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

SERVE • CONSERVE

March 31, 1999

CERTIFIED: Z 427 642 158
RETURN RECEIPT

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

RE: Response to FDEP Comments, FDEP File No. 0250314-002-AC (PSD-FL-249)
Alexander Orr, Jr. Water Treatment Plant

Dear Mr. Kahn:

This letter is written in response to comments we received from you in a letter dated June 17, 1998, regarding the above-referenced PSD Permit Application. A copy of the letter is included in attachment A.

Based on your comments and our discussions with you regarding this application, we request that the PSD application submitted for this facility be revised as follows:

- Replace the annual power output limitation of 40,110,000 kilowatt-hours (kW-hrs) with an annual fuel consumption limitation of 1,415,000 gallons diesel fuel; and

- Replace the power output-specific emissions limitation of 12.62 grams per kw-hr (g/kW-hr) with a heat input-based limitation of 4.12 pounds per million British Thermal Unit (lb/MMBTU);and

FDEP Form 62-210.900 signature pages and revised emissions unit information pages are provided in Attachment B. Our responses to FDEP's comments reflect these discussions and are provided below:

FDEP Comment No. 1 - FDEP requested verification that the startup and shutdown procedures provided with the application were correct; and that the frequency and duration of engine startup, shutdown, and maintenance activities, or any other times the engines are operating without producing power.

Response - Since the application is being revised from a power output-based approach to a fuel consumption-based approach, estimates of the frequency and duration of times when then engines operate without producing power should not be necessary.

FDEP Comment No. 2 - FDEP requested fuel usage information, including the heat input rate (MMBTU/hr) for each diesel engine; an explanation of why fuel limitations were not proposed; and NOx emission rate calculations in terms of lb/MMBTU for comparison to RACT limitations stated in Chapter 62-296.570(4), FAC.

Response - Fuel usage information was provided in Attachment 5 of Appendix A (Air Permit Application Form Supplemental Information) of the application. The heat-input rate is approximately 27 MMBTU/hr (API 36 diesel fuel with a higher heating value of 19,620 BTU/lb). No method is proposed to determine compliance with this rate, since it represents the maximum capacity of the engine (potential emissions).

The proposed fuel consumption limitation of 1,415,000 gallons diesel fuel corresponds to annual NOx emissions of 403 tons, which is equal to the level of emissions previously proposed. Emissions calculations and information in support of this request are provided in Attachment C. Daily and 365-day rolling total fuel consumption will be recorded from meters located between the fuel storage tank and the engine service tanks to monitor compliance with the annual limit. Emissions calculations indicate that the control technology proposed as BACT will comply with the Florida NOx RACT standard for diesel engines of 4.75 lb NOx/MMBTU.

FDEP Comment No. 3 - FDEP requested clarification of the NOx emission factor used for the 20F4B engines; the number of tests used to develop the emission factor; explanation of the inclusion of a safety factor; and NOx emission factors and emission rates if the engines were controlled by SCR.

Response - As stated above, we are requesting that the emissions limitation for the 20F4B engines be revised from a power output-based approach (emissions in terms of g/kW-hr) to a heat input-based approach (emissions in terms of lb/MMBTU). The initially requested emissions limit of 9.08 g/kW-hr is no longer relevant. Calculations provided show that no "safety factor" has been included in the determination of the heat input-based emissions limit of 4.12 lb/MMBTU (see Attachment C).

Maximum heat input-specific emissions, calculated from brake-specific fuel consumption (BSFC) rates and manufacturers test data, occur at full (100%) load operating conditions. According to information provided by EMD, uncontrolled NOx emissions from the 20F4B engine are 5.72 lb/MMBTU. This estimate is based on emissions testing performed by EMD (not on less accurate EPA emission factors). According to NOx control efficiency information provided by Engine Systems, Inc (ESI), NOx emissions reductions of 28% can be achieved through retarded fuel injection timing and aftercoolers. Therefore, controlled emissions of NOx from the 20F4B engines would be 4.12 lb/MMBTU. NOx emissions reductions of 20% to 40% are commonly accepted as achievable by retarded fuel injection timing, and some additional reduction can be achieved by cooling turbocharged combustion air (aftercoolers).

NOx emissions reductions of over 85% are commonly accepted as achievable using SCR, and the catalyst manufacturer (Peerless, Inc) has confirmed this level of efficiency. For full load operation, NOx emission rates with SCR would be 0.85 lb/MMBTU.

FDEP Comment No. 4 - FDEP noted an inconsistency in the number of 20F4B generator engines, as stated in Section 3.1.1, and the number stated in Table 3-1. FDEP also requested calculations supporting the proposed annual emission rates for comparison to PSD significant emission rates.

Response - The text in section 3.1.1 incorrectly stated that there are three 20F4B generator sets at the plant. There are actually four 20F4B generators at the plant. This was a grammatical error that had no effect on the emissions calculations presented in Table 3-1, which were based on total power output (see Attachment C).

FDEP Comment No. 5 - FDEP requested the origin of the NOx control efficiency for proposed BACT, and the effect of variable loads on this efficiency.

Response - ESI (the engine manufacturer's local representative) estimated that retarded injection timing plus an aftercooler would result in a NOx reduction of 28%. With the exception of SCR, no information is available to the applicant for any of the NOx emission control technologies evaluated regarding effectiveness as a function of load. For SCR, the treatment system becomes ineffective when exhaust temperatures drop below 550 F, which is common for reduced engine loads that typically occur at this facility.

FDEP Comment No. 6 - FDEP inquired if other NOx emission control technologies had been considered, such as alternative fuels, duel fuel firing, or engine retrofit kits. A summary of any information regarding these technologies was requested.

Response - In addition to proposed BACT, which consists of retarded injection timing plus installation of turbocharger aftercoolers, and SCR, several other NOx reduction alternatives were considered. These NOx control technology alternatives are provided in Attachment D. Proposed BACT is Alternative #2. Proposed BACT is a more effective means of NOx reduction than Alternative #1. Alternative #3 is similar to proposed BACT, except that additional cooling is assumed. A detailed cost effectiveness analysis was not performed for Alternatives #4 and #5 because the cost of these technologies approached the value of the engines.

