P 265 659 431

US Postal Service

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Street & Number: 1411 W 4 S Dept	
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Return Receipt Showing to Whom, Date, & Addressee's Address	
TOTAL Postage & Fees	$
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0250314-003-AC

PS Form **3800**, April 1995

Is your **RETURN ADDRESS** completed on the reverse side?

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- Complete items 1 and/or 2 for additional services.
- Complete items 3, 4a, and 4b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write *"Return Receipt Requested"* on the mailpiece below the article number.
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1. ☐ Addressee's Address
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Consult postmaster for fee.

3. Article Addressed to:
Mr. Robert Ready PE
Miami-Dade Water & Sewer
4200 Salzedo St.
Coral Gables, Fl 33146-0316

4a. Article Number: P 265 659 431

4b. Service Type
☐ Registered ☒ Certified
☐ Express Mail ☐ Insured
☐ Return Receipt for Merchandise ☐ COD

7. Date of Delivery: 3/8/99

5. Received By: *(Print Name)* L. BANFIELD

8. Addressee's Address *(Only if requested and fee is paid)*

6. Signature: *(Addressee or Agent)*
X L. Banfield

PS Form **3811**, December 1994 102595-97-B-0179 Domestic Return Receipt

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MAR 15 1999
BUREAU OF
AIR REGULATION

Department of Environmental Protection
Division of Air Resources Management
Bureau of Air Regulation, NSRS
2600 Blair Stone Road, MS 5505
Tallahassee, Florida 32399-2400

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NOTICE OF FINAL PERMIT

In the Matter of an
Application for Permit by:

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

DEP File No. 0250314-003-AC
Alexander Orr, Jr. WTP
Natural Gas Fueled Engine Driven Pump Sets
Miami-Dade County

Enclosed is Final Permit Number 0250314-003-AC. This permit authorizes Miami-Dade Water & Sewer Department to remove existing pumps and engines numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5 at the Alexander Orr, Jr. water treatment plant. This permit is issued pursuant to Chapter 403, Florida Statutes.

Any party to this order has the right to seek judicial review of it under section 120.68 of the Florida Statutes, by filing a notice of appeal under rule 9.110 of the Florida Rules of Appellate Procedure with the clerk of the Department of Environmental Protection in the Office of General Counsel, Mail Station #35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The notice must be filed within thirty days after this order is filed with the clerk of the Department.

Executed in Tallahassee, Florida.

C. H. Fancy, P.E., Chief
Bureau of Air Regulation

CERTIFICATE OF SERVICE

The undersigned duly designated deputy agency clerk hereby certifies that this Notice of Final Permit (including the Final permit) was sent by certified mail (*) and copies were mailed by U.S. Mail before the close of business on 3-5-99 to the person(s) listed:

Mr. Robert Ready, P.E. *
Mr. Richard O'Rourke, P.E.
Mr. Lennon Anderson, DEP, SED
Mr. Ewart Anderson, P.E., DERM

Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Kim Tober 3-5-99
(Clerk) (Date)

FINAL DETERMINATION

Miami-Dade Water & Sewer Department
Alexander Orr, Jr. WTP
Natural Gas Fueled Engine Driven Pump Sets
DEP File No. 0250314-003-AC

The Department distributed a public notice package on February 5, 1999 to allow the applicant to remove existing pumps and engines numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5 at the Alexander Orr, Jr. water treatment plant located at 6800 SW 87 Avenue, Miami, Miami-Dade County. The Public Notice of Intent to Issue was published in the Miami Daily Business Review on February 9, 1999.

COMMENTS

No comments were received by the Department from the public.

No comments were received from the applicant.

The Department did not identify any changes required to the draft permit.

CONCLUSION

The final action of the Department is to issue the permit with no changes.

Department of Environmental Protection

Jeb Bush
Governor

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

David B. Struhs
Secretary

PERMITTEE

Miami-Dade Water & Sewer Department
Alexander Orr, Jr. WTP

4200 Salzedo Street
Coral Gables, Florida 33146-0316

Permit No.	0250314-003-AC
Project	Three Natural Gas Fueled Engine Driven Pump Sets
SIC No.	4941
Expires:	February 25, 2000

Authorized Representative:

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

PROJECT AND LOCATION

This permit authorizes Miami-Dade Water & Sewer Department to remove existing pumps and engines numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5.

This facility is located at the Alexander Orr, Jr. Water Treatment Plant, 6800 SW 87 Avenue, Miami, Miami-Dade County. UTM coordinates are: Zone 17; 566.6 km E and 2843.5 km N.

STATEMENT OF BASIS

This construction permit is issued under the provisions of Chapter 403 of the Florida Statutes (F.S.), and the Florida Administrative Code (F.A.C.) Chapters 62-4, 62-204, 62-210, 62-212, 62-296, and 62-297. The above named permittee is authorized to perform the construction in accordance with the conditions of this permit and as described in the application, approved drawings, plans, and other documents on file with the Department of Environmental Protection (Department).

APPENDIX

The attached appendix is a part of this permit:

Appendix GC General Permit Conditions

Howard L. Rhodes, Director
Division of Air Resources
Management

SECTION I. FACILITY INFORMATION

FACILITY DESCRIPTION

This facility consists of a municipally owned water treatment plant providing potable water to the public.

PROJECT DETAILS

This permitting action is to remove existing engines and pumps numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5. Emissions units that will be removed are 001 (engine and pump #1), 002 (engine and pump #2 which were previously removed from service), 003 (engine and pump #3), 004 (engine and pump #4), and 005 (engine and pump #5). Emissions units addressed by this permit are:

EMISSIONS UNIT NO.	EMISSIONS UNIT DESCRIPTION
018	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 3. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 million gallons per day (MGD) water pumping capacity.
019	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 4. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 MGD water pumping capacity.
020	2090 brake hp natural gas fired Waukesha Model 8L-AT27GL engine for pump 5. Maximum heat input rate is 13.70 mmBtu/hr. Pump has 50 MGD water pumping capacity.

REGULATORY CLASSIFICATION

This facility is classified as a Major or Title V Source of air pollution because emissions of at least one regulated air pollutant, such as particulate matter (PM/PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), or volatile organic compounds (VOC) exceeds 100 tons per year (TPY).

This facility is not within an industry included in the list of the 28 Major Facility Categories per Table 62-212.400-1, F.A.C. Because emissions are greater than 250 TPY for at least one criteria pollutant, the facility is also a Major Facility with respect to Rule 62-212.400, Prevention of Significant Deterioration (PSD).

This project is exempt from the requirements of Rule 62-212.400, F.A.C., Prevention of Significant Deterioration (PSD) as discussed in the Technical Evaluation and Preliminary Determination dated February 3, 1999.

The emissions units included in this project are not subject to any unit-specific emission limiting standard (considered "unregulated" for purposes of Title V permitting).

PERMIT SCHEDULE

- 10/29/98 Received application for construction permit
- 12/07/98 Received response to request for additional information
- 12/07/98 Permit application deemed complete
- 2/4/99 Distributed Notice of Intent to Issue permit
- 2/9/99 Notice of Intent published in Miami Daily Business Review

RELEVANT DOCUMENTS

The documents listed below are the basis of the permit. They are specifically related to this permitting action. These documents are on file with the Department.

- Application received at the Bureau of Air Regulation on October 29, 1998
- Department's letter dated November 16, 1998
- Applicant's letter dated December 3, 1998 received December 7, 1998
- Department's Technical Evaluation and Preliminary Determination dated February 3, 1999
- Department's Intent to Issue and public notice information dated February 4, 1999

The following specific conditions apply to all emissions units at this facility addressed by this permit.

ADMINISTRATIVE

1. Regulating Agencies: All documents related to applications for permits to construct, operate or modify an emissions unit should be submitted to the Bureau of Air Regulation (BAR), Florida Department of Environmental Protection at Mail Station #5505, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400, phone number 850/488-0114. All documents related to reports, tests, minor modifications and notifications shall be submitted to the Department's Southeast District office at PO Box 15425, West Palm Beach, Florida, 33416-5425, and phone number 561/681-6600. Copies of all documents should be sent also to the Air Quality Management Division, Miami-Dade County Department of Environmental Resources Management, Suite 900 33 SW Second Avenue, Miami, Florida 33130-1540.
2. General Conditions: The owner and operator is subject to and shall operate under the attached General Permit Conditions G.1 through G.15 listed in Appendix GC of this permit. General Permit Conditions are binding and enforceable pursuant to Chapter 403 of the Florida Statutes. [Rule 62-4.160, F.A.C.]
3. Terminology: The terms used in this permit have specific meanings as defined in the corresponding chapters of the Florida Administrative Code.
4. Applicable Regulations, Forms and Application Procedures: Unless otherwise indicated in this permit, the construction and operation of the subject emissions unit shall be in accordance with the capacities and specifications stated in the application. The facility is subject to all applicable provisions of Chapter 403, F.S. and Florida Administrative Code Chapters 62-4, 62-110, 62-204, 62-212, 62-213, 62-296, 62-297 and the Code of Federal Regulations Title 40, Part 60, adopted by reference in the Florida Administrative Code (F.A.C.) regulations. The permittee shall use the applicable forms listed in Rule 62-210.900, F.A.C. and follow the application procedures in Chapter 62-4, F.A.C. Issuance of this permit does not relieve the facility owner or operator from compliance with any applicable federal, state, or local permitting or regulations. [Rules 62-204.800, 62-210.300 and 62-210.900, F.A.C.]
5. New or Additional Conditions: Pursuant to Rule 62-4.080, F.A.C., for good cause shown and after notice and an administrative hearing, if requested, the Department may require the permittee to conform to new or additional conditions. The Department shall allow the permittee a reasonable time to conform to the new or additional conditions, and on application of the permittee, the Department may grant additional time. [Rule 62-4.080, F.A.C.]
6. Expiration: This air construction permit shall expire on February 25, 2000. The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Department's Bureau of Air Regulation prior to 60 days before the expiration of the permit. [Rules 62-210.300(1), 62-4.070(4), 62-4.080, and 62-4.210, F.A.C]
7. Modifications: No emissions unit or facility subject to this permit shall be constructed or modified without obtaining an air construction permit from the Department. Such permit must be obtained prior to the beginning of construction or modification. [Rules 62-210.300(1) and 62-212.300(1)(a), F.A.C.]
8. Title V Operation Permit Required: This permit authorizes construction and/or installation of the permitted emissions unit and initial operation to determine compliance with Department rules. A Title V operation permit is required for regular operation of the permitted emissions unit. The owner or

operator shall apply for and receive a Title V operation permit prior to expiration of this permit. To apply for a Title V operation permit, the applicant shall submit the appropriate application form, compliance test results, and such additional information as the Department may by law require. The application shall be submitted to the Department's Southeast District office. [Rules 62-4.030, 62-4.050, 62-4.220, and Chapter 62-213, F.A.C.]

EMISSION LIMITING STANDARDS

9. General Visible Emissions Standard: Except for emissions units that are subject to a particulate matter or opacity limit set forth or established by rule and reflected by conditions in this permit, no person shall cause, let, permit, suffer, or allow to be discharged into the atmosphere the emissions of air pollutants from any activity, the density if which is equal to or greater than that designated as Number 1 on the Ringelmann Chart (20% opacity). The test method for visible emissions shall be EPA Method 9, incorporated and adopted by reference in Chapter 62-297, F.A.C. Test procedures shall meet all applicable requirements of Chapter 62-297, F.A.C. [Rule 62-296.320(4)(b)1, F.A.C.]

10. General Pollutant Emission Limiting Standards: [Rule 62-296.320(2), F.A.C.]

    No person shall cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor.

    [Note: An objectionable odor is defined in Rule 62-210.200(198), F.A.C., as any odor present in the outdoor atmosphere which by itself or in combination with other odors, is or may be harmful or injurious to human health or welfare, which unreasonably interferes with the comfortable use and enjoyment of life or property, or which creates a nuisance.]

OPERATIONAL REQUIREMENTS

11. Plant Operation - Problems: If temporarily unable to comply with any of the conditions of the permit due to breakdown of equipment or destruction by hazard of fire, wind or by other cause, the permittee shall immediately notify the Department's district office and, if applicable, appropriate local program. The notification shall include pertinent information as to the cause of the problem, and what steps are being taken to correct the problem and to prevent its recurrence, and where applicable, the owner's intent toward reconstruction of destroyed facilities. Such notification does not release the permittee from any liability for failure to comply with Department rules. [Rule 62-4.130, F.A.C.]

12. Circumvention: No person shall circumvent any air pollution control device or allow the emission of air pollutants without the applicable air pollution control device operating properly. [Rule 62-210.650, F.A.C.]

13. Excess Emissions:

    (a) Excess emissions resulting from start-up, shutdown or malfunction of any emissions units shall be permitted providing (1) best operational practices to minimize emissions are adhered to and (2) the duration of excess emissions shall be minimized, but in no case exceed two hours in any 24 hour period unless specifically authorized by the Department for longer duration. [Rule 62-210.700(1), F.A.C.]

(b) Excess emissions which are caused entirely or in part by poor maintenance, poor operation, or any other equipment or process failure which may reasonably be prevented during start-up, shutdown, or malfunction shall be prohibited. [Rule 62-210.700(4), F.A.C.]

COMPLIANCE MONITORING AND TESTING REQUIREMENTS

14. Special Compliance Tests: When the Department, after investigation, has good reason (such as complaints, increased visible emissions or questionable maintenance of control equipment) to believe that any applicable emission standard contained in a Department rule or in a permit issued pursuant to those rules is being violated, it shall require the owner or operator of the facility to conduct compliance tests which identify the nature and quantity of pollutant emissions from the emissions units and to provide a report on the results of said tests to the Department. [Rule 62-297.310(7)(b), F.A.C.]

REPORTING AND RECORD KEEPING REQUIREMENTS

15. Duration of Record Keeping: Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least five years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule. [Rules 62-4.160(14)(a)&(b) and 62-213.440(1)(b)2.b., F.A.C.]

16. Excess Emissions Report: If excess emissions occur, the owner or operator shall notify the Department within one working day of: the nature, extent, and duration of the excess emissions; the cause of the excess emissions; and the actions taken to correct the problem. In addition, the Department may request a written summary report of the incident. Pursuant to the New Source Performance Standards, excess emissions shall also be reported in accordance with 40 CFR 60.7, Subpart A. [Rule 62-4.130, F.A.C.]

17. Excess Emissions Report - Malfunctions: In case of excess emissions resulting from malfunctions, each owner or operator shall notify the Department or the appropriate local program in accordance with Rule 62-4.130, F.A.C. A full written report on the malfunctions shall be submitted in a quarterly report if requested by the Department. [Rule 62-210.700(6), F.A.C.]

18. Annual Operating Report for Air Pollutant Emitting Facility: The Annual Operating Report for Air Pollutant Emitting Facility shall be completed each year and shall be submitted to the Department's Southeast District office and, if applicable, the appropriate local program by March 1 of the following year. [Rule 62-210.370(3), F.A.C.]

The following specific conditions apply to the following emissions units after construction:

EMISSIONS UNIT NO.	EMISSIONS UNIT DESCRIPTION
018	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 3. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 million gallons per day (MGD) water pumping capacity.
019	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 4. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 MGD water pumping capacity.
020	2090 brake hp natural gas fired Waukesha Model 8L-AT27GL engine for pump 5. Maximum heat input rate is 13.70 mmBtu/hr. Pump has 50 MGD water pumping capacity.

Note: These emissions units are not subject to any unit-specific applicable requirements. They are subject to the requirements of Section II, Facility-Wide Specific Conditions, of this permit. This permit was written to authorize removal of emissions units 001 through 005 and installation of these emissions units. However, uncontrolled potential emissions are not significantly greater than past actual emissions for purposes of PSD. No further requirements, including unit-specific applicable requirements, are applicable to these emissions units.

OPERATIONAL REQUIREMENTS

1. Hours of Operation: These emissions units may operate continuously, i.e., 8,760 hours/year. [Rule 62-210.200, F.A.C., Definitions-potential to emit (PTE)]
2. Fuel: The owner or operator shall keep monthly records of total fuel consumption for these emissions units. [Rule 62-210.200, F.A.C., Definitions-potential to emit (PTE)]

APPENDIX GC
GENERAL PERMIT CONDITIONS [RULE 62-4.160, F.A.C.]

G.1 The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

G.2 This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings or exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

G.3 As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey and vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

G.4 This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

G.5 This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

G.6 The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

G.7 The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

(a) Have access to and copy and records that must be kept under the conditions of the permit;
(b) Inspect the facility, equipment, practices, or operations regulated or required under this permit, and,
(c) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

G.8 If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

(a) A description of and cause of non-compliance; and
(b) The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

G.9 In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extend it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

G.10 The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

G.11 This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 62-4.120 and 62-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

G.12 This permit or a copy thereof shall be kept at the work site of the permitted activity.

G.13 This permit also constitutes:

(a) Determination of Best Available Control Technology ( );
(b) Determination of Prevention of Significant Deterioration ( ); and
(c) Compliance with New Source Performance Standards ( ).

G.14 The permittee shall comply with the following:

(a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.
(b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application or this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.
(c) Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;
2. The person responsible for performing the sampling or measurements;
3. The dates analyses were performed;
4. The person responsible for performing the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

G.15 When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

Memorandum

Florida Department of
Environmental Protection

BAR

TO: Howard L. Rhodes

THRU: Clair Fancy
Al Linero

FROM: Joe Kahn

DATE: February 25, 1999

SUBJECT: Miami-Dade Water & Sewer Department
Alexander Orr, Jr. WTP
Three Natural Gas Fueled Engine Driven Pump Sets

Attached for approval and signature is the final construction permit for MDWASD's Alexander Orr, Jr. Water Treatment Plant. The permit is to remove existing pumps and engines numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5. The existing pump engines are fuel oil fired. The replacement engines have significantly lower air pollutant emissions on a brake horsepower basis. With the exception of carbon monoxide, potential emissions from the new engines are not expected to significantly increase compared to the past actual emissions of the existing engines. Carbon monoxide emissions do not increase above the PSD significance levels. An air quality impact analysis was not required or conducted.

These emissions units are "unregulated" emissions units, although the facility is a Title V facility because of other emissions sources. A construction permit was required for this project because it constitutes a modification pursuant to rule, although the new emissions units are not subject to any unit-specific applicable requirement.

No comments were received in response to the public notice.

I recommend your approval and signature.

Attachments

/jk

Check Sheet

Company Name: Miami-Dade W&SD - Alexander Orr
Permit Number: 0250314-003
PSD Number:
Permit Engineer: Joe Kahn

Application:

- [x] Initial Application
  - [x] Incompleteness Letters
  - [x] Responses
  - [ ] Waiver of Department Action
  - [ ] Department Response
  - [ ] Other

Cross References:

- [ ]
- [ ]
- [ ]

Intent:

- [x] Intent to Issue
- [x] Notice of Intent to Issue
- [x] Technical Evaluation
- [ ] BACT Determination
- [x] Unsigned Permit

Correspondence with:

- [ ] EPA
- [ ] Park Services
- [ ] Other

- [x] Proof of Publication
  - [ ] Petitions - (Related to extensions, hearings, etc.)
  - [ ] Waiver of Department Action
  - [ ] Other

Final Determination:

- [x] Final Determination
- [x] Signed Permit
- [ ] BACT Determination
  - [ ] Other

Post Permit Correspondence:

- [ ] Extensions/Amendments/Modifications
- [ ] Other

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

SERVE • CONSERVE

February 12, 1999

CERTIFIED: Z 427 642 154
RETURN RECEIPT

Mr. Joseph Kahn, P.E.
Air Quality Engineer
New Source Review Section
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RE: Draft Air Construction Permit for Alexander Orr, Jr. Water Treatment Plant
Florida DEP File No. 0250314-003-AC

Dear Mr. Kahn:

Attached, please find a certified proof of publication of the "Public Notice of the Notice of Intent to Issue Air Construction Permit" for the replacement pump engine sets at the Alexander Orr, Jr. Water Treatment Plant, as required by Section 403.815, Florida Statutes.

Should you have any questions, please call me at (305) 669-5749.

Sincerely,

Richard M. O'Rourke, P.E.
Environmental Permits

ro
Attachment

c: Isidore Goldman, FDEP Southeast District
Patrick Wong, Miami-Dade County DERM
David Lindberg, CH2M Hill, San Diego

L9907dep.wpd

MIAMI DAILY BUSINESS REVIEW

Published Daily except Saturday, Sunday and Legal Holidays
Miami, Dade County, Florida.

STATE OF FLORIDA
COUNTY OF DADE:

Before the undersigned authority personally appeared Octelma V. Ferbeyre, who on oath says that she is the Supervisor, Legal Notices of the Miami Daily Business Review f/k/a Miami Review, a daily (except Saturday, Sunday and Legal Holidays) newspaper, published at Miami in Dade County, Florida; that the attached copy of advertisement, being a Legal Advertisement of Notice in the matter of

PUBLIC NOTICE OF INTENT TO ISSUE
AIR CONSTRUCTION PERMIT
DEP FILE NO: 0250314-003-AC
MIAMI-DADE WATER & SEWER DEPT.
ALEXANDER ORR, JR., WATER
TREATMENT PLANT MIAMI-DADE COUNTY

in the XXXXX Court,

was published in said newspaper in the issues of
Feb 9, 1999

Affiant further says that the said Miami Daily Business Review is a newspaper published at Miami in said Dade County, Florida, and that the said newspaper has heretofore been continuously published in said Dade County, Florida, each day (except Saturday, Sunday and Legal Holidays) and has been entered as second class mail matter at the post office in Miami in said Dade County, Florida, for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that she has neither paid nor promised any person, firm or corporation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in the said newspaper.

Octelma V. Ferbeyre

Sworn to and subscribed before me this 9 day of February, A.D. 1999

Mariela Romero

(SEAL)

Octelma V. Ferbeyre personally known to me.

OFFICIAL NOTARY SEAL
MARIELA ROMERO
COMMISSION NUMBER
CC777419
MY COMMISSION EXPIRES
SEPT 22,2002
NOTARY PUBLIC STATE OF FLORIDA

PUBLIC NOTICE OF INTENT TO ISSUE AIR CONSTRUCTION PERMIT STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION DEP FILE NO. 0250314-003-AC MIAMI-DADE WATER & SEWER DEPARTMENT ALEXANDER ORR, JR. WATER TREATMENT PLANT MIAMI-DADE COUNTY

The Department of Environmental Protection (Department) gives notice of its intent to issue an air construction permit to Miami-Dade Water and Sewer Department, for the Alexander Orr, Jr. Water Treatment Plant located at 6800 SW 87 Avenue, Miami, Miami-Dade County. The permit is to remove existing pumps and engines numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5. The applicant's mailing address is: 4200 Salzedo Street, Coral Gables, Florida 33146-0316. A Best Available Control Technology (BACT) determination was not required pursuant to Rule 62-212.400, F.A.C. and 40 CFR 52.21, Prevention of Significant Deterioration (PSD).

The existing pump engines are fuel oil fired. The replacement engines have significantly lower air pollutant emissions per unit of work. With the exception of carbon monoxide, potential emissions from the new engines are not expected to significantly increase compared to the past actual emissions of the existing engines. Carbon monoxide emissions do not increase above the PSD significance levels. An air quality impact analysis was not required or conducted.

The Department will issue the Final permit with the attached conditions unless a response received in accordance with the following procedures results in a different decision or significant change of terms or conditions.

The Department will accept written comments concerning the proposed permit issuance action for a period of 14 (fourteen) days from the date of publication of this Public Notice of Intent to Issue Air Construction Permit. Written comments should be provided to the Department's Bureau of Air Regulation at 2600 Blair Stone Road, Mail Station #5505, Tallahassee, FL 32399-2400. Any written comments filed shall be made available for public inspection. If written comments received result in a significant change in the proposed agency action, the Department shall revise the proposed permit and require, if applicable, another Public Notice.

The Department will issue the permit with the attached conditions unless a timely petition for an administrative hearing is filed pursuant to sections 120.569 and 120.57 F.S., before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

Mediation is not available in this proceeding.

A person whose substantial interests are affected by the proposed permitting decision may petition for an administrative proceeding (hearing) under sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida, 32399-3000. Petitions filed by the permit applicant or any of the parties listed below must be filed within fourteen days of receipt of this notice of intent. Petitions filed by any persons other than those entitled to written notice under section 120.60(3) of the Florida Statutes must be filed within fourteen days of publication of the public notice or within fourteen days of receipt of this notice of intent, whichever occurs first. Under section 120.60(3), however, any person who asked the Department for notice of agency action may file a petition within fourteen days of receipt of that notice, regardless of the date of publication. A petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will be only at the approval of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information: (a) The name and address of each agency affected and each agency's file or identification number, if known; (b) The name, address, and telephone number of the petitioner, the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination; (c) A statement of how and when petitioner received notice of the agency action or proposed action; (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate; (e) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and (f) A demand for relief.

A petition that does not dispute the material facts upon which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

A complete project file is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at:

Dept. of Environmental Protection Bureau of Air Regulation Suite 4, 111 S. Magnolia Drive Tallahassee, Florida 32301 Telephone: 850/488-0114 Fax: 850/922-6979	Dept. of Environmental Protection Southeast District 400 North Congress Avenue West Palm Beach, Florida 33401 Telephone: 561/681-6600	Dade County Department of Environmental Resources Mgmt. Suite 900, 33 Southwest 2nd Ave. Miami, Florida 33130-1540 Telephone: 305/372-6925

The complete project file includes the application, technical evaluations, Draft permit, and the information submitted by the responsible official, exclusive of confidential records under Section 403.111, F.S. Interested persons may contact the Administrator, New Source Review Section, or the Department's reviewing engineer for this project, Joseph Kahn, P.E.,, at 111 South Magnolia Drive, Suite 4, Tallahassee, Florida 32301, or call 850/488-0114, for additional information.

Z 333 612 510

US Postal Service
Receipt for Certified Mail
No Insurance Coverage Provided.
Do not use for International Mail *(See reverse)*

Sent to Robert Ready	
Street & Number Miami-Dade	
Post Office, State, & ZIP Code Alexander Orr	
Postage Coral Gables, FL	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Addressee's Address	
TOTAL Postage & Fees	$
Postmark or Date 2-5-99	

PS Form **3800**, April 1995

SENDER:
- Complete items 1 and/or 2 for additional services.
- Complete items 3, 4a, and 4b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write *"Return Receipt Requested"* on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):
1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:
Robert Ready, PE
Miami-Dade W & S Dept.
4200 Salzedo St.
Coral Gables, FL
33146-0316

4a. Article Number
Z 333 612 510

4b. Service Type
☐ Registered ☒ Certified
☐ Express Mail ☐ Insured
☐ Return Receipt for Merchandise ☐ COD

7. Date of Delivery 2/8/99

5. Received By: *(Print Name)* L. BANFIELD

8. Addressee's Address *(Only if requested and fee is paid)*

6. Signature: *(Addressee or Agent)*
X L. Banfield

Is your RETURN ADDRESS completed on the reverse side?

Thank you for using Return Receipt Service.

PS Form **3811**, December 1994 102595-97-B-0179 Domestic Return Receipt

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Print your name, address, and ZIP Code in this box •

RECEIVED
FEB 11 1999
BUREAU OF
AIR REGULATION

Department of Environmental Protection
Division of Air Resources Management
Bureau of Air Regulation, NSRS
2600 Blair Stone Road, MS 5505
Tallahassee, Florida 32399-2400

Department of Environmental Protection

Jeb Bush
Governor

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

David B. Struhs
Secretary

February 4, 1999

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Re: DEP File No. 0250314-003-AC
Alexander Orr, Jr. WTP, Three Natural Gas Fueled Engine Driven Pump Sets

Dear Mr. Ready:

Enclosed is one copy of the Draft air construction permit for the Alexander Orr, Jr. WTP, Three Natural Gas Fueled Engine Driven Pump Sets, located at 6800 SW 87 Avenue, Miami, Miami-Dade County. The Technical Evaluation and Preliminary Determination, the Department's Intent to Issue Air Construction Permit and the Public Notice of Intent to Issue Air Construction Permit are also included.

The Public Notice of Intent to Issue Air Construction Permit must be published one time only, as soon as possible, in the legal advertisement section of a newspaper of general circulation in the area affected, pursuant to the requirements Chapter 50, Florida Statutes. Proof of publication, i.e., newspaper affidavit, must be provided to the Department's Bureau of Air Regulation office within seven days of publication. Failure to publish the notice and provide proof of publication may result in the denial of the permit.

Please submit any written comments you wish to have considered concerning the Department's proposed action to A. A. Linero, P.E., Administrator, New Source Review Section at the above letterhead address. If you have any other questions, please contact Joseph Kahn, P.E. at 850/921-9519 or Mr. Linero at 850/488-0114.

Sincerely,

C. H. Fancy, P.E., Chief,
Bureau of Air Regulation

CHF/jk

Enclosures

In the Matter of an
Application for Permit by:

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

DEP File No. 0250314-003-AC
Alexander Orr, Jr. WTP
Natural Gas Fueled Engine Driven Pump Sets
Miami-Dade County

INTENT TO ISSUE AIR CONSTRUCTION PERMIT

The Department of Environmental Protection (Department) gives notice of its intent to issue an air construction permit (copy of Draft permit attached) for the proposed project, detailed in the application specified above and the enclosed Technical Evaluation and Preliminary Determination, for the reasons stated below.

The applicant, Miami-Dade Water & Sewer Department, applied on October 29, 1998, to the Department for an air construction permit for its Alexander Orr, Jr. Water Treatment Plant located at 6800 SW 87 Avenue, Miami, Miami-Dade County. The permit is to remove existing pumps and engines numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5.

The Department has permitting jurisdiction under the provisions of Chapter 403, Florida Statutes (F.S.), and Florida Administrative Code (F.A.C.) Chapters 62-4, 62-210, and 62-212. The above actions are not exempt from permitting procedures. The Department has determined that an air construction permit is required to perform the proposed work.

The Department intends to issue this air construction permit based on the belief that reasonable assurances have been provided to indicate that operation of these emission units will not adversely impact air quality, and the emission units will comply with all appropriate provisions of Chapters 62-4, 62-204, 62-210, 62-212, 62-296, and 62-297, F.A.C.

Pursuant to Section 403.815, F.S., and Rule 62-110.106(7)(a)1., F.A.C., you (the applicant) are required to publish at your own expense the enclosed Public Notice of Intent to Issue Air Construction Permit. The notice shall be published one time only in the legal advertisement section of a newspaper of general circulation in the area affected. Rule 62-110.106(7)(b), F.A.C., requires that the applicant cause the notice to be published as soon as possible after notification by the Department of its intended action. For the purpose of these rules, "publication in a newspaper of general circulation in the area affected" means publication in a newspaper meeting the requirements of Sections 50.011 and 50.031, F.S., in the county where the activity is to take place. If you are uncertain that a newspaper meets these requirements, please contact the Department at the address or telephone number listed below. The applicant shall provide proof of publication to the Department's Bureau of Air Regulation, at 2600 Blair Stone Road, Mail Station #5505, Tallahassee, Florida 32399-2400 (Telephone: 850/488-0114; Fax 850/ 922-6979). You must provide proof of publication within seven days of publication, pursuant to Rule 62-110.106(5), F.A.C. No permitting action for which published notice is required shall be granted until proof of publication of notice is made by furnishing a uniform affidavit in substantially the form prescribed in section 50.051, F.S. to the office of the Department issuing the permit. Failure to publish the notice and provide proof of publication may result in the denial of the permit pursuant to Rules 62-110.106(9) & (11), F.A.C.

The Department will issue the final permit with the attached conditions unless a response received in accordance with the following procedures results in a different decision or significant change of terms or conditions.

The Department will accept written comments concerning the proposed permit issuance action for a period of 14 (fourteen) days from the date of publication of Public Notice of Intent to Issue Air Permit. Written comments should be provided to the Department's Bureau of Air Regulation at 2600 Blair Stone Road, Mail Station #5505, Tallahassee, FL 32399-2400. Any written comments filed shall be made available for public inspection. If written comments received result in a significant change in the proposed agency action, the Department shall revise the proposed permit and require, if applicable, another Public Notice.

The Department will issue the permit with the attached conditions unless a timely petition for an administrative hearing is filed pursuant to sections 120.569 and 120.57 F.S., before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the proposed permitting decision may petition for an administrative proceeding (hearing) under sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida, 32399-3000. Petitions filed by the permit applicant or any of the parties listed below must be filed within fourteen days of receipt of this notice of intent. Petitions filed by any persons other than those entitled to written notice under section 120.60(3) of the Florida Statutes must be filed within fourteen days of publication of the public notice or within fourteen days of receipt of this notice of intent, whichever occurs first. Under section 120.60(3), however, any person who asked the Department for notice of agency action may file a petition within fourteen days of receipt of that notice, regardless of the date of publication. A petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will be only at the approval of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information: (a) The name and address of each agency affected and each agency's file or identification number, if known; (b) The name, address, and telephone number of the petitioner, the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination; (c) A statement of how and when petitioner received notice of the agency action or proposed action; (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate; (e) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and (f) A demand for relief.

A petition that does not dispute the material facts upon which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation is not available in this proceeding.

In addition to the above, a person subject to regulation has a right to apply for a variance from or waiver of the requirements of particular rules, on certain conditions, under Section 120.542 F.S. The relief provided by this state statute applies only to state rules, not statutes, and not to any federal regulatory requirements. Applying for a variance or waiver does not substitute or extend the time for filing a petition for an administrative hearing or exercising any other right that a person may have in relation to the action proposed in this notice of intent.

The application for a variance or waiver is made by filing a petition with the Office of General Counsel of the Department, 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida 32399-3000. The petition must specify the following information: (a) The name, address, and telephone number of the petitioner; (b) The name, address, and telephone number of the attorney or qualified representative of the petitioner, if any; (c) Each rule or portion of a rule from which a variance or waiver is requested; (d) The citation to the statute underlying

(implemented by) the rule identified in (c) above; (e) The type of action requested; (f) The specific facts that would justify a variance or waiver for the petitioner; (g) The reason why the variance or waiver would serve the purposes of the underlying statute (implemented by the rule); and (h) A statement whether the variance or waiver is permanent or temporary and, if temporary, a statement of the dates showing the duration of the variance or waiver requested.

The Department will grant a variance or waiver when the petition demonstrates both that the application of the rule would create a substantial hardship or violate principles of fairness, as each of those terms is defined in Section 120.542(2) F.S., and that the purpose of the underlying statute will be or has been achieved by other means by the petitioner.

Persons subject to regulation pursuant to any federally delegated or approved air program should be aware that Florida is specifically not authorized to issue variances or waivers from any requirements of any such federally delegated or approved program. The requirements of the program remain fully enforceable by the Administrator of the EPA and by any person under the Clean Air Act unless and until the Administrator separately approves any variance or waiver in accordance with the procedures of the federal program.

Executed in Tallahassee, Florida.

C. H. Fancy, P.E., Chief
Bureau of Air Regulation

CERTIFICATE OF SERVICE

The undersigned duly designated deputy agency clerk hereby certifies that this Intent to Issue Air Construction Permit (including the Public Notice of Intent to Issue Air Construction Permit, Technical Evaluation and Preliminary Determination, and the Draft permit) was sent by certified mail (*) and copies were mailed by U.S. Mail before the close of business on 2-5-99 to the person(s) listed:

Mr. Robert Ready, P.E. *
Mr. Richard O'Rourke, P.E.
Mr. Lennon Anderson, DEP, SED
Mr. Ewart Anderson, P.E., DERM

Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Lori Tober 2-5-99
(Clerk) (Date)

PUBLIC NOTICE OF INTENT TO ISSUE AIR CONSTRUCTION PERMIT

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

DEP File No. 0250314-003-AC

Miami-Dade Water & Sewer Department
Alexander Orr, Jr. Water Treatment Plant
Miami-Dade County

The Department of Environmental Protection (Department) gives notice of its intent to issue an air construction permit to Miami-Dade Water & Sewer Department, for the Alexander Orr, Jr. Water Treatment Plant located at 6800 SW 87 Avenue, Miami, Miami-Dade County. The permit is to remove existing pumps and engines numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5. The applicant's mailing address is: 4200 Salzedo Street, Coral Gables, Florida 33146-0316. A Best Available Control Technology (BACT) determination was not required pursuant to Rule 62-212.400, F.A.C. and 40 CFR 52.21, Prevention of Significant Deterioration (PSD).

The existing pump engines are fuel oil fired. The replacement engines have significantly lower air pollutant emissions per unit of work. With the exception of carbon monoxide, potential emissions from the new engines are not expected to significantly increase compared to the past actual emissions of the existing engines. Carbon monoxide emissions do not increase above the PSD significance levels. An air quality impact analysis was not required or conducted.

The Department will issue the Final permit with the attached conditions unless a response received in accordance with the following procedures results in a different decision or significant change of terms or conditions.

The Department will accept written comments concerning the proposed permit issuance action for a period of 14 (fourteen) days from the date of publication of this Public Notice of Intent to Issue Air Construction Permit. Written comments should be provided to the Department's Bureau of Air Regulation at 2600 Blair Stone Road, Mail Station #5505, Tallahassee, FL 32399-2400. Any written comments filed shall be made available for public inspection. If written comments received result in a significant change in the proposed agency action, the Department shall revise the proposed permit and require, if applicable, another Public Notice.

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NOTICE TO BE PUBLISHED IN THE NEWSPAPER

A petition that disputes the material facts on which the Department's action is based must contain the following information: (a) The name and address of each agency affected and each agency's file or identification number, if known; (b) The name, address, and telephone number of the petitioner, the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination; (c) A statement of how and when petitioner received notice of the agency action or proposed action; (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate; (e) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and (f) A demand for relief.

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A complete project file is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at:

Dept. of Environmental Protection
Bureau of Air Regulation
Suite 4, 111 S. Magnolia Drive
Tallahassee, Florida, 32301
Telephone: 850/488-0114
Fax: 850/922-6979

Dept. of Environmental Protection
Southeast District
400 North Congress Avenue
West Palm Beach, Florida 33401
Telephone: 561/681-6600

Dade County Department of
Environmental Resources Mgmt.
Suite 900, 33 Southwest 2nd Ave.
Miami, Florida 33130-1540
Telephone: 305/372-6925

The complete project file includes the application, technical evaluations, Draft permit. and the information submitted by the responsible official, exclusive of confidential records under Section 403.111, F.S. Interested persons may contact the Administrator, New Source Review Section, or the Department's reviewing engineer for this project, Joseph Kahn, P.E.,, at 111 South Magnolia Drive, Suite 4, Tallahassee, Florida 32301, or call 850/488-0114, for additional information.

