-hr</u>
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
Annual Fuel Consumption

2.15 lb NOx/MMBTU * 0.0196 MMBTU/lb fuel * 7.043 lb/gal * 2525000 gal/yr = 375.2 tons NOx/yr
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 (ca)	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 - NO₂
 Central District WWTP
 Miami-Dade Water and Sewer Department

	Maximum Predicted Offsite Concentration (µg/m ³)				
	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 NO₂ = 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**

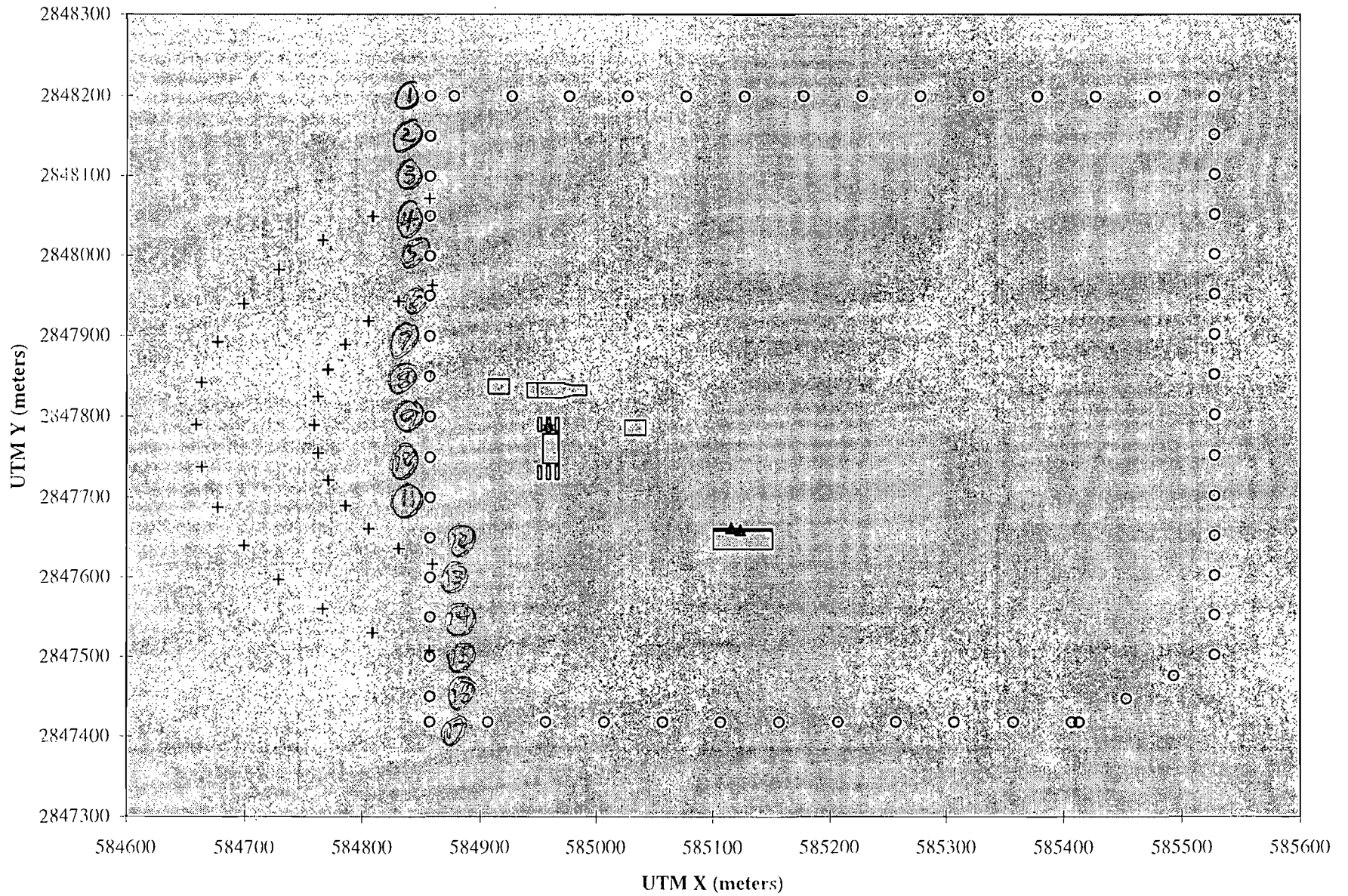
	Maximum Predicted Offsite Concentration (µg/m³)				
	1987	1988	1989	1990	1991
Maximum Predicted Impact	3.29	3.35	2.75	4.18	3.93
1197 Background - Key Biscayne	12.0	12.0	12.0	12.0	12.0
Maximum Predicted Concentration	15.3	15.4	14.8	16.2	15.9
NAAQS	100.00	100.00	100.00	100.00	101.00
Distance (m) to Max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