FDEP Comment No. 7 - FDEP requested clarification of whether or not the engine exhaust stacks would be able to comply with the requirements of Chapter 62-297.310(6) regarding sampling facilities, if not, FDEP requested clarification of how testing would be conducted to show compliance with the NOx emissions limit.

Response - The 20F4B engines will not be able to comply with Chapter 62-297.310(6) (a) and (e) because there is insufficient stack length available between obstructions for a permanent sampling system and sampling ports. We propose to collect NOx samples using a temporary sampling system in accordance with Chapter 62-297-310(6) (b) through a rake probe, which composites sample volume from 3 locations across the stack diameter. Since all sampling equipment and personnel will be working at ground level, work platform and access requirements in Chapter 62-297.310(6) (d) and (e) do not apply. The facility is in compliance with electrical power requirements in Chapter 62-297.310(6)(f).

FDEP Comment No. 8 - FDEP requested past actual and future potential emissions of criteria pollutants from the engine-driven pumps, including calculations. FDEP also questioned the use of a safety factor used to determine proposed emission rates for the engine-driven pumps.

Response - Actual emissions of criteria pollutants from the engine-driven pumps are reported to FDEP in Annual Operating Reports [FDEP Form 62-210.900(5), FAC], submitted to the Southeast District office annually. Calculation of emissions can be found in these reports. A summary of reported emissions (past actual), future potential emissions (as proposed), and potential emissions calculations is provided in Attachment E.

Emissions proposed in the application are based on past actual emissions. Use of site- and model-specific emissions test results is a more accurate method of estimating emissions than the use of AP-42 emission factors for the broad classification to which the engines belong. For diesel pump engine nos. 1, 3, 4, and 5, the proposed emission rate is based on the average plus one standard deviation (informally called a "safety factor") of stack test results from 1996 and 1997. The intent of the "safety factor" is to allow for variation in emissions historically observed from these engines when well maintained. For dual fuel pump engine no. 6, the proposed emission rate is based on the average plus one standard deviation of stack test results from 1996 only. Information is provided in Attachment E to support that actual emissions will not exceed future potential emissions when all 5 of the engines are properly maintained.

The MDWASD proposed under a separate application to remove pump engine nos. 1, 3, 4, and 5 in early 2000 and install new spark-ignition gas engines for pump nos. 3, 4, and 5. No engine replacements were proposed for pump engines nos.1 and 2 (currently out-of-service), and the permits for these engines will be retired. The project will result in a decrease in emissions of NOx. The FDEP issued Final Permit Number 0250314-003-AC to MDWASD for this project March 5, 1999.

FDEP Comment No. 9 - FDEP inquired about the operational status of pump engine number 2.

Response - Pump engine number 2 is no longer in service and has not operated since 1991. Many major engine components have been removed from pump engine no. 2 and used to keep the other identical pump engines operable (engines nos. 1, 3, and 4).

FDEP Comment No. 10 - FDEP requested physical and historic operational information regarding several portable diesel engine-driven generator sets that were observed at the site.

Response - During most of 1998, there were two 1,750- and one 1,250-kW portable generators available for use at the plant. The purpose of these portable generators had been to act as temporary replacements for the 20F4B engine-driven generators while the 20F4B engines were being repaired. The portable generators were intended for emergency use only (in case the plant lost power) and were never operated. The temporary generators were removed from the plant in December 1998 when three of the four 20F4B engines being repaired were tested and brought back on-line.

FDEP Comment No. 11 - FDEP requested a detailed map showing the location, in UTM coordinates, of all fenceline receptors used in the air quality impact analysis. FDEP also requested diskettes containing all air quality impact analysis modeling output files.

Response - A 7.5-minute series USGS map is included in Attachment F showing the location of all fine-grid modeling receptors. Since receptors close to the Alexander Orr, Jr. WTP are located too close together for the scale of the USGS map, a separate diagram showing receptor locations close to the facility is also included. UTM coordinates are displayed along the axis of both maps. The air quality modeling files are provided on the diskette enclosed with this letter.

If you have any questions regarding this, please contact Ms. Bertha Goldenberg, P.E. at (305) 669-5711 or Mr. David Lindberg, P.E. of CH2M Hill at (619) 687-0110.

Sincerely,

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

RCR/RMO/DL/ro

Attachments

c: Isidore Goldman, P.E., FDEP Southeast District
Patrick Wong, P.E., Dade County DERM
David Lindberg, P.E., CH2M HILL
EPA
NPS

ATTACHMENT A
FDEP Comments
Request for Additional Information Regarding Air Construction/Operation Permit Application
Project Number 0250314-002-AC (PSD-FL-249)
Alexander Orr, Jr. Water 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

June 17, 1998

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Re: Request for Additional Information Regarding Air Construction/Operation Permit Application
DEP File No. 0250314-002-AC (PSD-FL-249)
Alexander Orr, Jr. Water Treatment Plant

Dear Mr. Ready:

The Department has received your application for an air construction/operation permit for four diesel engine-driven generator sets, four diesel pump engines and one dual fuel pump engine at the Alexander Orr, Jr. Water Treatment Plant. The application was received on May 19, 1998, the date the complete fee was received. In order to continue processing your application, the Department will need the additional information below. Should your response to any of the below items require new calculations, please submit the new calculations, assumptions, reference material and appropriate revised pages of the application form.