NOTICE TO BE PUBLISHED IN THE NEWSPAPER

TECHNICAL EVALUATION

AND

PRELIMINARY DETERMINATION

Miami-Dade Water & Sewer Department

Alexander Orr, Jr. WTP

Three Natural Gas Fueled Engine Driven Pump Sets

Miami-Dade County

DEP File No. 0250314-003-AC

Department of Environmental Protection
Division of Air Resources Management
Bureau of Air Regulation

February 3, 1999

TECHNICAL EVALUATION AND PRELIMINARY DETERMINATION

1. GENERAL INFORMATION

1.1 APPLICANT NAME AND ADDRESS

Miami-Dade Water & Sewer Department
Alexander Orr, Jr. WTP
4200 Salzedo Street
Coral Gables, Florida 33146-0316

Authorized Representative: Mr. Robert Ready, P.E., Assistant Director of Treatment Facilities

1.2 REVIEWING AND PROCESS SCHEDULE

10/29/98	Receipt of application and fee
11/16/98	Department completeness request
12/07/98	Applicant's response to completeness request
12/07/98	Application complete
2/99	Intent issued

2. FACILITY INFORMATION

2.1 FACILITY LOCATION

The facility is located at the Alexander Orr, Jr. Water Treatment Plant, 6800 SW 87 Avenue, Miami, Miami-Dade County. UTM coordinates are: Zone 17; 566.6 km E and 2843.5 km N.

2.2 STANDARD INDUSTRIAL CLASSIFICATION CODES (SIC)

Industry Group No.	49	Electric, Gas, and Sanitary Services
Industry No.	4941	Water Supply

2.3 FACILITY CATEGORY

The facility, the Alexander Orr, Jr. Water Treatment Plant, is a municipally owned water treatment plant providing potable water to the public. The Miami-Dade Water and Sewer Department (WASD) is the sixth largest public utility in the United States, providing direct services to approximately 356,000 retail customers. Wholesale water service is provided to 14 municipalities and wholesale sewer service to 12 of the County's 29 municipalities. Miami-Dade County's current population of 2 million is expected to reach the 3 million mark by the year 2015.[1] The Alexander Orr, Jr. WTP supplies approximately half of the water supply of the WASD system.[2]

This facility is classified as a Major or Title V Source of air pollution because emissions of at least one regulated air pollutant, such as particulate matter (PM/PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), or volatile organic compounds (VOC) exceeds 100 tons per year (TPY).

This facility is not within an industry included in the list of the 28 Major Facility Categories per Table 62-212.400-1, F.A.C. Because emissions are greater than 250 TPY for at least one criteria pollutant, the facility is also a Major Facility with respect to Rule 62-212.400, Prevention of Significant Deterioration (PSD).

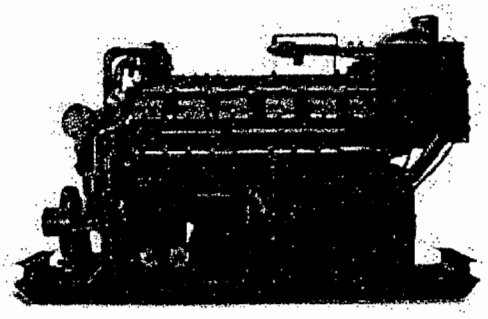
This project is exempt from the requirements of Rule 62-212.400, F.A.C., Prevention of Significant Deterioration (PSD) as discussed in this Technical Evaluation and Preliminary Determination. The emissions units included in this project are not subject to any unit-specific emission limiting standard (considered "unregulated" for purposes of Title V permitting) as described below.

3. PROJECT DESCRIPTION

This permitting action is to remove existing engines and pumps numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5. Emissions units that will be removed are 001 (engine and pump #1), 002 (engine and pump #2 which were previously removed from service), 003 (engine and pump #3), 004 (engine and pump #4), and 005 (engine and pump #5). Emissions units addressed by this permit are:

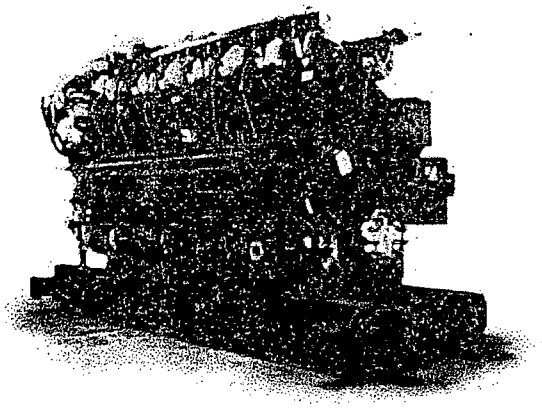
EMISSIONS UNIT NO.	EMISSIONS UNIT DESCRIPTION
018	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 3. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 million gallons per day (MGD) water pumping capacity.
019	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 4. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 MGD water pumping capacity.
020	2090 brake hp natural gas fired Waukesha Model 8L-AT27GL engine for pump 5. Maximum heat input rate is 13.70 mmBtu/hr. Pump has 50 MGD water pumping capacity.

The Model 3521GL engines are in Waukesha's VHP series engines which, according to Waukesha are designed to operate reliably at 900 to 1500 rpm continuous operating speeds. The Model 3521GL engine is an in-line 6 cylinder engine with a Bore & Stroke of 9.375 x 8.5 in. (238 x 216 mm) and displacement of 3520 cu. in. (58 liters). This is a naturally aspirated engine, and power output at the design intercooler operating temperature of 130° F ranges from 311 bhp at 700 rpm to 738 bhp at 1200 rpm. Following is a figure of a typical VHP series engine.[3]



Typical Waukesha VHP Series Engine

The Model 8L-AT27GL engine is an eight cylinder engine in Waukesha's ATGL series natural gas fueled engines. Waukesha characterizes this series as high horsepower, high torque engines that are designed for reliable operation, fuel economy and low emissions. The Model 8L-AT27GL has an in-line cylinder arrangement, with a bore and stroke of 10.83 x 11.81 in. (275 x 300 mm) and displacement of 8699 cu. in (143 liters). This is a turbocharged engine, and power output at the design intercooler operating temperature of 130° F ranges from 1565 bhp at 750 rpm to 2090 bhp at 1000 rpm. Following is a figure of a typical ATGL series engine.[4]



Typical Waukesha ATGL Series Engine

4. PROJECT EMISSIONS

The emissions associated with this project are the typical pollutants from combustion of natural gas in internal combustion reciprocating engines. The primary pollutants associated with this project are NOx and CO. Because this project essentially consists of replacing existing engines with new engines, the applicant performed a comparison of past actual to future potential emissions for the pollutants expected to be emitted from these engines. The existing engines are fuel oil fired internal combustion reciprocating engines. These will be replaced with natural gas fired internal combustion reciprocating engines, which are expected to emit much less NOx and CO on a g/bhp-hr basis than the existing engines. This is confirmed by the past actual to future potential analysis, which also demonstrated that this project is not subject to the requirements of PSD.

The applicant chose the two year period of November 1996 to October 1998 to use for the estimate of past actual emissions. The Department agreed that this was an appropriate period. The existing engines operated far less than 8760 hours per year, average, in this period. As noted previously, engine and pump #2 were previously removed from service but are still on-site; for the period chosen this engine and pump set did not operate, so no emissions were estimated from engine #2. In the period chosen, pump engine #1 operated an average of 383.5 hours per year, pump engine #2 was zero, pump engine #3 was 1201.8 hours per year, pump engine #4 was 1398.3 hours per year, and pump engine #5 was 1803.3 hours per year. Emissions were estimated from fuel consumption and operating hours.

Future potential emissions were estimated for the replacement engines based on operating at maximum capacity for 8760 hours per year. Emissions were estimated from EPA emission factors for SO_2 and PM_{10} and from manufacturer supplied factors for NOx and CO. VOC emissions were not calculated by the applicant, because they were not expected to increase significantly above past actual levels; natural gas fired engines have lower potential VOC emissions than diesel fired engines in terms of heat input. The Department estimated VOC emissions using emission factors and past and projected fuel consumption. A factor from EPA's FIRE 6.0 data was used to estimate emissions from natural gas engines (116 lb/mmcf x 227.8 mmcf) and a factor from EPA's AP-42 compilation, Table 3.3-1, was used for the diesel engines (0.36 lb/mmBtu x 28098 mmBtu). Past actual emissions of VOC are estimated to be 5 TPY and future potential (unrestricted) are estimated to be 13 TPY.

The following table summarizes the potential maximum emissions increases of air pollutants, comparing past actual to future potential emissions in TPY:

Pollutant	Past Actual Existing Engines	Future Potential New Engines	Maximum Emissions Change	PSD Significance Levels [1]	Subject to PSD Review?
NOx	34	40	6	40	No
CO	11	68	57	100	No
PM/PM_{10}	0.8	1.2	0.4	25/15	No
SO_2	0.7	0.3 [2]	-0.4	40	No
VOC	5	13	8 [3]	40	No

[1] Florida Administrative Code 212.400-2.

[2] SO_2 emissions, assuming a sulfur content in pipeline natural gas of 1 grain/100 cf, are estimated by the Department to be 0.3 tons per year. The applicant estimated SO_2 emissions to be <0.1 TPY.

[3] VOC emissions were not calculated by the applicant. The Department estimated VOC emissions.

The proposed project results in net emissions decreases or less-than-significant increases in PSD pollutants. Emission decreases will occur for sulfur dioxide (SO_2). Emission increases of carbon monoxide (CO), particulate matter (PM/PM_{10}), volatile organic compounds (VOC), and nitrogen oxides (NOx) will be less than the significant emission levels per Table 62-212.400-2, F.A.C. This project will emit negligible quantities of sulfuric acid mist (H_2SO_4 mist or SAM), fluorides, beryllium, mercury and lead. Therefore the modification is not subject to PSD.

5. RULE APPLICABILITY

The proposed project is subject to preconstruction review requirements under the provisions of Chapter 403, Florida Statutes, and Chapters 62-4, 62-204, 62-210, 62-212, 62-214, 62-296, and 62-297 of the Florida Administrative Code (F.A.C.).

This facility is located in an area designated, in accordance with Rule 62-204.340, F.A.C., as attainment for the criteria pollutants ozone, PM_{10}, carbon monoxide, sulfur dioxide, and nitrogen dioxide; designated as unclassifiable for lead; and also designated as a maintenance area for ozone.

The proposed project is not subject to review under Rule 62-212.400., F.A.C., Prevention of Significant Deterioration (PSD) as discussed above.

Rule 62-4.030, F.A.C., prohibits modification of any existing emissions unit without first receiving a permit. It further specifies that a permitted installation may only be modified in a manner that is consistent with the terms of such a permit. Rule 62-210.200, F.A.C., defines "modification" to mean generally a change that results in an increase in actual emissions of air pollutants. As discussed above, emissions will increase, although not significantly. Rules 62-210.300(1) and 62-212.300(1)(a), F.A.C., also reiterate the requirement for construction permits. As noted above, future potential emissions were estimated based on unrestricted operation of the new engines. Since future potential emissions were estimated with no restrictions on operating hours or fuel consumption, such limits are not required in the construction permit for this project. There are no unit-specific emission limiting standards applicable to these units. Rule 62-296.570(4)(b)9., F.A.C., the NOx RACT requirements for other combustion units is not applicable to the new engines pursuant to guidance memo DARM-PER/GEN-39, dated July 29, 1998. (This memo also clarifies that the NOx RACT requirements for diesel generators are not applicable to any of the existing units either.) Therefore, the permit will authorize installation of the new engines to replace the existing engines, but will not subject the new engines to unit-specific limitations on emissions or operation.

The emission units affected by this permit shall comply with all applicable provisions of the Florida Administrative Code (including applicable portions of the Code of Federal Regulations incorporated therein) and, specifically, the following Chapters and Rules.

5.1 STATE REGULATIONS

Chapter 62-4	Permits.
Rule 62-204.220	Ambient Air Quality Protection
Rule 62-204.240	Ambient Air Quality Standards
Rule 62-204.800	Federal Regulations Adopted by Reference
Rule 62-210.200	Definitions
Rule 62-210.300	Permits Required
Rule 62-210.350	Public Notice and Comments
Rule 62-210.370	Reports
Rule 62-210.550	Stack Height Policy
Rule 62-210.650	Circumvention
Rule 62-210.700	Excess Emissions
Rule 62-210.900	Forms and Instructions
Rule 62-212.300	General Preconstruction Review Requirements
Rule 62-213	Operation Permits for Major Sources of Air Pollution
Rule 62-296.320	General Pollutant Emission Limiting Standards

6. AIR POLLUTION CONTROL TECHNIQUES

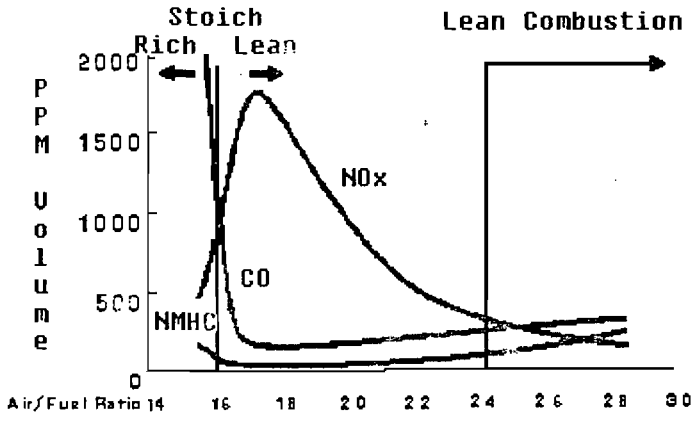
Emissions from this project are those that typically result from combustion of natural gas in internal combustion reciprocating engines: NOx, PM/PM_{10}, CO and VOC. SO_2 is not a pollutant emitted in significant quantity by natural gas fuel engines. Combustion control is the technique used to control emissions from these engines. Combustion is controlled by electronic engine controls which are discussed in more detail below.[5]

6.4.1 NITROGEN OXIDES (NOX) EMISSIONS

Nitrogen oxides form in the combustion process as a result of the dissociation of molecular nitrogen and oxygen to their atomic forms and subsequent recombination into seven different oxides of nitrogen. Thermal NOx forms as a result of high temperatures in the combustion chamber (cylinders in IC engines). Increased combustion temperatures lead to increased NOx formation. In internal combustion engines, combustion temperature is dependent upon the ratio of air to fuel, and the formation of thermal NOx is highly dependent on this ratio.

Fuel NOx is formed when fuels containing bound nitrogen are burned. This phenomenon is not important when combusting natural gas because natural gas has little or no fuel nitrogen. Because natural gas will be the only fuel used, the fuel NOx phenomenon is not important for this project.

The following figure illustrates the effect of the air/fuel ratio on emissions of NOx in natural gas fired internal combustion engines. To the rich side of the stoichiometric ratio, NOx decreases because of a lack of oxygen in the combustion chamber and lower combustion temperatures. Fuel quenching occurs under these conditions, which keeps combustion temperatures low. To the lean side of the stoichiometric ratio, NOx reaches a peak where combustion temperature is high and ample oxygen exists for thermal NOx formation. As conditions become leaner (air/fuel ratio increases) the combustion temperature decreases because of air quenching, The lowest NOx emissions occur in under the leanest combustion conditions.



Exhaust Emissions from Natural Gas Engines (ppmv at 15% O2 vs. Air/Fuel Ratio)

6.4.2 PARTICULATE MATTER (PM/PM_{10}) EMISSIONS

Particulate matter is formed in internal combustion engines primarily through combustion of fuel oil and lubricating oil. The particulate matter emitted from IC engines will mainly be less than 10 microns in diameter (PM_{10}). PM emissions from natural gas fired engines is very low because natural gas is efficiently combusted and contains no ash. Combustion of natural gas under lean fuel conditions results in low PM and PM_{10} emissions.

6.4.3 CARBON MONOXIDE (CO) EMISSIONS

Carbon monoxide is emitted from combustion processes due to incomplete fuel combustion. Incomplete combustion occurs when insufficient oxygen exists near the fuel molecule or when quenching of combustion occurs, thus preventing complete conversion of fuel carbon to carbon dioxide. Proper combustion design and operation ensure that CO emissions are minimized. The previous figure also illustrates the effect of fuel to air ratio on CO emissions. CO emissions are lowest under combustion conditions that are slightly lean of the stoichiometric ratio because sufficient oxygen is present for complete oxidation of the fuel carbon while temperature is at its greatest. Under fuel rich conditions, there is not sufficient oxygen for complete combustion. CO emissions increase slightly under the leanest combustion conditions because of lower combustion temperatures and lower fuel mixture flammability.

6.4.4 VOLATILE ORGANIC COMPOUND (VOC) EMISSIONS

In natural gas fired IC engines, hydrocarbon emissions are present in exhaust gas because of incomplete combustion of fuel. Natural gas is composed of several gaseous hydrocarbons including methane, ethane, propane, butane and heavier hydrocarbons. A portion of these will pass through the combustion chamber without reacting and will be found in the engine exhaust. Regulated volatile organic compounds (VOC) are comprised of the non-methane portion of the total hydrocarbons, because methane is considered to be not photochemically reactive. Emissions of VOC are similar to CO emissions: higher at operating conditions richer and leaner than the stoichiometric ratio. This is illustrated in the previous figure.

6.4.5 EMISSIONS CONTROL TECHNIQUES

Generally emissions are controlled in these engines by operating under lean air/fuel combustion conditions. Operation in the lean combustion range results in the lowest NOx emissions, with minimal CO and VOC

emissions. Although CO and VOC emissions are lower under conditions just leaner than the stoichiometric ratio, emissions of these pollutants do not substantially increase under the leanest conditions. Operation under the leanest conditions results in a good compromise between dramatically reducing emissions of NOx and slightly increasing emissions of CO and VOC.

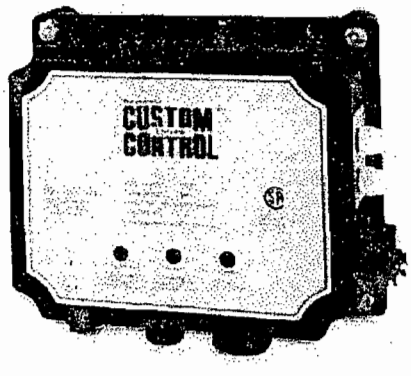
Waukesha also provides a number of electronic engine controls that optimize engine operation by continually balancing power output, fuel economy and air/fuel ratio. While not specifically designed for emissions control, these controls work to maintain lean combustion conditions, which result in the lowest emissions, while maintaining a large operating range for the engines. A discussion of these controls follows.[6]

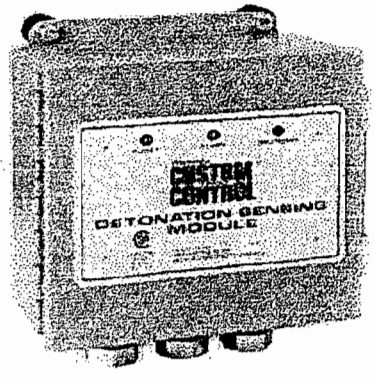
Waukesha's Custom Engine Control® (CEC) Air/Fuel Module (AFM) has the ability to actively monitor exhaust temperature and oxygen content to adjust the air/fuel ratio for lean burn natural gas engines. Unlike other systems which have single set-point control, the AFM permits the air/fuel mixture to be tailored with engine load to meet the specific needs of any application. It also employs safety limits to be sure no unsafe fueling conditions occur. The AFM can be used with other CEC modules to optimize engine performance even with changes to engine load, speed, fuel pressure, fuel quality, and ambient conditions.

Waukesha's Custom Engine Control® (CEC) Ignition Module (IM) provides accurate and reliable ignition timing for optimum stationary engine operation. The IM offers improved starting, smoother operation, and increased spark plug life. The IM is an electronic, microcircuit-based digital ignition system that is standard on AT-GL and VHP engines. When the IM is integrated with the CEC Detonation Sensing Module (DSM) system, the ignition system protects the engine from detonation and costly downtime, and maximizes power availability under adverse conditions.

Waukesha's Custom Engine Control® (CEC) Detonation Sensing Module (DSM) has the ability to sense detonation occurring in a cylinder and retard timing as necessary on an individual cylinder basis. The DSM works directly through the CEC Ignition Module's (IM) expansion port to adjust timing. Timing is adjusted every second. Sensors located on or near the cylinder heads send a continuous signal to a DSM filter when the engine is operating. The filter sorts out the signals that represent detonation, and relays that information to the DSM. The DSM evaluates the filtered signal and adjusts timing accordingly until detonation is eliminated or a maximum timing retard value is reached.

Following are figures of Waukesha's AFM, IM and DSM.[7]





The ATGL engine also includes Waukesha's Custom Engine Control® (CEC) electronic Turbocharger Control Module (TCM) that allows one turbocharger to perform under a range of loads and speeds without experiencing turbocharger surge. Turbocharger surge is a phenomenon that occurs under less than full load where sudden changes in air flow produce instability in the compressor side of the engine's turbocharger. This phenomenon results in wasted energy, poor engine performance and speed instability. The module allows for more precise control than mechanical methods of bypass valving and wastegate valving. The TCM improves engine turndown capability.[8]

6.5 COMPLIANCE PROCEDURES

There are no specific compliance requirements because there are no unit-specific limitations on emissions or operation. The engines are subject to the general visible emissions limitation of less than 20% opacity of Rule 62-296.320(4)(b), F.A.C. Regular compliance testing for visible emissions is not required pursuant to guidance memo DARM-PER/GEN-38, dated June 12, 1998.

6.6 EXCESS EMISSIONS

Allowable Excess Emissions: The provisions of Rule 62-210.700 F.A.C., regarding excess emissions are not applicable because there are no unit-specific emission limits.

7. SOURCE IMPACT ANALYSIS

An impact analysis was not required for this project because it is not subject to the requirements of PSD.

8. CONCLUSION

Based on the foregoing technical evaluation of the application and additional information submitted by the applicant and other available information, the Department has made a preliminary determination that the proposed project will comply with all applicable state and federal air pollution regulations. The Department will issue a draft permit to the applicant that allows replacement of the existing engine driven pumps #1 through #5 with new engines and pumps 3, 4 and 5. The new engines will be subject to the requirements of the facility-wide specific conditions of Section II of the permit, but will not be subject to any unit-specific emission limits.

This evaluation was prepared by:

Joseph Kahn, P.E.
Mail Station #5505
2600 Blair Stone Road
Tallahassee, Florida 32399-2400
850/921-9519

REFERENCES

[1] Provided by WASD at www.metro-dade.com/wasd/customer.htm.

[2] Telephone conversation with Richard O'Rourke of WASD, January 1999.

[3] Information and photo from Waukesha's promotional and technical information found at www.waukeshaengine.com.

[4] Information and photo from Waukesha's promotional and technical information found at www.waukeshaengine.com.

[5] The text of this section and the figure presented are adapted from *Gas Engine Emissions Technology*, Form 536, Third Edition, Waukesha Engine Division, Dresser Industries, Inc., Waukesha, WI, 1993 (printed 5/96).

[6] The information about Waukesha's engine controls described in this section is excerpted from Waukesha's promotional and technical information found at www.waukeshaengine.com.

[7] Figures are from Waukesha's web site at www.waukeshaengine.com.

[8] Adapted from a Waukesha White Paper about the Turbocharger Control Module, Form M1565, Waukesha Engine Division, Dresser Industries, Inc., Waukesha, WI, Nov. 1, 1996.

Department of Environmental Protection

Jeb Bush
Governor

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

David B. Struhs
Secretary

PERMITTEE

Miami-Dade Water & Sewer Department
Alexander Orr, Jr. WTP

4200 Salzedo Street
Coral Gables, Florida 33146-0316

Permit No.	0250314-003-AC
Project	Three Natural Gas Fueled Engine Driven Pump Sets
SIC No.	4941
Expires:	^DRAFT

Authorized Representative:

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

PROJECT AND LOCATION

This permit authorizes Miami-Dade Water & Sewer Department to remove existing pumps and engines numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5.

This facility is located at the Alexander Orr, Jr. Water Treatment Plant, 6800 SW 87 Avenue, Miami, Miami-Dade County. UTM coordinates are: Zone 17; 566.6 km E and 2843.5 km N.

STATEMENT OF BASIS

This construction permit is issued under the provisions of Chapter 403 of the Florida Statutes (F.S.), and the Florida Administrative Code (F.A.C.) Chapters 62-4, 62-204, 62-210, 62-212, 62-296, and 62-297. The above named permittee is authorized to perform the construction in accordance with the conditions of this permit and as described in the application, approved drawings, plans, and other documents on file with the Department of Environmental Protection (Department).

APPENDIX

The attached appendix is a part of this permit:

Appendix GC General Permit Conditions

DRAFT

Howard L. Rhodes, Director
Division of Air Resources Management

FACILITY DESCRIPTION

This facility consists of a municipally owned water treatment plant providing potable water to the public.

PROJECT DETAILS

This permitting action is to remove existing engines and pumps numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5. Emissions units that will be removed are 001 (engine and pump #1), 002 (engine and pump #2 which were previously removed from service), 003 (engine and pump #3), 004 (engine and pump #4), and 005 (engine and pump #5). Emissions units addressed by this permit are:

EMISSIONS UNIT NO.	EMISSIONS UNIT DESCRIPTION
018	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 3. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 million gallons per day (MGD) water pumping capacity.
019	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 4. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 MGD water pumping capacity.
020	2090 brake hp natural gas fired Waukesha Model 8L-AT27GL engine for pump 5. Maximum heat input rate is 13.70 mmBtu/hr. Pump has 50 MGD water pumping capacity.

REGULATORY CLASSIFICATION

This facility is classified as a Major or Title V Source of air pollution because emissions of at least one regulated air pollutant, such as particulate matter (PM/PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), or volatile organic compounds (VOC) exceeds 100 tons per year (TPY).

This facility is not within an industry included in the list of the 28 Major Facility Categories per Table 62-212.400-1, F.A.C. Because emissions are greater than 250 TPY for at least one criteria pollutant, the facility is also a Major Facility with respect to Rule 62-212.400, Prevention of Significant Deterioration (PSD).

This project is exempt from the requirements of Rule 62-212.400, F.A.C., Prevention of Significant Deterioration (PSD) as discussed in the Technical Evaluation and Preliminary Determination dated February 3, 1999.

The emissions units included in this project are not subject to any unit-specific emission limiting standard (considered "unregulated" for purposes of Title V permitting).

PERMIT SCHEDULE

- 10/29/98 Received application for construction permit
- 12/07/98 Received response to request for additional information
- 12/07/98 Permit application deemed complete
- 2/4/99 Distributed Notice of Intent to Issue permit
- ^DRAFT Notice of Intent published in ^DRAFT

DRAFT

RELEVANT DOCUMENTS

The documents listed below are the basis of the permit. They are specifically related to this permitting action. These documents are on file with the Department.

- Application received at the Bureau of Air Regulation on October 29, 1998
- Department's letter dated November 16, 1998
- Applicant's letter dated December 3, 1998 received December 7, 1998
- Department's Technical Evaluation and Preliminary Determination dated February 3, 1999
- Department's Intent to Issue and public notice information dated February 4, 1999

The following specific conditions apply to all emissions units at this facility addressed by this permit.

ADMINISTRATIVE

1. Regulating Agencies: All documents related to applications for permits to construct, operate or modify an emissions unit should be submitted to the Bureau of Air Regulation (BAR), Florida Department of Environmental Protection at Mail Station #5505, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400, phone number 850/488-0114. All documents related to reports, tests, minor modifications and notifications shall be submitted to the Department's Southeast District office at PO Box 15425, West Palm Beach, Florida, 33416-5425, and phone number 561/681-6600. Copies of all documents should be sent also to the Air Quality Management Division, Miami-Dade County Department of Environmental Resources Management, Suite 900 33 SW Second Avenue, Miami, Florida 33130-1540.

2. General Conditions: The owner and operator is subject to and shall operate under the attached General Permit Conditions G.1 through G.15 listed in Appendix GC of this permit. General Permit Conditions are binding and enforceable pursuant to Chapter 403 of the Florida Statutes. [Rule 62-4.160, F.A.C.]

3. Terminology: The terms used in this permit have specific meanings as defined in the corresponding chapters of the Florida Administrative Code.

4. Applicable Regulations, Forms and Application Procedures: Unless otherwise indicated in this permit, the construction and operation of the subject emissions unit shall be in accordance with the capacities and specifications stated in the application. The facility is subject to all applicable provisions of Chapter 403, F.S. and Florida Administrative Code Chapters 62-4, 62-110, 62-204, 62-212, 62-213, 62-296, 62-297 and the Code of Federal Regulations Title 40, Part 60, adopted by reference in the Florida Administrative Code (F.A.C.) regulations. The permittee shall use the applicable forms listed in Rule 62-210.900, F.A.C. and follow the application procedures in Chapter 62-4, F.A.C. Issuance of this permit does not relieve the facility owner or operator from compliance with any applicable federal, state, or local permitting or regulations. [Rules 62-204.800, 62-210.300 and 62-210.900, F.A.C.]

5. New or Additional Conditions: Pursuant to Rule 62-4.080, F.A.C., for good cause shown and after notice and an administrative hearing, if requested, the Department may require the permittee to conform to new or additional conditions. The Department shall allow the permittee a reasonable time to conform to the new or additional conditions, and on application of the permittee, the Department may grant additional time. [Rule 62-4.080, F.A.C.]

6. Expiration: This air construction permit shall expire on ^**DRAFT**. The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Department's Bureau of Air Regulation prior to 60 days before the expiration of the permit. [Rules 62-210.300(1), 62-4.070(4), 62-4.080, and 62-4.210, F.A.C]

7. Modifications: No emissions unit or facility subject to this permit shall be constructed or modified without obtaining an air construction permit from the Department. Such permit must be obtained prior to the beginning of construction or modification. [Rules 62-210.300(1) and 62-212.300(1)(a), F.A.C.]

8. Title V Operation Permit Required: This permit authorizes construction and/or installation of the permitted emissions unit and initial operation to determine compliance with Department rules. A Title V operation permit is required for regular operation of the permitted emissions unit. The owner or

operator shall apply for and receive a Title V operation permit prior to expiration of this permit. To apply for a Title V operation permit, the applicant shall submit the appropriate application form, compliance test results, and such additional information as the Department may by law require. The application shall be submitted to the Department's Southeast District office. [Rules 62-4.030, 62-4.050, 62-4.220, and Chapter 62-213, F.A.C.]

EMISSION LIMITING STANDARDS

9. General Visible Emissions Standard: Except for emissions units that are subject to a particulate matter or opacity limit set forth or established by rule and reflected by conditions in this permit, no person shall cause, let, permit, suffer, or allow to be discharged into the atmosphere the emissions of air pollutants from any activity, the density if which is equal to or greater than that designated as Number 1 on the Ringelmann Chart (20% opacity). The test method for visible emissions shall be EPA Method 9, incorporated and adopted by reference in Chapter 62-297, F.A.C. Test procedures shall meet all applicable requirements of Chapter 62-297, F.A.C. [Rule 62-296.320(4)(b)1, F.A.C.]

10. General Pollutant Emission Limiting Standards: [Rule 62-296.320(2), F.A.C.]

    No person shall cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor.

    [Note: An objectionable odor is defined in Rule 62-210.200(198), F.A.C., as any odor present in the outdoor atmosphere which by itself or in combination with other odors, is or may be harmful or injurious to human health or welfare, which unreasonably interferes with the comfortable use and enjoyment of life or property, or which creates a nuisance.]

OPERATIONAL REQUIREMENTS

11. Plant Operation - Problems: If temporarily unable to comply with any of the conditions of the permit due to breakdown of equipment or destruction by hazard of fire, wind or by other cause, the permittee shall immediately notify the Department's district office and, if applicable, appropriate local program. The notification shall include pertinent information as to the cause of the problem, and what steps are being taken to correct the problem and to prevent its recurrence, and where applicable, the owner's intent toward reconstruction of destroyed facilities. Such notification does not release the permittee from any liability for failure to comply with Department rules. [Rule 62-4.130, F.A.C.]

12. Circumvention: No person shall circumvent any air pollution control device or allow the emission of air pollutants without the applicable air pollution control device operating properly. [Rule 62-210.650, F.A.C.]

13. Excess Emissions:

    (a) Excess emissions resulting from start-up, shutdown or malfunction of any emissions units shall be permitted providing (1) best operational practices to minimize emissions are adhered to and (2) the duration of excess emissions shall be minimized, but in no case exceed two hours in any 24 hour period unless specifically authorized by the Department for longer duration. [Rule 62-210.700(1), F.A.C.]

(b) Excess emissions which are caused entirely or in part by poor maintenance, poor operation, or any other equipment or process failure which may reasonably be prevented during start-up, shutdown, or malfunction shall be prohibited. [Rule 62-210.700(4), F.A.C.]

COMPLIANCE MONITORING AND TESTING REQUIREMENTS

14. Special Compliance Tests: When the Department, after investigation, has good reason (such as complaints, increased visible emissions or questionable maintenance of control equipment) to believe that any applicable emission standard contained in a Department rule or in a permit issued pursuant to those rules is being violated, it shall require the owner or operator of the facility to conduct compliance tests which identify the nature and quantity of pollutant emissions from the emissions units and to provide a report on the results of said tests to the Department. [Rule 62-297.310(7)(b), F.A.C.]

REPORTING AND RECORD KEEPING REQUIREMENTS

15. Duration of Record Keeping: Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least five years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule. [Rules 62-4.160(14)(a)&(b) and 62-213.440(1)(b)2.b., F.A.C.]

16. Excess Emissions Report: If excess emissions occur, the owner or operator shall notify the Department within one working day of: the nature, extent, and duration of the excess emissions; the cause of the excess emissions; and the actions taken to correct the problem. In addition, the Department may request a written summary report of the incident. Pursuant to the New Source Performance Standards, excess emissions shall also be reported in accordance with 40 CFR 60.7, Subpart A. [Rule 62-4.130, F.A.C.]

17. Excess Emissions Report - Malfunctions: In case of excess emissions resulting from malfunctions, each owner or operator shall notify the Department or the appropriate local program in accordance with Rule 62-4.130, F.A.C. A full written report on the malfunctions shall be submitted in a quarterly report if requested by the Department. [Rule 62-210.700(6), F.A.C.]

18. Annual Operating Report for Air Pollutant Emitting Facility: The Annual Operating Report for Air Pollutant Emitting Facility shall be completed each year and shall be submitted to the Department's Southeast District office and, if applicable, the appropriate local program by March 1 of the following year. [Rule 62-210.370(3), F.A.C.]

The following specific conditions apply to the following emissions units after construction:

EMISSIONS UNIT NO.	EMISSIONS UNIT DESCRIPTION
018	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 3. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 million gallons per day (MGD) water pumping capacity.
019	738 brake hp natural gas fired Waukesha Model 3521GL engine for pump 4. Maximum heat input rate is 5.44 mmBtu/hr. Pump has 20 MGD water pumping capacity.
020	2090 brake hp natural gas fired Waukesha Model 8L-AT27GL engine for pump 5. Maximum heat input rate is 13.70 mmBtu/hr. Pump has 50 MGD water pumping capacity.

Note: These emissions units are not subject to any unit-specific applicable requirements. They are subject to the requirements of Section II, Facility-Wide Specific Conditions, of this permit. This permit was written to authorize removal of emissions units 001 through 005 and installation of these emissions units. However, uncontrolled potential emissions are not significantly greater than past actual emissions for purposes of PSD. No further requirements, including unit-specific applicable requirements, are applicable to these emissions units.

OPERATIONAL REQUIREMENTS

1. Hours of Operation: These emissions units may operate continuously, i.e., 8,760 hours/year. [Rule 62-210.200, F.A.C., Definitions-potential to emit (PTE)]
2. Fuel: The owner or operator shall keep monthly records of total fuel consumption for these emissions units. [Rule 62-210.200, F.A.C., Definitions-potential to emit (PTE)]

APPENDIX GC
GENERAL PERMIT CONDITIONS [RULE 62-4.160, F.A.C.]

G.1 The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

G.2 This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings or exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

G.3 As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey and vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

G.4 This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

G.5 This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

G.6 The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

G.7 The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

(a) Have access to and copy and records that must be kept under the conditions of the permit;
(b) Inspect the facility, equipment, practices, or operations regulated or required under this permit, and,
(c) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

G.8 If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

(a) A description of and cause of non-compliance; and
(b) The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

G.9 In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extend it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

G.10 The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

G.11 This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 62-4.120 and 62-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

G.12 This permit or a copy thereof shall be kept at the work site of the permitted activity.

G.13 This permit also constitutes:

(a) Determination of Best Available Control Technology ( );
(b) Determination of Prevention of Significant Deterioration ( ); and
(c) Compliance with New Source Performance Standards ( ).

G.14 The permittee shall comply with the following:

(a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.
(b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application or this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.
(c) Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;
2. The person responsible for performing the sampling or measurements;
3. The dates analyses were performed;
4. The person responsible for performing the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

G.15 When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

Memorandum

Florida Department of
Environmental Protection

TO: Clair Fancy

THRU: Al Linero

FROM: Joe Kahn

DATE: February 4, 1999

SUBJECT: Miami-Dade Water & Sewer Department
Alexander Orr, Jr. WTP, Three Natural Gas Fueled Engine Driven Pump Sets

Attached for approval and signature is the construction permit for MDWASD's Alexander Orr, Jr. Water Treatment Plant. The permit is to remove existing pumps and engines numbers 1, 2, 3, 4 and 5 and to install new pumps with natural gas fired engines numbers 3, 4 and 5. The existing pump engines are fuel oil fired. The replacement engines have significantly lower air pollutant emissions on a brake horsepower basis. With the exception of carbon monoxide, potential emissions from the new engines are not expected to significantly increase compared to the past actual emissions of the existing engines. Carbon monoxide emissions do not increase above the PSD significance levels. An air quality impact analysis was not required or conducted.

These emissions units are "unregulated" emissions units, although the facility is a Title V facility because of other emissions sources. A construction permit was required for this project because it constitutes a modification pursuant to rule, although the new emissions units are not subject to any unit-specific applicable requirement.

I recommend your approval and signature.

Attachments

/jk

Department of Environmental Protection

Jeb Bush
Governor

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

David B. Struhs
Secretary

P.E. Certification Statement

Miami-Dade Water & Sewer Department
Alexander Orr, Jr. WTP
Three Natural Gas Fueled Engine Driven Pump Sets

DEP File No.: 0250314-003-AC
Facility ID No.: 0250314

Project: Air Construction Permit

I HEREBY CERTIFY that the engineering features described in the above referenced application and related additional information submittals, if any, and subject to the proposed permit conditions, provide reasonable assurance of compliance with applicable provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 62-4 and 62-204 through 62-297. However, I have not evaluated and I do not certify aspects of the proposal outside of my area of expertise (including but not limited to the electrical, mechanical, structural, hydrological, and geological features).