$Q_s = 10.81 \text{ g/s NO}_x$ standby generators
 $Q_s = 2.67 \text{ g/s NO}_x$ superior engines - horizontal
 $Q_s = 0.00 \text{ g/s NO}_x$ diesel blower engines removed
 Concentration NO₂ = 0.75*Concentration NO_x

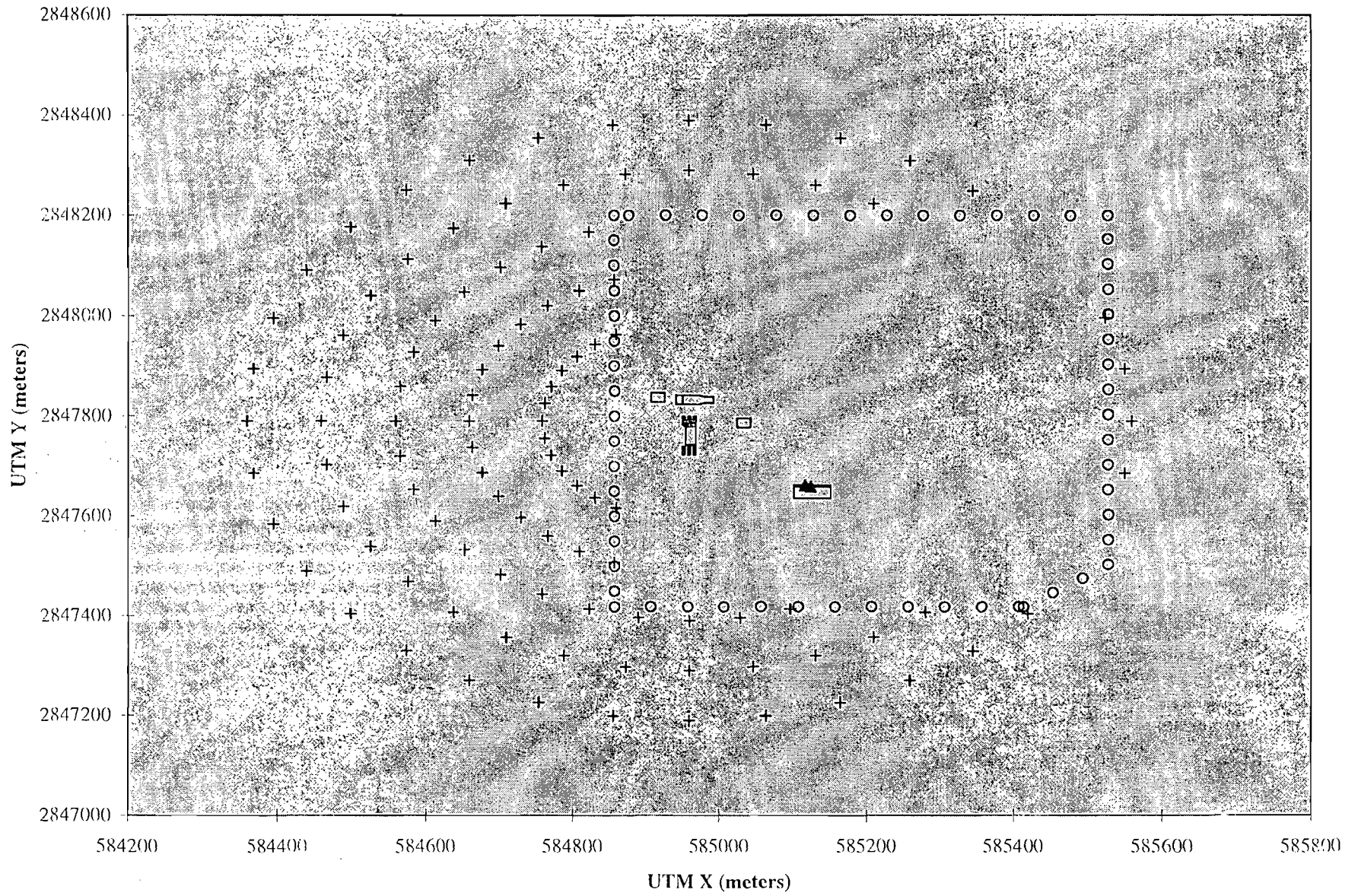
* PM10 emissions do not exceed significant emission rates.

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

ISC Modeling Receptor Locations
Central District WWTP



ISC Modeling Receptor Locations
Central District WWTP



ISC Modeling Receptor Locations
Central District WWTP