1. Please verify that the chart for the procedures for startup and shutdown in Attachment 8 is correct for this facility. We note that six units are listed in the chart, while there are four generator sets. Please indicate the times (duration) and frequency (i.e. twice per day, five days per week) of maintenance of the four diesel engine-driven generator sets, or any other time the engines are running but do not produce power.
2. Please provide fuel usage information, including the heat input rate (mmBtu/hr) for each diesel generator. Also, explain why fuel limitations are ~~not proposed.~~ Please provide emission rate calculations for NOx in units of lb/mmBtu and compare with emission limits of NOx RACT, Rule 62-296.570(4), F.A.C.
3. Please verify that the g/bhp-hr factor used for the chosen control technology at 100% load is 9.08 for NOx for the generator sources. Does the 9.08 g/bhp-hr factor include a safety factor? If so, please explain what this safety factor is. In Attachment 3, the spreadsheet of Emissions from 20F4B Standby Generators shows that the NOx emission factor at various speeds is from test data. How many tests are used to determine the emission factor? What are the manufacturer's emission factors? Provide the factors as well as emission rates for NOx for the SCR control technology option.

In Attachment 3 calculations are provided for the 20F4B standby generators for NOx that include a safety factor. What is the safety factor and why is it used? Past actual data from ARMS show:

Emissions Unit	Test Date	NOx, lb/hr
Generator Set #1	9/18/96	62.46
Generator Set #2	9/18/96	62.84
Generator Set #3	9/18/96	61.53
Generator Set #4	9/19/96	59.95

If these generator sets can attain these emission rates, provide justification for increasing potential emissions with a safety factor.

4. In section 2.3 there are four generator sets, while in section 3.1 the data is for three 20F4B generator sets. Please indicate if this data is for all four 20F4B generator sets, and if not, please provide the data for the fourth generator set. Table 3-1 provides a comparison of proposed annual emissions with PSD significant emission rates for the EMD Model 20F4B standby generators. Please provide the supporting calculations for each proposed annual emission.

5. Please provide the calculation or origin of the efficiency for NOx reduction of 28%. Is this factor applicable at all loads?

6. Have you considered other options towards reducing NOx, such as alternative fuels, duel fuel firing, or engine retrofit kits? If so, please provide a summary, or explain why none of these considerations were chosen.

7. Please indicate if the facility will be able to comply with the requirements of Rule 62-297.310(6), F.A.C., regarding safe, permanent sampling platforms. Please note that annual testing will be required, so permanent test sampling facilities will be required.

8. Please provide past actual annual emissions of CO, NOx, SO_2, PM/PM_{10} and VOC for all of the diesel engine driven pumps, including the calculations. Also, please calculate future potential emissions and show the calculations. Please provide other supporting information to demonstrate that future potential emissions will not exceed past actual emissions. In Attachment 3, the measured emissions plus the safety factor for NOx is higher than most of the data found in ARMS.

Emissions Unit	Test Date	NOx, lb/hr
Diesel Engine Driven Pump #1	9/25/97	9.31
Diesel Engine Driven Pump #3	9/25/97	7.85
Diesel Engine Driven Pump #4	10/2/97	12.71

What is the safety factor and why is it used when the diesel engine driven pumps can attain lower emission rates?

9. How has pump engine 2 been removed from service? Have the controls and fuel source been disconnected?

10. We request the following information regarding the portable diesel engine generators that were on site during our site visit of May 4th, 1998. Please provide the engine bhp, electric generating capacity and fuel usage at full load, date of arrival on site, duration of expected use, operating hours to date on site and expected total operating hours, and an emissions estimate similar to the permanent units, and any other supporting information.

11. Please provide a detailed map showing the location of all of the fenceline receptors used in the air quality impact analysis. These receptor locations should be shown in UTM coordinates since the UTM coordinate system is used in the modeling. In addition send us diskettes containing all of the air quality impact analysis modeling output files.

Rule 62-4.050(3), F.A.C. requires that all applications for a Department permit must be certified by a professional engineer registered in the State of Florida. This requirement also applies to responses to Department requests for additional information of an engineering nature. As a result your response should be certified by a professional engineer registered in the State of Florida. A copy of your response should be sent to Isidore Goldman, DEP Southeast District and Patrick Wong, Dade County DERM.

If you should have any questions, please call Susan DeVore-Fillmore (engineer) or Cleve Holladay (meteorologist) [project engineer] at 850/921-9537 or 850/921-9530, respectively.

Sincerely,

FOR

A.A. Linero, P.E. Administrator
New Source Review Section

AAL/sdf

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

ATTACHMENT B
Revised FDEP Form 62-210.900 Pages
Alexander Orr, Jr. Water Treatment Plant, Dade County

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
Signature

3-31-99
Date

* Attach letter of authorization if not currently on file.

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 3-31-99

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 2/26/99
(seal)

26 February 1999
Date

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 2/26/99 (seal)

26 February 1999
Date

ATTACHMENT C
Emissions Calculations
EMD 20-645F4B Engine
Alexander Orr, Jr. Water Treatment Plant, Dade County

NOx Emissions Calculations
Alexander Orr, Jr. Water Treatment Plant

Project Emissions Summary

Source	NOx Emissions tons/yr		lb/MMBTU	Monitoring Frequency	Proposed Limitation	Units
Before Project						
20F4B Generators	0.0					
Pump Engine Nos. 1,3, & 4	15.7		2.35			
Pump Engine No. 5	12.4		2.45			
Pump Engine No. 6	94.7		1.92			
Alexander Orr Lime Kiln	28.4		0.133	monthly	n/a	
Alexander Orr, Jr. WTP	151.2	Minor Source				
PSD Threshold	250.0					
After Project						
20F4B Generators	402.4	New Major PSD Source	4.12	daily	1,415,000	gallons (0.05 wt% sulfur)
Pump Engine Nos. 1, 3, & 4	41.3		3.12			
Pump Engine No. 5	0.0	(backup for No. 6)	1.70			
Pump Engine No. 6	81.2		1.21			
Alexander Orr Lime Kiln	28.4		0.13		n/a	
	553.3	PSD Major Source				
PSD Threshold	250.0					

* lime kiln NOx emissions are assumed equal to 140 lb/mmcf, based on an AP-42, Table 1-4.2, natural gas external combustion (commercial/institutional).