This review was conducted by me.

(Seal)

Joseph Kahn, P.E.

Date

Permitting Authority:
Florida Department of Environmental Protection
Division of Air Resources Management
Bureau of Air Regulation
New Source Review Section
Mail Station #5505
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Telephone: 850/488-0114
Fax: 850/922-6979

US EPA - FIRE 6.0
Report Date: 2/1/99

SCC	20300201
SCC Description	Internal Combustion Engines Commercial/Institutional Natural Gas Reciprocating
Pollutant	Volatile organic compounds (VOC)
CAS No.	
Primary Control **Secondary Control**	UNCONTROLLED
Emission Factor:	1.160E2 Lb per Million Cubic Feet Burned
Quality	A
Standard AIRs Units:	Yes

Reference:
EPA. 1995. Section 3.2, Heavy Duty Natural Gas Fired Pipeline Compressor Engines. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

Notes:
reported as TNMOC

Reason for Duplicate Factor:

IC ENGINES
DIESEL
2-03-001-01

AP-42, TABLE 3.3-1

TOC
EXHAUST 0.35
CRANKCASE 0.01
0.036 LB/MMBTU

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

SERVE • CONSERVE

December 1, 1998

Mr. Thomas Tittle
Southeast District Office
Florida Department of Environmental Protection
Southeast District
P.O. Box 15425
West Palm Beach, FL 33416

Subj: Compliance Testing of Stand by Generators at Alexander Orr, Jr. Water Treatment Plant
Facility I.D.: 50WPB0250314

Dear Mr. Tittle:

This letter is to advise you that the three plant standby generators mentioned in our letter dated September 23, 1998 are repaired and the deferred NOx RACT compliance testing for Federal Fiscal year 1997-1998 is now scheduled for December 17, 1998. Repairs to the forth standby generator should be completed by the end of January 1999 and compliance testing will be scheduled 2 to 4 weeks after it is operational.

Should you have any questions regarding this, please contact me at (305) 669-7668 or Mr. Richard M. O'Rourke at (305) 669-5749.

Sincerely,

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

RCR/RMO/ro

cc: Al Linero, FDEP/TAL ✓

L9881dep.wpd

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

SERVE • CONSERVE

December 3, 1998

CERTIFIED: Z 427 642 131
RETURN RECEIPT

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

RE: Application for Air Construction Permit for Three Natural Gas Fueled Engine-Driven Pump Sets at the Alexander Orr, Jr. Water Treatment Plant, Miami, Florida - Facility ID No. 0250314, DEP File No. 0250314-003-AC

Dear Mr. Kahn:

MDWASD has prepared responses to the comments found in the Florida Department of Environmental Protection (FDEP) letter, dated November 16, 1998, for the above referenced application. The letter in included in Attachment A. A signed P.E. certification statement is included in Attachment B along with a signed Responsible Official Certification Statement.

Our responses to the FDEP comments are as follows:

FDEP Comment No. 1: Please provide a comparison of past actual emissions to potential emissions for the existing and proposed replacement engine driven pump sets for the pollutants NOx, SO2, CO and PM10. Past actual emissions should be based on an average of two representative years of operation in the past five years.

Response: A table of calculated past actual emissions for the existing engines and the proposed replacement engine driven pump sets is provided in Attachment C.

FDEP Comment No. 2: It appears as though pump engine number 6 need not be included in this application as it does not affect the netting calculation because of historical high use (the Department's ARMS data shows 8350 hours per year average for 1996 and 1997). Do you wish to exclude this engine from further consideration in this action?

Response: The operations of pump engine number 6 continue to remain high. Please exclude this engine from any further consideration in this application.

FDEP Comment No. 3: Were/are the existing pumps subject to NOx RACT? Please confirm that no pump engine set can generate electrical power other than set number 1.

Response: Only the existing pump engine number one is capable of generating electrical power and subject to NOx RACT. Upon completion of this project, none of the pump engines will be capable of generating electrical power and will not be subject to the NOx RACT rule.

FDEP Comment No. 4: Please provide typical startup and shutdown procedures for the proposed engine sets.

Response: The normal startup and shutdown procedures for the proposed pump engine sets is provided in Attachment D.

FDEP Comment No. 5: Please provide a copy of current permit(s) for these engines including any air construction permits.

Response: A copy of the effective operating permit and related correspondence is provided in Attachment E.

If you have any questions about this application, please contact Bertha Goldenberg at (305) 669-5711 or Richard O'Rourke at (305) 669-5749.

Sincerely,

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

c: Isidore Goldman, FDEP Southeast District
Patrick Wong, Miami-Dade County DERM
David Lindberg, CH2M HILL

ATTACHMENT A
FDEP Request for Additional Information dated 16 November 1998
Air Construction Permit Application, DEP File No. 0250314-003-AC
Alexander Orr, Jr. Water Treatment Plant

Department of Environmental Protection

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

Lawton Chiles
Governor

Virginia B. Wetherell
Secretary

November 16, 1998

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Re: Alexander Orr, Jr. WTP
Three Natural Gas Fueled Engine Driven Pump Sets
DEP File No. 0250314-003-AC

Dear Mr. Ready:

The Department has received your application for installation of three natural gas fueled engine driven pump sets to replace existing diesel engine driven pump sets. The application was received on October 29, 1998. In order to continue processing your application, the Department will need the additional information below. Should your response to any of the following items require new calculations, please submit the new calculations, assumptions, reference material and appropriate revised pages of the application form.

1. Please provide a comparison of past actual emissions to potential emissions for the existing and proposed replacement engine driven pump sets for the pollutants NOx, SO_2, CO and PM_{10}. Past actual emissions should be based on an average of two representative years of operation in the past five years.

2. It appears as though pump engine number 6 need not be included in this application as it does not affect the netting calculation because of historical high use (the Department's ARMS data shows 8350 hours per year average for 1996 and 1997). Do you wish to exclude this engine from further consideration in this action?

3. Were/are the existing pumps subject to NOx RACT? Please confirm that no pump engine set can generate electrical power other than set number 1.

4. Please provide typical startup and shutdown procedures for the proposed engine sets.

5. Please provide a copy of current permit(s) for these engines including any air construction permits.

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. Material changes to the application should also be accompanied by a new certification statement by the authorized representative or responsible official. A copy of your response should be sent to Mr. Isidore Goldman, P.E., DEP Southeast District and Mr. Patrick Wong, Dade County DERM.

If you should have any questions, please call me at 850/921-9519, respectively.

Sincerely,

Joseph Kahn, P.E.
New Source Review Section

jk

cc: Isidore Goldman, P.E., DEP Southeast District
Patrick Wong, Dade County DERM
Richard O'Rourke, WASD (via e-mail)
Bertha Goldenberg, WASD (via e-mail)

ATTACHMENT B
Responsible Official and P.E. Certification Statements
Alexander Orr, Jr. Water Treatment Plant

Owner/Authorized Representative or Responsible Official

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

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

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

Organization/Firm : Miami-Dade Water & Sewer Dept.
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 12-3-98

Signature Date

* Attach letter of authorization if not currently on file.

4. Professional Engineer Statement :

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

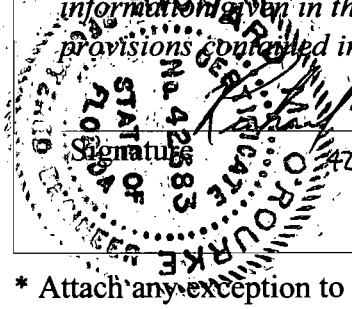
(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollutant control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions 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 [X] 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 42683

3 DECEMBER 1998
Date

* Attach any exception to certification statement.

ATTACHMENT C
Emission Calculations - Historic & Proposed
with Emission Test Results from September 1998 Tests.
Alexander Orr, Jr. Water Treatment Plant

Alexander Orr, Jr. Water Treatment Plant
Miami-Dade Water and Sewer Department
East Pump Room - Pump Replacement Project
Replacement of Pump Diesel Engines Nos. 1, 3 & 4 and Pump Dual Fueled Engine No. 5

Emission Calculations of Past Actual Emissions from Existing Engine Driven Pumps and Proposed Replacements

Existing Annual Pump Engine Emissions

			Average Annual Operations November 1996 - October 1998					
			Pump Engine 1	Pump Engine 3	Pump Engine 4	Sum Pump Engines 1, 3 & 4	Pump Engine 5	Total Pump Engines 1, 3, 4 & 5
Annual Average Operating Hours, 24-Month Period, November 1996 - October 1998			383.5	1,201.8	1,398.3	2,983.5	1,803.3	4,786.8
Fuel Consumption [1] gals/hr			31	31	31		60	
Estimated Average Annual Fuel consumption in gallons 10^3			11.9	37.3	43.3	92.5	108.2	200.7
MMbtus based on 140 / SCC Unit (10^3 gallons)			1,666	5,222	6,062	12,950	15,148	28,098
			Estimated Past Annual Emissions in Tons					
Internal Combustion Engines, Industrial, Large Bore Engine, Diesel, SCC = 20200401 [2]	Emission Factor	Units	Pump Engine 1	Pump Engine 3	Pump Engine 4	Sum Pump Engines 1, 3 & 4	Pump Engine 5	Total Pump Engines 1, 3, 4 & 5
Average Nitrogen Oxides (NOx) Emission Tests, Emission Factor in Lbs/MMbtu			2.19	2.10	2.76		2.45	
Nitrogen Oxides (NOx)	-	-	1.82	5.48	8.37	15.67	18.56	**34.23**
Sulfur Oxides (SOx)	1.38E+02	Lbs/1000gals	0.0	0.1	0.1	0.3	0.4	**0.69**
Carbon Monoxide (CO)	1.11E+02	Lbs/1000gals	0.7	2.1	2.4	5.1	6.0	**11.14**
PM_{10}, Total	7.85E+00	Lbs/1000gals	0.0	0.1	0.2	0.4	0.4	**0.79**

Proposed Annual Pump Engine Emissions

			Proposed Annual Operations				
			Pump Engine 3	Pump Engine 4	Sum Pump Engines 3 & 4	Pump Engine 5	Total Pump Engines 3,4&5
Hours of Operation			8,760.0	8,760.0	17,520.0	8,760.0	26,280.0
Fuel Consumption in MCF/hr			5.759	5.759		14.495	
Estimated Annual Fuel consumption in MCF			50.4	50.4	100.8	127.0	227.8
			Estimated Proposed Annual Emissions in Tons					
Internal Combustion Engines, Commercial / Institutional, Natural Gas, Reciprocating SCC = 20300201 [2]	Emission Factor	Units	Pump Engine 3	Pump Engine 4	Sum Pump Engines 3 & 4	Pump Engine 5	Total Pump Engines 3,4&5	Net Annual Increase / (Decrease) in Tons
Manufacturer Supplied Emission Factor Nitrogen Oxides (NOx) lbs/hr		Lbs/Hr	2.4	2.4		4.4		
Nitrogen Oxides (NOx)	-	-	10.5	10.5	21.00	19.3	**40.30**	**6.07**
Sulfur Oxides (SOx)	6.00E-01	Lbs/MCF	-	-	-	-	-	**(0.69)**
Manufacturer Supplied Emission Factor Carbon Monoxide (CO) lbs/hr		Lbs/Hr	4.3	4.3		6.9		
Carbon Monoxide (CO)	-	-	18.8	18.8	37.60	30.2	**67.80**	**56.66**
PM_{10}, Filterable	1.00E+01	Lbs/MCF	0.30	0.30	0.60	0.60	**1.20**	**0.41**

Notes:

1. Estimated rates based on usage prior to service tank change, less than full load rates.
2. EPA Source Classification Codes
3. Emissions Factors based on Emissions Testing, Manufacturer Supplied Data or EPA Source Classification Codes
4. Emissions (tons/yr) = (emission factor [lbs/unit]) x (units) / 2000 lbs/ton
5. Net Annual Increase / (Decrease) in Tons of Emissions (tons/yr) = Proposed Annual Emissions (tons/yr) - Past Annual Emissions (tons/yr)

Alexander Orr, Jr. Water Treatment Plant
Miami-Dade Water and Sewer Department
East Pump Room - Pump Replacement Project
Replacement of Pump Diesel Engines Nos. 1, 3 & 4
and Pump Dual Fueled Engine No. 5

Summary of Past Emissions Test Results

Existing 3 - 825 HP Diesel Engines, each Driving a Pump
Existing 1 - 1,500 HP Diesel Engine Driving Pump No. 5
NOx Testing 1997 & 1998, Emissions in Lbs/MMBtu.

	No. 1	No. 3	No.4	No. 5
1997	2.12	1.83	2.95	2.60
1998	2.26	2.36	2.57	2.29
Average	2.19	2.10	2.76	2.45

South Florida
Environmental Services

EMISSIONS TEST REPORT

PREPARED FOR: Miami-Dade Water & Sewer Department
4200 Salzedo Street
Room 112
Coral Gables, FL 33146

CONCERNING: Visible Emissions and NOx RACT Testing
Alexander Orr Jr. Water Treatment Plant
Diesel Pumps
September 16 & 17, 1998

PREPARED BY: South Florida Environmental Services
6821 Vista Parkway North
West Palm Beach, Florida 33411

PROJECT #: 97-584.AO

S. Joseph Mercadante
President

10/23/98
Date

Reviewed By:

Thomas S. Siegert
Thomas S. Siegert
Environmental Scientist

10/23/98
Date

TABLE OF CONTENTS

APPENDICES

1.0 COMPENDIUM

South Florida Environmental Services a division of Eastmount Environmental Inc. conducted an emissions testing program on behalf of Miami-Dade Water & Sewer Department at their Alexander Orr Jr. facility located in Miami, Florida. Testing was performed on Diesel Pumps 1, 3, 4, 5, and 6 for the determination of NOx, O2 and Visible Emissions. Testing was conducted on September 16 and 17, 1998.

Testing was conducted to demonstrate compliance with Visible Emissions and NOx RACT standards. All testing was conducted in accordance with procedures set forth in Appendix A of 40 CFR 60, as amended. A detailed explanation of these procedures can be found in Section 3.0 of this report.

Each compliance test series consisted of three one hour runs. Compliance testing was conducted at or above 90% of full load for each unit. All unit were tested while firing #2 fuel oil except Pump #6 which fired a combination of natural gas and #2 fuel oil.

The results of the NOx emissions test program can be found in Table 1-1 and Visible Emission results can be found in table 1-2.

Michael Mercadante was responsible for all phases of the emissions test program. Francis Morlu assisted throughout the sampling phase of the program. S. Joseph Mercadante conducted the calculations and wrote the Final Report. Thomas Siegert assisted in the report preparation and reviewed the Final Report. Richard O'Rourke of Miami-Dade Water and Sewer Department was responsible for coordination plant operations. Ms. Raisa Neginsky of the Florida Department of Environmental Protection in West Palm Beach observed the testing.

South Florida Environmental Services

1.0 COMPENDIUM (cont.)

SUMMARY OF RESULTS

Table 1-1

NOx Tests

	NOx lb/mm Btu			
Source	Run 1	Run 2	Run 3	Average
Pump #1	2.33	2.29	2.15	2.26
Pump #3	2.46	2.26	2.35	2.36
Pump #4	2.58	2.65	2.49	2.57
Pump #5	2.43	1.99	2.44	2.29
Pump #6	1.20	1.27	1.55	1.34

Results of the NOx testing can be compared to the State of Florida's allowable RACT limit of 4.75 lb/mm Btu.

Table 1-2

Visible Emissions Tests

Source	Highest Six Minute Average	Overall Opacity Average
Diesel Pump #1	2.29 %	0.79 %
Diesel Pump #3	6.43 %	4.59 %
Diesel Pump #4	2.92 %	0.98 %
Diesel Pump #5	13.21 %	10.34 %
Diesel Pump #6	0.00 %	0.00 %

Results of the Visible Emission testing can be compared to the State of Florida's allowable Visible Emissions limit of 20% opacity.

South Florida Environmental Services

2.0 SAMPLING POINT LOCATION

Sampling was conducted in the exhaust stack of each unit downstream of the silencers and prior to entering the atmosphere. Based upon the requirements in 40 CFR 60 Appendix B, Specification 2, Section 3.2, Reference Method Measurement Location and Sampling Points, the CEM probe sampled a total of three points during each test run.

3.0 SAMPLING TRAIN AND ANALYTICAL PROCEDURES

As discussed in Section 1, the subject units at the facility were tested for Oxides of Nitrogen and Visible Emissions. Each parameter was tested in strict accordance with official EPA procedures set forth in 40 CFR 60 Appendix A as amended.

3.1 DESCRIPTION OF METHODOLOGY

3.1.1 Oxygen

Oxygen was measured in accordance with EPA Method 3A. This method utilizes continuous emissions monitoring instrumentation. SFES used a Teledyne Model 326A monitor with a range from 0-25%. The instrument meets all of the performance specifications of these methods. It was calibrated before and after each test period with gases prepared according to EPA Protocol #1.

3.1.2 Oxides of Nitrogen

Oxides of Nitrogen were measured in accordance with EPA Method 7E. This Method utilizes continuous emissions monitoring instrumentation. SFES uses a Thermo Electron Model 10A NOx chemiluminescent monitor with 8 ranges from 0-10,000 PPM. The instrument meets all of the performance specifications of the Method. It was calibrated before and after each test period using calibration gases prepared according to EPA Protocol #1.

3.2. DESCRIPTION OF CEM SAMPLING

What follows is a description of the transportable continuous emissions monitor system that was used to quantify Oxygen and Oxides of Nitrogen from subject boilers at the facility. The system meets all the specifications of Reference Methods 3A (O2), and 7E (NOx).

3.0 SAMPLING TRAIN AND ANALYTICAL PROCEDURES (cont.)

3.2.1 CEM Sampling System

Sample Probe - A stainless steel probe of sufficient length to sample three locations specified in Section 2.0.

Sample Line - Approximately 75' to 100' of 3/8" Teflon tubing (1/16" wall) to transport the sample gas from the probe to the sample conditioning system.

Sample Conditioning System-

Filter - A spun glass fiber filter, located near the probe to remove particulate from the gas stream.
Condenser (2) - a Universal Analyzer Sample Cooler or ice cooled condenser located near the probe for bulk moisture removal and a thermo-electric condenser system downstream from the pump to remove any remaining moisture from the gas stream.

Sample Pump - A diaphragm type vacuum pump to draw gas from the probe through the conditioning system and to the analyzers. The pump head is stainless steel, the valve disks are Viton and the diaphragm is Teflon coated.

Calibration Valve - A tee valve, located at the base of the probe, allows the operator to select either the sample stream or inject calibration gas to the CEM system.

Sample Distribution System - A series of flow meters, valves and back pressure regulators allows the operator to maintain constant flow and pressure conditions during sampling and calibration.

Gas Analyzers - capable of the continuous determination of O2, CO2, and NOx concentrations in a sample gas stream. They each meet or exceed the following specifications:

Calibration Error	- Less than ±2% of span for the zero, mid- and hi-range calibration gases.
System Bias	- Less than ±5% of span for the zero, mid- or hi-range calibration gases.
Zero Drift	- Less than ±3% of span over the period of each test run (1 hour).
Calibration Drift	- Less than ±3% of span over the period of each test run (1 hour).

South Florida Environmental Services

3.0 SAMPLING TRAIN AND ANALYTICAL PROCEDURES (cont.)

Data Acquisition System - A Molytek strip chart/data logger system was used to record analyzer response to the sample and calibration gas streams. The chart recorder operated continuously while the data logger recorded thirty (30) minute interval averages.

The Molytek was linked, via an RS232 cable, to an IBM compatible computer system with a VGA screen. Data was written to file at fifteen (15) second intervals. Separate files for each run, and associated calibrations, were generated. Data was loaded into a spreadsheet for calculation of interval averages and emission rates. Preliminary reports were available on-site.

3.2.2 CEMS Sampling Procedures

All sampling and analytical procedures were conducted in accordance with EPA Reference Methods 3A, and 7E (40CFR60, Appendix A). The following is the sequence of events leading up to and including the compliance test:

Selection of Sampling Traverse Point Locations - Sampling point locations were determined prior to testing in accordance with EPA Methods 3A, and 7E.

Determination of System Response Time - System response time was determined prior to testing. System response time was determined according to procedures delineated in Performance Specification 2 (40CFR60, Appendix B).

Determination of Analyzer Calibration Error - Analyzer calibration error was determined immediately prior to testing in accordance with EPA Methods 3A, and 7E.

Determination of Sampling System Bias - Sampling system bias was determined immediately prior to testing in accordance with EPA Methods 3A, and 7E.

Determination of Zero and Calibration Drift - Before and after each test run each analyzer's response to zero and mid- or hi-range calibration gases was determined. The pre-and post-test analyzer responses were compared to determine drift. The results were evaluated based upon specifications defined in EPA Methods 3A, and 7E.

Data Reduction - An average pollutant/diluent concentration for each test run was determined from the data acquisition system. This data was then reduced to determine relative pollutant concentrations.

4.0 QUALITY CONTROL PROCEDURES

Sampling was conducted by trained personnel with extensive experience in Reference Method sampling. All sampling and analysis was conducted in strict accordance with EPA test procedures, including quality control procedures found in the EPA Quality Assurance Handbook for Air Pollution Measurement Systems.

South Florida Environmental Services entire equipment inventory is on a schedule of routine maintenance and calibration.

All calculations were conducted in strict accordance with the equations found in the individual Methods. Emission rate calculations were conducted on a computer and a person other than the original operator to ensure that it was correct checked the input data.

These specific procedures, in addition to South Florida Environmental Services usual high standard of quality control, validate the results obtained during the test program. South Florida Environmental Services is staffed by a team of qualified, experienced environmental professionals. As the majority of our emissions testing work is done for compliance purposes, strict QC procedures are incorporated into our everyday work performance.

ATTACHMENT D
Typical Startup and Shutdown Procedures
Alexander Orr, Jr. Water Treatment Plant

Procedures for Startup
Engine Driven Pumps
Alexander Orr, Jr. Water Treatment Plant
Miami-Dade Water and Sewer Department

Normal Startup

The engine driven pumps at the Alexander Orr, Jr. WTP are started by air power. Prior to start up the starting air cylinders and compressors will be checked for adequate air supply and operation. The engine and drive gear operating fluid levels will be checked with additions made as necessary. Engine cooling water, fuel supply, starting air supply valves and pump suction valves will be aligned to the proper condition for startup. Start engine auxiliary pumps and pre-lubrication pumps if supplied. Open priming water supply valves, verify priming water supply to the main pump. To begin startup, the starting air is applied to the air motor, once the engine begins to turn over, the spark ignition will begin. After ignition, shut off the starting air, along with the engine pre-lubrication pump. The engine will be running at idle setting. Since the pump is directly coupled through the drive gears to the engine, the pump will be engaged. Let engine run for 2 to 3 minutes before putting the pump on the line. Actuate the cone valve and observe the valve open. (The pointer that indicates open or closed position is on the side of the cone valve.) After the cone valve is open and the engine loaded, shut off the main pump priming water supply. Check engine, gauges and auxiliaries to make sure there are no leaks, etc. Monitor engine exhaust and operating parameters for any abnormalities that would require shut down. Following operations at minimum speed to allow the engine to reach minimum operating temperatures, the engine speed may be increased as required. Adjust engine speed to desired operating range. The pump engines will be operating under load within 3 minutes of startup and approximately 15 minutes to before a full load is applied.

Excess Emissions

Excess emissions that occur during startup will consist of elevated hydrocarbon (HC), carbon monoxide (CO), and particulate (PM) emissions as a result of cold combustion temperatures. As the pump engine warms up and additional load, emissions of these pollutants will decrease. Emissions of nitrogen oxides (NOx) will increase as the engines warm up and reaches a fully loaded condition.

Since limitations in the permit application are based on the consumption of fuel, emissions resulting from startup of the pump engines are accounted for in monitoring, recordkeeping, and reporting.

ATTACHMENT E
Current Effective Air Operating Permit & Related Correspondence
Alexander Orr, Jr. Water Treatment Plant

Department of
Environmental Protection

Lawton Chiles
Governor

Southeast District
P.O. Box 15425
West Palm Beach, Florida 33416

Virginia B. Wetherell
Secretary

cc: TS
ROR
D. Lindberg/
CHAMU

November 29, 1995

Mr. Anthony J. Clemente, Director
Miami-Dade Water & Sewer Authority
P.O. Box 330316
Miami, FL 33233-0316

RE: Title V Air Operation Permit for Alexander Orr Facility

Dear Mr. Clemente:

Previous Department correspondence addressed to Mr. Garrett Sloan (copy enclosed) stated that the permit for the diesel engines at this facility was extended by rule until July 2, 1995. The permit has again been extended by rule, until August 15, 1996, per Florida Administrative Code (F.A.C.) Rule 62-210.300(2)(a)3.a.

That letter also instructed WASAD to apply to DERM for the air Title V permit required by F.A.C. Rule 62-213. Please disregard those instructions as they are now incorrect. Applications for all Title V permits required for WASAD facilities should be submitted to the Department of Environmental Protection, Southeast District Office, at the address indicated on our letterhead.

We apologize for any confusion this may have caused. Please contact me at 407-433-2650, extension 136, if you have any questions.

Sincerely,

Joseph Kahn, P.E.
Air Permitting Supervisor

enclosure

cc: Patrick Wong, DERM

MIAMI-DADE
WATER AND SEWER DEPARTMENT
RECEIVED
DEC 04 1995
DIRECTOR'S OFFICE

Department of
Environmental Protection

Lawton Chiles
Governor

Southeast District
P.O. Box 15425
West Palm Beach, Florida 33416

Virginia B. Wetherell
Secretary

FILE

DEC 0 5 1994

Mr. Garrett Sloan, Director
Miami-Dade Water & Sewer Authority
P.O. Box 330316
Miami, Florida 33133

Dade County
AP - AO 13-177245
Diesel Engines 1 to 6
Alexander Orr Facility

RE: Extension of Permit Expiration

Dear Mr. Sloan

Permit AO 13-177245 for the above referenced facility was to expire on February 10, 1995. At no fee, this date has been extended to September 2, 1995. Florida Administrative Code Rule 17-4.090, requires that at least sixty (60) days before the expiration of any Department permit, the owner shall apply for a Title V permit; this date is July 2, 1995. Please be advised that, should you allow your present permit to expire without having submitted an application for permit renewal, you will be required to submit an application for a new permit. In this event, the "Application to Construct/Operate" will result in additional significant expenditures of time and money on your part.

Your application is to be submitted to the Dade County Environmental Resource Management, Air Control Section, 33 S.W. 2nd Avenue, Suite 9-223, Miami, FL 33130-1540. A copy of your application should be submitted to our office for comments. If you have any questions, please contact Stephanie Brooks of this office, telephone 407/433-2650, X136.

Sincerely,

Stephanie S. Brooks, P.E.

Stephanie Brooks, P.E.
Supervisor, Air Program

SSB/hh/ms

Enclosures

cc:DERM

Florida Department of Environmental Regulation

Southeast District ● 1900 S. Congress Ave., Suite A ● West Palm Beach, Florida 33406 ● 407-964-9668

Bob Martinez, Governor | Dale Twachtmann, Secretary | John Shearer, Assistant Secretary
Scott Benyon, Deputy Assistant Secretary

NOTICE OF PERMIT

MAY 25 1990

Dade County
AP - Miami-Dade Water & Sewer Authority
Diesel Engines 1 to 6 - Alexander Orr Plant

Mr. Garrett Sloan, Director
Miami-Dade Water & Sewer Authority
P. O. Box 330316
Miami, Florida 33133

Dear Mr. Sloan:

Enclosed is Permit Number AO 13-177245 to operate an air pollution source issued pursuant to Section 403.087, Florida Statutes.

Persons whose substantial interests are affected by this permit have a right, pursuant to Section 120.57, Florida Statutes, to petition for an administrative determination (hearing) on it. The petition must conform to the requirements of Chapters 17-103 and 28-5.201, FAC, and must be filed (received) in the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, FL 32399-2400, within fourteen (14) days of receipt of this notice. Failure to file a petition within the fourteen (14) days constitutes a waiver of any right such person has to an administrative determination (hearing) pursuant to Section 120.57, Florida Statutes. This permit is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with this paragraph or unless a request for extension of time in which to file a petition is filed within the time specified for filing a petition and conforms to Rule 17-103.070, FAC. Upon timely filing of a petition or a request for an extension of time this permit will not be effective until further Order of the Department.

When the Order (Permit) is final, any party to the Order has the right to seek judicial review of the Order pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, FL 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the Final Order is filed with the Clerk of the Department.

In addition, please be advised that some processes generate hazardous wastes. Please consult 40 C.F.R. Parts 260-271 and Chapter 17-730, F.A.C. for specific rules and regulations applicable to hazardous waste handlers. Attached for your use is a document entitled "Highlights of Hazardous Waste Regulations" which outlines typical compliance items applicable to various hazardous waste generators/facilities.

Executed in West Palm Beach, Florida

STATE OF FLORIDA
DEPARTMENT OF REGULATION

J. Scott Benyon
Deputy Assistant Secretary
1900 South Congress Ave., Suite A
West Palm Beach, FL 33406
407/964-9668

MIAMI • DADE
WATER AND SEWER AUTHORITY DEPT.
MAY 29 19[illegible]
DIRECTOR'S OFFICE

JSB:SSB/k57

cc: William Arlington, SFES
Dade County Environmental Resources Management

PERMITTEE:
Mr. Garrett Sloan, Director
Miami-Dade Water & Sewer Authority
Miami, Florida

I.D. NUMBER: 50/DAD/13/0314/01-06
PERMIT/CERTIFICATION NUMBER: AO 13-177245
DATE OF ISSUE: MAY 25 1990
EXPIRATION DATE: February 10, 1995

SPECIFIC CONDITIONS:

1. Compliance testing shall be conducted for the sources covered by this permit by September 1990 and annually thereafter in accordance with the methods specified below.

2. Emission limiting standard is as follows:

   a. In accordance with Florida Administrative Code Rule 17-2.610(2) - No person shall cause, let, permit, suffer or allow the discharge of pollutants to the atmosphere greater than 20 percent.

3. The compliance test report shall include results of tests by the following methods:

Source/Emission Point	Pollutant	Test Method
Engine Stacks	Visible Emissions	EPA Method 9

The compliance test report shall be submitted to the Department in accordance with Florida Administrative Code (F.A.C.) Rule 17-2.700(7).

4. Testing of emissions should be conducted using the fuel and/or process input which are expected to result in the highest emissions and within ten percent (10%) of the rated capacity of the source. Otherwise the Department may require the test to be repeated or modify the permit to reflect tested rates and/or fuels.

5. The Department shall be notified of expected test dates at least fifteen (15) days prior to compliance testing.

6. On or before March 1 of each calendar year, a completed DER Form 17-1.202(6), Annual Operations Report Form for Air Emissions Sources shall be submitted to the Department.

7. Copies of all reports, tests, notifications or other submittals required by this permit shall be submitted to both the Department of Environmental Regulation, Southeast District Office and Dade County Environmental Resources Management.

8. The permittee shall be aware of and operate under the attached "General Permit Conditions #1 thru 14.". General Permit Conditions are binding upon the permittee and enforceable pursuant to Chapter 403 of the Florida Statutes.

Issued this 25th day of May, 1990

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

J. Scott Benyon
Deputy Assistant Secretary

CURRENT

Florida Department of Environmental Regulation

Southeast District • 1900 S. Congress Ave., Suite A • West Palm Beach, Florida 33406 • 407-964-9668

Bob Martinez, Governor Dale Twachtmann, Secretary John Shearer, Assistant Secretary
Scott Benyon, Deputy Assistant Secretary

PERMITTEE:
Mr. Garrett Sloan, Director
Miami-Dade Water & Sewer Authority
P. O. Box 330316
Miami, Florida 33133

I.D. NUMBER: 50/DAD/13/0314/01-06
PERMIT/CERTIFICATION NUMBER: AO 13-177245 *
DATE OF ISSUE: MAY 25 1990
EXPIRATION DATE: February 10, 1995
COUNTY: Dade
LATITUDE/LONGITUDE: 25°42'35"N/80°20'11"W
UTM: Zone 17; 566.6 Km. E; 2840.0 Km. N
PROJECT: Miami-Dade Water & Sewer Authority
Diesel Engines 1 to 6 - Alexander Orr Plant

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Rule 17-2, and in conformance with all existing regulations of the Florida Department of Environmental Regulation. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

OPERATE: An air pollution source consisting of:

a) Units 1 to 4 - four similar Worthington 825HP diesel engines (Serial Nos: VO-3242 - Unit #1; VO-3229 - Unit #2; VO-3241 - Unit #3; VO-3240 - Unit #4) which operate alternately. Engines are coupled to a pump for use in pumping water.

b) Unit 5 - A Worthington 1500 HP diesel engine (Serial No. VO-3451) driving a 21,000 gpm water pump, operating alternately with Unit 6.

c) Unit 6 - An Enterprise 2113HP diesel engine (Serial No. 61001) driving a 26,000 gpm water pump alternating operation with Unit 5.

All the above units discharge emission through stacks 28 feet above ground level and operate without external controls.

IN ACCORDANCE WITH: Application for Renewal of Permit to Operate Air Pollution Sources received March 8, 1990 and Application to Operate Air Pollution Sources for Diesel Engines 1 to 6, all dated June 6, 1974 (none are attached).

LOCATED AT: 6800 S.W. 87the Avenue, Miami, Dade County, Florida.

TO SERVE: A water supply system (SIC # 4941).

SUBJECT TO: General Conditions 1-14 and Specific Conditions 1-8.

* This permit is a renewal of AO 13-094566 issued March 4, 1985.

DER Form 17-1.201 (57)
Effective November 30, 1982

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in thi permit, are "permit conditions" and are binding and enforceable pursuant to Sections 403.141, 403.727, or 403.859 through 403.861, F.S. The permittee is placed on notice tha The Department will review this permit periodically and may initiate enforcement action f any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in subsections 403.087(6) and 403.722(5), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, no any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspec of the total project which are not addressed in the permit.

4. This permit conveys no title to land or water, does not constitute State recognitio or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to hum health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:

   (a) Have access to and copy any records that must be kept under the conditions o the permit;

   (b) Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

   (c) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

   Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in the permit, the permittee shall immedi ately notify and provide the Department with the following information:

   (a) A description of and cause of noncompliance; and

   (b) The period of noncompliance, including exact dates and times; or, if not cor rected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncon pliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

GENERAL CONDITIONS:

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department, may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.111 and 403.73, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Rule 17-4.120 and 17-30.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. The permittee shall comply with the following :

(a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically, unless otherwise stipulated by the Department.

(b) The permittee shall hold at the facility or other location designated by this permit, records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report or application unless otherwise specified by Department rule.

(c) Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurements;
- the date(s) analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

14. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware the relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be submitted or corrected promptly.

DER Permit Number AO 13-177245

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on MAY 25 1990 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGEMENT FILED, on this date, pursuant to §120.52(10), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Phyllis J. Kern
Clerk

MAY 25 19
Date

Z 333 612 582

US Postal Service

Receipt for Certified Mail

No Insurance Coverage Provided.

Do not use for International Mail *(See reverse)*

Sent to Robert Ready	
Street & Number Miami-Dade WASD	
Post Office, State, & ZIP Code 4200 Salzedo St Coral Gables, FL	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Addressee's Address	
TOTAL Postage & Fees	$
Postmark or Date 0250314-003-AE 11-16-98	

PS Form **3800**, April 1995

Is your **RETURN ADDRESS** completed on the reverse side?

SENDER:

- Complete items 1 and/or 2 for additional services.
- Complete items 3, 4a, and 4b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write *"Return Receipt Requested"* on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:
Robert Ready, PE
Miami Dade WASD
4200 Salzedo St.
Coral GABLES, FL
33146-0316

4a. Article Number
Z 333 612 582

4b. Service Type
☐ Registered ☒ Certified
☐ Express Mail ☐ Insured
☐ Return Receipt for Merchandise ☐ COD

7. Date of Delivery
11-20-98

5. Received By: *(Print Name)*
L. BANFIELD

8. Addressee's Address *(Only if requested and fee is paid)*

6. Signature: *(Addressee or Agent)*
X L. Banfield

PS Form **3811**, December 1994 102595-97-B-0179 Domestic Return Receipt

Thank you for using Return Receipt Service.

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Print your name, address, and ZIP Code in this box •

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BUREAU OF
AIR REGULATION

Department of Environmental Protection
Division of Air Resources Management
Bureau of Air Regulation, NSRS
2600 Blair Stone Road, MS 5505
Tallahassee, Florida 32399-2400

Department of Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

November 16, 1998

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Re: Alexander Orr, Jr. WTP
Three Natural Gas Fueled Engine Driven Pump Sets
DEP File No. 0250314-003-AC

Dear Mr. Ready:

The Department has received your application for installation of three natural gas fueled engine driven pump sets to replace existing diesel engine driven pump sets. The application was received on October 29, 1998. In order to continue processing your application, the Department will need the additional information below. Should your response to any of the following items require new calculations, please submit the new calculations, assumptions, reference material and appropriate revised pages of the application form.

1. Please provide a comparison of past actual emissions to potential emissions for the existing and proposed replacement engine driven pump sets for the pollutants NOx, SO_2, CO and PM_{10}. Past actual emissions should be based on an average of two representative years of operation in the past five years.

2. It appears as though pump engine number 6 need not be included in this application as it does not affect the netting calculation because of historical high use (the Department's ARMS data shows 8350 hours per year average for 1996 and 1997). Do you wish to exclude this engine from further consideration in this action?

3. Were/are the existing pumps subject to NOx RACT? Please confirm that no pump engine set can generate electrical power other than set number 1.

4. Please provide typical startup and shutdown procedures for the proposed engine sets.

5. Please provide a copy of current permit(s) for these engines including any air construction permits.

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. Material changes to the application should also be accompanied by a new certification statement by the authorized representative or responsible official. A copy of your response should be sent to Mr. Isidore Goldman, P.E., DEP Southeast District and Mr. Patrick Wong, Dade County DERM.

If you should have any questions, please call me at 850/921-9519, respectively.