EMD Model 20-645F4B
Alexander Orr, Jr. Water Treatment Plant (4)
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
4398	110%	0.346	1522	29.9	78,812	173.6	5.81	17.92	56,745	125.0	4.19	12.90
4008	100%	0.346	1387	27.2	70,621	155.6	5.72	17.62	50,847	112.0	4.12	12.69
3001	75%	0.352	1056	20.7	44,445	97.9	4.72	14.81	32,000	70.5	3.40	10.66
2000	50%	0.373	746	14.6	27,140	59.8	4.08	13.57	19,541	43.0	2.94	9.77
999	25%	0.465	465	9.1	14,705	32.4	3.55	14.72	10,588	23.3	2.56	10.60

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 20-645F4B
Fuel Use and NOx Emissions Calculations
Alexander Orr, Jr. Water Treatment Plant (4)

Engine Load	Fuel Consumption (lb/hr)	(gal/hr)	(MMBTU/hr)
110 % load (4398 bhp)	0.346 lb fuel/bhp-hr * 4398 bhp = 1,522 lb/hr	1,522 lb/hr * gal 36-deg API/7.043 lb = 216.1 gal/hr	1,522 lb/hr * 0.0196 MMBTU/lb = 29.9 MMBTU/hr
100 % load (4008 bhp)	0.346 lb fuel/bhp-hr * 4008 bhp = 1,387 lb/hr	1,387 lb/hr * gal 36-deg API/7.043 lb = 196.9 gal/hr	1,387 lb/hr * 0.0196 MMBTU/lb = 27.2 MMBTU/hr
75 % load (3001 bhp)	0.352 lb fuel/bhp-hr * 3001 bhp = 1,056 lb/hr	1,056 lb/hr * gal 36-deg API/7.043 lb = 150.0 gal/hr	1,056 lb/hr * 0.0196 MMBTU/lb = 20.7 MMBTU/hr
50 % load (2000 bhp)	0.373 lb fuel/bhp-hr * 2000 bhp = 746 lb/hr	746 lb/hr * gal 36-deg API/7.043 lb = 105.9 gal/hr	746 lb/hr * 0.0196 MMBTU/lb = 14.6 MMBTU/hr
25 % load (999 bhp)	0.465 lb fuel/bhp-hr * 999 bhp = 465 lb/hr	465 lb/hr * gal 36-deg API/7.043 lb = 66.0 gal/hr	465 lb/hr * 0.0196 MMBTU/lb = 9.1 MMBTU/hr

Engine Load	NOx Emissions - Uncontrolled (lb/MMBTU)	NOx Emissions - Controlled (lb/MMBTU)
110 % load (4398 bhp)	17.92 g/bhp-hr * 4398 bhp * lb/454g * hr/29.9 MMBTU = 5.81 lb/MMBTU	12.90 g/bhp-hr * 4398 bhp * lb/454g * hr/29.9 MMBTU = 4.1
100 % load (4008 bhp)	17.62 g/bhp-hr * 4008 bhp * lb/454g * hr/27.2 MMBTU = 5.72 lb/MMBTU	12.69 g/bhp-hr * 4008 bhp * lb/454g * hr/27.2 MMBTU = 4.1
75 % load (3001 bhp)	14.81 g/bhp-hr * 3001 bhp * lb/454g * hr/20.7 MMBTU = 4.72 lb/MMBTU	10.66 g/bhp-hr * 3001 bhp * lb/454g * hr/20.7 MMBTU = 3.4
50 % load (2000 bhp)	13.57 g/bhp-hr * 2000 bhp * lb/454g * hr/14.6 MMBTU = 4.08 lb/MMBTU	9.77 g/bhp-hr * 2000 bhp * lb/454g * hr/14.6 MMBTU = 2.94
25 % load (999 bhp)	14.72 g/bhp-hr * 999 bhp * lb/454g * hr/9.1 MMBTU = 3.55 lb/MMBTU	10.60 g/bhp-hr * 999 bhp * lb/454g * hr/9.1 MMBTU = 2.56 l

Engine Load	NOx Emissions Equivalent Hours of Operation
110 % load (4398 bhp)	1415000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/29.9 MMBTU = 6,549 hrs/yr
100 % load (4008 bhp)	1415000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/27.2 MMBTU = 7,186 hrs/yr
75 % load (3001 bhp)	1415000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/20.7 MMBTU = 9,434 hrs/yr
50 % load (2000 bhp)	1415000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/14.6 MMBTU = 13,359 hrs/yr
25 % load (999 bhp)	1415000 gal/yr * 7.043 lb/gal * 0.0196 MMBTU/lb * hr/9.1 MMBTU = 21,453 hrs/yr

	(tons/yr)
@ 4.12 lb/MMBTU	4.12 lb NOx/MMBTU * 0.0196 MMBTU/lb fuel * 7.043 lb/gal * 1415000 gal/yr = 402 tons NOx/yr
Annual Fuel Consumption	1,415,000 gallons

EMD Model 20-645F4B
Emissions Calculations - All Pollutants - Based on information provided by EMD
Alexander Orr, Jr. Water Treatment Plant (4)