Sincerely,

Joseph Kahn, P.E.
New Source Review Section

jk

cc: Isidore Goldman, P.E., DEP Southeast District
Patrick Wong, Dade County DERM
Richard O'Rourke, WASD (via e-mail)
Bertha Goldenberg, WASD (via e-mail)

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

SERVE • CONSERVE

October 23, 1998

CERTIFIED: Z 427 642 095
RETURN RECEIPT

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

RE: Application for Air Construction Permit for Three Natural Gas Fueled Engine-Driven Pump Sets at the Alexander Orr, Jr. Water Treatment Plant, Miami, Florida - Facility ID No. 0250314 -003-AC

Dear Mr. Linero:

Enclosed, please find our application to obtain an air construction permit for replacement of five diesel fueled engine driven pump sets with three natural gas-fueled engine driven pump sets at the above-referenced facility and the application includes:

1) One (1) signed and sealed filled application.
2) Three (3) additional signed and sealed signature pages.
3) Four (4) diskettes copies of the application in the Electronic Submission of Application System (ELSA) format.
4) Check in amount of $750 for the application.

We request that this permit be reviewed along with the current applications under review. If you have any questions about this application, please contact Bertha Goldenberg at (305) 669-5711 or Richard O'Rourke at (305) 669-5749.

Sincerely,

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

c: Isidore Goldman, FDEP Southeast District
Patrick Wong, Dade County DERM
David Lindberg, CH2M HILL

L9875dep.wpd

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

SERVE • CONSERVE

October 23, 1998

CERTIFIED: Z 427 642 095
RETURN RECEIPT

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

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David Lindberg, CH2M HILL

L9875dep.wpd

Owner/Authorized Representative or Responsible Official

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

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

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

   Organization/Firm : Miami-Dade Water & Sewer Dept.
   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

   10-23-98 — 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 C. Ready, P.E.
Title : Asst. Director,Treatment Facilities

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

Organization/Firm : Miami-Dade Water & Sewer Dept.
Street Address : 4200 Salzedo Street
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Name : Robert C. Ready, P.E.
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R C Ready
Signature

10-23-98
Date

* Attach letter of authorization if not currently on file.

Department of
Environmental Protection

DIVISION OF AIR RESOURCES MANAGEMENT

APPLICATION FOR AIR PERMIT - LONG FORM

I. APPLICATION INFORMATION

Identification of Facility Addressed in This Application

1. Facility Owner/Company Name : Miami-Dade Water & Sewer Dept.
2. Site Name : Alexander Orr, Jr. WTP
3. Facility Identification Number : 50WPB13 [ ] Unknown
4. Facility Location : Alexander Orr, Jr. Water Treatment Plant Miami-Dade Water & Sewer Dept. Street Address or Other Locator : 6800 S.W. 87th Avenue City : Miami County : Miami Dade Zip Code : 33133 0316
5. Relocatable Facility? [ ] Yes [X] No 6. Existing Permitted Facility? [X] Yes [ ] No

Rec'd Oct. 29, 1998

0250314-003-AC

DEP Form No. 62-210.900(1) - Form
Effective : 3-21-96

Owner/Authorized Representative or Responsible Official

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

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

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

Organization/Firm : Miami-Dade Water & Sewer Dept.
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

10-23-98
Date

* Attach letter of authorization if not currently on file.

Scope of Application

Emissions Unit ID	Description of Emissions Unit	Permit Type
003-004	Pump Engine Nos. 3, 4 (Natural Gas)	AC1F
005	Pump Engine No. 5 (Natural Gas)	AC1F
006	Pump Engine No. 6 (Dual Fuel)	ACM1

Purpose of Application and Category

Category I : All Air Operation Permit Applications Subject to Processing Under Chapter 62-213, F.A.C.

This Application for Air Permit is submitted to obtain :

[ ] Initial air operation permit under Chapter 62-213, F.A.C., for an existing facility which is classified as a Title V source.

[ ] Initial air operation permit under Chapter 62-213, F.A.C., for a facility which, upon start up of one or more newly constructed or modified emissions units addressed in this application, would become classified as a Title V source.

Current construction permit number :

[ ] Air operation permit renewal under Chapter 62-213, F.A.C., for a Title V source.

Operation permit to be renewed :

[ ] Air operation permit revision for a Title V source to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number :

Operation permit to be revised :

[ ] Air operation permit revision or administrative correction for a Title V source to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application.

Operation permit to be revised/corrected :

[ ] Air operation permit revision for a Title V source for reasons other than construction or modification of an emissions unit.

Operation permit to be revised :

Reason for revision :

Category II : All Air Operation Permit Applications Subject to Processing Under Rule 62-210.300(2)(b), F.A.C.

This Application for Air Permit is submitted to obtain :

[ ] Initial air operation permit under Rule 62-210.300(2)(b), F.A.C., for an existing facility seeking classification as a synthetic non-Title V source.

Current operation/construction permit number(s) :

[ ] Renewal air operation permit under Fule 62-210.300(2)(b), F.A.C., for a synthetic non-Title V source.

Operation permit to be renewed :

[ ] Air operation permit revision for a synthetic non-Title V source.

Operation permit to be revised :

Reason for revision :

Category III : All Air Construction Permit Applications for All Facilities and Emissions Units

This Application for Air Permit is submitted to obtain :

[**X**] Air construction permit to construct or modify one or more emissions units within a facility (including any facility classified as a Title V source).

Current operation permit number(s), if any :
AO13-177245

[ ] Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

Current operation permit number(s) :

[ ] Air construction permit for one or more existing, but unpermitted, emissions units.

Application Processing Fee

Check one :

[X] Attached - Amount : $750.00 [ ] Not Applicable.

Construction/Modification Information

1. Description of Proposed Project or Alterations :

   Construction permit is requested to remove existing pumps and engines 1,2,3,4, & 5; and to install proposed pumps and corresponding natural gas power engines No.3 (738 bhp), No.4 (738 bhp) & No. 5 (2090 bhp). The two (2) 738 bhp engines are proposed in this application as a single, collectively regulated emissions unit. The 2090 bhp engine is proposed in this application as a single regulated emisions unit. A minor revision to limit fuel consumption of existing pump engine 6 (2113 bhp) is also proposed.

   The engine-driven pumps are covered under FDEP operating permit No. AO13-177245. This application is for a construction permit to replace existing diesel fueled pump engines with natural gas fueled engines and to establish enforceble limitations to minimize impact on ambient air quality.

2. Projected or Actual Date of Commencement of Construction : 01-Jun-1999

3. Projected Date of Completion of Construction : 31-Dec-2000

Professional Engineer Certification

1. Professional Engineer Name : Richard M. O'Rourke, P.E.
   Registration Number : 42683

2. Professional Engineer Mailing Address :

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

3. Professional Engineer Telephone Numbers :
   Telephone : (305)669-5749 Fax : (305)669-5717

4. Professional Engineer Statement :

I, the undersigned, hereby certified, 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 [X] 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

October 23, 1998
Date

FL No. 42683

No. 42683

STATE OF

* Attach any exception to certification statement.

Application Contact

1. Name and Title of Application Contact :

Name : Bertha Goldenberg, P.E.
Title : Environmental Coordinator

2. Application Contact Mailing Address :

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

3. Application Contact Telephone Numbers :

Telephone : (305)669-5711 Fax : (305)669-5717

Application Comment

The purpose of this application is to obtain construction permits to remove existing pumps and engines no. 1 and 2 and to replace existing pumps and engines nos. 3 through 5 with pumps and natural gas powered engines no. 3, 4, and 5.

The application fee of $750 submitted for this application consists of $250 for the replacement of engine-driven pump no. 5 (Net Potential Decrease of 71 tpy NOx emissions [existing 90 tpy less proposed of 19 tpy]), $250 for the replacement of engine-driven pump nos. 3 & 4 (Net Potential Decrease of -100 tpy NOx emissions [existing 121 tpy less proposed of 21 tpy]) and $250 for a minor revision for engine no. 6 limiting fuel consumption.

Total NOx potential decrease in tons for proposed natural gas powered engines no. 3, 4 & 5 is 171 tpy. Information included in these construction permit applications should be assimilated into the Title V operating permit application submitted to the Department.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility, Location, and Type

1. Facility UTM Coordinates :
   Zone : 17 East (km) : 566.60 North (km) : 2843.50

2. Facility Latitude/Longitude :
   Latitude (DD/MM/SS) : 25 42 30 Longitude (DD/MM/SS) : 80 20 10

3. Governmental Facility Code :	4. Facility Status Code :	5. Facility Major Group SIC Code :	6. Facility SIC(s) :
3	A	49	4941

7. Facility Comment :

The facility is a municipally owned water treatment plant providing public water supply.

Facility Contact

1. Name and Title of Facility Contact :

Tom Segars
Superintendent of Water Production

2. Facility Contact Mailing Address :
   Organization/Firm : Miami-Dade Water & Sewer Department
   Street Address : 700 W. Second Ave.
   City : Hialeah State : FL Zip Code : 33010-0006

3. Facility Contact Telephone Numbers :
   Telephone : (305)888-2522 Fax : (305)889-0156

Facility Regulatory Classifications

1. Small Business Stationary Source?	N
2. Title V Source?	Y
3. Synthetic Non-Title V Source?	N
4. Major Source of Pollutants Other than Hazardous Air Pollutants (HAPs)?	Y
5. Synthetic Minor Source of Pollutants Other than HAPs?	N
6. Major Source of Hazardous Air Pollutants (HAPs)?	N
7. Synthetic Minor Source of HAPs?	N
8. One or More Emissions Units Subject to NSPS?	Y
9. One or More Emission Units Subject to NESHAP?	N
10. Title V Source by EPA Designation?	Y
11. Facility Regulatory Classifications Comment :	

B. FACILITY REGULATIONS

Rule Applicability Analysis

The Alexander Orr, Jr. WTP is a major source of air pollution and is required to obtain a Title V operating permit (Chapter 62-213, FAC). An application has been submitted to the Department. A PSD determination is also under review by the Department for this Facility (Chapter 62-204, FAC).

This application requests a construction permit to replace existing sources and a minor revision to an existing source. General Preconstruction Review applies to the new construction (Chapter 62-212.300, FAC).

B. FACILITY REGULATIONS

List of Applicable Regulations

62-204.240, FAC: Ambient Air Quality Standards

62-212.300, FAC: General Preconstruction Review

62-296.320, FAC: General Pollutant Emissions Limiting Standards

C. FACILITY POLLUTANTS

Facility Pollutant Information

1. Pollutant Emitted	2. Pollutant Classification
PM	B
NOX	A
CO	A

D. FACILITY POLLUTANT DETAIL INFORMATION

Facility Pollutant Information Pollutant 4

1. Pollutant Emitted : PM
2. Requested Emissions Cap : (lbs/hour) (tons/year)
3. Basis for Emissions Cap Code :
4. Facility Pollutant Comment : No emissions cap is requested for PM.

D. FACILITY POLLUTANT DETAIL INFORMATION

Facility Pollutant Information Pollutant 1

1. Pollutant Emitted : NOX
2. Requested Emissions Cap : (lbs/hour) (tons/year)
3. Basis for Emissions Cap Code :
4. Facility Pollutant Comment : No emissions cap is requested for NOx.

D. FACILITY POLLUTANT DETAIL INFORMATION

Facility Pollutant Information Pollutant 2

1. Pollutant Emitted : CO
2. Requested Emissions Cap : (lbs/hour) (tons/year)
3. Basis for Emissions Cap Code :
4. Facility Pollutant Comment : No emissions cap is requested for CO.

D. FACILITY SUPPLEMENTAL INFORMATION

Supplemental Requirements for All Applications

1. Area Map Showing Facility Location :	Attachment 1
2. Facility Plot Plan :	Attachment 2
3. Process Flow Diagram(s) :	NA
4. Precautions to Prevent Emissions of Unconfined Particulate Matter :	NA
5. Fugitive Emissions Identification :	NA
6. Supplemental Information for Construction Permit Application :	Attachment 3

Additional Supplemental Requirements for Category I Applications Only

7. List of Proposed Exempt Activities :	NA
8. List of Equipment/Activities Regulated under Title VI :	NA
9. Alternative Methods of Operation :	NA
10. Alternative Modes of Operation (Emissions Trading) :	NA
11. Identification of Additional Applicable Requirements :	NA
12. Compliance Assurance Monitoring Plan :	NA
13. Risk Management Plan Verification :	NA
14. Compliance Report and Plan :	NA
15. Compliance Certification (Hard-copy Required) :	NA

III. EMISSIONS UNIT INFORMATION

A. TYPE OF EMISSIONS UNIT
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 1

Pump Engine Nos. 3, 4 (Natural Gas)

Type of Emissions Unit Addressed in This Section

1. Regulated or Unregulated Emissions Unit? Check one :

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

2. Single Process, Group of Processes, or Fugitive Only? Check one :

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

III. EMISSIONS UNIT INFORMATION

A. TYPE OF EMISSIONS UNIT
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 2

Pump Engine No. 5 (Natural Gas)

Type of Emissions Unit Addressed in This Section

1. Regulated or Unregulated Emissions Unit? Check one :

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

2. Single Process, Group of Processes, or Fugitive Only? Check one :

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

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III. EMISSIONS UNIT INFORMATION

A. TYPE OF EMISSIONS UNIT
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 3

Pump Engine No. 6 (Dual Fuel)

Type of Emissions Unit Addressed in This Section

1. Regulated or Unregulated Emissions Unit? Check one :

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

2. Single Process, Group of Processes, or Fugitive Only? Check one :

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

Emissions Unit Information Section 1

B. GENERAL EMISSIONS UNIT INFORMATION
(Regulated and Unregulated Emissions Units)

Emissions Unit Description and Status

1. Description of Emissions Unit Addressed in This Section : Pump Engine Nos. 3, 4 (Natural Gas)		
2. Emissions Unit Identification Number : 003-004 [ ] No Corresponding ID [ ] Unknown		
3. Emissions Unit Status Code : A	4. Acid Rain Unit? [ ] Yes [X] No	5. Emissions Unit Major Group SIC Code : 49
6. Emissions Unit Comment : Pump engine nos. 1 & 2 (Emission Unit ID Nos. 001-002) will be permanently removed from service. Pump engine nos. 3, & 4 each drive a 20 mgd pump.		

Emissions Unit Information Section 2

B. GENERAL EMISSIONS UNIT INFORMATION
(Regulated and Unregulated Emissions Units)

Emissions Unit Description and Status

1. Description of Emissions Unit Addressed in This Section : Pump Engine No. 5 (Natural Gas)		
2. Emissions Unit Identification Number : 005 [ ] No Corresponding ID [ ] Unknown		
3. Emissions Unit Status Code : A	4. Acid Rain Unit? [ ] Yes [X] No	5. Emissions Unit Major Group SIC Code : 49
6. Emissions Unit Comment : Pump engine no. 5 drives a 50 mgd pump.		

Emissions Unit Information Section 3

B. GENERAL EMISSIONS UNIT INFORMATION
(Regulated and Unregulated Emissions Units)

Emissions Unit Description and Status

1. Description of Emissions Unit Addressed in This Section : Pump Engine No. 6 (Dual Fuel)		
2. Emissions Unit Identification Number : 006 [ ] No Corresponding ID [ ] Unknown		
3. Emissions Unit Status Code : A	4. Acid Rain Unit? [ ] Yes [X] No	5. Emissions Unit Major Group SIC Code : 49
6. Emissions Unit Comment : Pump engine no. 6 drives a 50 mgd pump.		

Emissions Unit Information Section 1
Pump Engine Nos. 3, 4 (Natural Gas)

Emissions Unit Control Equipment 1

1. Description : BACT for NOx emmisions (air fuel ratio controller for best economy and emmisions. NOx-CO2 sensor in the exhaust).
2. Control Device or Method Code : 99

Emissions Unit Information Section 2
Pump Engine No. 5 (Natural Gas)

Emissions Unit Control Equipment 1

1. Description : BACT for NOx emmisions (air fuel ratio controller for best economy and emmisions. NOx-CO2 sensor in the exhaust).
2. Control Device or Method Code : 99

C. EMISSIONS UNIT DETAIL INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 1
Pump Engine Nos. 3, 4 (Natural Gas)

Emissions Unit Details

1. Initial Startup Date :	01-Jan-2001
2. Long-term Reserve Shutdown Date :	
3. Package Unit : Manufacturer : Waukesha	Model Number : 3521GL
4. Generator Nameplate Rating :	MW
5. Incinerator Information :	
Dwell Temperature :	Degrees Fahrenheit
Dwell Time :	Seconds
Incinerator Afterburner Temperature :	Degrees Fahrenheit

Emissions Unit Operating Capacity

1. Maximum Heat Input Rate :	5	mmBtu/hr	
2. Maximum Incinerator Rate :		lb/hr	tons/day
3. Maximum Process or Throughput Rate :			
4. Maximum Production Rate :	738	bhp	
5. Operating Capacity Comment : Engine rpm and fuel consumption are indicators of operating capacity. Maximum Heat Input Rate: 5.44 mmBtu/hour			

Emissions Unit Operating Schedule

Requested Maximum Operating Schedule :	
24 hours/day	7 days/week
52 weeks/year	8,760 hours/year

C. EMISSIONS UNIT DETAIL INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 2
Pump Engine No. 5 (Natural Gas)

Emissions Unit Details

1. Initial Startup Date :	01-Jan-2001
2. Long-term Reserve Shutdown Date :	
3. Package Unit : Manufacturer : Waukesha	Model Number : 8L-AT27GL
4. Generator Nameplate Rating :	MW
5. Incinerator Information :	
Dwell Temperature :	Degrees Fahrenheit
Dwell Time :	Seconds
Incinerator Afterburner Temperature :	Degrees Fahrenheit

Emissions Unit Operating Capacity

1. Maximum Heat Input Rate :	14	mmBtu/hr	
2. Maximum Incinerator Rate :		lb/hr	tons/day
3. Maximum Process or Throughput Rate :			
4. Maximum Production Rate :	2090	bhp	
5. Operating Capacity Comment : Engine rpm and fuel consumption are indicators of operating capacity. Maximum Heat Input Rate: 13.70 mmBtu/hour			

Emissions Unit Operating Schedule

Requested Maximum Operating Schedule :	
24 hours/day	7 days/week
52 weeks/year	8,760 hours/year

C. EMISSIONS UNIT DETAIL INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 3
Pump Engine No. 6 (Dual Fuel)

Emissions Unit Details

1. Initial Startup Date :	01-May-1961
2. Long-term Reserve Shutdown Date :	
3. Package Unit :	
Manufacturer : Enterprise	Model Number : VO-61001
4. Generator Nameplate Rating :	MW
5. Incinerator Information :	
Dwell Temperature :	Degrees Fahrenheit
Dwell Time :	Seconds
Incinerator Afterburner Temperature :	Degrees Fahrenheit

Emissions Unit Operating Capacity

1. Maximum Heat Input Rate :	15	mmBtu/hr	
2. Maximum Incinerator Rate :		lb/hr	tons/day
3. Maximum Process or Throughput Rate :			
4. Maximum Production Rate :	2113	hp	
5. Operating Capacity Comment :			
Maximum Heat Input Rate: 15.31 mmBtu/hour			

Emissions Unit Operating Schedule

Requested Maximum Operating Schedule :	
24 hours/day	7 days/week
52 weeks/year	8,760 hours/year

D. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

Emissions Unit Information Section 1
Pump Engine Nos. 3, 4 (Natural Gas)

Rule Applicability Analysis

General Preconstruction Review (Chapter 62-212.300, FAC) applies to the application for this emissions unit.

D. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

Emissions Unit Information Section 2
Pump Engine No. 5 (Natural Gas)

Rule Applicability Analysis

General Preconstruction Review (Chapter 62-212.300, FAC) applies to the application for this emissions unit.

D. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

Emissions Unit Information Section 3
Pump Engine No. 6 (Dual Fuel)

Rule Applicability Analysis

Minor Revision Existing emissions unit.

List of Applicable Regulations

Chapter 62-212.300, FAC: General Preconstruction Review

List of Applicable Regulations

Chapter 62-212.300, FAC: General Preconstruction Review

E. EMISSION POINT (STACK/VENT) INFORMATION

Emissions Unit Information Section 2

Pump Engine No. 5 (Natural Gas)

Emission Point Description and Type :

1. Identification of Point on Plot Plan or Flow Diagram : # 5 SDR		
2. Emission Point Type Code : 1		
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking : (limit to 100 characters per point) SDR #5 (2nd from north end): vertical stack located outside the building with silencer.		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common :		
5. Discharge Type Code :	V	
6. Stack Height :	32	feet
7. Exit Diameter :	1.5	feet
8. Exit Temperature :	715	°F
9. Actual Volumetric Flow Rate :	1258	acfm
10. Percent Water Vapor :		%
11. Maximum Dry Standard Flow Rate :		dscfm
12. Nonstack Emission Point Height :		feet
13. Emission Point UTM Coordinates : Zone : 17 East (km) : 566.598 North (km) : 2843.550		
14. Emission Point Comment :		

E. EMISSION POINT (STACK/VENT) INFORMATION

Emissions Unit Information Section 3

Pump Engine No. 6 (Dual Fuel)

Emission Point Description and Type :

1. Identification of Point on Plot Plan or Flow Diagram : #6 Enterprise		
2. Emission Point Type Code : 1		
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking : (limit to 100 characters per point) Enterprise #6 (1st stack from north end): vertical stack with silencer outside of the building.		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common : #6 Enterprise		
5. Discharge Type Code :	V	
6. Stack Height :	31	feet
7. Exit Diameter :	1.0	feet
8. Exit Temperature :	735	°F
9. Actual Volumetric Flow Rate :	1392	acfm
10. Percent Water Vapor :		%
11. Maximum Dry Standard Flow Rate :		dscfm
12. Nonstack Emission Point Height :		feet
13. Emission Point UTM Coordinates : Zone : 17 East (km) : 566.598 North (km) : 2843.570		
14. Emission Point Comment :		

E. EMISSION POINT (STACK/VENT) INFORMATION

Emissions Unit Information Section 1

Pump Engine Nos. 3, 4 (Natural Gas)

Emission Point Description and Type :

1. Identification of Point on Plot Plan or Flow Diagram :	# 3 CC, # 4 CC	
2. Emission Point Type Code :	3	
3. Descriptions of Emission Points Comprising this Emissions Unit : # 3 CC, Pump Engine No. 3 (4th from north end): vertical stack outside building with silencer.		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common : #3CC, #4CC		
5. Discharge Type Code :	V	
6. Stack Height :	32	feet
7. Exit Diameter :	1.00	feet
8. Exit Temperature :	712	°F
9. Actual Volumetric Flow Rate :	1,222	acfm
10. Percent Water Vapor :		%
11. Maximum Dry Standard Flow Rate :		dscfm
12. Nonstack Emission Point Height :		feet
13. Emission Point UTM Coordinates : Zone : 17 East (km) : 566.598 North (km) : 2,843.531		
14. Emission Point Comment :		

E. EMISSION POINT (STACK/VENT) INFORMATION

Emissions Unit Information Section 1

Pump Engine Nos. 3, 4 (Natural Gas)

Emission Point Description and Type :

1. Identification of Point on Plot Plan or Flow Diagram :	# 3 CC, # 4 CC
2. Emission Point Type Code :	3
3. Descriptions of Emission Points Comprising this Emissions Unit :	
# 4 CC Engine No. 4 (3rd from north end): vertical stack outside building with silencer.	
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common :	
#3CC, #4CC	
5. Discharge Type Code :	V
6. Stack Height :	32 feet
7. Exit Diameter :	1.00 feet
8. Exit Temperature :	712 °F
9. Actual Volumetric Flow Rate :	1,222 acfm
10. Percent Water Vapor :	%
11. Maximum Dry Standard Flow Rate :	dscfm
12. Nonstack Emission Point Height :	feet
13. Emission Point UTM Coordinates :	
Zone : 17 East (km) : 566.598 North (km) : 2,843.531	
14. Emission Point Comment :	

F. SEGMENT (PROCESS/FUEL) INFORMATION

Emissions Unit Information Section 1

Pump Engine Nos. 3, 4 (Natural Gas)

Segment Description and Rate : Segment 1

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) : Natural gas powered internal combustion engines (emissions related to thousand Cubic feet burned)	
2. Source Classification Code (SCC) : 2-02-004-01	
3. SCC Units : Million Cubic Feet Burned (all gaseous fuels)	
4. Maximum Hourly Rate : 0.01	5. Maximum Annual Rate : 100.85
6. Estimated Annual Activity Factor : 0.90	
7. Maximum Percent Sulfur :	8. Maximum Percent Ash :
9. Million Btu per SCC Unit : 1,058	
10. Segment Comment : Maximum hourly & annual fuel rates are based on brake specific fuel consumption of 7,377 BTU/bhp-hr. Annual fuel rate is for both units. Pump Engine Nos. 3 & 4 each consume 0.0058 MMCF/hr at rated capacity.	

F. SEGMENT (PROCESS/FUEL) INFORMATION

Emissions Unit Information Section 2

Pump Engine No. 5 (Natural Gas)

Segment Description and Rate : Segment 1

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) : Natural gas powered internal combustion engines (emissions related to millions cubic feet burned)	
2. Source Classification Code (SCC) : 2-02-004-01	
3. SCC Units : Million Cubic Feet Burned (all gaseous fuels)	
4. Maximum Hourly Rate : 0.01	5. Maximum Annual Rate : 126.98
6. Estimated Annual Activity Factor : 0.90	
7. Maximum Percent Sulfur :	8. Maximum Percent Ash :
9. Million Btu per SCC Unit : 1,058	
10. Segment Comment : Maximum hourly & annual fuel rates are based on brake specific fuel consumption of 6,556 BTU/bhp-hr. Pump Engine No. 5 consumes 0.0145 MMCF/hr at rated capacity.	

F. SEGMENT (PROCESS/FUEL) INFORMATION

Emissions Unit Information Section 3

Pump Engine No. 6 (Dual Fuel)

Segment Description and Rate : Segment 1

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) : Dual fuel internal combustion engines (emissions related to million cubic feet burned)	
2. Source Classification Code (SCC) : 2-02-002-01	
3. SCC Units : Million Cubic Feet Burned (all gaseous fuels)	
4. Maximum Hourly Rate : 0.01	5. Maximum Annual Rate : 122.64
6. Estimated Annual Activity Factor : 0.90	
7. Maximum Percent Sulfur : 0.05	8. Maximum Percent Ash :
9. Million Btu per SCC Unit : 1,058	
10. Segment Comment : Pump Engine No. 6 consumes 0.014 mmcf/hr natural gas and 15 gal/hr diesel fuel at full capacity when operating in natural gas mode with diesel fuel used as pilot fuel. Pump Engine No. 6 consumes 116 gal/hr diesel fuel at full capacity when operating in full diesel mode.	

F. SEGMENT (PROCESS/FUEL) INFORMATION

Emissions Unit Information Section 3

Pump Engine No. 6 (Dual Fuel)

Segment Description and Rate : Segment 2

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) : Diesel internal combustion engine (emissions related to thousand gallons)	
2. Source Classification Code (SCC) : 2-02-002-01	
3. SCC Units : Thousand Gallons Burned (all liquid fuels)	
4. Maximum Hourly Rate : 0.12	5. Maximum Annual Rate : 1,016.16
6. Estimated Annual Activity Factor : 0.10	
7. Maximum Percent Sulfur : 0.05	8. Maximum Percent Ash :
9. Million Btu per SCC Unit : 132	
10. Segment Comment : Pump Engine No. 6 consumes 116 gallons/hr diesel fuel in pure diesel fueled mode of operation, 15 gallons/hr diesel for pilot fuel when using natual gas as primary fuel.	

G. EMISSIONS UNIT POLLUTANTS
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 1
Pump Engine Nos. 3, 4 (Natural Gas)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
1 - NOX			EL
2 - CO			NS

G. EMISSIONS UNIT POLLUTANTS
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 2
Pump Engine No. 5 (Natural Gas)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
1 - NOX			EL
2 - CO			NS

G. EMISSIONS UNIT POLLUTANTS
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 3
Pump Engine No. 6 (Dual Fuel)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
1 - NOX			EL
2 - CO			NS

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1
Pump Engine Nos. 3, 4 (Natural Gas)

Pollutant Potential/Estimated Emissions : Pollutant 1

1. Pollutant Emitted : **NOX**
2. Total Percent Efficiency of Control : %
3. Potential Emissions : 2.40 lb/hour 21.00 tons/year
4. Synthetically Limited? [ ] Yes [X] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor : Reference : Manufacturer
7. Emissions Method Code : 5
8. Calculations of Emissions : Manufacturer Supplied NOx emissions: 1.5 g/bhp-hr NOx, each Hourly Emissions: (1 engine) x (738 bhp) x (1.5 g/bhp-hr NOx) x (1 lb/454 g) = 2.4 lbs/hr. Annual Emissions: (2 engines) x (738 bhp) x (1.5 g/bhp-hr NOx) x (1 lb/454 g) x (8,760 hr/yr) x (ton/2,000 lb) = 21 tpy
9. Pollutant Potential/Estimated Emissions Comment : Hourly emissions are for a single unit. Annual emissions are for both units 3 and 4.

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1
Pump Engine Nos. 3, 4 (Natural Gas)

Pollutant Potential/Estimated Emissions : Pollutant 2

1. Pollutant Emitted : **CO**
2. Total Percent Efficiency of Control : %
3. Potential Emissions : 4.30 lb/hour 38.00 tons/year
4. Synthetically Limited? [X] Yes [ ] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor : Reference : Manufacturer
7. Emissions Method Code :
8. Calculations of Emissions : Manufacturer Supplied CO emissions: 2.7 g/bhp-hr NOx, each Hourly Emissions: (1 engine) x (738 bhp) x (2.7 g/bhp-hr CO) x (1 lb/454 g) = 4.3 lbs/hr. Annual Emissions: (2 engines) x (738 bhp) x (2.7 g/bhp-hr CO) x (1 lb/454 g) x (8,760 hr/yr) x (ton/2,000 lb) = 38 tpy
9. Pollutant Potential/Estimated Emissions Comment : Hourly emissions are for a single unit. Annual emissions are for units 3 and 4.

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2
Pump Engine No. 5 (Natural Gas)

Pollutant Potential/Estimated Emissions : Pollutant 1

1. Pollutant Emitted : **NOX**
2. Total Percent Efficiency of Control : %
3. Potential Emissions : 4.60 lb/hour 20.00 tons/year
4. Synthetically Limited? [X] Yes [ ] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor : Reference : Manufacturer
7. Emissions Method Code : 5
8. Calculations of Emissions : Manufacturer Supplied NOx emissions: 1.0 g/bhp-hr NOx Hourly Emissions: (2090 bhp) x (1.0 g/bhp-hr NOx) x (1 lb/454 g) = 4.6 lbs/hr. Annual Emissions: (2090 bhp) x (1.0 g/bhp-hr NOx) x (1 lb/454 g) x (8,760 hr/yr) x (ton/2,000 lb) = 20 tpy
9. Pollutant Potential/Estimated Emissions Comment : Manufacturer Supplied NOx emissions: 1.0 g/bhp-hr NOx at full load.

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2
Pump Engine No. 5 (Natural Gas)

Pollutant Potential/Estimated Emissions : Pollutant 2

1. Pollutant Emitted : **CO**
2. Total Percent Efficiency of Control : %
3. Potential Emissions : 6.90 lb/hour 30.00 tons/year
4. Synthetically Limited? [X] Yes [ ] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor : Reference : Manufacturer
7. Emissions Method Code :
8. Calculations of Emissions : Manufacturer Supplied CO emissions: 1.5 g/bhp-hr CO Hourly Emissions: (2090 bhp) x (1.5 g/bhp-hr CO) x (1 lb/454 g) = 6.9 lbs/hr. Annual Emissions: (2090 bhp) x (1.5 g/bhp-hr CO) x (1 lb/454 g) x (8,760 hr/yr) x (ton/2,000 lb) = 30 tpy
9. Pollutant Potential/Estimated Emissions Comment : Manufacturer Supplied CO emissions: 1.5 g/bhp-hr CO at full load.

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 3
Pump Engine No. 6 (Dual Fuel)

Pollutant Potential/Estimated Emissions : Pollutant 1

1. Pollutant Emitted : **NOX**
2. Total Percent Efficiency of Control : %
3. Potential Emissions : 29.40 lb/hour 129.00 tons/year
4. Synthetically Limited? [ ] Yes [X] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor : Reference : Historical Tests
7. Emissions Method Code : 1
8. Calculations of Emissions : Based on source test results: 1.92 lb/mmbtu-hr NOx Hourly Emissions: (1.92 lb/mmbtu-hr NOx) x (15.31 mmbtu) = 29.4 lbs/hr Annual Emissions: (1.92 lb/mmbtu-hr NOx) x (15.31 mmbtu) x (8,760 hr/yr) x (ton/2,000 lb) = 129 tpy
9. Pollutant Potential/Estimated Emissions Comment : Test Run #1, dated 26-Sep-97. Tested in dual fuel mode only.

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 3
Pump Engine No. 6 (Dual Fuel)

Pollutant Potential/Estimated Emissions : Pollutant 2

1. Pollutant Emitted : **CO**
2. Total Percent Efficiency of Control : %
3. Potential Emissions : 12.50 lb/hour 55.00 tons/year
4. Synthetically Limited? [ ] Yes [X] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor : Reference : SCC 20200402
7. Emissions Method Code : 3
8. Calculations of Emissions : Hourly Emissions: (5.9 lb/1000 hp-hr CO) x (2,113 hp) = 12 lbs/hr Annual Emissions: (5.9 lb/1000 hp-hr CO) x (2,113 hp) x (8,760 hr/yr) x (ton/2,000 lb) = 55 tpy
9. Pollutant Potential/Estimated Emissions Comment : SCC: Internal Combustion Engines - Industrial, Large Bore Dual Fuel

Emissions Unit Information Section 1
Pump Engine Nos. 3, 4 (Natural Gas)

Pollutant Information Section 1

Allowable Emissions 1

1. Basis for Allowable Emissions Code :	AMBIENT			
2. Future Effective Date of Allowable Emissions :	01-Jan-2001			
3. Requested Allowable Emissions and Units :	0.44	lb/MMBTU		
4. Equivalent Allowable Emissions :	2.40	lb/hour	21.00	tons/year
5. Method of Compliance : Annual stack testing for NOx - EPA Method 7 (or equivalent)				
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : Future Effective Date of Allowable dependent on the Replacement of the Existing Units. Monitoring of fuel consumption and engine operating parameters.				

Emissions Unit Information Section 2
Pump Engine No. 5 (Natural Gas)

Pollutant Information Section 1

Allowable Emissions 1

1. Basis for Allowable Emissions Code :	AMBIENT			
2. Future Effective Date of Allowable Emissions :	01-Jan-2001			
3. Requested Allowable Emissions and Units :	0.34	lb/MMBTU		
4. Equivalent Allowable Emissions :	4.60	lb/hour	20.00	tons/year
5. Method of Compliance : Annual stack testing for NOx-EPA Method 7 (or equivalent)				
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : Future Effective Date of Allowable dependent on the Replacement of the Existing Units. Monitoring of fuel consumption and engine operating parameters.				

Emissions Unit Information Section 3
Pump Engine No. 6 (Dual Fuel)

Pollutant Information Section 1

Allowable Emissions 1

1. Basis for Allowable Emissions Code :	AMBIENT			
2. Future Effective Date of Allowable Emissions :				
3. Requested Allowable Emissions and Units :	1.92	lb/mmbtu-hr		
4. Equivalent Allowable Emissions :	29.40	lb/hour	128.40	tons/year
5. Method of Compliance : Annual stack testing for NOx-EPA Method 7 (or equivalent)				
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : Requested modification of existing permit conditions. Monitoring of fuel consumption and engine operating parameters. Limit fuel input to engine no 6 to 15.3 mmbtu-hr and 134,000 mmbtu-yr. Requested Allowable Emissions for Diesel fuel only 4.75 lbs/mmbtu-hr.				

I. VISIBLE EMISSIONS INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 1
Pump Engine Nos. 3, 4 (Natural Gas)

Visible Emissions Limitation : Visible Emissions Limitation 1

1. Visible Emissions Subtype :	VE	
2. Basis for Allowable Opacity :	RULE	
3. Requested Allowable Opacity :		
Normal Conditions :	20	%
Exceptional Conditions :	40	%
Maximum Period of Excess Opacity Allowed :	2	min/hour
4. Method of Compliance : Perform annual VE Compliance monitoring using EPA Method 9.		
5. Visible Emissions Comment :		

I. VISIBLE EMISSIONS INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 2
Pump Engine No. 5 (Natural Gas)

Visible Emissions Limitation : Visible Emissions Limitation 1

1. Visible Emissions Subtype :	VE	
2. Basis for Allowable Opacity :	RULE	
3. Requested Allowable Opacity :		
Normal Conditions :	20	%
Exceptional Conditions :	40	%
Maximum Period of Excess Opacity Allowed :	2	min/hour
4. Method of Compliance : Perform annual VE Compliance monitoring using EPA Method 9.		
5. Visible Emissions Comment :		

I. VISIBLE EMISSIONS INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 3
Pump Engine No. 6 (Dual Fuel)

Visible Emissions Limitation : Visible Emissions Limitation 1

1. Visible Emissions Subtype :	VE	
2. Basis for Allowable Opacity :	RULE	
3. Requested Allowable Opacity :		
Normal Conditions :	20	%
Exceptional Conditions :	40	%
Maximum Period of Excess Opacity Allowed :	2	min/hour
4. Method of Compliance :		
Perform annual VE Compliance monitoring using EPA Method 9.		
5. Visible Emissions Comment :		

J. CONTINUOUS MONITOR INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section _____

Continuous Monitoring System : Continuous Monitor _____

1. Parameter Code :	2. Pollutant :
3. CMS Requirement :	
4. Monitor Information : Manufacturer : Model Number : Serial Number :	
5. Installation Date :	
6. Performance Specification Test Date :	
7. Continuous Monitor Comment :	

K. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENT TRACKING INFORMATION

Emissions Unit Information Section 1

Pump Engine Nos. 3, 4 (Natural Gas)

PSD Increment Consumption Determination

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

[ ] The emissions unit is undergoing PSD review as part of this application, or has undergone PSD review previously, for particulate matter or sulfur dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after January 6, 1975. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after January 6, 1975, but before December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

2. Increment Consuming for Nitrogen Dioxide?

[ ] The emissions unit addressed in this section is undergoing PSD review as part of this application, or has undergone PSD review previously, for nitrogen dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after February 8, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after February 8, 1988, but before March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] None of the above apply. If so, baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

3. Increment Consuming/Expanding Code :		
PM : U	SO2 : U	NO2 : U
4. Baseline Emissions :		
PM :	lb/hour	tons/year
SO2 :	lb/hour	tons/year
NO2 :		tons/year
5. PSD Comment :		

K. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENT TRACKING INFORMATION

Emissions Unit Information Section 2

Pump Engine No. 5 (Natural Gas)

PSD Increment Consumption Determination

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

[ ] The emissions unit is undergoing PSD review as part of this application, or has undergone PSD review previously, for particulate matter or sulfur dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after January 6, 1975. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after January 6, 1975, but before December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

2. Increment Consuming for Nitrogen Dioxide?

[ ] The emissions unit addressed in this section is undergoing PSD review as part of this application, or has undergone PSD review previously, for nitrogen dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after February 8, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after February 8, 1988, but before March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] None of the above apply. If so, baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

3. Increment Consuming/Expanding Code :		
PM : U	SO2 : U	NO2 : U
4. Baseline Emissions :		
PM :	lb/hour	tons/year
SO2 :	lb/hour	tons/year
NO2 :		tons/year
5. PSD Comment :		

K. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENT TRACKING INFORMATION

Emissions Unit Information Section 3

Pump Engine No. 6 (Dual Fuel)

PSD Increment Consumption Determination

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

[ ] The emissions unit is undergoing PSD review as part of this application, or has undergone PSD review previously, for particulate matter or sulfur dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after January 6, 1975. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after January 6, 1975, but before December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

2. Increment Consuming for Nitrogen Dioxide?

[ ] The emissions unit addressed in this section is undergoing PSD review as part of this application, or has undergone PSD review previously, for nitrogen dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after February 8, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after February 8, 1988, but before March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] None of the above apply. If so, baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

3. Increment Consuming/Expanding Code :

PM : U	SO2 : U	NO2 : U

4. Baseline Emissions :

PM :	lb/hour	tons/year
SO2 :	lb/hour	tons/year
NO2 :		tons/year

5. PSD Comment :

Unit in place since 1961, Permitted Dual Fuel with Full Diesel fuel capability. No Previous Operating

Permit restrictions.

L. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Emissions Unit Information Section 1

Pump Engine Nos. 3, 4 (Natural Gas)

Supplemental Requirements for All Applications

1. Process Flow Diagram :	NA
2. Fuel Analysis or Specification :	Attachment 4
3. Detailed Description of Control Equipment :	Attachment 5
4. Description of Stack Sampling Facilities :	Attachment 6
5. Compliance Test Report :	NA
6. Procedures for Startup and Shutdown :	Attachment 8
7. Operation and Maintenance Plan :	NA
8. Supplemental Information for Construction Permit Application :	Attachment 9
9. Other Information Required by Rule or Statue :	NA

Additional Supplemental Requirements for Category I Applications Only

10. Alternative Methods of Operations :	NA
11. Alterntive Modes of Operation (Emissions Trading) :	NA

12. Identification of Additional Applicable Requirements :	NA
13. Compliance Assurance Monitoring Plan :	NA

14. Acid Rain Application (Hard-copy Required) :

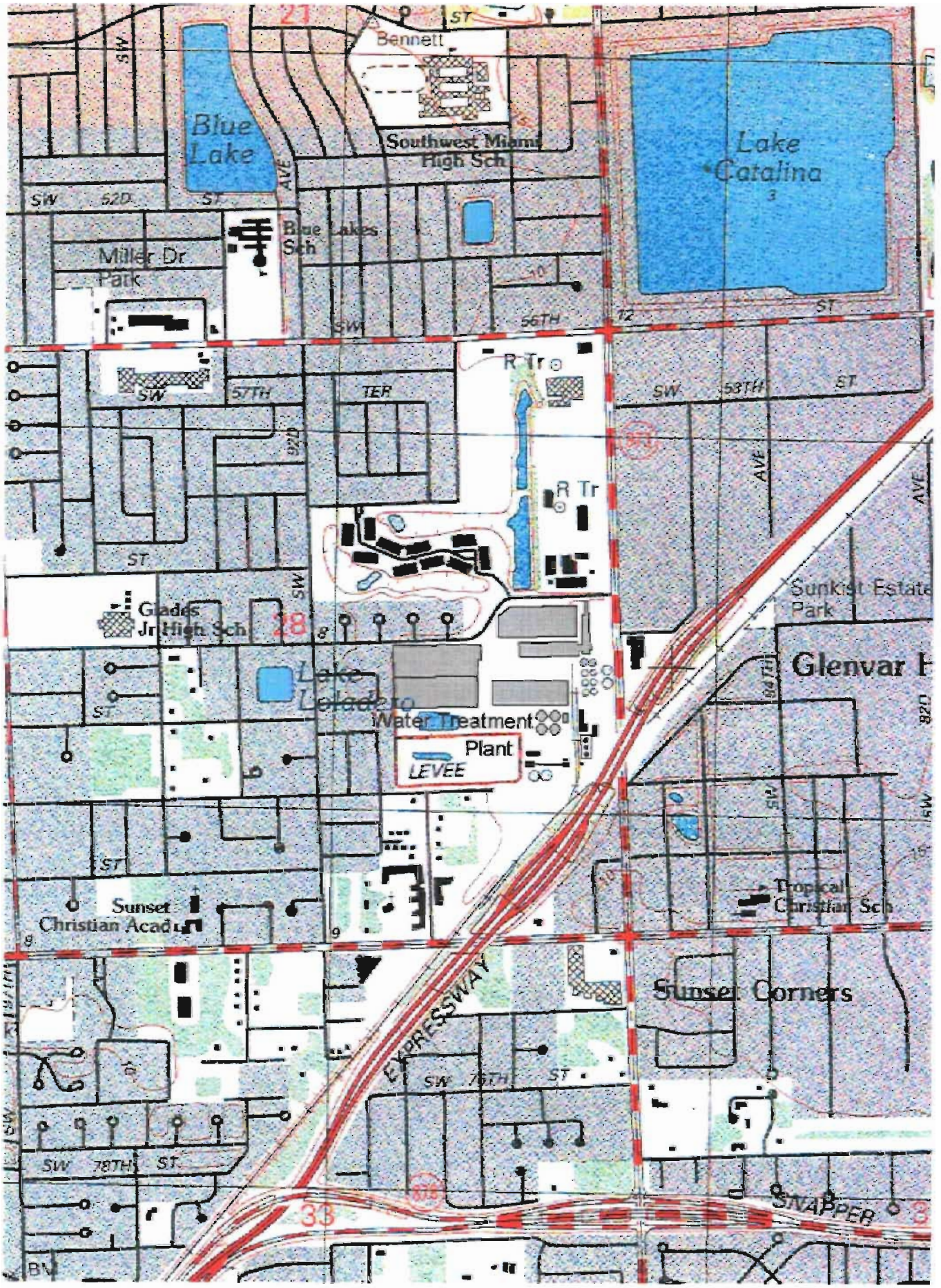
NA	Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
NA	Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
NA	New Unit Exemption (Form No. 62-210.900(1)(a)2.)
NA	Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)

Attachment 1

Area Map (USGS)
Aerial Photograph (USGS)

South Miami, Florida

BEST AVAILABLE COPY

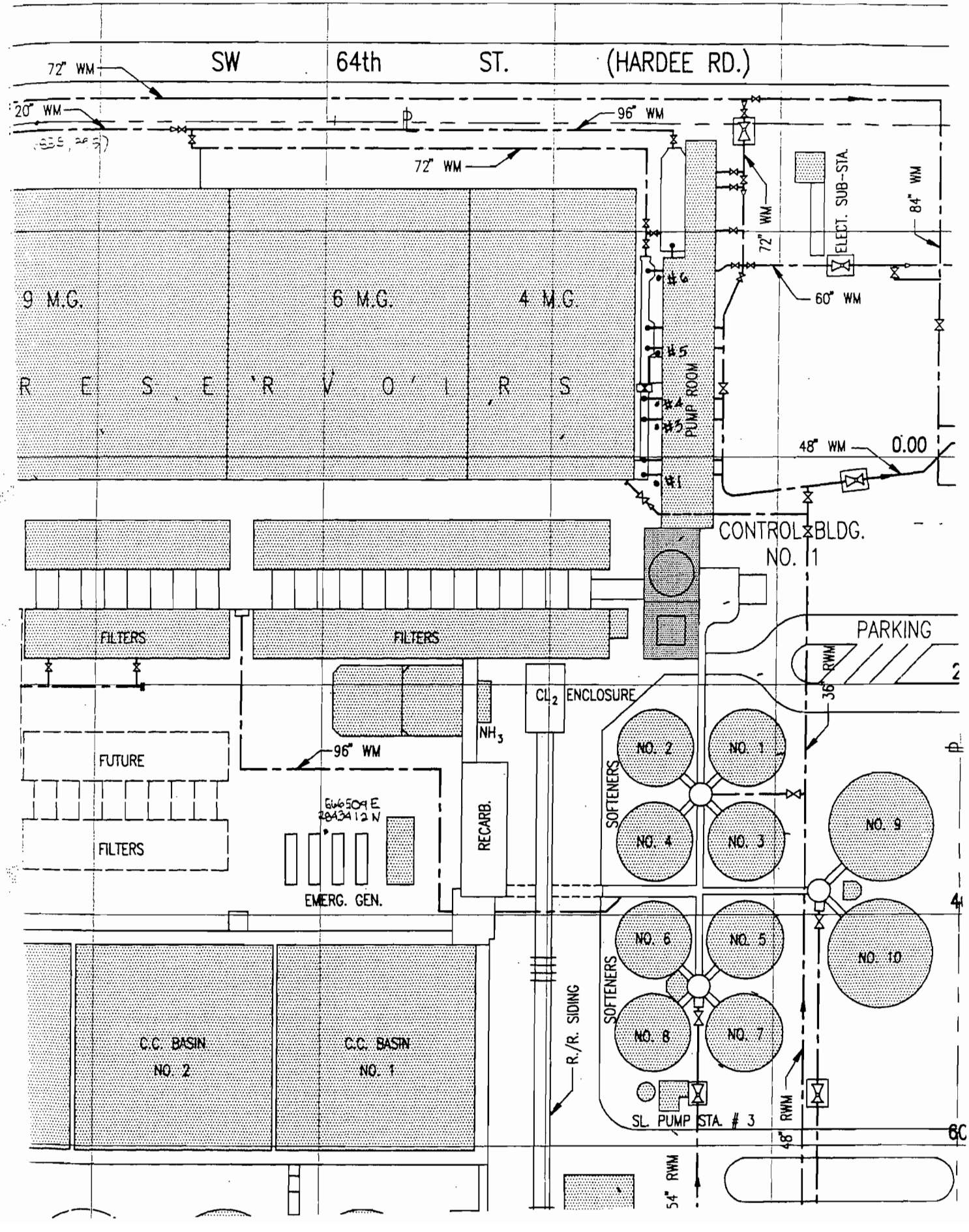



#6 Enterprise
#6 SDR
#4 CC
#3 CC
USGS
USGS

Attachment 2

Site Maps

Alexander Orr, Jr.
Water Treatment Plant



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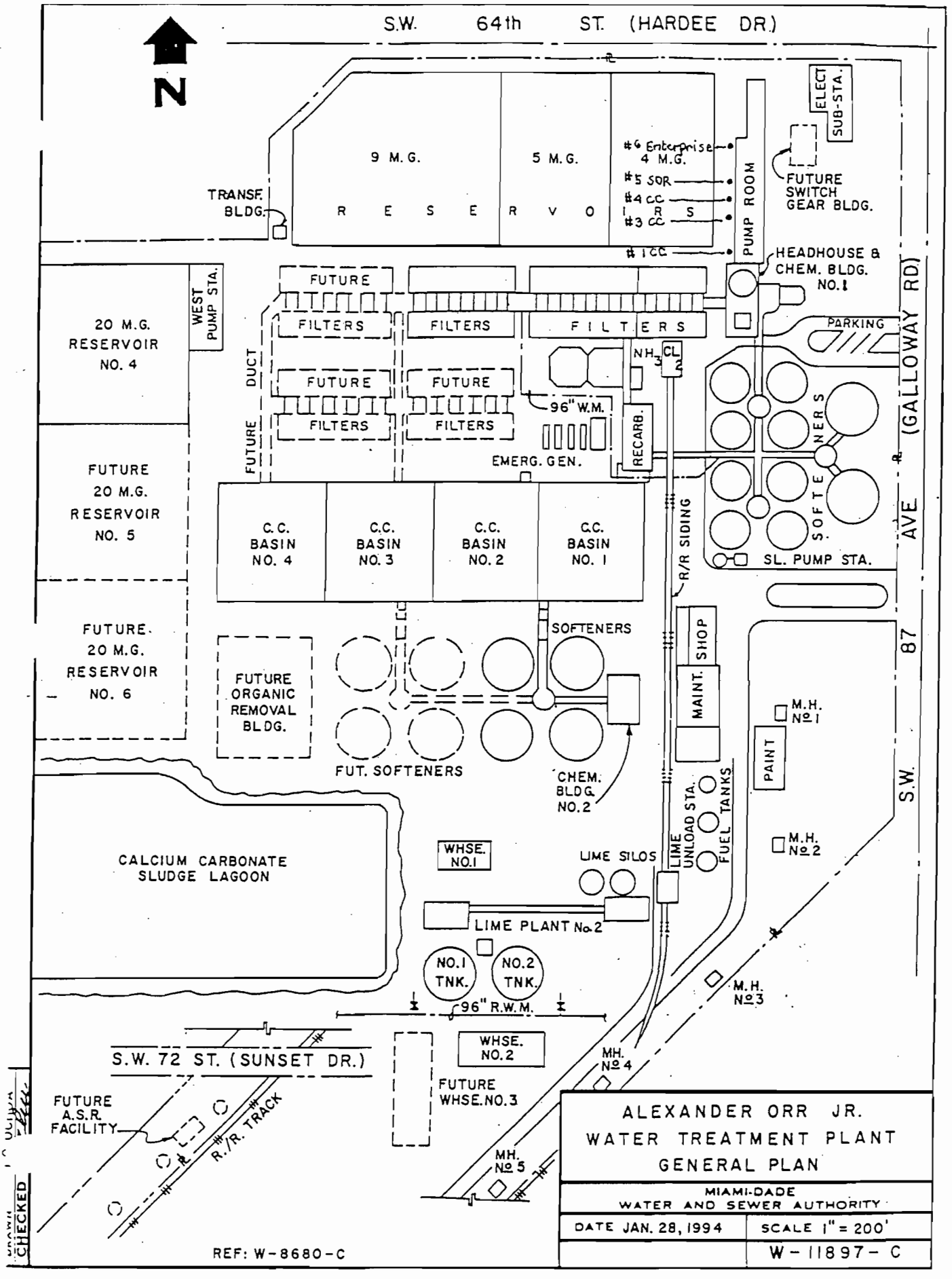

ALEXANDER ORR JR. WATER TREATMENT PLANT GENERAL PLAN

MIAMI-DADE WATER AND SEWER AUTHORITY

DATE JAN. 28, 1994	SCALE 1" = 200'
	W - 11897 - C

Attachment 3

Emission Calculations - Nox
Replacement Sources

Alexander Orr, Jr.
Water Treatment Plant

REAGAN EQUIPMENT CO., INC.
190 SOUTH BRYAN ROAD
DANIA, FL 33004

954.925.6300
FAX 954.925.5808

Wilfredo M. Fernandez
Miami-Dade Water and Sewer Department
3575 South Le Jeune Road
Miami, Florida 33233

August 31, 1998

Ref: Alexander Orr Jr. Water Treatment Plant

I have received the information that you had requested from me, regarding the emissions levels of the Waukesha engines, model 8L-AT27GL and the F3521GL and the exhaust emissions out of the engines are expected to be as follows:

8L-AT27GL

Load:	**100%**	**75%**	**50%**	**25%**
Bhp@1000 Rpm	**2090**	**1568**	**1045**	**N/A**
NOx:(g/bhp-hr)	**1.0**	**1.1**	**1.4**	**N/A**
CO:(g/bhp-hr)	**1.5**	**1.8**	**1.8**	**N/A**
NMHC:(g/bhp-hr)	**0.4**	**0.65**	**0.70**	**N/A**

F3521GL

Bhp@1200 Rpm	**738**	**554**	**369**	**N/A**
NOx:(g/bph-hr)	**1.5**	**1.2**	**1.0**	**N/A**
CO:(g/bhp-hr)	**2.65**	**2.65**	**3.0**	**N/A**
NMHC:(g-bhp-hr)	**1.0**	**1.2**	**1.6**	**N/A**

The factory does not have sufficient data to estimate 25% load emissions.

If you need further information or have some questions please contact me at (954) 925-6300

REAGAN EQUIPMENT CO., INC.

Sincerely Yours,

Robert C. Lopez
Sales Representative

MIAMI-DADE
WATER AND SEWER DEPT
RECEIVED
SEP 01 1998
ENGINEERING
DIVISION
(PROJECT MANAGER)

PROJECT FILE (CONTRACT W-655)

REAGAN EQUIPMENT CO., INC.
190 SOUTH BRYAN ROAD
DANIA, FL 33004

954.925.6300
FAX 954.925.5808

Wilfredo M. Fernandez
Miami-Dade Water and Sewer Department
3575 South Le Jeune Road
Miami, Florida 33233

September 9, 1998

Ref: Alexander Orr Jr. Water Treatment Plant

I have received the information that you had requested from me, regarding the fuel consumption of the Waukesha engines, model 8L-AT27GL and the F3521GL and the following fuel consumption are estimated at the following loads.

8L-AT27GL

Power and Speed	**Load**	**BSFC**
2090 Bhp @ 1000 Rpm	**100%**	**6556 Btu/bhp-hr**
1568 Bhp @ 750 Rpm	**75%**	**6337 Btu/bhp-hr**

The 8L-AT27GL engine can not pull full torque below 750 Rpm.

F3521GL

Power and Speed	**Load**	**BSFC**
738 Bhp @ 1200 Rpm	**100%**	**7377 Btu/bhp-hr**
554 Bhp @ 900 Rpm	**75%**	**6989 Btu/bhp-hr**

The F3521GL engine can not pull full torque below 800 Rpm.

If you need further information or have some questions please contact me (954) 925-6300

REAGAN EQUIPMENT CO., INC.

Sincerely Yours,

Robert C. Lopez
Sales Representative

MIAMI-DADE WATER AND SEWER DEPT.
RECEIVED
SEP 10 1998
ENGINEERING DIVISION
(PROJECT MANAGER)

PROJECT FILE (CONTRACT W-655)

Alexander Orr, Jr. Water Treatment Plant
Miami-Dade Water and Sewer Department
East Pump Room - Pump Replacement Project
Replacement of Pump Diesel Engines Nos. 1, 3 & 4
and Pump Dual Fueled Engine No. 5

Existing 3 - 825 HP DIESEL ENGINES, EACH DRIVING A PUMP
NOx RACT Testing 1996 & 1997, Emissions in Lbs/Hr.

	No. 1	No. 3	No.4	Avg.
1996	8.23	6.63	10.45	8.44
1997	9.13	7.85	12.71	9.90
Avg.	8.68	7.24	11.58	9.2

Proposed 2 - 738 HP Natural Gas Engines, each driving a pump.

Manufacturers supplied NOx emissions, g/bhp-hr:	1.5
Manufacturers supplied NOx emissions, lbs/hr:	2.4

Annual Potential Emissions

	Engines :	Hours ea.:	NOx lbs/hr:	Tons
Existing	3	8,760	9.2	121
Proposed	2	8,760	2.4	21
Net NOx Potential Increase (Decrease) in Tons:				(100)

Existing 1 - 1,500 HP Diesel Engine Driving Pump No. 5
NOx RACT Testing 1997, Emissions in Lbs/Hr.

	No. 5
1997	20.53

Proposed - 1,980 HP Natural Gas Engine, Driving Pump No. 5

Manufacturers supplied NOx emissions, g/bhp-hr:	1.0
Manufacturers supplied NOx emissions, lbs/hr:	4.4

Annual Potential Emissions

	Engines :	Hours ea.:	NOx lbs/hr:	Tons
Existing	1	8,760	20.5	90
Proposed	1	8,760	4.4	19
Net NOx Potential Increase (Decrease) in Tons:				(71)

(171)

Alexander Orr, Jr. Water Treatment Plant
Miami-Dade Water and Sewer Department
East Pump Room - Pump Replacement Project
Replacement of Pump Diesel Engines Nos. 1, 3 & 4
and Pump Dual Fueled Engine No. 5

Replacement Pump Engines Nos. 3 and 4 - Waukesha Model F3521GL

		Fuel Consumption				NOx Emissions					CO Emissions				
bhp	% load	BTU/bhp-hr	MMBTU/hr	scf/hr	Annual Rate MMCF	g/bhp-hr	g/hr	lb/hr	lb/MMBTU	Nox (tons) Annual	g/bhp-hr	g/hr	lb/hr	lb/MMBTU	CO (tons) Annual
738	100%	7377	5.44	5756	100.85	1.5	1,107	2.4	0.44	21	2.7	1,956	4.3	0.79	38
664	90%	7222	4.80	5078	88.97	1.4	930	2.0	0.42	18	2.7	1,793	3.9	0.81	34
554	75%	6989	3.87	4094	71.73	1.2	665	1.5	0.39	13	2.7	1,468	3.2	0.83	28

Replacement Pump Engine No. 5 - Waukesha Model 8L-AT27GL

		Fuel Consumption				NOx Emissions					CO Emissions				
bhp	% load	BTU/bhp-hr	MMBTU/hr	scf/hr	Annual Rate MMCF	g/bhp-hr	g/hr	lb/hr	lb/MMBTU	Nox (tons) Annual	g/bhp-hr	g/hr	lb/hr	lb/MMBTU	CO (tons) Annual
2090	100%	6556	13.70	14495	126.98	1.0	2,090	4.6	0.34	20	1.5	3,135	6.9	0.50	30
1881	90%	6468	12.17	12876	112.79	1.0	1,881	4.1	0.34	18	1.6	3,010	6.6	0.54	29
1568	75%	6336	9.93	10506	92.03	1.1	1,725	3.8	0.38	17	1.8	2,822	6.2	0.62	27

Notes: 1. Values for % load other that 100% and 75% are interpolated.
2. Fuel consumptions based on a heating value of 1058 Btu/cf as provided to City Gas by Florida Gas Transmission Company.
3. All calculated values rounded to most significant figure.
4. Annual Emissions for Replacement Pump Engines Nos. 3 & 4 are for both engines.

Attachment 4

Fuel Specifications
Natural Gas
Diesel Fuel

Alexander Orr, Jr.
Water Treatment Plant

NUI City Gas Company of Florida

Miami Division
955 East 25th Street
Hialeah, FL 33013-3498
Tel: (305) 691-8710
Fax: (305) 691-7112
www.nui.com

NUI Corporation (NYSE: NUI)

July 22, 1998

Mr. Wilfredo M. Fernandez
Miami Dade Water & Sewer Department
P.O. Box 330316
Miami, Florida 33233-0316

Re: Heating Value of natural gas

Dear Wilfredo:

Attached please find a fuel analysis provided to City Gas by Florida Gas Trnasmission Company. In it you will note that the heating value of the natural gas delivered to City Gas is 1058 Btu/cf at standard pressure and temperature

Please, call me if you have any questions or need additional information.

Sincerely,

Adrian S. Morera
Key Account Manager
Enclosure

cc: J. Pappas
M. Blanco-Pape
V. Fernandez-Cuervo
T. Chu
J. Murias
F. Sagastume
Project File (~~CO~~ WATER 46495)
R. O'Rourke

Spot Analysis of Natural Gas for Delivery in Florida

(West Palm Beach Chromatograph)

DATE: November 17, 1997

TIME: 06:12

Component Name	Mole %
Hexane	0.094
Propane	0.865
Isobutane	0.215
n-Butane	0.175
Isopentane	0.064
n-Pentane	0.037
Nitrogen	0.387
Methane	93.317
CO2	1.029
Ethane	3.814
Totals	100.000

Dry Btu/cf @ 14.730 psia and 60°F= 1058.4

Real Relative Density= 0.6037

Total Sulfur	NA PPM
H^2S	NA PPM
H^2O	4.41 lb/MMcf

COASTAL REFINING & MARKETING

Coastal
energy People

CUSTOMER NO.	INVOICE DATE	INVOICE NO.
MIAMID	12/02/96	D40579

METHOD OF DELIVERY
COMPANY TRUCK

SHIP TO:
MIAMI DADE WATER AND SEWR
PRESTON PLANT
1100 W 2 AVE PO J01428B
HIALEAH FL 33010

SOLD TO:

REFERENCE NO. 0361-MIAMID-D40579 MIAMI1

MIAMI DADE WATER SEWER
ATTN: ACCOUNTS PAYABLE
PO BOX 330316
MIAMI FL 33233-0316

TERMS: NET 30 DAYS DOI

BILLING INQUIRIES: CALL CUST SERVICE AT 1-800-(FL) 432-3691, (NAT'L) 327-2495

SALES/P.O. NUMBER: S081358

TICKET NUMBER	TICKET DATE	LOC CODE	DESCRIPTION	DS ST.	QUANTITY	UM	UNIT PRICE	AMOUNT
00103463	112796	PORT	DIESEL - 0.05 S MAX DSLS	FL	7436.30	GAL	~~.791500~~ .7865	~~5885.83~~ 5848.64 ~~5885.83~~
			SUBTOTAL		7436.30			
			COUNTY ROAD TAX - DIESEL	FL	7436.30	GAL	.117000	870.05
			DIESEL FUEL TAX - UNDYED	FL	7436.30	GAL	.125000	929.54
			COASTAL PROTECTION TAX	FL	7436.30	GAL	.000476	3.54
			WATER QUALITY TAX	FL	7436.30	GAL	.001190	8.85
			INLAND PROTECTION TAX	FL	7436.30	GAL	.019047	141.64

CAR # RECEIVED	DATE	V
00103463	11/27/96	

CHARGE TO ACCOUNT: 6498487-5201 POSTED

APPROVED BY: [signature] 12/12/96

DATE 12/5/96

PLEASE CODE AND ACKNOWLEDGE RECEIPT BY COB 12/6 SERVICES

UG A/P

FEIN: 84-0429897

CASH DISCOUNT	IF PAID BY	PAY THIS AMOUNT	INVOICE TOTAL
		7,839.45	~~7839.45~~ 7802.26

IF PAYMENT IS MADE VIA WIRE TRANSFER, PLEASE WIRE FUNDS TO
CITIBANK NA, NY,NY ACCT #4056-8303 ABA #021000089

The buyer agrees to a late payment charge of 1.00 % per month, 12.00 % per annum or the maximum permitted by law from the invoice due date and agrees to pay any collection or attorney fees if incurred in the collection of this invoice.

COMP	CUSTOMER	INVOICE NO
0361	MIAMID	D40579

AMOUNT PAID

PLEASE DETACH AND RETURN THIS PORTION WITH PAYMENT

REMIT TO:
COASTAL REFINING & MARKETING
P.O. BOX 65776, CHARLOTTE, N.C. 28265

0361 MIAMID D40579 000000 000000783945 000000783945

Attachment 5

Detailed Description of Control Equipment
Proposed Natural Gas Pump Engines

Alexander Orr, Jr.
Water Treatment Plant

L. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Emissions Unit Information Section 2

Pump Engine No. 5 (Natural Gas)

Supplemental Requirements for All Applications

1. Process Flow Diagram :	NA
2. Fuel Analysis or Specification :	Attachment 4
3. Detailed Description of Control Equipment :	Attachment 5
4. Description of Stack Sampling Facilities :	Attachment 6
5. Compliance Test Report :	NA
6. Procedures for Startup and Shutdown :	Attachment 8
7. Operation and Maintenance Plan :	
8. Supplemental Information for Construction Permit Application :	Attachment 9
9. Other Information Required by Rule or Statue :	NA

Additional Supplemental Requirements for Category I Applications Only

10. Alternative Methods of Operations :	NA
11. Alterntive Modes of Operation (Emissions Trading) :	NA

12. Identification of Additional Applicable Requirements :	NA
13. Compliance Assurance Monitoring Plan :	NA

14. Acid Rain Application (Hard-copy Required) :

NA	Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
NA	Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
NA	New Unit Exemption (Form No. 62-210.900(1)(a)2.)
NA	Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)

L. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Emissions Unit Information Section 3

Pump Engine No. 6 (Dual Fuel)

Supplemental Requirements for All Applications

1. Process Flow Diagram :	NA
2. Fuel Analysis or Specification :	Attachment 4
3. Detailed Description of Control Equipment :	NA
4. Description of Stack Sampling Facilities :	Attachment 6
5. Compliance Test Report :	Attachment 7
6. Procedures for Startup and Shutdown :	Attachment 8
7. Operation and Maintenance Plan :	NA
8. Supplemental Information for Construction Permit Application :	NA
9. Other Information Required by Rule or Statue :	NA

Additional Supplemental Requirements for Category I Applications Only

10. Alternative Methods of Operations :	NA
11. Alterntive Modes of Operation (Emissions Trading) :	NA

12. Identification of Additional Applicable Requirements :	NA
13. Compliance Assurance Monitoring Plan :	NA

14. Acid Rain Application (Hard-copy Required) :

NA	Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
NA	Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
NA	New Unit Exemption (Form No. 62-210.900(1)(a)2.)
NA	Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)

Waukesha CUSTOM ENGINE CONTROL®

White Paper

TURBOCHARGER CONTROL MODULE (TCM)

INTRODUCTION

Waukesha Engine Division's Custom Engine Control® (CEC) Turbocharger Control Module (TCM) is designed for the ATGL engine family to allow one turbocharger match to perform across a wide load and speed range without experiencing turbocharger surge (turbo surge). Turbo surge is the part-load phenomenon where sudden changes in air flow produce the banging and swishing heard in the compressor side of the engine's turbocharger. Although not normally detrimental to engine components, turbo surge does represent wasted energy, poor engine performance and speed instability. The TCM system is more effective than mechanical methods of turbocharger control for maintaining optimum efficiency and performance because it allows for the best match between engine and turbocharger under a wide range of altitudes and changing ambient conditions by electronically controlling the bypass and wastegate valving.

BENEFITS

Few lean burn natural gas engines are marketed without some type of turbocharger control. The most common type is the mechanically-controlled wastegate valve which is used only to limit engine power and turbocharger speed. Another type of mechanical control is the bypass valve which is used to increase engine stability by decreasing the differential pressure across the throttle, thereby, eliminating turbocharger surge.

The Waukesha TCM system combines these two types of controls into one package. An electronic control module and actuators are used to adjust the wastegate and bypass valves to a predetermined setting (see Figure 1 and Figure 2). The control module microprocessor contains sets of tabular values (maps) which direct a signal to individual actuators (electric motors) to reposition the wastegate or bypass valves. The TCM system maps are customized for each engine application based on site specific information with a personal computer (PC).

The electrically controlled wastegate and bypass valves can be managed to reduce turbocharger surge; improve engine speed turn down; improve engine response to load changes; and allow one turbocharger match for elevations ranging from sea level to upwards of 5000 feet (1524 m) and for engine speeds from 750 – 1000 rpm. High throttle plate differential pressures are also eliminated, thus preventing poor engine stability without sacrificing engine response.

Maps are preprogrammed at the factory for either a typical power generation or gas compression load characteristic and are adjustable based on site requirements and/or needs with the use of a PC. The customer supplied PC, required for setup and adjustments, can also be dedicated for constant monitoring of the TCM system.

Since the TCM was intended to be engine mounted, extensive temperature, vibration and electro-magnetic interference testing was performed to ensure reliable operation. Field test units ran a total of 49,000 hours before production release.

Figure 1. Turbocharger Control Module

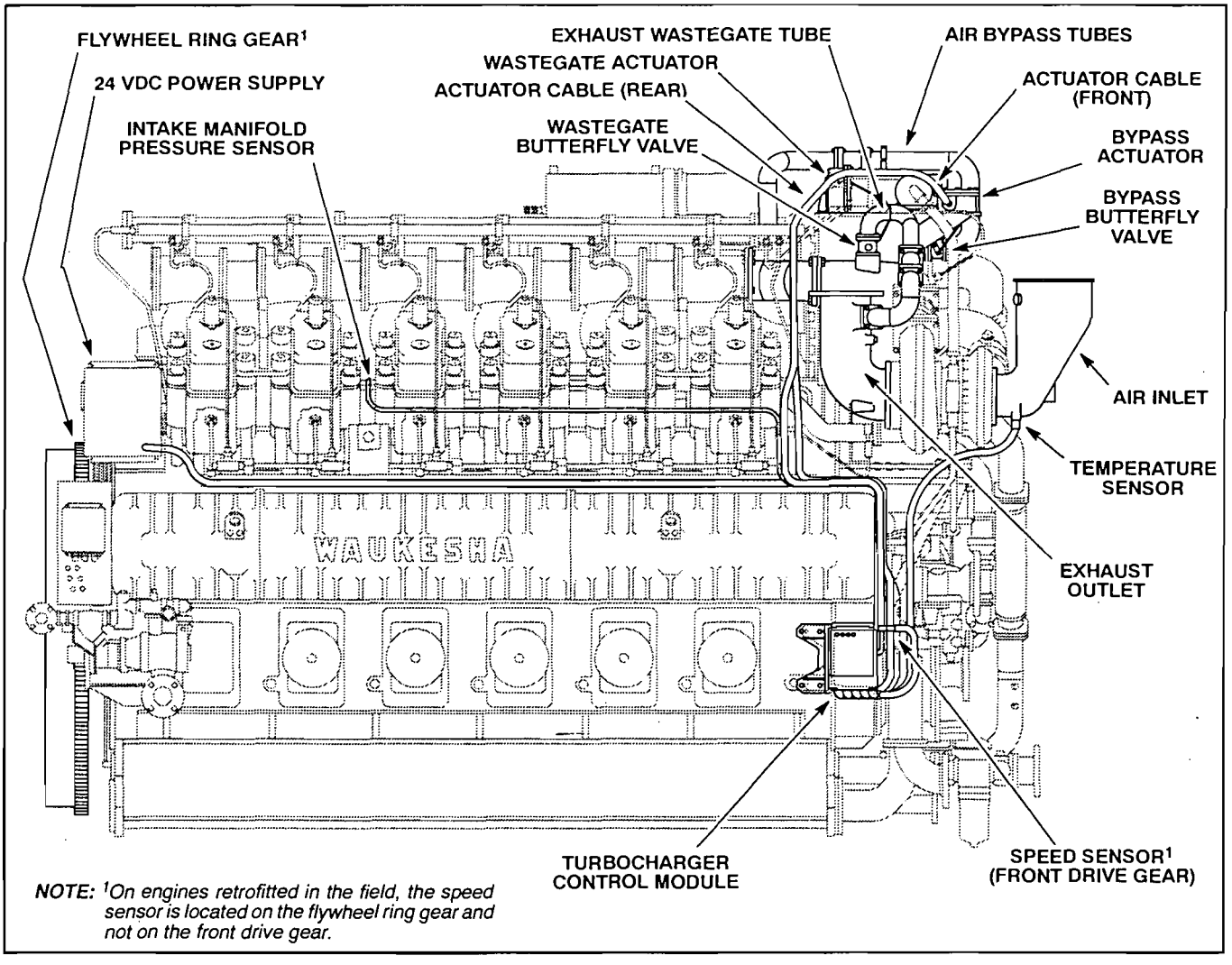

Figure 2. Typical TCM System on a Model 12V-ATGL Engine

A Failure Modes and Effects Analysis (FMEA) was also completed to verify the design integrity of the TCM. The actuators used to drive the bypass and wastegate valves were chosen so that in the event of an actuator motor failure, the bypass or wastegate valve would be held in the current position until the problem could be corrected.

Designed with extensive self diagnostic capability, the TCM uses sensibility checks to locate potential problems. This in turn triggers status LEDs (light emitting diodes) on the front panel of the module to show the cause of any system faults. These faults can also be seen on the screen of the dedicated PC. In addition, the TCM uses 50 VDC, 1 amp sinking devices for external alarm and shutdown devices.

The TCM is a stand alone system requiring no external input from other Waukesha CEC products. The only external input required is a 24 VDC power supply and a PC for installation and programming setup.

The TCM system meets North American Canadian Standards Association (CSA) Class I, Group D, Division 2 Hazardous Location requirements. Under this classification, the TCM system can operate safely in locations where there's danger of explosion due to the presence of flammable gases. While most industrialized countries have their own systems for certifying industrial equipment, those that don't normally recognize certification by the country of origin. Due to rigorous CSA Certification requirements, the TCM system has been built to more than satisfy the standards established by most countries throughout the world.

TCM Components and Features

The TCM system consists of engine speed, intake manifold pressure and ambient temperature sensors; an electronic control module; and electric actuators driving compressor bypass and wastegate valves. The electronic control module provides the necessary signals for optimizing the wastegate and bypass valve positions (see Figure 3). When the turbocharger is compressing more air than required for engine operation, excess air is directed through the bypass valve. The bypass valve directs air from downstream of the turbocharger compressor to upstream of the turbine, increasing turbocharger speed and air flow through the compressor without increasing air flow to the engine. The wastegate valve protects the turbocharger from overspeeding and the engine from overloading, thus controlling compressor discharge pressure by directing a portion of the exhaust gases around the turbine.