CO		tons CO/yr = gal/yr * lb fuel/gal * MMBTU/lb fuel* lb CO/hr * hr/MMBTU * ton/2000 lb
100 % load (4,008 bhp)	2.47 lb CO/hr	tons CO/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 2.47 lb CO/hr * hr/27.21 MMBTU * ton/2000 lb = 8.9 tons CO/yr
75 % load (3,001 bhp)	1.98 lb CO/hr	tons CO/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 1.98 lb CO/hr * hr/20.73 MMBTU * ton/2000 lb = 9.4 tons CO/yr
50 % load (2,000 bhp)	1.41 lb CO/hr	tons CO/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 1.41 lb CO/hr * hr/14.64 MMBTU * ton/2000 lb = 9.4 tons CO/yr
25 % load (999 bhp)	1.94 lb CO/hr	tons CO/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 1.94 lb CO/hr * hr/9.11 MMBTU * ton/2000 lb = 20.8 tons CO/yr
NOx (controlled)		tons NOx/yr = gal/yr * lb fuel/gal * MMBTU/lb fuel* lb NOx/MMBTU * ton/2000 lb
100 % load (4,008 bhp)	4.12 lb NOx/MMBTU	tons NOx/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 4.12 lb NOx/MMBTU * ton/2000 lb = 402 tons NOx/yr
75 % load (3,001 bhp)	3.40 lb NOx/MMBTU	tons NOx/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 3.40 lb NOx/MMBTU * ton/2000 lb = 332 tons NOx/yr
50 % load (2,000 bhp)	2.94 lb NOx/MMBTU	tons NOx/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 2.94 lb NOx/MMBTU * ton/2000 lb = 287 tons NOx/yr
25 % load (999 bhp)	2.56 lb NOx/MMBTU	tons NOx/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 2.56 lb NOx/MMBTU * ton/2000 lb = 250 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 (4,008 bhp)	0.05 weight % S	tons SO2/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 5.0 tons SO2/yr
75 % load (3,001 bhp)	0.05 weight % S	tons SO2/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 5.0 tons SO2/yr
50 % load (2,000 bhp)	0.05 weight % S	tons SO2/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 5.0 tons SO2/yr
25 % load (999 bhp)	0.05 weight % S	tons SO2/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 5.0 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 (4,008 bhp)	0.057 lb PM-10/MMBTU	tons PM-10/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.06 lb PM-10/MMBTU * ton/2000 lb = 5.6 tons PM-10/yr
75 % load (3,001 bhp)	0.057 lb PM-10/MMBTU	tons PM-10/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.06 lb PM-10/MMBTU * ton/2000 lb = 5.6 tons PM-10/yr
50 % load (2,000 bhp)	0.057 lb PM-10/MMBTU	tons PM-10/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.06 lb PM-10/MMBTU * ton/2000 lb = 5.6 tons PM-10/yr
25 % load (999 bhp)	0.057 lb PM-10/MMBTU	tons PM-10/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.06 lb PM-10/MMBTU * ton/2000 lb = 5.6 tons PM-10/yr
NMHC		tons NMHC/yr = gal/yr * lb fuel/gal * MMBTU/lb fuel* lb NMHC/MMBTU * ton/2000 lb
100 % load (4,008 bhp)	0.08 lb NMHC/MMBTU	tons NMHC/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.08 lb NMHC/MMBTU * ton/2000 lb = 7.8 tons NMHC/yr
75 % load (3,001 bhp)	0.08 lb NMHC/MMBTU	tons NMHC/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.08 lb NMHC/MMBTU * ton/2000 lb = 7.8 tons NMHC/yr
50 % load (2,000 bhp)	0.08 lb NMHC/MMBTU	tons NMHC/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.08 lb NMHC/MMBTU * ton/2000 lb = 7.8 tons NMHC/yr
25 % load (999 bhp)	0.08 lb NMHC/MMBTU	tons NMHC/yr = 1415000 gal/yr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.08 lb NMHC/MMBTU * ton/2000 lb = 7.8 tons NMHC/yr

ATTACHMENT D
Cost Estimates and NOx Control Efficiencies for Diesel Engines
Alexander Orr, Jr. Water Treatment Plant, Dade County

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMISSIONS REDUCTIONS ALT. #1

ENGINE MODEL (# OF ENGINES)	BASIC NOX EMISSIONS (*TONS)	20% NOX REDUCTION (TONS)	REVISED NOX EMISSIONS (TONS)	REVISED OPERATING HOURS	ESTIMATED COST
20E4 (11)	177.5	35.5	142		$ 56,100
20E4B (4)	88.3	17.7	70.64		$ 20,400
20F4B (8)	247.8	49.6	198.24		$ 40,800
16G4A (2)	31.3	6.3	25.04		$ 10,380
12E4B (1)	13.3	2.7	10.64		$ 3,600
TOTAL (26)	558.2	111.6	446.6	500	$ 131,280
*NOTE: BASED ON 400/YR OPERATION-FULL LOAD					

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMISSIONS REDUCTIONS ALT. #1
NOTES

ALL EMISSIONS FIGURES QUOTED ARE MINIMUM REDUCTIONS ANTICIPATED

REQUIRES

1) RETARDED INJECTOR TIMING 4 DEGREES NO MATERIAL REVISIONS

OPERATING IMPACT

1) INCREASED FUEL CONSUMPTION + 2 %

2) INCREASED PARTICULATE MATTER + 25 %

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMISSIONS REDUCTIONS ALT.#2

ENGINE MODEL (# OF ENGINES)	BASIC NOX EMISSIONS (*TONS)	28% NOX REDUCTION (TONS)	REVISED NOX EMISSIONS (TONS)	REVISED OPERATING HOURS	ESTIMATED COST
20E4 (11)	177.5	49.7	127.8		$ 176,605
20E4B (4)	88.3	24.7	63.6		$ 64,220
20F4B (8)	247.8	69.4	178.4		$ 128,440
16G4A (2)	31.3	8.8	22.5		$ 31,490
12E4B (1)	13.3	3.7	9.6		$ 15,650
TOTAL (28)	558.2	156.3	401.9	556	$ 416,405
*NOTE: BASED ON 400/YR OPERATION-FULL LOAD					

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMISSIONS REDUCTIONS ALT. 2
NOTES

ALL EMISSIONS FIGURES QUOTED ARE MINIMUM REDUCTIONS ANTICIPATED

REQUIRES

1) RETARDED INJECTOR TIMING 4 DEGREES
2) RETRO FIT OF 4-PASS AFTERCOOLERS

OPERATING IMPACT

1) REDUCED PARTICULATE MATTER 7 %

2) REDUCED FUEL CONSUMPTION .7 %

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMISSIONS REDUCTIONS ALT. #3

ENGINE MODEL (# OF ENGINES)	BASIC NOX EMISSIONS (*TONS)	36% NOX REDUCTION (TONS)	REVISED NOX EMISSIONS (TONS)	REVISED OPERATING HOURS	ESTIMATED COST
20E4 (11)	177.5	63.9	113.6		$ 423,280
20E4B (4)	88.3	31.8	56.5		$ 153,920
20F4B (8)	247.8	89.2	158.6		$ 307,840
16G4A (2)	31.3	11.3	20.0		$ 77,620
12E4B (1)	13.3	4.8	8.5		$ 38,070
TOTAL (26)	558.2	201.0	357.2	625	$ 1,000,730
*NOTE: BASED ON 400/YR OPERATION-FULL LOAD					