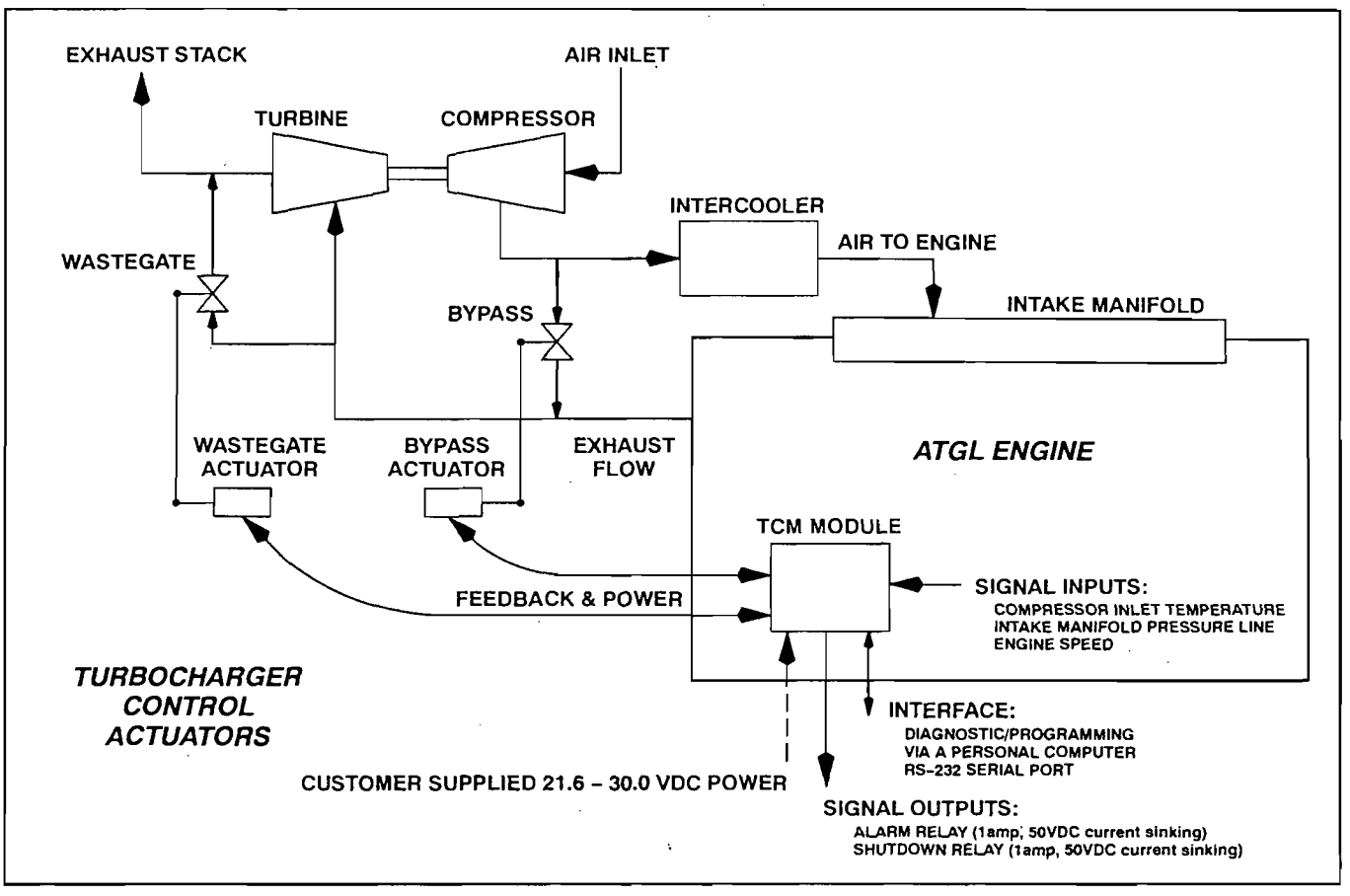

Figure 3. Turbocharger Control Management System Wastegate and Bypass Valving

The TCM is controlled by the microprocessor within the module which provides proper balance of the bypass and wastegate valve positions through mapping. The map is a tabular list of engine speed and intake manifold pressure versus wastegate or bypass valve positions. When the engine operates at a certain intake manifold pressure and speed, the module sends a signal to the actuators which makes the necessary adjustment to the wastegate and bypass valves. A feedback loop is also provided which sends a signal from the actuator back to the microprocessor, verifying that the bypass or wastegate valve is at the desired position. A correction formula is stored in the module's microprocessor which changes the desired wastegate and bypass positions as a function of compressor inlet air temperature.

Theory of Operation

Turbo surge is a condition caused by a sudden change in air flow in the compressor due to low mass flow rates and high adverse pressure gradients. Surge can be caused in lean burn, turbocharged natural gas engines by rapidly closing the throttle, which is located downstream of the compressor. This rapid closing of the throttle creates an increase in pressure ratio across the compressor and results in surge. Surge can also be caused by a restricted air inlet circuit or an increase in exhaust system back pressure. With the use of the electrically controlled wastegate and bypass valves, turbocharger surge can be avoided.

The turbocharger compressor performs best when it operates along the line of peak efficiency (see Figure 4), which runs through the center of the peak efficiency islands. If the engine was commissioned at a higher altitude or as ambient temperature decreases, the operating point of the compressor would move from the line of peak efficiency toward the surge line. The engine then could begin to operate in an unstable condition.

By using a combination of bypass and wastegate settings, the TCM system works to move the ratio point back towards the center of the efficiency island through the entire operating range of the engine to afford optimal performance and to eliminate a surge problem.

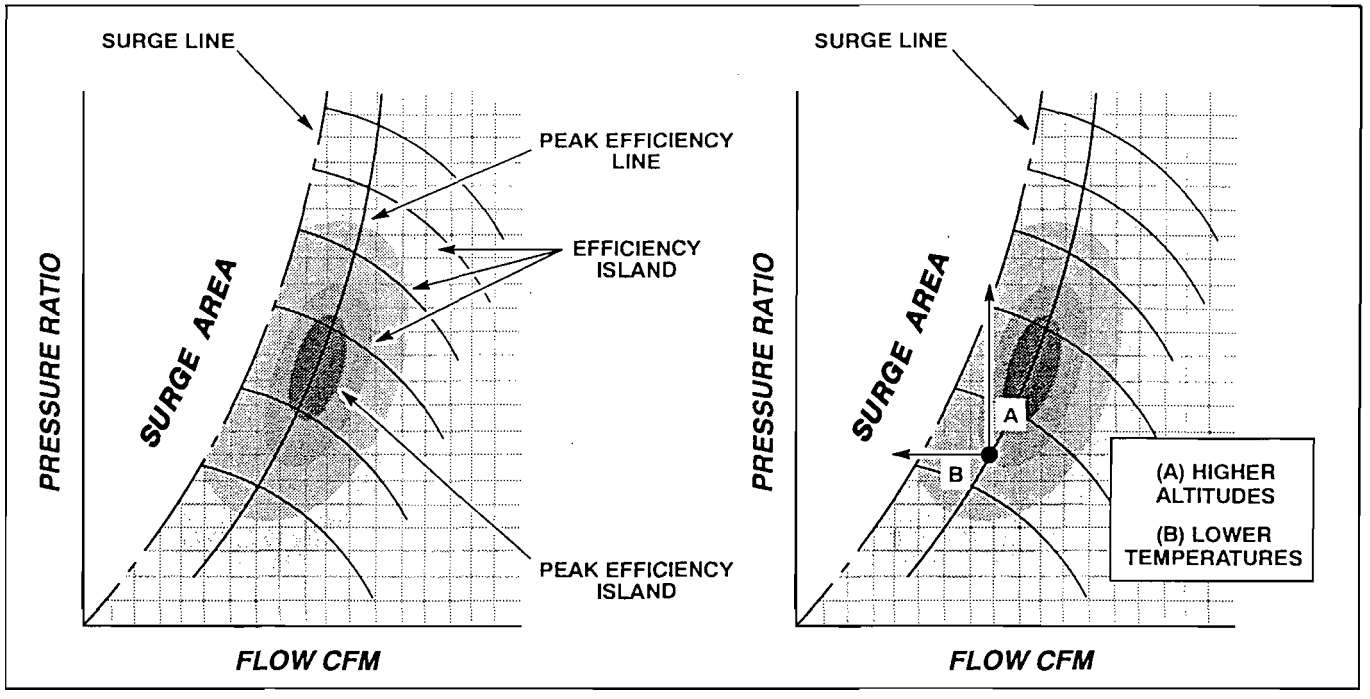

Figure 4. Turbocharger Peak Efficiency And Turbo Surge Graphs

Table 1. Turbocharger Control Module Power Supply Requirements

CEC Product	Nominal Voltage (volts DC)	Tolerance (volts DC)	Operating Range (volts DC)	Ripple Peak-to-Peak (volts AC)	Operating Current (amps)
TCM	24	+25%, -10%	21.6 - 30	< 2	1.5

System Power Requirements

Power supply requirements for the TCM system are listed in Table 1.

System Setup

The TCM is a stand-alone CEC product supplied as standard equipment on Waukesha 8L-AT27GL, 12V-AT25GL, and 12V-AT27GL engines.

The TCM is customized for each application by running a Waukesha supplied setup program on an IBM compatible personal computer. Minimum requirements include an 80386-20 MHz microprocessor, a 3.5 inch high density (1.44 MB) floppy disk drive, an RS-232 serial port, a DB-9 serial cable, and MS-DOS 3.3 or higher.

TCM Retrofit Kits

The TCM system can be installed on the 12V-AT25GL engines in the field. For retrofitting considerations, installation procedure and operation, refer to the *Custom Engine Control® Turbocharger Control Module Installation, Operation and Maintenance Manual* (Form 6267).

Waukesha's TCM vs. the Competition

The TCM has many advantages over mechanical wastegates.

First, the TCM offers the flexibility to program the wastegate and bypass valve mapping. From the factory, the TCM has preprogrammed map points in the module, allowing for engine startup and operation. If a more precise setpoint is desired, the map points can be modified with the use of a PC. With a mechanical system, the wastegate is set at a single operating point, typically maximum load, which opens based on a spring rate, as compressor discharge pressure increases. The mechanical differential pressure controller for the compressor bypass valve also opens at a single operating point. To optimize the turbocharger to best fit the engine's load characteristics, a flexible system is required.

Secondly, the TCM system bypass circuit routes air from the compressor discharge to the turbine inlet. On mechanical systems, the pressure differential valve typically routes air from the compressor discharge to atmosphere. The current TCM system arrangement is beneficial to turbocharger operation because the mass flow is balanced between the compressor and turbine,

allowing the turbocharger to operate within the design envelope for both sides. The TCM also allows more air flow increase with minimal turbocharger speed increase. Turbochargers are designed to deliver a certain range of air flow and pressure based on the turbine speed and exhaust gas flow. When this design envelope is not maintained, the turbocharger could operate inefficiently or even cause failure.

Thirdly, the mechanical system opens the wastegate at a predetermined set point, thus reducing the turndown capability of the engine. The TCM allows the wastegate to be closed at high load, low speed situations improving turndown capability.

Lastly, the TCM increases efficiency over load and speed range. On engines equipped with the commonly called delta P wastegate valve, part load efficiency is improved by changing the wastegate position to hold a fixed pressure drop across the throttle. This constant pressure drop (delta P) across the throttle is maintained as the engine is decreased in load by opening the wastegate valve, thus opening the throttle which reduces engine pumping losses. However, this type of control has poor transient load response due to the reduced pressure drop across the throttle (throttle reserve) and reduced turbocharger speed at a given engine load.

A specific map in the module allows the TCM to manage the wastegate and bypass valves, providing improved engine efficiency, throttle control and response (reserve), and turbocharger performance.

WAUKESHA'S CEC PRODUCT FAMILY

The CEC Ignition Module and the three CEC expansion modules—Detonation Sensing Module (DSM), Turbocharger Control Module (TCM), and Air/Fuel Module (AFM)—are programmed with site-specific information that customizes the modules to work interactively. This modular building block approach offers engine owners the option of using only the components they need. The CEC product family is one of the most comprehensive control management systems on the market today for enhancing engine performance and prolonging engine life.

Printed on Recycled Paper Nov. 1, 1996

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Waukesha CUSTOM ENGINE CONTROL®

White Paper

IGNITION MODULE (IM)

INTRODUCTION

Waukesha Engine Division's Custom Engine Control® (CEC) Ignition Module (IM) provides optimum timing control to individual cylinders on the company's engines. The Waukesha CEC IM is a simple and reliable ignition system that allows independent setup, depending on site conditions and requirements. The system provides accurate and precise timing for better overall engine performance and extended life. The IM is part of an electronic, digital-circuit ignition system, that is standard equipment on Waukesha AT, VHP, and VGF engines. In addition, the IM has an expansion port for the CEC Detonation Sensing Module (DSM). When the CEC DSM is integrated with the IM, the ignition system provides maximum power and timing advance for varying fuel knock indexes and ambient conditions. Together the IM and DSM provide an around-the-clock protection system to extend engine life.

BENEFITS

Ignition timing has become increasingly important as horsepower demands grow and as engine operation becomes more diversified. The IM can provide timing for more than one fuel or more than one load point. With two 16 position IM timing switches (A and B), the engine can be set up to operate on two different fuels, on fuel with two different heating values or knock indexes in the main gas supply, or at two distinct load conditions (see Figures 1 and 2). The two switches on the IM eliminate the need to make manual timing adjustments after the engine is setup properly for an application. Waukesha's CEC IM has the ability to secure engine timing to within one-half degree of the desired setting. With more consistent firing of each cylinder, the engine will be optimized for power, performance and emissions. Other benefits include improved starting, smoother operation and increased spark plug life, thus decreasing down-time. In the long run, the engine runs better and will have more consistent up time.

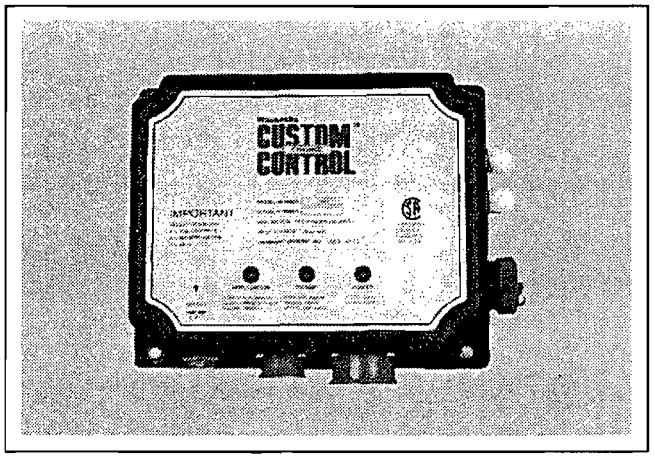

Figure 1. CEC Ignition Module

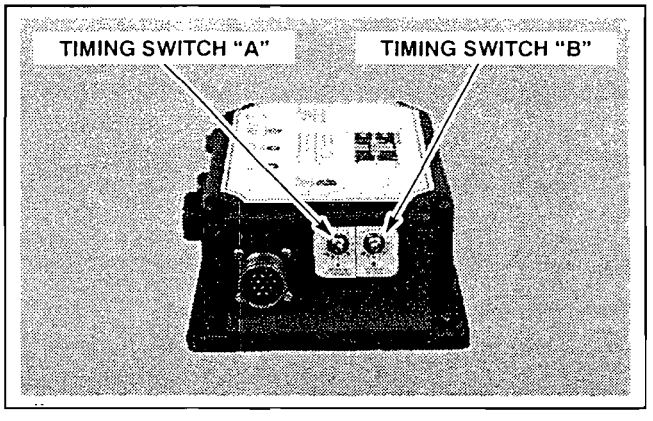

Figure 2. IM 16 Position Timing Switches

IM COMPONENTS AND FEATURES

The IM system consists of an electronic ignition module (IM), wiring harnesses, timing disc or gear, engine and site-specific ignition coils, high tension leads, and a Hall-effect pickup sensor (two for AT27GL engines) (see Figure 3).

Waukesha has released an updated, enhanced IM. The new IM has three significant distinctions from the previous model. First, three diagnostic LEDs (light emitting diodes) are now included on the front of the IM for ease in troubleshooting.

Secondly, the outer casing of the IM has been redesigned to further protect the electronic circuit boards inside the module. The upgraded IM casing is made of a new heavy-duty, cast aluminum for strength and durability. Improved gaskets have been added to prevent moisture and dirt from entering the casing, even under the most severe conditions. The electronic boards are rigidly mounted inside the IM to reduce vibration fatigue. The allowable temperature range for the IM is -40°F to 150°F.

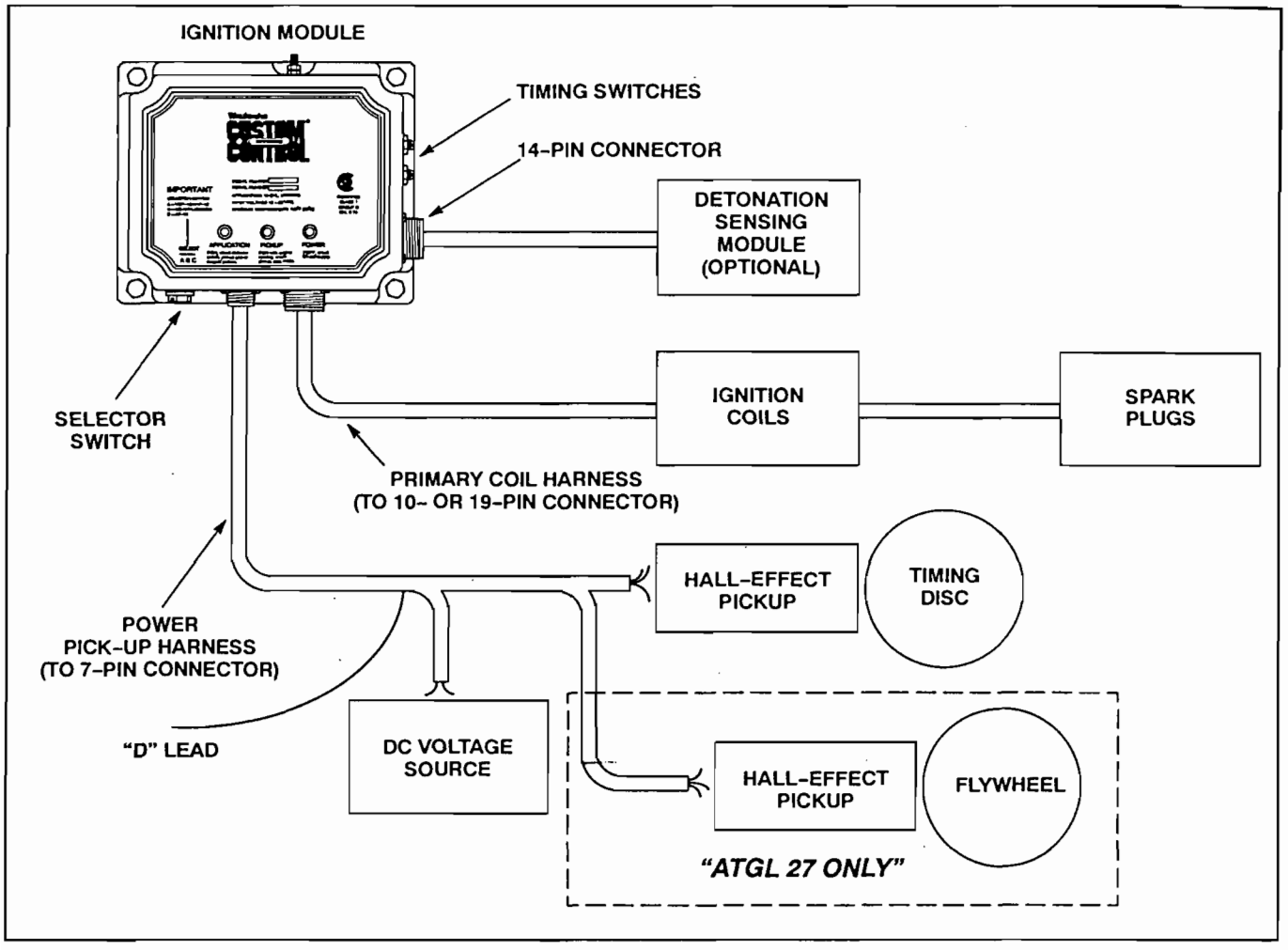

Figure 3. General IM System Layout

Finally, the IM features a new three position Selector Switch. The switch setting is dependent on the engine model. The Selector Switch programs the IM for a specific engine model—6- versus 8-cylinder, AT versus VHP. If the actual firing pattern does not match the Selector Switch setting, an LED on the front of the IM will light informing the operator of a mismatch between the Selector Switch setting and the firing pattern of the engine.

The IM is equipped with three diagnostic LEDs on front of the IM housing: Power, Pickup, and Application (see Figure 4). The LEDs give operators visual confirmation on (1) incoming power, (2) Hall-effect pickup signal and (3) proper application settings.

- The Power LED is supplied to confirm power has been connected to the IM and remains on during engine operation.

- The Application LED is provided for problem detection. If during setup the wrong application is chosen, for example, a 6-cylinder instead of an 8-cylinder engine is selected, the magnet pattern will not match the selection of the IM, and the application LED will illuminate. The Application LED will also illuminate if no application is chosen by the Selector Switch, or if one sensor is lost in the two sensor system of AT27 engines.

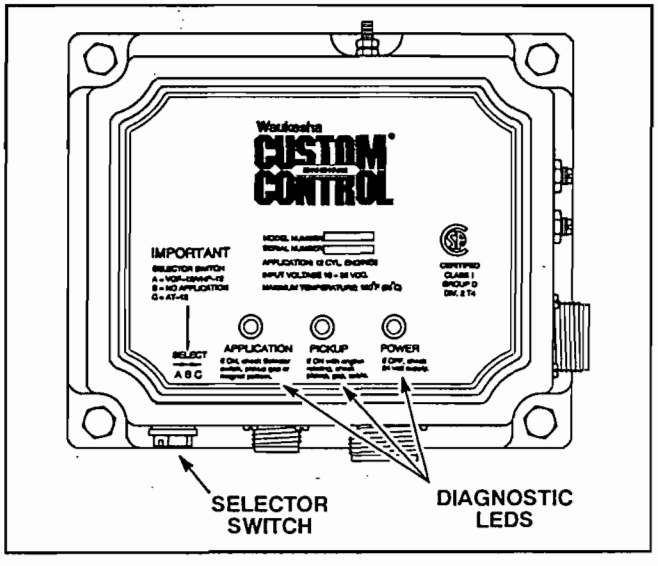

Figure 4. IM Diagnostic LEDs

- The Pickup LED is provided for problem detection. The Pickup LED illuminates if the Hall-effect sensor signal is lost due to a faulty sensor or if a loose connection exists. The Pickup LED will also illuminate if the air gap between the Hall-effect sensor and timing disc magnets is too large or if the engine is in a no-crank state.

The Selector Switch on the IM makes it possible to control all Waukesha engines with only three different IM models. Table 1 lists the IM models and their engine applications.

Table 1. IM Model Engine Applications

IGNITION MODULE MODELS		
Model 811	**Model 1211**	**Model 1611**
VHP 6-Cylinder Engines	VHP 12-Cylinder Engines	VHP 16-Cylinder Engines
VGF 6- and 8-Cylinder Engines	VGF 12-Cylinder Engines	VGF 16-Cylinder Engines
AT 8-Cylinder Engines	AT 12-Cylinder Engines	AT 16-Cylinder Engines

The Selector Switch is a three position switch: position B is OFF and position A and C are ON (see Table 2). For Models 1211 and 1611, the Selector Switch is either set for VHP/VGF or AT engines. This selection is important because of the difference between cylinder bank angles for an AT engine versus VHP/VGF engines. Model 811 is set for either a 6- or 8-cylinder engine.

Table 2. Ignition Module Selector Switch Settings

SELECTOR SWITCH SETTING	IGNITION MODULE MODELS		
	Model 811 for 6- & 8-Cylinder Engines	**Model 1211 for All 12-Cylinder Engines**	**Model 1611 for All 16-Cylinder Engines**
A	VHP/VGF 6-Cylinder Engines	VHP/VGF 12-Cylinder Engines	VHP/VGF 16-Cylinder Engines
B	No Application	No Application	No Application
C	VGF/AT 8-Cylinder Engines	AT 12-Cylinder Engines	AT 16-Cylinder Engines

As site location safety requirements continue to become more stringent throughout the world, Waukesha has responded with the latest monitoring technology to meet these demands. The IM system meets North American Canadian Standards Association (CSA) Class I, Group D, Division 2 Hazardous Location requirements. Under this classification, the IM system can operate safely in locations where there's danger of explosion due to the presence of flammable gases. While most industrialized countries have their own systems for certifying industrial equipment, those that don't normally recognize certification by the country of origin. Due to rigorous CSA Certification requirements, the IM system has been built to more than satisfy the standards established by most countries throughout the world.

Description of Operation

The IM system will not deviate from the original settings after the engine is operational. Once the correct settings are in place on the IM and the engine is running, it will continue to run at those conditions until they are manually changed by grounding the D lead to switch to the other timing setting or adjust the timing switches. If the DSM is connected, manual control is not necessary as the DSM makes necessary changes to protect the engine from detonation.

With the engine running, the Hall-effect pickup sensor sends a signal to the IM, and with the index magnet, the IM knows exactly which cylinder should fire. The IM then sends out a signal to the appropriate coil and spark plug to achieve accurate timing. With the DSM connected to the IM, timing is allowed to vary as the DSM deems necessary within its programmed limits. With the DSM absent, there is no threshold for protection against detonation, therefore, manual changes to the timing can be made by using the D lead or one of the timing switches.

Service and maintenance of the IM involves periodic inspection of wiring and the components. Engine shutdown can be executed by simply disconnecting the power to the IM. Refer to the *Custom Engine Control® Ignition Module Installation, Operation And Maintenance Manual* (Form 6253) for proper startup and shutdown procedures.

DSM Expansion

The CEC DSM interfaces with the IM and is connected to the IM's 14-pin expansion port. When the CEC DSM is connected to the IM, maximum power and timing advance are achieved while protecting the engine from detonation due to varying fuel knock indexes and ambient conditions.

With the DSM system connected, the timing switches on the IM become non-functional and timing varies individually among the cylinders from a range of preset values. This individual cylinder timing allows maximum advance for cylinders that are not experiencing detonation to a predetermined setting.

Detonation is the autoignition of the end gases that have not been consumed in normal flame-front reaction in an engine's combustion chamber. Avoiding this condition is critical since detonation is normally detrimental to engine components.

Table 3. IM System And DSM Power Supply Requirements

Waukesha's CEC Module	Nominal Voltage (volts DC)	Voltage Tolerance (volts DC)	Operating Range (volts DC)	Ripple Peak-to-Peak (volts AC)	Steady State Operating Current (amps)
IM System	24	+33%, -58%	10 - 32	less than 2	6 (30 amp pulses)
DSM System	24	+25%, -10%	21.6 - 30	less than 2	1.5

System Power Requirements

Power supply requirements for the IM system and the optional DSM system are listed in Table 3.

For compatibility with the DSM, a nominal 24 volts is recommended. Use of a power supply with a battery will eliminate the possibility of engine shutdown if main power is lost.

System Setup

The IM system is easy to setup and does not require a personal computer. All adjustments are made either on the IM or at the Hall-effect sensor location.

Three settings must be adjusted on the IM. First, the application must be chosen for a specific engine model with the Selector Switch. If the Selector Switch is set for the wrong application, the IM will not work or it will fire incorrectly (depending on the application). Secondly, the two 16 position timing switches (A and B) must be set for correct engine timing. After the timing switches are set, the D lead in the 7-pin connector must be grounded or open. The timing switch that is active is determined by the status of the D lead in the 7-pin connector. If the D lead is grounded, switch A is active; if the D lead is not grounded, switch B is active.

The gap between the Hall-effect sensor and magnets affects engine operation. This gap should be set to factory tolerances to ensure every magnet is reported to the IM as it passes the Hall-effect sensor. If the magnets are too far away from the sensor, the pickup LED will illuminate. If one is missing, the application LED will illuminate and ignition will be prevented for the entire engine. After the gaps are set, timing can be checked and verified with a timing light while cranking the engine in a no-fuel state.

Retrofit Capability

For engines that are operating without a CEC IM system, retrofit kits are available with required parts for specific engines. Parts include the engine specific IM, wiring, timing disc or timing gear, and a Hall-effect sensor. The main difference between kits is the timing magnet's location and the type of timing disc for each engine family.

AT27GL engines have two Hall-effect sensors. One sensor is mounted on the end of the camshaft for reading the timing disc that contains only the index magnet and the other is mounted at the flywheel where it monitors the magnets threaded in the flywheel. With the magnets in the flywheel, the effects of camshaft gear lash are eliminated from the information relayed to the IM. All AT27GL flywheels come predrilled so that magnet installation is quick, simple and accurate. AT25GL engines have all the magnets, index and firing, mounted on the timing disc. Thus, only one sensor is needed to read the timing disc and no holes are necessary on the flywheel.

VHP 6- and 12-cylinder engines have all the firing and index magnets mounted on one timing disc located inside the governor drive housing. The difference in the kits is the type of timing disc used. From the factory, a slotted disc is issued, while the retrofits have the option of getting a solid disc which needs to be drilled, or a predrilled disc that needs to be pinned after installation.

The 6- and 8-cylinder VGF engines, like the VHP engines, have the magnets mounted on one rotating disc. The vee engines have magnets threaded into the cam gear.

Waukesha's CEC Family

The CEC Ignition Module and the three CEC expansion modules—Detonation Sensing Module (DSM), Turbocharger Control Module (TCM), and Air/Fuel Module (AFM)—are programmed with site-specific information that customizes the modules to work interactively. This modular building block approach offers engine owners the option of using only the components they need. The CEC product family is one of the most comprehensive control management systems on the market today for enhancing engine performance and prolonging engine life.

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Waukesha
CUSTOM ENGINE CONTROL®

White Paper

DETONATION SENSING MODULE (DSM) SYSTEM

INTRODUCTION

Waukesha Engine Division's Custom Engine Control® (CEC) Detonation Sensing Module (DSM) system provides individual cylinder timing for maximum power, while protecting a gas engine against detonation. The DSM system is an accessory to the CEC Ignition Module (IM) and is connected to the IM's expansion port. The system functions by monitoring vibrations at each cylinder with detonation sensors. When a signal from one of these sensors exceeds a detonation threshold, the DSM system, through the IM, retards ignition timing incrementally for that cylinder. If detonation continues once the maximum retard timing is reached, the system provides an output signal which can be used to activate warning devices, change air/fuel ratio, reduce engine power, or initiate an engine shutdown.

BENEFITS

Detonation sensing provides many advantages in efficient engine operation. By sensing when detonation occurs, engine adjustments can be made to compensate for several environmental and operating factors that can contribute to detonation. These factors include changes in engine load, speed, fuel composition, cooling system temperature and ambient conditions.

The DSM system has the ability to keep the engine out of detonation and, at the same time, keeps it operating in a timing window that allows optimum performance and fuel economy. Overall engine efficiency and productivity are increased without having detonation problems. Continuous detonation ultimately results in severe engine damage which leads to the loss of valuable uptime. The DSM system constantly monitors timing and detonation potential so that the performance of the engine is maximized.

Waukesha's DSM system also has the ability to sense the vibrations generated in individual cylinders by measuring a very specific range of frequencies generated when a cylinder goes into detonation. Each cylinder can behave differently due to differences in compression ratio, incoming mixture composition, burn rate, spark plug conditions, combustion chamber deposits and combustion chamber cooling. Detonation monitoring requires accurate measuring techniques which cannot be achieved with a single detonation sensor per bank of cylinders. Sensing vibration generated per bank of cylinders, as practiced by some manufactures, may not prevent detonation from occurring on every cylinder. Over-sensitive detonation sensors may react prematurely to extraneous noise, causing engine timing to retard on all of the cylinders simultaneously. The retardation will increase fuel consumption, exhaust emissions and decrease power with a possible engine shutdown. Under-sensitive sensors may not detect detonation that could be occurring on one of the cylinders, thus resulting in detonation damage. Waukesha's per cylinder detonation sensing philosophy helps prevent loss of performance, which cannot be achieved with the necessary accuracy, when sensing detonation per bank of cylinders.

DSM SYSTEM COMPONENTS AND FEATURES

The DSM and its related system components function directly with the IM. There is a 14-pin expansion port on the IM which interfaces with the DSM. The DSM system includes a Waukesha-designed electronic filter, detonation sensors, and a number of interconnecting cables and harnesses (see Figures 1 and 2).

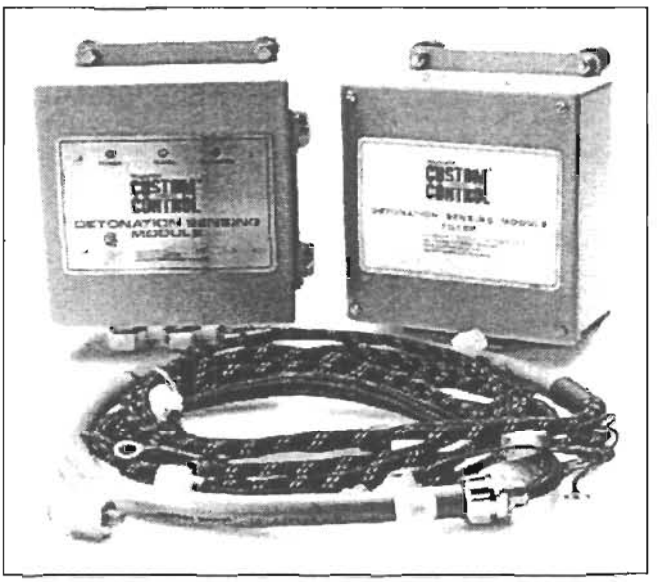

Figure 1. CEC Detonation Sensing Module System

The DSM is equipped with several features to inform site personnel of system status. LEDs (Light Emitting Diodes) are displayed on the front panel to indicate power, alarm and shutdown. Interface with Programmable Logic Controllers (PLCS) also is available to actuate remote alarms, lights or engine shutdowns. The system uses 50 V, 1 amp sinking devices for external alarm and shutdown signals. An internally mounted LCD (Liquid Crystal Display) constantly shows the current status of the system. For external current status monitoring, the system also is equipped with an RS-232 full duplex serial port. Retard and status information for each cylinder are included in the serial data stream. Text messages are transmitted to indicate the start and end of special functions, while numerical messages indicate status code.

As site location safety requirements continue to become more stringent throughout the world, Waukesha has responded with the latest monitoring technology to meet these demands. The DSM and IM systems meet North American Canadian Standards Association (CSA) Class I, Group D, Division 2 Hazardous Location requirements. Under this classification, the DSM and IM systems can operate safely in locations where there's danger of explosion due to the presence of flammable gases. While most industrialized countries have their own systems for certifying industrial equipment, those that don't normally recognize certification by the country of origin. Due to rigorous CSA Certification requirements, the DSM and IM systems have been built to more than satisfy the standards established by most countries throughout the world.

WAUKESHA'S DETONATION SENSING MODULE SYSTEM

DETONATION SENSING MODULE (DSM)

- Single common unit for all engines, PC programmable
- Individual cylinder sensing and timing control
- Front panel power, alarm, and shutdown LEDs
- 14-pin input connection from DSM filter
- Power supply, alarm, and shutdown port
- 14-pin connection from IM

DSM FILTER

- 19-pin input connection from detonation sensors
- 14-pin output connection to DSM
- 3-pin power supply connection

DETONATION SENSORS

- One sensor per cylinder except for 112 & 6 cylinder and VGF series engines which have one sensor per every two cylinders
- Sensor harness connects to DSM filter
- Identical sensors for all applications

CUSTOM ENGINE CONTROL® IGNITION MODULE (REQUIRED FOR DSM SYSTEM OPERATION)

- Two 16-position ignition timing control switches
- 14-pin connection from DSM
- 7-pin input connection for timing and power supply
- Multiple-pin connection for power output to coils

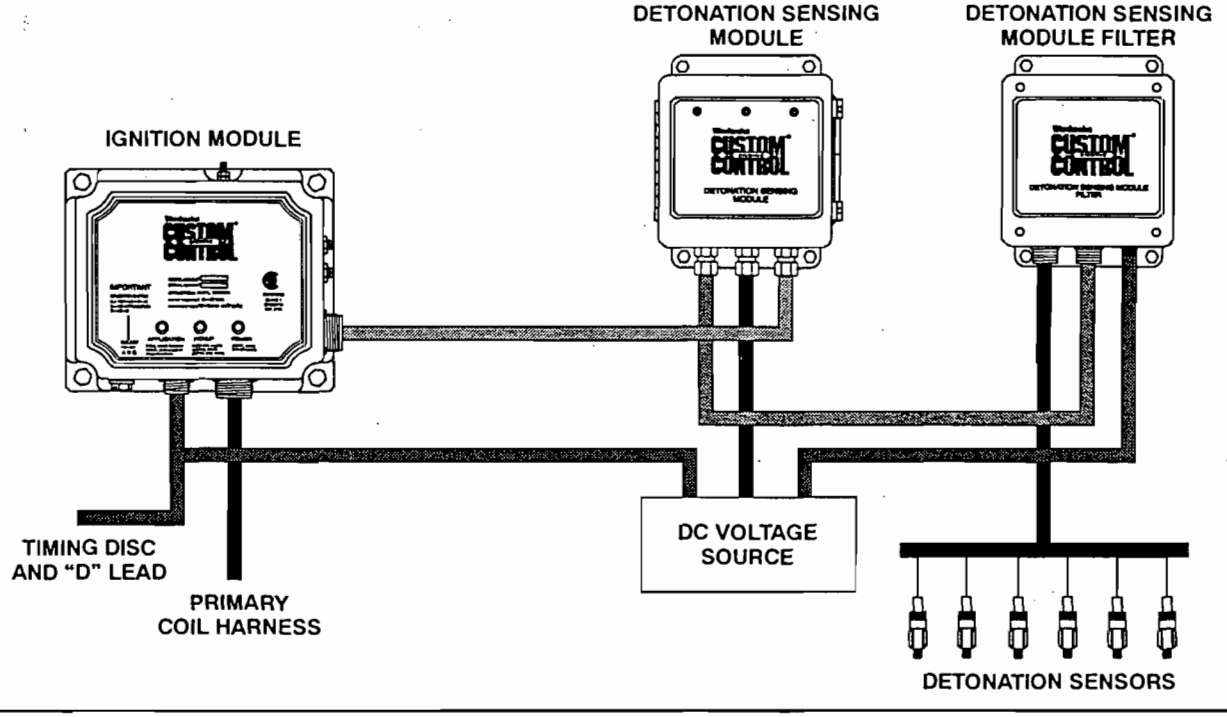

Figure 2. Detonation Sensing Module System Layout

Detonation Theory

Internal combustion engine detonation is an extremely complex subject. Because it's normally detrimental to engine components, detonation has been a known adversary of engine operation for many years. Severe detonation often damages pistons, cylinder heads, valves and piston rings, and eventually leads to complete failure of the affected part.

Detonation is due to autoignition of the end gases. These gases consist of the air/fuel mixture in the combustion chamber not yet consumed by the normal flame-front initiated by the spark plug firing. Detonation occurs when compression of the unburned end gases, caused by expansion of the burned gas charge, raises its temperature and pressure above the unburned fuel's stability limits to the point where the end gases will ignite. This results in uncontrolled burning of the remaining unburned gases, frequently including multiple flame fronts. The extremely high cylinder temperatures and pressures cause severe engine damage.

Detonation is identifiable by its characteristic sound, which is the result of intense pressure waves in the combustion chamber created by the multiple flame fronts which force the cylinder walls to vibrate. The natural frequencies of these sound waves are governed by the size and shape of the combustion chamber and the velocity of the sound in the charge. Detonation promoters are listed as follows:

- High cylinder temperatures
- Low knock index fuels
- Advanced spark timing
- High intake manifold pressure
- High coolant system temperatures
- Low engine speeds
- Low atmospheric humidity
- High engine loads
- Stoichiometric air/fuel ratio operation

Theory of Operation

The DSM system senses detonation with a technique called windowing. This technique allows the system to look for detonation only during the combustion time when detonation could be present, as indicated in Figure 3.