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMISSSIONS REDUCTIONS ALT. #3
NOTES

ALL EMISSIONS FIGURES QUOTED ARE MINIMUM REDUCTIONS ANTICIPATED

REQUIRES

1) RETARDED INJECTOR TIMING 4 DEGREES
2) SEPERATE AFTERCOOLING OF AFTERCOOLER CIRCUIT
   CURRENT ASSUMPTION: MKW PROVIDES/INSTALLS PIPING & PUMP
   FROM FRONT OR REAR OF ENGINE
   TO HEAT EXCHANGER. DEPARTMENT PROVIDES PIPING
   FROM HEAT EXCHANGER TO WATER SOURCE

OPERATING IMPACT

1) REDUCED FUEL CONSUMPTION 1.2 %
2) REDUCED PARTICULATE MATTER 4 %

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMISSIONS REDUCTION ALT. #4

ENGINE MODEL (# OF ENGINES)	BASIC NOX EMISSIONS (*TONS)	50% NOX REDUCTION (TONS)	REVISED NOX EMISSIONS (TONS)	REVISED OPERATING HOURS	ESTIMATED COST
20E4 (11)	177.5	88.75	88.75		$ 3,167,340
20E4B (4)	88.3	44.15	44.2		$ 948,560
20F4B (8)	247.8	123.9	123.9		$ 515,120
16G4A (2)	31.3	15.65	15.7		$ 298,000
12E4B (1)	13.3	6.65	6.7		$ 152,670
TOTAL (26)	558.2	279.1	279.1	800	$ 5,081,690
*NOTE: BASED ON 400/YR OPERATION-FULL LOAD					

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMISSIONS REDUCTION ALT. #4

ALL EMISSIONS FIGURES QUOTED ARE MINIMUM REDUCTIONS ANTICIPATED

REQUIRES

645 E ENGINES

1) ALL PREVIOUS MODIFICATIONS
2) HIGH COMPRESSION PISTON & HUB LINERS
3) CBOI INJECTORS
4) 17.9:1 TURBOCHARGERS (IF NOT SO EQUIPPED)
5) RETARDED ENGINE TIMING

645E4B ENGINES

1) ALL PREVIOUS MODIFICATIONS
2) HIGH COMPRESSION PISTON & HUB LINERS
3) CBOI INJECTORS
5) RETARDED ENGINE TIMING

645 FB ENGINES

1) ALL PREVIOUS MODIFICATIONS
2) CBOI INJECTORS
3) RETARDED ENGINE TIMING

710 ENGINES

1) SEPARATELY COOLED AFTERCOOLERS
2) EMD ENGINE EMDEC FUEL SYSTEM

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMMISSIONS REDUCTIONS ALT. #5

ENGINE MODEL (# OF ENGINES)	BASIC NOX EMISSIONS (*TONS)	70% NOX REDUCTION (TONS)	REVISED NOX EMISSIONS (TONS)	REVISED OPERATING HOURS	ESTIMATED COST
20E4 (11)	177.5	124.25	53.25		$ 4,712,895
20E4B (4)	88.3	61.8	26.5		$ 1,713,780
20F4B (8)	247.8	173.5	74.3		$ 3,585,960
16G4A (2)	31.3	15.65	15.7		
12E4B (1)	13.3	9.3	4.0		$ 360,530
TOTAL (26)	558.2	384.5	173.7	1445	$ 10,373,165
*NOTE: BASED ON 400/YR OPERATION-FULL LOAD					

MIAMI DADE WATER SEWER
ENGINE POPULATION Nox EMISSIONS REDUCTIONS ALT #5
NOTES

ALL EMISSIONS FIGURES QUOTED ARE MINIMUM REDUCTIONS ANTICIPATED

REQUIRES

1) ALL 645 SERIES ENGINES BE RETROFITTED WITH ECI DUAL FUEL CONVERSION KIT

CONVERSION KIT NOT CURRENTLY AVAILABLE FOR SERIES 710 ENGINE UNDER DEVELOPMENT WITH EMD ASSISTANCE

OPERATING IMPACT

1) MAJOR INCREASE IN TIMES BETWEEN OVERHAULS

2)LOWER FUEL COSTSi GAS VERSUS DIESEL FUEL

3) LESS FREQUENT OIL CHANGES

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

FACSIMILE MESSAGE

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 20E4 (3)	$450K
Preston WTP 20E4 (3) 20F4B (3)	$450K $550K
Orr WTP 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 20E4 16G4A	23 ea. 18 ea.	$165K ea. $150K ea.	6 Systems $1.1M
Preston WTP 20E4 20F4B	23 ea. 48 ea.	$165K ea. $200K ea.	6 Systems $1.35M
Orr WTP 20F4B	48 ea.	$200K ea.	4 Systems $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\1998\CH2MHILL.FAX

ATTACHMENT E
Summary of Past Actual and Future Potential Emissions
Engine-Driven Pump Nos. 1, 3, 4, 5, and 6
Alexander Orr, Jr. Water Treatment Plant

Pump Engine Nos. 1 - 6
Historical NOx Emissions Test Results
Alexander Orr, Jr. Water Treatment Plant

	Engine No. 1		Engine No. 3		Engine No. 4		Engine No. 5		Engine No. 6*	
	(lb/hr)	(lb/MMBTU)	(lb/hr)	(lb/MMBTU)	(lb/hr)	(lb/MMBTU)	(lb/hr)	(lb/MMBTU)	(lb/hr)	(lb/MMBTU)
1996	8.23	2.34	6.63	1.81	10.45	2.97	na	na	17.88	1.53
1997	9.13	2.12	7.85	1.83	12.71	2.95	20.53	2.60	23.28	1.84
1998	na	2.26	na	2.36	na	2.57	na	2.29	na	1.34
Avg		2.24		2.00		2.83		2.45		1.57
Proposed 4/98[1]	11.1	3.12	11.1	3.12	11.1	3.12	20.2	3.12	18.63	1.21

1 Emissions calculations are provided on the following pages.

2 Engine Nos. 1, 3, 4, and 5 are to be removed from service in early 2000. New gas engines will be installed on Pump Nos. 3, 4, and 5, as proposed in the application submitted to FDEP on 20 October 1998.