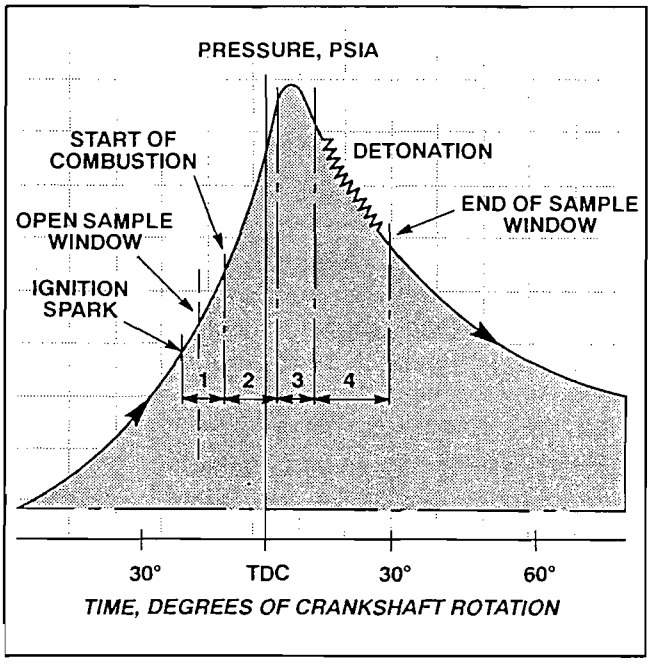

Figure 3. Windowing Chart

The DSM module uses the frequency output of each cylinder along with engine mounted sensors to monitor for detonation. A unique vibration called knock frequency is produced during detonation. Knock is just one of the many frequencies created in a cylinder during engine operation. Detonation sensors convert engine vibrations to electrical signals and routes them through a Waukesha-designed electronic filter. The filter removes electrical signals not associated with detonation and routes the knock signal to the DSM module. When the filtered signal exceeds a predetermined limit, defined as the detonation threshold, the DSM module in conjunction with the IM retards the ignition timing for the cylinder associated with that sensor. The detonation threshold and the rate and amount of retard can be programmed using the DSM system's setup software and a personal computer.

The DSM system controls timing between two programmable predetermined limits—the Most Advanced Timing, designated as nameplate timing, and the Most Retarded Timing. Several factors determine the retard limit, including minimum required power, exhaust temperatures and emission considerations.

When the DSM system senses detonation, ignition timing will retard at a predetermined rate until either the signal from the sensor falls below the detonation threshold or the Most Retarded Timing position is reached. As soon as detonation ceases, the DSM system will advance spark timing to the original setpoint. However, if detonation continues, the module will illuminate the shutdown LED and will provide an output signal that can be used to activate engine control devices or shut down the engine.

Table 1. DSM System and IM Power Supply Requirements

Waukesha's CEC Product	Nominal Voltage (volts DC)	Voltage Tolerance (volts DC)	Operating Range (volts DC)	Ripple Peak-to-Peak (volts AC)	Steady State Operating Current (amps)
DSM System	24	+25%, -10%	21.6 - 30	less than 2	1.5
Ignition Module	24	+33%, -10%	10 - 32	less than 2	6 (30 amp pulses)

The system also has a programmable default timing value that is used during a warmup period and when a low sensor output is detected. During engine warmup, the DSM system is disabled with the default timing value active. The purpose of this delay is to prevent misleading vibration signals from being incorrectly detected as detonation signals.

Other methods of reducing or eliminating damaging detonation are to increase the air/fuel ratio or reduce the load on the engine. This has the advantage of allowing the engine to continue operating while still protecting the engine. With the addition of a customer supplied external control such as a Programmable Logic Controller (PLC), the DSM system can be tailored in many ways. When detonation occurs the DSM system will first retard timing. If retarding the timing does not bring the engine out of detonation, a signal could be sent to change the air/fuel ratio, when utilizing the CEC Air/Fuel Module, or reduce the engine load. If detonation is still occurring, the engine can be shut down. This technique effectively protects the engine from detonation damage while increasing engine uptime.

System Power Requirements

Power supply requirements for the DSM system and the required IM are listed in Table 1.

At least 15 volts DC are required to maintain normal operating functions of the DSM system during engine startup. Once the engine is operating, the DSM system requires minimum power of 21.6 volts DC even though the IM can operate separately at power as low as 10 volts DC. Allowable operating temperature range for the DSM module and filter is –40°F to 150°F.

System Setup

The DSM system is standard equipment on all Waukesha ATGL and VHP series engines. The DSM system will be available on VGF series engines in 1997.

The DSM system is customized for each application by running a Waukesha supplied setup program on an IBM compatible personal computer (PC). Minimum requirements include an 80286–12 MHz microprocessor, a 3.5 inch high density (1.44 MB) floppy disk drive, an RS–232 serial port, a DB–9 serial cable, and MS–DOS 3.3 or higher. DSM system operating parameters can be tailored to include maximum timing advance and retard, timing adjustment rates, warmup and shutdown delays. A switchable second set of timing parameters is also available for dual fuel applications.

The DSM module features alarm and shutdown sinking device terminals to provide auxiliary output signals for external devices. These terminals can be used as a trigger to drive, through a relay, remote devices such as alarms or lights.

DSM System Retrofit Kits

Retrofit kits are available for existing VHP and ATGL engines. The only external requirement is the IM, which interfaces with the DSM system. The DSM module and filter may be mounted on or off the engine using the supplied vibration isolators. The module must be mounted within 20 feet of the IM and DSM filter. Drilling and tapping fixtures are supplied to locate, drill and tap holes for the detonation sensors in the cylinder heads or engine block. Individual sensor wires can be routed to the DSM filter through an engine–mounted junction box or directly to the filter. The DSM module and filter power supply connections are made in accordance with system requirements. Alarm and shutdown auxiliary output terminals are wired to interface with the required external shutdown and electrical devices. The DSM system is programmed with a PC.

Waukesha's CEC Product Family

The CEC Ignition Module and the three CEC expansion modules—Detonation Sensing Module (DSM), Turbocharger Control Module (TCM), and Air/Fuel Module (AFM)—are programmed with site-specific information that customizes the modules to work interactively. This modular building block approach offers engine owners the option of using only the components they need. The CEC product family is one of the most comprehensive control management systems on the market today for enhancing engine performance and prolonging engine life.

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Attachment 6

Description of Stack Sampling Facilities

Alexander Orr, Jr.
Water Treatment Plant

Description of Stack Sampling Facilities
Alexander Orr, Jr. Water Treatment Plant
Miami-Dade Water and Sewer Department

East Pump Room Switchgear & Pumps Replacement

REPLACEMENT PUMP ENGINES NOS. 3 AND 4 - WAUKESHA MODEL F3521GL

Diameter:	12 inches
Orientation:	Horizontal
Height Above Grade:	Approximately 14 ft
Means of Access:	No platform is provided to access the sampling port. Therefore, an extension ladder must be obtained from plant maintenance staff.
Sampling Ports:	Ports to be installed during construction.

REPLACEMENT PUMP ENGINE NO. 5 - WAUKESHA MODEL 8L-AT27GL

Diameter:	18 inches
Orientation:	Horizontal
Height Above Grade:	Approximately 14 ft
Means of Access:	No platform is provided to access the sampling port. Therefore, an extension ladder must be obtained from plant maintenance staff.
Sampling Ports:	Ports to be installed during construction.

EXISTING PUMP ENGINE NO. 6 - ENTERPRISE MODEL VO-61001

Diameter:	18 inches
Orientation:	Vertical
Height Above Grade:	Approximately 31 ft
Means of Access:	Permanent ladder is installed on the exterior of the building to reach the roof.
Sampling Ports:	No sampling ports are installed in exhaust. The applicant proposed to conduct sampling through a rake probe, which composites exhaust gas collected at several points across the stack diameter. The rake probe can be inserted into the end of the exhaust stack.

Attachment 7

Compliance Test Results

Alexander Orr, Jr.
Water Treatment Plant

South Florida
Environmental Services

FINAL REPORT

NOx RACT COMPLIANCE TEST PROGRAM

MIAMI-DADE WATER & SEWER DEPARTMENT

ALEXANDER ORR JR. FACILITY

Prepared For:
Miami-Dade Water & Sewer Department
3575 South Le Jeune Road
Miami, Florida 33133

Concerning:

NOx RACT Compliance Testing
Alexander Orr Jr. Plant #2
Standby Generators and Pumps
September October, 1997

Prepared By:

South Florida Environmental Services
6821 Vista Parkway North
West Palm Beach, Florida 33411

Ron C. Cook Jr.
Manager Technical Operations

11/14/97
Date

REVIEW BY : Thomas S. Siegert
Thomas S. Siegert
Environmental Scientist

6821 Vista Parkway North, West Palm Beach, FL 33411
Tel: 407-687-5300 Fax: 407-687-3676

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APPENDICES

1.0 COMPENDIUM

South Florida Environmental Services conducted an emissions compliance test program on behalf of Miami-Dade Water & Sewer Department at their Alexander Orr Jr. facility located in Miami, Florida. Testing was performed on Standby Generators 1, 2, 3, and 4 and Pumps 1, 3, 4, 5, and 6 for the determination of NOx, O2 and Visible Emissions. Testing was conducted on September 23, 24, 25, 26 and October 2, 1997.

Emissions testing was conducted to demonstrate compliance with NOx RACT. All testing was conducted in accordance with procedures set forth in Appendix A of 40 CFR 60, as amended. A detailed explanation of these procedures can be found in Section 3.0 of this report.

A compliance test series consisting of three one hour runs was conducted on each unit. Compliance testing was conducted at or above 90% of full load for each unit. All unit were tested while firing #2 fuel oil except Pump #6 which fired a combination of natural gas and #2 fuel oil.

The results of the NOx emissions test program can be found in Table 1-1 and Visible Emission results can be found in table 1-2.

Ron C. Cook Jr., Manager Technical Operations, was responsible for all phases of the emissions test program, He was assisted by Carl Adams. Richard O'Rourke of Miami-Dade Water & Sewer Department was responsible for coordinating plant operations.

1.0 COMPENDIUM (cont.)

Table 1-1

STANDBY GENERATOR #1
Date Tested 23-Sep-97

Run #	% O_2	Unit Load	NOx lb/mmbtu	NOx lb/hr	Start Time	Stop Time
1	12.46	2500KW	3.74	82.95	1405	1505
2	12.39	2500KW	3.65	80.88	1515	1615
3	12.47	2500KW	3.74	82.90	1645	1745
Average	**12.44**	**2500KW**	**3.71**	**82.24**		

STANDBY GENERATOR #2
Date Tested 23-Sep-97

Run #	% O_2	Unit Load	NOx lb/mmbtu	NOx lb/hr	Start Time	Stop Time
1	12.32	2500KW	4.06	89.90	1030	1130
2	12.36	2500KW	3.46	76.61	1140	1240
3	12.30	2500KW	3.48	77.26	1250	1350
Average	**12.33**	**2500KW**	**3.66**	**81.26**		

STANDBY GENERATOR #3
Date Tested 24-Sep-97

Run #	% O_2	Unit Load	NOx lb/mmbtu	NOx lb/hr	Start Time	Stop Time
1	12.35	2500KW	2.81	62.37	0820	0920
2	12.28	2500KW	3.24	71.87	0930	1030
3	12.35	2500KW	3.06	67.84	1035	1135
Average	**12.33**	**2500KW**	**3.04**	**67.36**		

1.0 COMPENDIUM (cont.)

Table 1-1 (cont.)

STANDBY GENERATOR #4
Date Tested 24-Sep-97

Run #	% O_2	Unit Load	NOx lb/mmbtu	NOx lb/hr	Start Time	Stop Time
1	12.14	2500KW	3.12	69.26	1145	1245
2	12.09	2500KW	3.09	68.52	1250	1350
3	12.10	2500KW	3.15	69.83	1355	1455
Average	**12.11**	**2500KW**	**3.12**	**69.20**		

PUMP #1
Date Tested 25-Sep-97

Run #	% O_2	Unit Load	NOx lb/mmbtu	NOx lb/hr	Start Time	Stop Time
1	12.82	410RPM	2.12	9.44	1110	1210
2	12.64	410RPM	2.16	9.13	1245	1345
3	12.10	410RPM	2.09	8.83	1351	1451
Average	**12.52**	**410RPM**	**2.12**	**9.13**		

PUMP #3
Date Tested 25-Sep-97

Run #	% O_2	Unit Load	NOx lb/mmbtu	NOx lb/hr	Start Time	Stop Time
1	13.24	420RPM	1.69	7.52	0745	0845
2	13.19	420RPM	1.87	7.90	0850	0950
3	13.30	420RPM	1.93	8.14	0955	1055
Average	**13.24**	**420RPM**	**1.83**	**7.85**		

South Florida Environmental Services

1.0 COMPENDIUM (cont.)

Table 1-1

PUMP #4
Date Tested 2-Oct-97

Run #	% O_2	Unit Load	NOx lb/mmbtu	NOx lb/hr	Start Time	Stop Time
1	13.48	430RPM	2.94	13.09	0925	1025
2	13.78	430RPM	2.92	12.35	1035	1135
3	13.74	430RPM	3.00	12.69	1145	1245
Average	**13.66**	**430RPM**	**2.95**	**12.71**		

PUMP #5
Date Tested 25-Sep-97

Run #	% O_2	Unit Load	NOx lb/mmbtu	NOx lb/hr	Start Time	Stop Time
1	12.76	400RPM	2.64	20.81	1455	1555
2	12.71	405RPM	2.58	20.34	1601	1701
3	12.67	405RPM	2.59	20.44	1720	1820
Average	**12.71**	**403RPM**	**2.60**	**20.53**		

PUMP #6
Date Tested 26-Sep-97

Run #	% O_2	Unit Load	NOx lb/mmbtu	NOx lb/hr	Start Time	Stop Time
1	11.64	320RPM	1.92	24.33	0900	1000
2	11.55	330RPM	1.79	22.68	1005	1105
3	11.64	330RPM	1.81	22.87	1110	1210
Average	**8.71**	**327RPM**	**1.84**	**23.28**		

1.0 **COMPENDIUM** (cont.)

Table 1-3
Visible Emission Tests

Unit #	Length of Test	Highest 6 min. Average	Readings above 20%
PUMP #1	30	5%	NONE
PUMP #3	30	5%	NONE
PUMP #4	30	5%	NONE
PUMP #5	30	6.25	NONE
PUMP #6	30	5%	NONE
STBY GEN #1	60	0%	NONE
STBY GEN #2	60	0%	NONE
STBY GEN #3	60	0%	NONE
STBY GEN #4	60	0%	NONE

2.0 SAMPLING POINT LOCATION

Sampling was conducted in the exhaust stack of each unit downstream of the silencers and prior to entering the atmosphere. Based upon the requirements in 40 CFR 60 Appendix B, Specification 2, Section 3.2, Reference Method Measurement Location and Sampling Points, the CEM probe sampled a total of three points during each one hour test run. A rake probe was used to satisfy this criteria.

3.0 SAMPLING TRAIN AND ANALYTICAL PROCEDURES

As discussed in Section 1, the subject units at the facility were tested for nitrogen oxides and Visible Emissions. Each pollutant parameter was tested in strict accordance with official EPA procedures set forth in 40 CFR 60 Appendix A at the sampling location described in Sections 1 and 2 of this Report. In this section, the test procedures that were followed, including sampling and analysis, are discussed.

3.1 DESCRIPTION OF METHODOLOGY

3.1.1 Oxygen

Oxygen was measured in accordance with EPA Method 3A. This method utilizes continuous emissions monitoring instrumentation. SFES used a Teledyne Model 326A monitor with a range from 0-25%. The instrument meets all of the performance specifications of these methods. It was calibrated before and after each test period with gases prepared according to EPA Protocol #1.

3.1.2 Carbon Dioxide

Carbon Dioxide was measured in accordance with EPA Method 3A. This method utilizes continuous emissions monitoring instrumentation. SFES used a Fuji Model 3400 non-dispersive infra red analyzer with a 0-20% range. This instrument meets all of the performance specifications of the method. It was calibrated before and after each test period with gases prepared according to EPA Protocol #1.

3.1.3 Oxides of Nitrogen

Oxides of nitrogen was measured in accordance with EPA Method 7E. This Method utilizes continuous emissions monitoring instrumentation. SFES uses a Thermo Electron Model 10A NOx chemiluminescent monitor with 8 ranges from 0-10,000 PPM. The instrument meets all of the performance specifications of the Method. It was calibrated before and after each test period using calibration gases prepared according to EPA Protocol #1.

3.0 SAMPLING TRAIN AND ANALYTICAL PROCEDURES (cont.)

3.2. DESCRIPTION OF CEM SAMPLING

What follows is a description of the transportable continuous emissions monitor system that was used to quantify oxygen, carbon dioxide, and oxides of nitrogen from subject boilers at the facility. The system meets all the specifications of Reference Methods 3A (O2, CO2), and 7E (NOx).

3.2.1 CEM Sampling System

Sample Probe - A stainless steel probe of sufficient length to sample three locations specified in Section 2.0.

Sample Line - Approximately 75' to 100' of 3/8" Teflon tubing (1/16" wall) to transport the sample gas from the probe to the sample conditioning system.

Sample Conditioning System-

Filter - A spun glass fiber filter, located near the probe to remove particulate from the gas stream.
Condenser (2) - a Universal Analyzer Sample Cooler or ice cooled condenser located near the probe for bulk moisture removal and a thermo-electric condenser system downstream from the pump to remove any remaining moisture from the gas stream.

Sample Pump - A diaphragm type vacuum pump to draw gas from the probe through the conditioning system and to the analyzers. The pump head is stainless steel, the valve disks are Viton and the diaphragm is Teflon coated.

Calibration Valve - A tee valve, located at the base of the probe, allows the operator to select either the sample stream or inject calibration gas to the CEM system.

Sample Distribution System - A series of flow meters, valves and back pressure regulators allows the operator to maintain constant flow and pressure conditions during sampling and calibration.

3.0 SAMPLING TRAIN AND ANALYTICAL PROCEDURES (cont.)

Gas Analyzers - capable of the continuous determination of O2, CO2, and NOx concentrations in a sample gas stream. They each meet or exceed the following specifications:

Calibration Error	- Less than ±2% of span for the zero, mid- and hi-range calibration gases.
System Bias	- Less than ±5% of span for the zero, mid- or hi-range calibration gases.
Zero Drift	- Less than ±3% of span over the period of each test run (1 hour).
Calibration Drift	- Less than ±3% of span over the period of each test run (1 hour).

Data Acquisition System - A Molytek strip chart/data logger system was used to record analyzer response to the sample and calibration gas streams. The chart recorder operated continuously while the data logger recorded thirty (30) minute interval averages.

The Molytek was linked, via an RS232 cable, to an IBM compatible computer system with a VGA screen. Data was written to file at fifteen (15) second intervals. Separate files for each run, and associated calibrations, were generated. Data was loaded into a spreadsheet for calculation of interval averages and emission rates. Preliminary reports were available on-site.

3.2.2 CEMS Sampling Procedures

All sampling and analytical procedures were conducted in accordance with EPA Reference Methods 3A, and 7E (40CFR60, Appendix A). The following is the sequence of events leading up to and including the compliance test:

Selection of Sampling Traverse Point Locations - Sampling point locations were determined prior to testing in accordance with EPA Methods 3A, and 7E.

Determination of System Response Time - System response time was determined prior to testing. System response time was determined according to procedures delineated in Performance Specification 2 (40CFR60, Appendix B).

Determination of Analyzer Calibration Error - Analyzer calibration error was determined immediately prior to testing in accordance with EPA Methods 3A, and 7E.

Determination of Sampling System Bias - Sampling system bias was determined immediately prior to testing in accordance with EPA Methods 3A, and 7E.

3.0 SAMPLING TRAIN AND ANALYTICAL PROCEDURES (cont.)

Determination of Zero and Calibration Drift - Before and after each test run each analyzer's response to zero and mid- or hi-range calibration gases was determined. The pre-and post-test analyzer responses were compared to determine drift. The results were evaluated based upon specifications defined in EPA Methods 3A, and 7E.

Data Reduction - An average pollutant/diluent concentration for each test run was determined from the data acquisition system. This data was then reduced to determine relative pollutant concentrations.

4.0 QUALITY CONTROL PROCEDURES

Sampling was conducted by trained personnel with extensive experience in Reference Method sampling. All sampling and analysis was conducted in strict accordance with EPA test procedures, including quality control procedures found in the EPA Quality Assurance Handbook for Air Pollution Measurement Systems.

South Florida Environmental Services entire equipment inventory is on a schedule of routine maintenance and calibration.

All calculations were conducted in strict accordance with the equations found in the individual Methods. Emission rate calculations were conducted on a computer and the input data was checked by a person other than the original operator to ensure that it was correct.

These specific procedures, in addition to South Florida Environmental Services usual high standard of quality control, validate the results obtained during the test program. South Florida Environmental Services is staffed by a team of qualified, experienced environmental professionals. As the majority of our emissions testing work is done for compliance purposes, strict QC procedures are incorporated into our everyday work performance.

South Florida Environmental Services

Attachment 8

Procedures for Startup and Shutdown

Alexander Orr, Jr.
Water Treatment Plant

Waukesha DRESSER

Start-Up Report

MAIL TO: WAUKESHA ENGINE DIVISION
Dresser Industries, Inc.
1000 West St. Paul Avenue
Waukesha, Wisconsin 53188-4999
Attn: Warranty Department

SOLD BY:	ENGINE MODEL:	SERVICE REP.:
ADDRESS:	S/N.: SPEC.:	ORGANIZATION:
OWNER:	COMPRESSION RATIO:	ADDRESS:
ADDRESS:	NAME & MODEL OF DRIVEN EQUIPMENT:	
ENGINE LOC.:		DATE OF START-UP:
	APPLICATION:	FAB.REP.PERFORMING START-UP:
FABRICATED BY:	DUTY CYCLE:	

LUBE OIL & FILTER

BRAND:
API CLASS.:
VISCOSITY:
OIL CHANGE HOURS:
ADVISE CUSTOMER OF W.E.D.'s RECOMMENDATIONS?

COOLING SYSTEM INFORMATION

TYPE:
WATER HARDNESS:
TREATMENT USED:
MAINTAINED BY:

FUEL INFORMATION

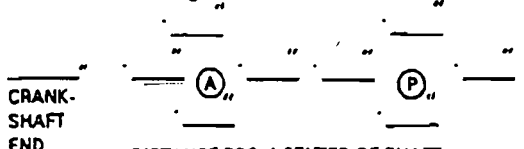
TYPE:
OCTANE/CETANE:
BTU CONTENT (LHV):
FILTRATION TYPE:
% OF H_2S OR micro g/l HCL :

0. "	0. "	0. "
0. "	0. "	0. "

FINAL CRANKCASE DEFLECTION (PRESTART)

HOT ALIGNMENT

Readings in .001" increments



CRANK-SHAFT END PLAY

DISTANCE FROM CENTER OF SHAFT TO THE ANGULAR DIAL INDICATOR

HEAD(S) RETORQUED TO: FT. LBS.

VALVES ADJUSTED TO:
INT. " EXH. "
HYD. LIFTER TO: TURNS
INJ. PUMP. STATIC TIMING: RB: °
(BTDC) LB: °

FUNCTION TEST NO LOAD OPERATION. ENGINE RAN FOR _____ MINUTES.

RPM			IGN. TIMING @	INT. MFLD.	GAS OVER	SAFETY TRIP POINTS					CHECKED OILING	
IDLE	HI IDLE	GOV.	GOV. RPM BTDC	VAC. AT IDLE	AIR RATIO	HI WATER	LOW OIL	O.S. GOV.	INT. MFLD.	FUEL SHUTOFF	ROCKER ARMS	TURBO.
			RB: °	"Hg	"H_2O	°F	PSI	RPM	°F	PSI		
			LB: °	"Hg	"H_2O							

FUNCTION TEST LOADED OPERATION. ENGINE RAN FOR _____ HOURS.

RPM	WATER OUT TEMP.	OIL TEMP.	OIL PRESS.	C. CASE PRESS.	EXH. BACK PRESS.	LOAD	IGN. TIMING @ GOV. RPM-BTDC	INT. MFLD. VAC./PRESS.	EXHAUST TEMP.	RACK EXT.	FUEL PRESS. @ REG. IN.	GAS OVER AIR RATIO
	° F	°F	PSI	"H_2O	"H_2O	BHP	RB: °	"Hg	°F		PSI	"H_2O
						KW	LB: °	"Hg	°F		PSI	"H_2O

FOR "GL" ENGINES COMPLETE REVERSE SIDE ALSO.

NOTE ANY OIL OR WATER LEAKS and any discrepancies which should be corrected. Explain any support systems such as fuel, cooling, air induction, exhaust, or general installation features which may be detrimental to engine performance or service life.

REMARKS:

DISCUSSED WARRANTY? _____ DISCUSSED SPARE PARTS STOCK? _____ ADVISED CUSTOMER WHERE TO OBTAIN PARTS AND SERVICE? _____
SUPPLIED OPERATION AND SERVICE MANUAL? _____ DISCUSSED OPERATION AND MAINTENANCE WITH CUSTOMER/OPERATOR? _____

CUSTOMER'S SIGNATURE (Required)
(Indicating Start-Up Performance to His Satisfaction)

SERVICEMAN'S SIGNATURE

CERTIFIED SERVICEMAN'S SIGNATURE

EXPLANATION OF ABBREVIATIONS: "HG (Inches of Mercury), "H_2O (Inches of Water), °F (Degree Fahrenheit), R.B. (Right Bank), L.B. (Left Bank), RPM (Engine Crankshaft RPM), PSI (Pounds Per Square Inch), O.S. (Over Speed), A= Angular P=Parallel

GL O_2 Sensor S/N (If Applicable) S/N _____

Fuel System Adjustments with Natural Gas Only

Fuel System Adjustment at Idle No Load
Gas Supply Pressure to Engine Mounted Regulator _____ psi

Fuel Only Regulator Pressure Differential $\frac{\text{Prechamber Manifold}}{\text{Intake Manifold}}$ _____ " Hg ΔP

Gas Over Air Ratio @ Idle No Load: RB: _____ " H_2O ΔP LB: _____ " H_2O ΔP

Fuel System Adjustment at 100 BMEP
(10" Hg Gauge Manifold Pressure)

Exhaust Gas O_2% Before the Turbocharger: RB: _____ % O_2 LB: _____ % O_2

Fuel System Adjustment at Full (Rated) Load
Exhaust Gas O_2% Before The Turbocharger: RB: _____ % O_2 LB: _____ % O_2

Gas Over Air Ratio at Full Load: RB: _____ " H_2O ΔP LB: _____ " H_2O ΔP

Intake Manifold Pressure - Gauge: RB: _____ " Hg LB: _____ " Hg
(Both Banks on Vee Engines)

Fuel System Adjustment on Dual Fuel & Low Btu Fuel Only

Fuel System Adjustment at Idle No Load
Gas Supply Pressure to Engine Mounted Regulator _____ psi

Fuel Only Regulator Pressure Differential $\frac{\text{Prechamber Manifold}}{\text{Intake Manifold}}$ _____ " Hg ΔP

Gas Over Air Ratio @ Idle No Load
- Lower Btu Fuel: RB: _____ " H_2O ΔP LB: _____ " H_2O ΔP
- Higher Btu Fuel: RB: _____ " H_2O ΔP LB: _____ " H_2O ΔP

Fuel System Adjustment at 50 BMEP
(0" Hg Gauge Manifold Pressure)

Exhaust Gas % O_2 Before the Turbocharger
- Lower Btu Fuel: RB: _____ % O_2 LB: _____ % O_2
- Higher Btu Fuel: RB: _____ % O_2 LB: _____ % O_2

Fuel System Adjustment at 100 BMEP
(10" Hg Gauge Manifold Pressure)

Exhaust Gas % O_2 Before the Turbocharger
- Lower Btu Fuel: RB: _____ % O_2 LB: _____ % O_2
- Higher Btu Fuel: RB: _____ % O_2 LB: _____ % O_2

Fuel System Adjustment at Full (Rated) Load
Exhaust Gas % O_2 Before the Turbocharger
- Lower Btu Fuel: RB: _____ % O_2 LB: _____ % O_2
- Higher Btu Fuel: RB: _____ % O_2 LB: _____ % O_2

Gas Over Air Ratio at Full Load
- Lower Btu Fuel: RB: _____ " H_2O ΔP LB: _____ " H_2O ΔP
- Higher Btu Fuel: RB: _____ " H_2O ΔP LB: _____ " H_2O ΔP

Intake Manifold Pressure - Gauge
(Both Banks on Vee Engines)
- Lower Btu Fuel: RB: _____ " Hg LB: _____ " Hg
- Higher Btu Fuel: RB: _____ " Hg LB: _____ " Hg

Waukesha DRESSER

AT27GL FIELD COMMISSIONING REPORT

Please complete the form and mail to the address below:

MAIL TO: WAUKESHA ENGINE DIVISION
Dresser Industries, Inc
1000 West St. Paul Avenue
Waukesha, Wisconsin 53188-4999
Attn: Warranty Department

I APPLICATION INFORMATION

ENGINE MODEL:_____	SERVICE REP.: _____	SOLD BY: _____
S/N: _____	_____	_____
SPECIFICATION:_____	ORGANIZATION: _____	ADDRESS: _____
APPLICATION: _____	_____	_____
_____	ADDRESS: _____	OWNER: _____
SAA#_____	_____	ADDRESS: _____
DUTY CYCLE: _____	DATE OF START-UP: _____	_____
NAME & MODEL OF DRIVEN	FAB. REP PERFORMING START-UP:	ENGINE LOCATION: _____
EQUIPMENT:_____	_____	_____
_____	FABRICATOR: _____	SITE OPERATOR: _____
	_____	PHONE #: _____

LUBE OIL	COOLING SYSTEM	FUEL INFORMATION
BRAND: _____	SYSTEM TYPE: _____	TYPE: _____
VISCOSITY: _____	WATER HARDNESS: _____	WKI™ NUMBER: _____
EQUIPPED WITH MICROSPIN™	TREATMENT USED: _____	BTU CONTENT (LHV): _____
_____YES _____NO	MAINTAINED BY:_____	FILTRATION TYPE: _____
	_____	_____
	DESIGNED COOLING SYSTEM TEMP	% OF H2S: _____
	MAIN _____°F	µg/l OF CL:_____
	AUXILIARY _____°F	

POWER SUPPLY

TYPE: ☐ BATTERIES WITH CHARGER

☐ ALTERNATOR, ☐ WITH BATTERIES

☐ AC/DC CONVERTER

☐ OTHER_____

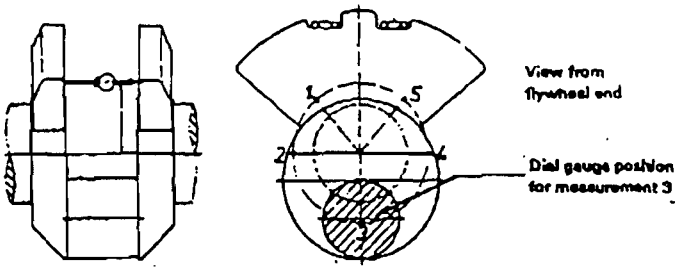
CAPACITY (AMPS):_____

II. MOUNTING & ALIGNMENT

A. Record Crankshaft EndPlay: _____
Specifications: 8LAT27GL 0.004" – 0.017" (0.152 – 0.304 mm)
12VAT27GL 0.006" – 0.012" (0.152 – 0.304 mm)
16VAT27GL 0.006" – 0.018" (0.015 – 0.46 mm)

B. Crankshaft Web Deflection:

NOTE: *Engines must be mounted per form 1214, Mounting and Alignment of Waukesha ATGL Engines.*
NOTE: *Location punch marks are factory supplied.*
NOTE: *Crankshaft web deflection has to be done before preliminary alignment.*
NOTE: *The measurements are normally taken at room temperature of 68 °F (20C°)*



Check-point	Crank 1	Crank 2	Crank 3	Crank 4	Crank 5	Crank 6	Crank 7	Crank 8	Crank 9	Crank 10
1										
2										
3										
4										
5										

Crankshaft Web Deflection Specifications:

Next to Flywheel:	**All Other Webs**
+0 / - .004"	+.0015" / -.0015"
(+0 /- .105 mm)	(+ .035 mm / - .035mm)

C. **Cold Coupling Alignment:**

NOTE: *Heat growth of driven equipment and engine will require misalignment cold to achieve desired alignment hot.*

Crankshaft Heat Growth Specifications – Vertical

These are based on temperature change from 70° F (21° C) to 180° F (82° C) operating oil temperature.

8LAT27GL .010" - .013" (.27 - .34 mm)
12VAT27GL .012" - .015" (.31 - .39 mm)
16VAT27GL .012" - .015" (.31 - .39 mm)

Cold Coupling Alignment

	Angular			**Parallel**	
_____	**A**	_____	_____	**P**	_____

Alignment Specifications

Angular alignment is correct when total indicator runout is less than .005" (.127mm) per foot of radius from center of shaft to where the dial indicator reads.
Parallel alignment is correct when total indicator runout is less than .005"(.127mm)

D. Recheck Crank Web Deflection

After completion of alignment recheck and record crankshaft web deflection.

Check-point	Crank 1	Crank 2	Crank 3	Crank 4	Crank 5	Crank 6	Crank 7	Crank 8	Crank 9	Crank 10
1										
2										
3										
4										
5										

III. Cooling System Checks

A. Verify that there are 1-1/2" (38 mm) balance lines installed from the bottom (below coolant level) of the expansion tank to the suction side of the main and auxiliary water pumps.

NOTE: *Both lines have to be independent of each other. Additionally, a separate expansion tank is required for each circuit.*

Acceptable _____ Unacceptable _____

B. Verify that there are vent lines installed from the highest points of each cooling system, entering the surge or expansion tanks below water level. Vent lines should slope continuously upward.

Vent Line Specifications

A ¼" (6.35 mm) throttling device, located as close to the engine as possible, is required in each vent line. Piping size is ½" (12.7 mm) I.D. for both auxiliary and main water systems.

Acceptable _____ Unacceptable _____

C. Verify that there are throttling devices installed in main and auxiliary water systems minimum 2" (50.8 mm).

Completed ☐

IV. Lube Oil System

CAUTION

DO NOT START THE ENGINE WITH THE PAPER ELEMENTS IN FINAL STRAINER. NOTE THAT FOUR PAPER ELEMENTS ARE INCLUDED WITH EACH ENGINE.

A. Install paper elements into the lube oil strainer and circulate oil with prelube pump to remove pipe debris. (1 hour minimum).

Completed ☐

B. Install second set of paper elements into the lube oil strainer; prelube (1 hour minimum).

Completed ☐

C. Continue the above process until all pipe debris is removed from the lube oil system.

Completed ☐

D. Reinstall steel element prior to start up.

Completed ☐

V. Function Test – No Load

A. Adjust butterfly valve (located on fuel piping to the carburetor) so it is 50% open.

Completed ☐

B. Set gas supply to the main chamber (Fisher 99 regulator) to 45-60 PSI (310 - 414 Kpa).

GAS PRESSURE _____

C. Start engine on hand throttle.

D. Confirm engine oil pressure 45 – 50 PSI (310 – 345 Kpa) at header.
Lube oil temperature should be at 175 – 180° F (79 - 82° C.)

PRESSURE _____

E. Set gas-over air at idle, no load to 15"-18" H_2O (38.1 – 45.7 cm). With the AFM in manual mode, set gas over air using stepper motor and record as start position.

START POSITION _____

PRESSURE _____

F. Verify governor control.

Acceptable _____ Unacceptable _____

G. Set prechamber fuel regulator pressure differential to 3" – 5" Hg (7.62 – 12.7 cm).

_____ HgΔP

H. Verify ignition timing with timing light. DSM should be disconnected.

Timing _____ Nameplate Spec. _____

I. Check all engine protection device set points and record below.

Shutdown Set Points							
HIGH JWT	LOW OIL PRESSURE	OVER SPEED TRIP	INTAKE MANIFOLD TEMPERATURE				

J. Check CEC Power
*Measurement to be taken at engine-mounted junction box
**Measurement to be taken at CEC device terminals inside of control module
***Measurement from CEC device ground to chassis ground

	At Power Supply	IM*	TCM**	DSM**	AFM**
Voltage (V_{DC})					
Ripple (V_{P-P})					
Resistance (OHMS)***					

VI. Function Test – Loaded

The DSM should be disabled and the AFM left in Manual mode for this initial test

A. The TCM system should be mapped to hold a consistent ΔP (Throttle Reserve) of 9 – 13" Hg throughout the load and speed range of the application. The maps should be adjusted to attain this reserve at all load points. Record in the form below.

Completed ☐

Bypass Map Editing												
	RPM		RPM		RPM		RPM		RPM		RPM	
	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG
1												
2												
3												
4												
5												
6												
7												
8												

Wastegate Map Editing												
	RPM		RPM		RPM		RPM		RPM		RPM	
	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG	Pa IN-Hg	POS DEG
1												
2												
3												
4												
5												
6												
7												
8												

B. At rated load and speed (see name plate on engine) move ball valve to adjust post-turbo exhaust O_2 to 11.4%. Contact the factory for alternative fuel settings.

Record reading _____ % O_2 LB

C. At 11.4% O_2 calibrate the AFM potentiometer to 2.50 volts.

Completed ☐

D. Set up the AFM according to the AFM Installation, Operational and Maintenance Manual (Form 6263). Record settings below.

Intake Manifold Pressure (psiA)	O2%	O_2 Sensor Set Point (Volts)	Current Stepper Position	Lean Limit	Rich Limit
		Left	Left	Left	Left
10.0					
15.0					
20.0					
25.0					
30.0					
35.0					
40.0					

Original G/A Setting	Left	Stepper Start Position	Left	Pinch Valve Position	Degree

E. Record exhaust temperatures and engine data at rated load:

1R _____	1L _____
2R _____	2L _____
3R _____	3L _____
4R _____	4L _____
5R _____	5L _____
6R _____	6L _____
7R _____	7L _____
8R _____	8L _____
Pre-Turbo _____	Pre-Turbo _____
Post-Turbo _____	Post-Turbo _____

RPM	JW Outlet Temp.	Oil Temp.	Oil Press.	C. Case Vacuum	Exhaust Back Press "H20	Load	Timing	Intake Manifold Press.	Gov. Load Ind.	Fuel Press.	G/A Press.
						BHP kW					

F. Record water pump inlet pressures. _____JW _____ Auxiliary

G. Record jacket water pump discharge pressure and temperature specification (ref. S9068). (Δ 17-19° F) (9 to 10° C)

_____JW Psi _____ JW Temp

H. Check auxiliary system component temperature differentials per below at 48" Hg ± 1" Hg intake manifold pressure.

_____Auxiliary Psi _____ Auxiliary Temp

		800 RPM	1000 RPM	Record Actual
H2O	Intercooler	6°F (3°C)	8° F (4° C)	_____ _____
	Oil Cooler	10° F (6° C)	12° F (7° C)	_____ _____
Or				
50/50	Intercooler	7° F (4° C)	9° F (5° C)	_____ _____
Glycol	Oil Cooler	11.5° F (7° C)	13.5° F (8° C)	_____ _____

I. Air inlet restriction at rated load. _____

J. Set up the DSM system according to DSM Installation, Operation and Maintenance Manual, (Form 6268). Record Autocal values below.