* Emissions reported for Engine No. 6 are uncontrolled. Proposed limit of 1.21 lb/MMBTU (4/98) to be attained by installing aftercooler and retarding in.

Worthington CC Diesel Engines (3), 825 bhp; Limited to 4360 hours per year operation (aggregate)
Emissions Calculations - All Pollutants - Based on emissions tests and AP-42 emissions factors for Diesel Engines (AP-42, Table 3.4-1)
Alexander Orr, Jr. Water Treatment Plant

CO		tons CO/yr = hr/yr * gal/hr * lb fuel/gal * MMBTU/lb fuel* lb CO/MMBTU * ton/2000 lb
AP-42, Table 3.4-1	0.85 lb CO/MMBTU	tons CO/yr = 4360 hr/yr * 44 gal/hr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.85 lb CO/MMBTU * ton/2000 lb = 11.2 tons CO/yr
NOx		tons NOx/yr = hr/yr * gal/hr * lb fuel/gal * MMBTU/lb fuel* lb NOx/MMBTU * ton/2000 lb
1996 & 1997 Stack Tests Results*	3.12 lb NOx/MMBTU	tons NOx/yr = 4360 hr/yr * 44 gal/hr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 3.12 lb NOx/MMBTU * ton/2000 lb = 41 tons NOx/yr
SO2 (0.05 weight % fuel sulfur content)		tons SO2/yr = hr/yr* gal/hr * lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb
Mass Balance	0.05 weight % S	tons SO2/yr = 4360 hr/yr * 44 gal/hr * 7.043 lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 0.7 tons SO2/yr
PM-10		tons PM-10/yr = hr/yr * gal/hr * lb fuel/gal * MMBTU/lb fuel* lb PM-10/MMBTU * ton/2000 lb
AP-42, Table 3.4-2	0.050 lb PM-10/MMBTU	tons PM-10/yr = 4360 hr/yr * 44 gal/hr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.05 lb PM-10/MMBTU * ton/2000 lb = 0.7 tons PM-10/yr
NMHC		tons NMHC/yr = hr/yr * gal/hr * lb fuel/gal * MMBTU/lb fuel* lb NMHC/MMBTU * ton/2000 lb
AP-42, Table 3.4-1	0.08 lb NMHC/MMBTU	tons NMHC/yr = 4360 hr/yr * 44 gal/hr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.08 lb NMHC/MMBTU * ton/2000 lb = 1.1 tons NMHC/yr

Worthington SDR Diesel Engine, 1500 bhp (serves as backup for Engine No. 6)
Emissions Calculations - All Pollutants - Based on emissions tests and AP-42 emissions factors for Dual Fuel Engines (AP-42, Table 3.4-1)
Alexander Orr, Jr. Water Treatment Plant

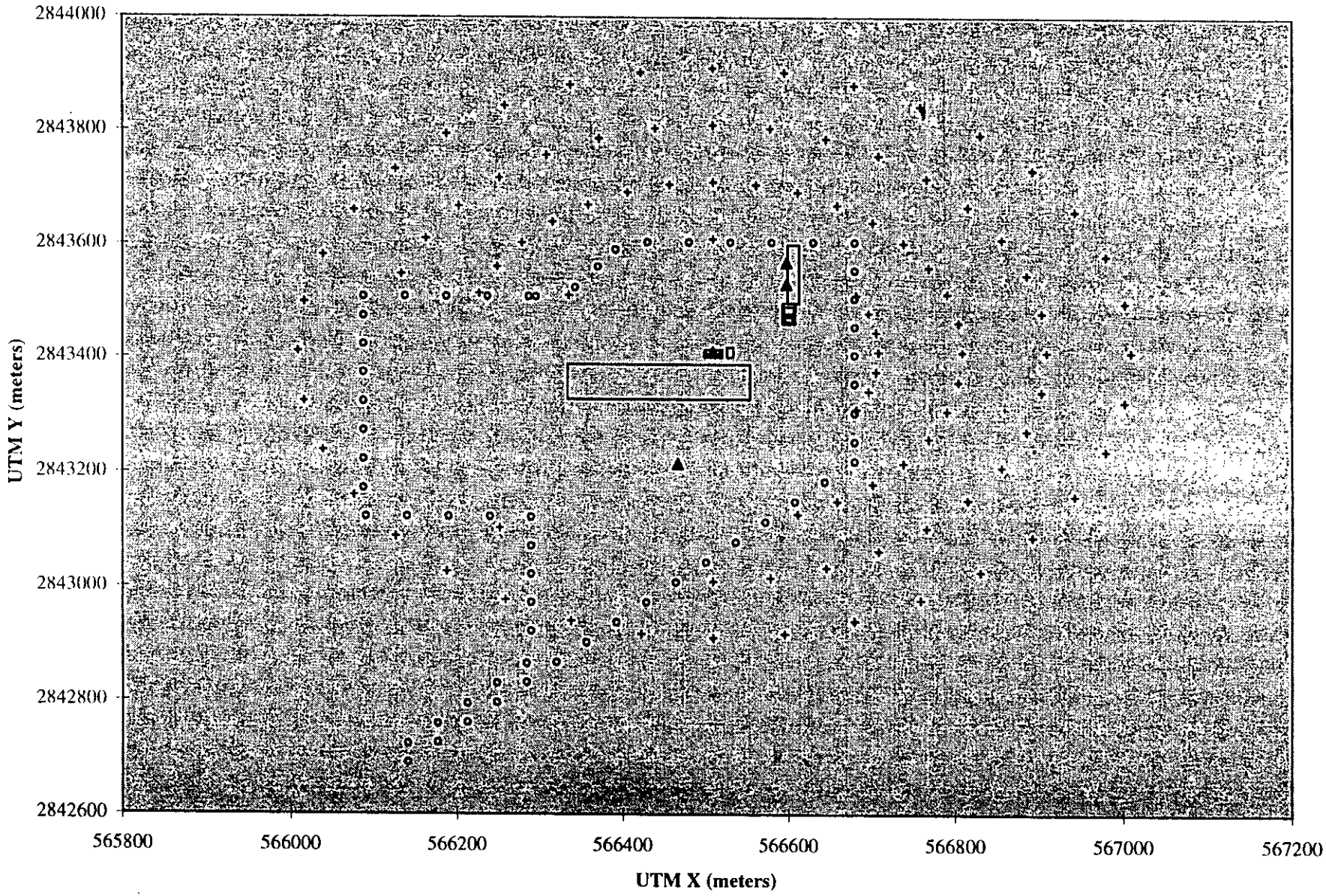
CO		tons CO/yr = hr/yr * gal/hr * lb fuel/gal * MMBTU/lb fuel* lb CO/MMBTU * ton/2000 lb
AP-42, Table 3.4-1	0.85 lb CO/MMBTU	tons CO/yr = 0 hr/yr * 80 gal/hr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.85 lb CO/MMBTU * ton/2000 lb = 0.0 tons CO/yr
NOx		tons NOx/yr = hr/yr * gal/hr * lb fuel/gal * MMBTU/lb fuel* lb NOx/MMBTU * ton/2000 lb
1996 & 1997 Stack Tests Results*	3.12 lb NOx/MMBTU	tons NOx/yr = 0 hr/yr * 80 gal/hr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 3.12 lb NOx/MMBTU * ton/2000 lb = 0.0 tons NOx/yr
SO2 (0.05 weight % fuel sulfur content)		tons SO2/yr = hr/yr* gal/hr * lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb
Mass Balance	0.05 weight % S	tons SO2/yr = 0 hr/yr * 80 gal/hr * 7.043 lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 0.0 tons SO2/yr
PM-10		tons PM-10/yr = gal/yr * lb fuel/gal * MMBTU/lb fuel* lb PM-10/MMBTU * ton/2000 lb
AP-42, Table 3.4-2	0.050 lb PM-10/MMBTU	tons PM-10/yr = 0 hr/yr * 80 gal/hr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.05 lb PM-10/MMBTU * ton/2000 lb = 0.0 tons PM-10/yr
NMHC		tons NMHC/yr = gal/yr * lb fuel/gal * MMBTU/lb fuel* lb NMHC/MMBTU * ton/2000 lb
AP-42, Table 3.4-1	0.08 lb NMHC/MMBTU	tons NMHC/yr = 0 hr/yr * 80 gal/hr * 7.043 lb fuel/gal * 0.01962 MMBTU/lb fuel * 0.08 lb NMHC/MMBTU * ton/2000 lb = 0.0 tons NMHC/yr

Enterprise Dual Fuel Engine, 2113 bhp
Emissions Calculations - All Pollutants - Based on emissions tests and AP-42 emissions factors for 4-Cycle Lean-Burn Engines (AP-42, Table 3.4-1)
Alexander Orr, Jr. Water Treatment Plant

CO		tons CO/yr = hr/yr * MMBTU/hr * lb CO/MMBTU * ton/2000 lb
AP-42, Table 3.2-1	1.16 lb CO/MMBTU	tons CO/yr = 8760 hr/yr * 15.3 MMBTU/hr * 1.16 lb CO/MMBTU * ton/2000 lb = 77.8 tons CO/yr
NOx		tons NOx/yr = hr/yr * MMBTU/hr * lb NOx/MMBTU * ton/2000 lb
1996 Stack Tests Results*	1.21 lb NOx/MMBTU	tons NOx/yr = 8760 hr/yr * 15.3 MMBTU/hr * 1.21 lb NOx/MMBTU * ton/2000 lb = 81.2 tons NOx/yr
SO2 (0.05 weight % fuel sulfur content)		tons SO2/yr = hr/yr* gal/hr * lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb
Mass Balance	0.05 weight % S	tons SO2/yr = 8760 hr/yr * 15 gal/hr * 7.043 lb fuel/gal * 0.0005 lb S/lb fuel * 2 lb SO2/lb S * ton/2000 lb = 0.5 tons SO2/yr
PM-10		tons PM-10/yr = hr/yr * MMBTU/hr * lb PM-10/MMBTU * ton/2000 lb
AP-42, Table 3.4-2	0.005 lb PM-10/MMBTU	tons PM-10/yr = 8760 hr/yr * 15.3 MMBTU/hr * 0.005 lb PM-10/MMBTU * ton/2000 lb = 0.3 tons PM-10/yr
NMHC		tons NMHC/yr = hr/yr * MMBTU/hr * lb NMHC/MMBTU * ton/2000 lb
AP-42, Table 3.4-1	0.2 lb NMHC/MMBTU	tons NMHC/yr = 8760 hr/yr * 15.3 MMBTU/hr * 0.200 lb NMHC/MMBTU * ton/2000 lb = 13.4 tons NMHC/yr

ATTACHMENT F
Alexander Orr ISCST3 Receptor Locations Superimposed onto USGS Map of South Miami Quadrangle
Close-Up Printout of ISCST3 Receptor Locations at Alexander Orr, Jr. WTP
Alexander Orr, Jr. Water Treatment Plant

Alexander Orr Jr. Water Treatment Plant
ISCST3 Dispersion Modeling Receptors



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