Engine Family: AT Gas Engine Engine Model: _____ # of Cylinders: _____ Primary Fuel: _____ Secondary Fuel: _____		Detonation Level Select
Timing Disk Reference _____ °BTDC D- Lead Position Grounded Open Most Advanced Timing _____ °BTDC _____ °BTDC Most Retarded Timing _____ °BTDC _____ °BTDC Default Timing _____ °BTDC _____ °BTDC End of Sample Window _____ ° ATDC		Sensor 1 _____ mV Sensor 2 _____ mV Sensor 3 _____ mV Sensor 4 _____ mV Sensor 5 _____ mV Sensor 6 _____ mV Sensor 7 _____ mV Sensor 8 _____ mV Sensor 9 _____ mV Sensor 10 _____ mV Sensor 11 _____ mV Sensor 12 _____ mV Sensor 13 _____ mV Sensor 14 _____ mV Sensor 15 _____ mV Sensor 16 _____ mV
Retard _____ Every _____ Seconds Advance _____ Every _____ Seconds		
Warm-up Delay Time _____ Seconds Shutdown Delay Time _____ Seconds		

VII. Hot Alignment

Angular				Parallel	
_____				_____	
_____	A	_____	_____	P	_____
_____				_____	

Alignment Specification

Angular alignment is correct when total indicator runout is less that .005" (.127 mm) per foot of radius from center of shaft to where the dial indicator reads.

Parallel alignment is correct when total indicator runout is less than .005" (.127 mm)

NOTE: Record any oil or water leaks and any discrepancies, which should be corrected. Explain any support systems such as fuel, cooling, air induction, exhaust, or general installation features, which may be detrimental to engine performance or service life.

REMARKS:

_____

_____

_____

_____

VIII. Customer Satisfaction Checklist.

Provided and discussed warranty? _____

Discussed spare parts stock and provided recommended service parts list? _____

_____

Provided operator orientation training? _____

Confirmed operator manuals are on site? _____

Advised customer where to obtain parts and service? _____

_____

Provided a CEC computer loaded with software? Yes ☐ No ☐

If yes, name of person accepting it: _____

_____ _____

CUSTOMERS SIGNATURE (Required)
(Indicating Start-up Performance to Satisfaction)

CERTIFIED SERVICEMAN'S SIGNATURE

Print _____ Print _____

EXPLANATION OF ABBREVIATIONS: "Hg (Inches of Mercury), "H2O (Inches of Water), °F (Degree Fahrenheit), R.B. (Right Bank), L.B. (Left Bank), RPM (Engine Crankshaft Rotations per Minute), PSI (Pounds Per Square Inch), O.S. (Over Speed), A= Angular, P= Parallel. ΔP = Pressure Differential, ΔT = Temperature Differential.

Attachment 9

Supplemental Information for Construction Permit Application

Alexander Orr, Jr. Water Treatment Plant

ASME International
The American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017

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The Waukesha Turbocharger Control Module: A Tool for Improved Engine Efficiency and Response

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Dresser Industries Inc.
Waukesha, Wisconsin

Jim Mueller
Barber-Colman Co.

ABSTRACT

The Waukesha Turbocharger Control Module allows optimum control of turbochargers on lean burn gaseous fueled engines. The Turbocharger Control Module is user programmed to provide either maximum engine efficiency or best engine response to load changes. In addition, the Turbocharger Control Module prevents undesirable turbocharger surge. The Turbocharger Control Module consists of an electronic control box, engine speed, intake manifold pressure, ambient temperature sensors, and electric actuators driving compressor bypass and wastegate valves. The Turbocharger Control Module expands the steady state operational environment of the Waukesha AT27GL natural gas engine from sea level to 1525 m altitude with one turbocharger match and improves the engine speed turn down by 80 RPM. Finally, the Turbocharger Control Module improves engine response to load changes.

INTRODUCTION

The necessity for controls on turbochargers became evident soon after the widespread use of turbochargers on reciprocating internal combustion engines. Early controls were used to control maximum turbocharger speed for turbocharger protection and maximum boost pressure for engine protection. More recently turbocharger controls have been used to maximize engine performance and efficiency. The wastegate valve routes exhaust around the turbine of the turbocharger. Another type of turbocharger control is the compressor bypass valve, which routes compressed air from downstream of the compressor to either upstream of the turbine or directly to ambient. Less common are variable geometry turbochargers (1) which change either the angle of entry of exhaust gasses to the turbine wheel or the area of the turbine nozzle.

Few lean burn natural gas engines are produced without some type of turbocharger control. The most common turbocharger control is a wastegate valve that is used to control maximum intake manifold pressure. When used to control maximum intake manifold pressure, the wastegate is being used only to limit maximum engine power. Part load efficiency improvements are possible by changing the wastegate position to hold a fixed pressure drop across the throttle (2). This type of control is the commonly called "delta-P" wastegate control. Unlike a diesel engine, as load is decreased on a lean burn natural gas engine, the air-fuel ratio richens from the rated load setting. This richer air-fuel ratio increases the energy available to the turbocharger, resulting in higher air flow than is needed. The reason the delta-P wastegate improves efficiency is due to reduced engine pumping losses. As the wastegate is opened, the throttle also opens, reducing engine pumping losses. The disadvantage of the delta-P wastegate control is poorer transient response due to the reduced pressure drop across the throttle ("throttle reserve") and reduced turbocharger speed at a given engine load.

The compressor bypass valve works by increasing air flow through the compressor without increasing air flow through the engine. Surge is a condition caused by a temporary reversal of flow in a compressor due to high adverse pressure gradients and low mass flow rates. Surge can be caused in lean burn natural gas engines by rapidly closing the throttle for engines where the throttle is located downstream of the compressor. Surge produces loud "banging" noise and can disrupt stable engine operation. A compressor bypass valve can be used to reduce the tendency to surge. The increased air flow through the compressor moves the operating point on the compressor map away from the surge line.

The Waukesha Turbocharger Control Module (TCM) (3) includes both wastegate and compressor bypass valves. The TCM is a fully electronic control with electrical actuators for both wastegate and bypass. Engine speed, ambient temperature, and intake manifold absolute pressure are used as inputs to determine the desired positions for the bypass and wastegate valves. The compressor bypass discharges into the exhaust manifold upstream of the turbine to balance the mass flow through the compressor and turbine and to maximize efficiency of the system. A user input map of wastegate and bypass position as a function of intake

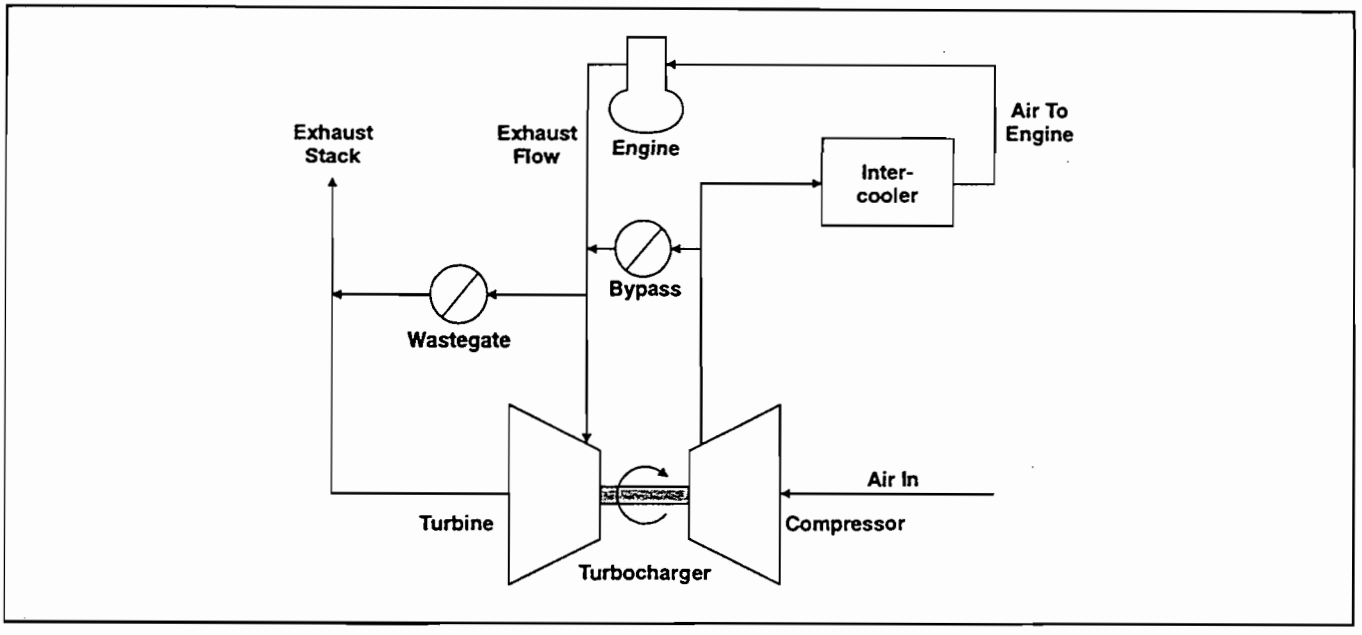

FIGURE 1. THE TCM AS INSTALLED ON THE WAUKESHA AT27GL LEAN BURN NATURAL GAS ENGINE

manifold absolute pressure and engine speed provides the setpoints for the TCM. *Figure 1* shows a schematic drawing of the TCM as installed on the Waukesha AT27GL lean burn natural gas engine (4).

TCM DESIGN

Because the TCM was designed to be engine mounted, extensive temperature, vibration, and EMC testing were performed. The actuators are DC electric motors driving an output shaft through a gear train. These actuators were chosen so that if there were any kind of failure in the TCM, the motors would hold the current position of bypass and wastegate valves, enabling continued engine operation until the problem could be corrected.

The specific tests that the controller and actuators had to pass included:

Vibration. A search for resonant frequencies in each of three mutually exclusive axes was performed to determine where the actuator and controller may be most susceptible. The devices were then operated normally while being subjected to continuous vibration for several million cycles at these resonant frequencies.

Thermal Shock. Controller and actuator were subjected to 25 cycles of instantaneous thermal change from -40 to +85 Celsius and back to -40 Celsius. Units were soaked for three hours at each temperature.

Salt Fog. Both controller and actuator were subjected to a 1000 hour salt fog test.

EMC. Both controller and actuator were subjected to a conducted susceptibility test equivalent to a radiated field of 200 Volts/meter.

Combined Environment Test. The actuator and controller were subjected to 60 cycles of temperature cycling over 500 hours with intermittent periods of continuous vibration. This test method was very significant to show the overall integrity and reliability of the actuator and controller assemblies.

The TCM has extensive self diagnostics capability. Sensibility checks are used to detect sensor faults. For example, a failure of the engine speed sensor is detected if high intake manifold pressure is measured with the engine speed less than 500 RPM. The controller then moves the wastegate and bypass valves to default positions that enable the engine to continue operating until the failure can be corrected. LEDs on the front of the TCM show the cause of any faults. In addition, there are alarm and shutdown relays that can be used by the customer for other control actions. *Table 1* shows diagnostic checks and control action taken upon fault detection. A design Failure Modes and Effects Analysis (FMEA) was done to verify the design integrity.

The user programs the TCM with software that runs on a standard personal computer.

STEADY STATE RESULTS

Steady state simulation results using the WAVE (5) engine simulation program show that the TCM permits the engine to have a wider range of operating conditions than with the previous popoff wastegate valve. Using only one turbocharger match, the engine can operate at 15 Bar BMEP (220 psi) from sea level to 1525 m (5000 ft) elevation and from 750 to 1000 RPM. If the air-fuel ratio is richened, the engine is capable of operation at 15 Bar BMEP to an elevation of 2134 m (7000 feet). The use of one turbocharger match for all applications simplifies turbocharger replacement and reduces the need to stock many variations. The original power limiting type wastegate valve limited the engine speed turn down to 830 RPM. The TCM allows the engine to maintain rated torque from 1000 RPM down to 750 RPM. All simulation results were verified in the laboratory. For applications

TABLE 1. TCM FAULT DETECTION LOGIC		
FAULT	**DETECTION**	**CONTROL ACTION**
Manifold pressure sensor	Press. > 310 kPa, or < 34 kPa and engine speed > 800 RPM	Immediately hold existing actuator positions. After 20 seconds activate alarm relay. If engine speed drops to zero after 20 seconds then activate shutdown relay.
Engine speed sensor	Average engine speed < 500 RPM and manifold pressure > 118 kPa	Immediately move wastegate and bypass to positions assuming an engine speed of 950 RPM. After 20 seconds activate alarm relay.
Bypass actuator position feedback potentiometer	Sensing resistor and software logic	Immediately hold existing actuator positions. After 20 seconds activate alarm relay. If engine speed drops to zero after 20 seconds then activate shutdown relay.
Wastegate actuator position feedback potentiometer	Sensing resistor and software logic	Immediately hold existing actuator positions. After 20 seconds activate alarm relay. If engine speed drops to zero after 20 seconds then activate shutdown relay.
Bypass or wastegate actuator drive electronics	Actuator drive electronics	Immediately hold existing actuator positions. After 20 seconds activate alarm relay. If engine speed drops to zero after 20 seconds then activate shutdown relay.
Calibration of actuator feedback potentiometers	Actuator fails to move, or moves in the wrong direction during calibration.	Hold existing actuator positions and activate alarm and shutdown relays.
Ambient air temperature	Temp. > 70° C or < -35° C	Immediately hold existing actuator positions. After 20 seconds activate alarm relay. If engine speed drops to zero after 20 seconds then activate shutdown relay.

where a reduced power output is needed, it is much more efficient to operate the engine at rated torque and reduced engine speed than at rated engine speed and reduced torque. One example where engine speed turndown is important is gas compression applications. The gas compressor is a constant torque load on the engine and gas flow rate is adjusted by changing engine speed. Engine fuel economy is improved at reduced engine speeds due to reductions in friction and pumping losses with decreased speed. The TCM expands the capability of the engine to run at rated torque and reduced speeds. The TCM improves engine performance in two other ways besides improved speed turndown. The first is that it allows the engine to be run at part load, with good throttle reserve and without surge.

Since air-fuel ratios are typically richened at part load, this operation is the most difficult operating point for a turbocharged lean burn natural gas engine. Test results of part load operation of the Waukesha 8L-AT27GL are shown on the compressor map in Figure 2. The engine was operated at the production excess air ratio of 2.0. Two part load operating conditions are shown as "a" and "b" on *Figure 2*. Three operating conditions for changing from load "a" to load "b" are shown by the three lines; "A," "B," and "C." Line "A" represents the operation with sufficient throttle reserve for good engine response and load acceptance with both the wastegate and bypass valves closed. Obviously, the turbocharger is well into the surge region and operation here is impossible. By opening the wastegate to lower the compressor pressure ratio, the operating line can be lowered to line "B." Here the turbocharger is near surge, the engine is in an unstable operating condition, and load response is very poor. By opening the bypass and thus increasing airflow through the compressor, the operating line is shifted from "A" to "C." Now the turbocharger is operating at its maximum efficiency and the engine is in stable operation with good load response. The TCM also improves altitude capability of the engine. With the ability to increase the turbocharger airflow, as shown in *Figure 2*, by moving from point 2a to 2c, a larger turbo compressor with a higher airflow can be used. This improves the engines ability to operate at high elevations. In *Figure 2*, point 3 represents engine operation at rated speed and load, at sea level. For operation at 1525 m (5000 ft), the operating point moves to 4. If the compressor had been sized smaller, so points 1 and 2a were on the map, then point 4 would be off the map. With the larger compressor, the elevation capabilities are increased by over 600 m (2000 ft). The operational range of the AT increased from 915 m (3000 ft) to 1515 m (5000 ft).

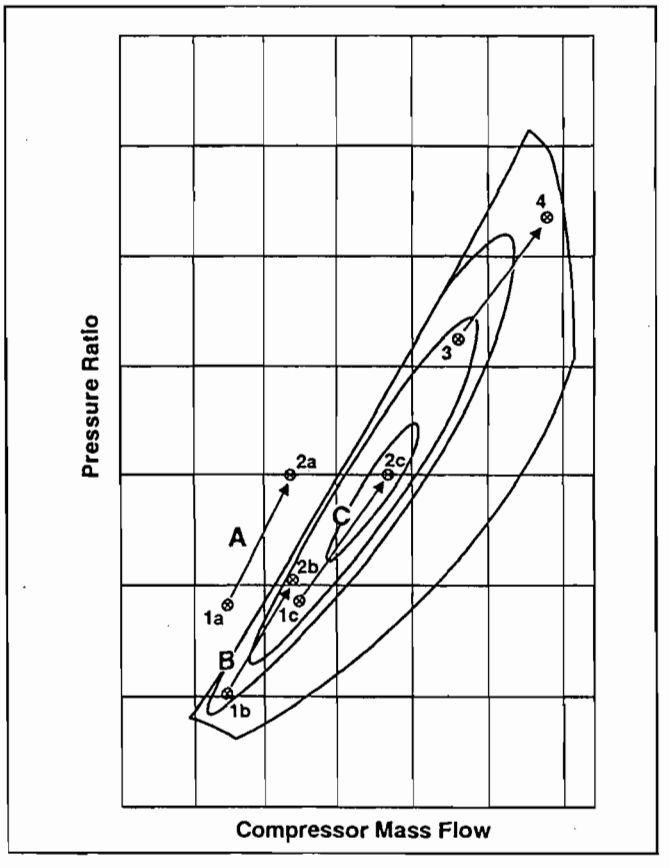

FIGURE 2. TEST RESULTS OF PART AND FULL LOAD OPERATION OF THE WAUKESHA 8L-AT27GL

Fluctuations in ambient air density change the operating point of the turbocharger for constant power engine operation. Since this is a stationary engine, the largest factor affecting ambient air density is the ambient air temperature. Therefore, a compressor inlet temperature sensor is used with the TCM. A correction formula stored in the TCM controller changes the desired wastegate and bypass positions as a function of compressor inlet temperature. The temperature correction equation was derived from engine simulations.

By simple programming of the desired wastegate position versus load and speed, the TCM can be made to mimic a delta-P type wastegate control. This provides maximum fuel economy for applications where engine transient response is not important.

ELECTRIC POWER GENERATION RESULTS

When used for stand-alone power generation, an engine must be responsive to load changes. The mapping of the TCM for engines powering generators is totally different from the mapping used for engines driving gas compressors. Rapid load increases demand that both the wastegate and bypass valves be closed for best response. Rapid load decreases demand that both the wastegate and bypass valves be opened to reduce engine speed overshoot and compressor surge. During a rapid load increase the engine speed drops. As the throttle opens, there is a rapid increase in flow through the compressor and a slight drop in compressor pressure ratio as the pressure is equalized upstream and downstream of the throttle. After pressure equalization across the throttle there is a slower increase in mass flow and pressure ratio as the turbocharger speed increases. As the engine returns to governed speed, the throttle closes and both the compressor pressure ratio and the mass flow decrease to new steady state values.

Transient engine simulations were used to determine the operating strategy of the TCM when driving a generator set. The simulation used is a mean value engine model (6) which runs under the Matlab/Simulink (7) simulation program. Mean value engine models are powerful tools for developing control algorithms and evaluating new control schemes. *Figure 3* shows simulation results from a 25% load increase. The wastegate has been adjusted to maintain approximately 34 kPa (10 inches mercury) pressure drop across the throttle. As the engine speed slows in response to the load increase, the throttle opens and the wastegate and bypass valves close. The engine returns to governed speed in about six seconds. *Figure 4* shows the engine response for an almost closed wastegate. The throttle reserve has increased to 51 kPa (15 inches mercury). The engine returns to governed speed in approximately four seconds. By opening the bypass, the operating point on the compressor map can be moved towards higher mass flow and slightly higher pressure ratio. This prevents surge while still permitting a slightly higher throttle reserve for better transient response. An additional advantage of opening the bypass valve is the higher initial turbocharger speed. *Figure 5* shows engine response to a 25 percent load bump with the bypass opened for improved transient response. The engine returns to governed speed in approximately three seconds.

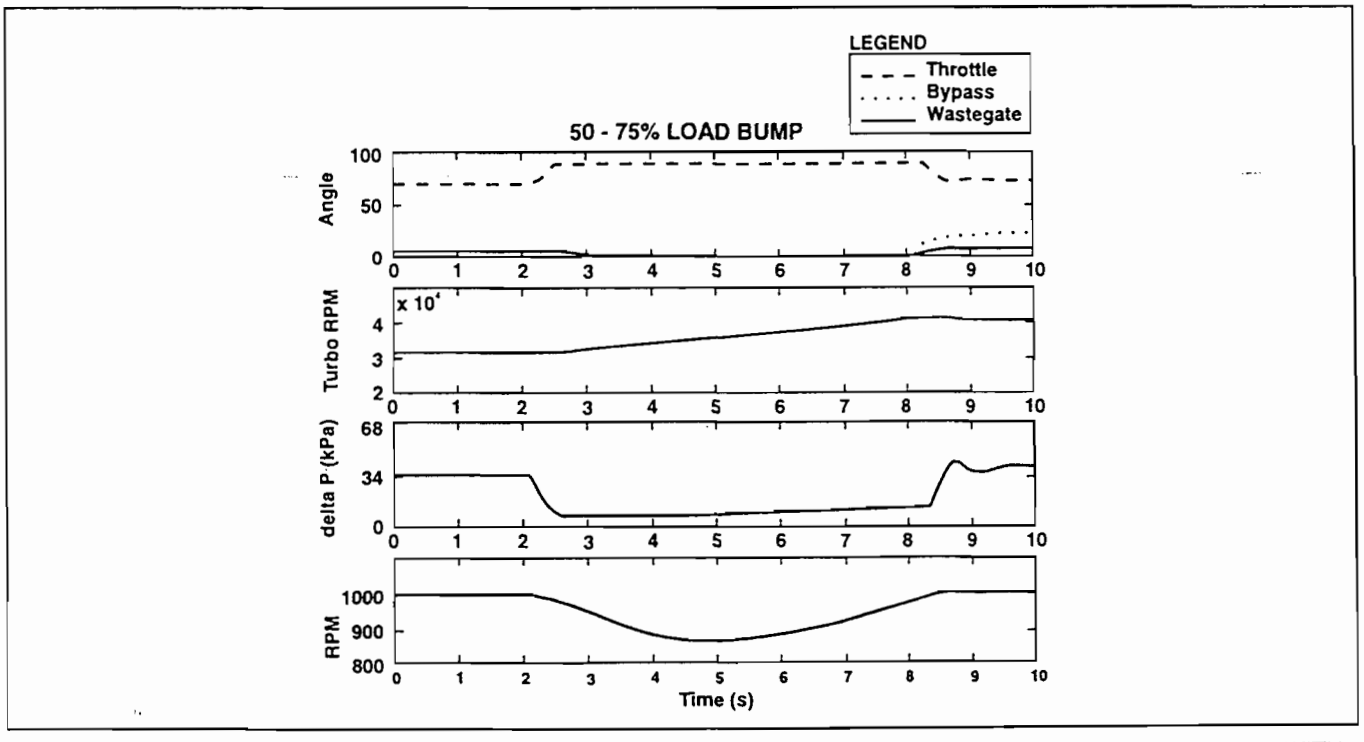

FIGURE 3. MATLAB/SIMULINK SIMULATION RESULTS OF ENGINE RESPONSE FROM A 25% LOAD INCREASE WITH STANDARD WASTEGATE AND BYPASS SETTINGS

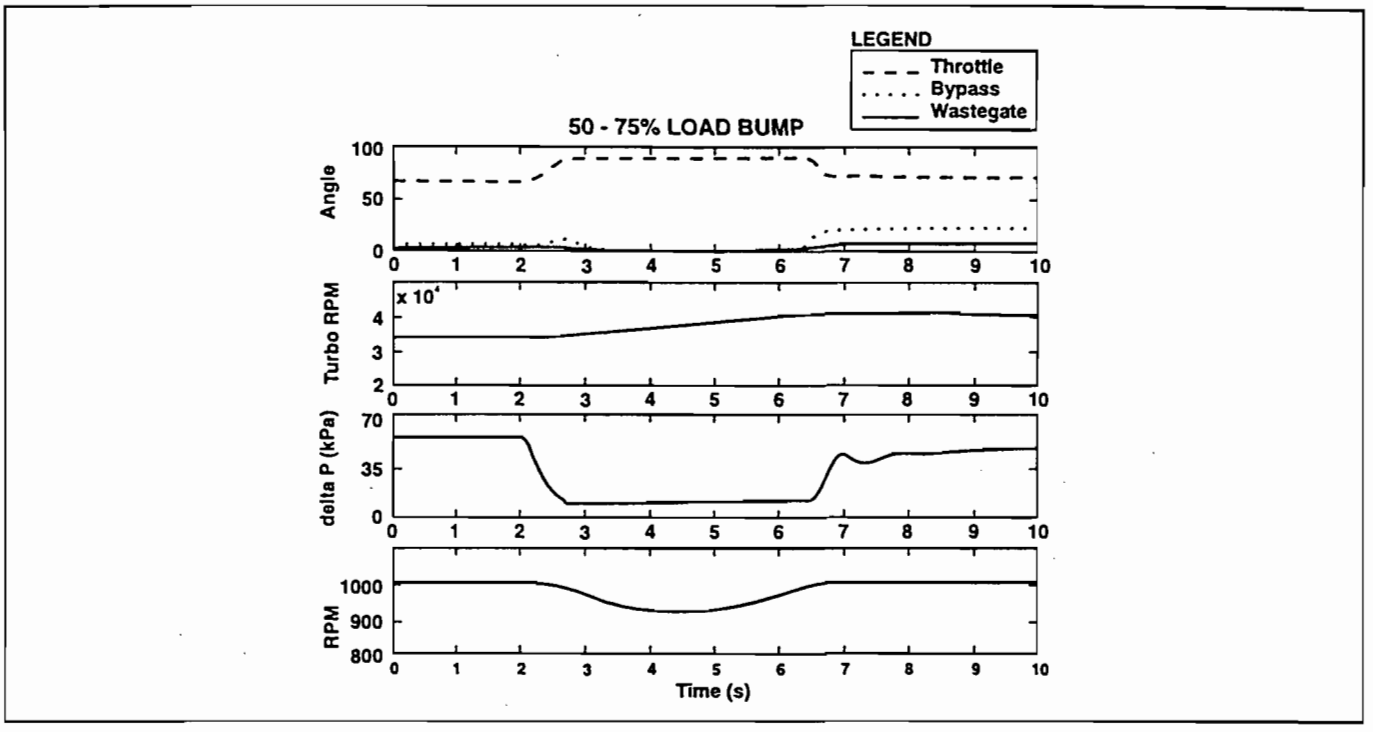

FIGURE 4. SIMULATION RESULTS FROM A 25% LOAD INCREASE WITH AN ALMOST CLOSED WASTEGATE

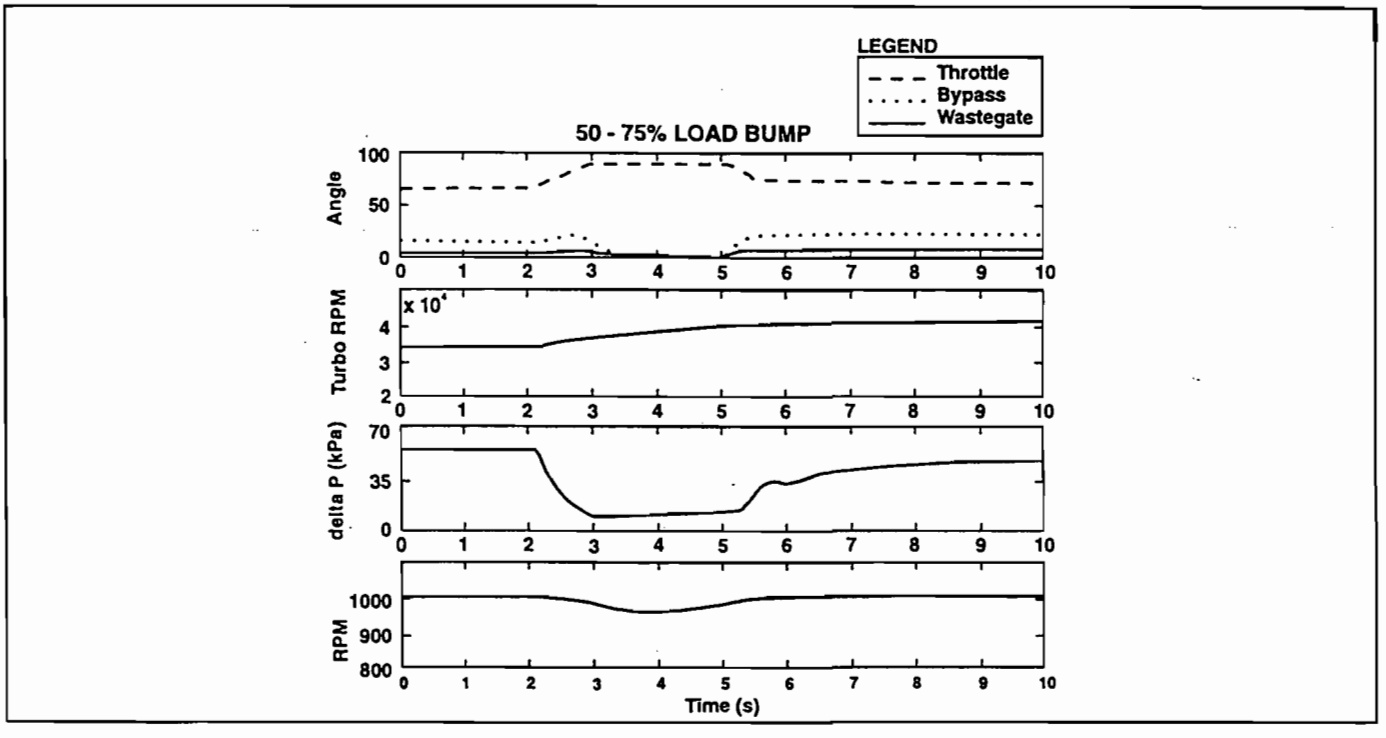

FIGURE 5. SIMULATION RESULTS FROM A 25% LOAD INCREASE WITH THE BYPASS OPENED FOR IMPROVED TRANSIENT RESPONSE

Compared to a popoff style wastegate, the TCM has the potential for improved response. By opening the bypass, the initial turbocharger speed can be increased. To reach the rated load point, the intake manifold pressure must increase above the steady state rated load intake manifold pressure. A popoff style wastegate limits the maximum intake manifold pressure, thus limiting engine power. During a load increase to rated load, the popoff style wastegate limits the maximum intake manifold pressure, thus reducing the transient response of the engine. The TCM can be programmed to hold the wastegate closed as long as the engine speed is below the governed speed regardless of the intake manifold pressure. Similarly, for a sudden load decrease the TCM can be programmed to open the bypass and wastegate valves as the engine speed increases. This helps limit engine overspeed and reduces the occurrence of undesirable compressor surge.

FIELD TESTS

The TCM was extensively field tested before production release. One test site involved a generator application where the generator was driving approximately 60 electric pump jacks. The pump jacks would randomly stop and start, rapidly changing the load on the engine. Occasionally several pump jacks would start or stop simultaneously, resulting in large load changes on the engine. Modifications to the desired wastegate and bypass position maps eliminated surge and improved engine response to load changes. Over 49,000 hours were put on field test units prior to production release. The TCM is standard on the entire Waukesha AT family of engines.

CONCLUSIONS

The Waukesha TCM is a flexible turbocharger management system that allows independent optimization for either maximum engine efficiency or best load acceptance. Undesirable turbocharger surge is reduced with the TCM. Engine speed turndown is also improved with the TCM. The flexibility of the TCM allows one turbocharger match for all engine applications, reducing the need to stock many turbocharger models.

ACKNOWLEDGEMENTS

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GAS ENGINE EMISSIONS TECHNOLOGY

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Deterioration of the atmosphere from gaseous pollutants is an important environmental issue. Local, state, and national governments continue to enact stricter exhaust emissions legislation to reduce and possibly reverse the atmospheric deterioration. This legislation often affects natural gas engine installations by limiting the horsepower allowed or requiring very low emissions levels out of the engine. Natural gas engine manufacturers continue to develop products which help to meet these requirements. In addition exhaust treatment companies have developed processes which reduce pollutants by converting them into safe, naturally occurring compounds which are not damaging to the atmosphere.

This paper discusses how air pollutants are formed in natural gas engines and the health risks and atmospheric deterioration which result from these pollutants. Some of the current emissions regulations are presented and how they apply to gas engines is addressed. Technology for reducing emissions is also discussed along with estimated cost comparisons for determining which processes are the most economical.

ATMOSPHERIC POLLUTANTS

Pollutants which can be produced in natural gas engines are classified in six different categories:

NO_x (oxides of nitrogen)
CO (carbon monoxide)
HC (hydrocarbons)
SO_x (oxides of sulfur)
CHO (aldehydes)
PM_{10} (particulate matter 10 microns and smaller)

NO_x

Oxides of nitrogen consist of NO (nitric oxide) molecules and NO_2 (nitrogen dioxide) molecules which are formed when N_2 (nitrogen) and O_2 (oxygen), from the air, react with each other. This reaction requires a high combustion temperature and the presence of nitrogen and oxygen in the combustion chamber as the fuel is burned.

NO_2 harms humans and animals by reducing breathing capacity and limiting the blood's ability to carry O_2. It is also harmful to vegetation. In the lower atmosphere NO_2 and NO, when exposed to sunlight, act as precursors in the formation of O_3 (ozone). Ozone in the lower atmosphere damages plants and synthetics, and causes coughing, choking and headaches in humans. Photochemical smog contains NO_2, which is a yellowish–brown color, and ozone.[1]

CO

Carbon monoxide is formed by incomplete combustion of the fuel. Complete combustion of a methane molecule is represented by the formula below:

$$CH_4 + 2O_2 \Rightarrow CO_2 + 2H_2O$$

Incomplete combustion of a methane molecule will produce CO instead of CO_2 (carbon dioxide). Incomplete combustion occurs when there is insufficient oxygen near the hydrocarbon (fuel) molecule for complete combustion or when combustion is quenched near a cold surface in the combustion chamber.

Carbon monoxide is a poisonous gas which causes nausea, headache and fatigue, and, in heavy enough concentrations, CO can even cause death. In the upper atmosphere CO reacts with O_3 (ozone) producing CO_2, which depletes the ozone layer of the upper atmosphere. This ozone layer screens harmful sun rays from reaching the Earth's surface. Depleting the ozone layer allows more harmful rays to reach the surface.[1]

HC

Natural gas is a fuel made up of several hydrocarbon gases including: CH_4 (methane), C_2H_6 (ethane), C_3H_8 (propane), C_4H_{10} (butane), and other heavier compounds. A small fraction of these hydrocarbons will pass through the combustion chamber without reacting. Therefore these hydrocarbons will retain their form in the exhaust (ie. some methane, ethane, and propane etc. will be found in the exhaust). These hydrocarbon emissions are commonly broken down into two categories and sometimes a third. These categories are:

1) THC (Total Hydrocarbons) or TOC (Total Organic Compounds)
2) NMHC (Non–Methane Hydrocarbons) or VOC (Volatile Organic Compounds) or ROG (Reactive Organic Gases) or ROC (Reactive Organic Compounds).
3) NMHC–NEHC (Non–Methane, Non–Ethane Hydrocarbons)

THC

Total hydrocarbon emissions include all of the hydrocarbon gases found in the exhaust stream.

NMHC

Non–methane hydrocarbons are the portion of the THC (total hydrocarbons) which does not include methane. For example an exhaust gas contains:

1000	PPMV Methane
200	PPMV Ethane
100	PPMV Propane
+ 50	PPMV Butane
1350	PPMV THC

The non–methane portion of the THC is:

1350	PPMV THC
–1000	PPMV Methane
350	PPMV NMHC

Non–methane hydrocarbons are singled out from methane because they can react with NO_x in the lower atmosphere, acting as a precursor in the formation of photochemical smog. Methane will not readily react in the lower atmosphere in the smog reactions.[1] Ethane is also disregarded in some controlled areas because it has a much lower reactivity than the heavier hydrocarbons. In these areas the regulations are based on non–methane, non–ethane hydrocarbons.

SO_x

Oxides of sulfur are formed when sulfur containing compounds, in the fuel or lube oil, are oxidized in the combustion chamber. In gaseous fuels sulfur can be present in the form of H_2S (hydrogen sulfide). Oxides of sulfur enter the atmosphere and combine with water in the air forming H_2SO_3 (sulfurous acid) and H_2SO_4 (sulfuric acid). These acids return to Earth as acid rain.

H_2S can be removed from gaseous fuels with proper treatments which will decrease the SO_x exhaust emission levels.

CHO

Aldehydes are formed during the combustion of liquid fuels and lube oil in an engine. They also are a part of the resulting smog from photochemical reactions between oxygen and hydrocarbons. The reaction's unbalanced chemical equations are:

$$O_3 + NMHC \Rightarrow CHO + CO_2$$
$$O + NMHC \Rightarrow CHO + CO_2$$
$$CHO \Rightarrow Smog$$

Aldehyde levels from gaseous fueled engines are extremely low when compared to liquid fueled engines and normally are not regulated for gaseous fueled engines.

Aldehydes contribute to eye irritation, and polymerize to form visibility–reducing aerosols.[4]

PM_{10}

Particulate matter is formed during combustion of liquid fuels and engine lubricating oil. Particulates are often seen as black smoke coming from diesel truck engines. Particulate levels from natural gas engines are extremely low when compared to diesel engines.

Particulates from diesel engine exhaust have been labeled as a possible carcinogen (cancer causing agent) by some regulatory agencies.

EMISSIONS REGULATIONS

Regulations governing the quantity of pollutants which a gas engine can discharge vary between different regions due to the air quality in these regions. Regions with poor air quality have much tighter restrictions on exhaust emissions than areas where the air quality is good. For this reason the local air quality board must be contacted to determine emission requirements when engines are considered for new projects or re–powers.

There are four common methods of classifying the amount of pollutant discharge that are acceptable. These are:

1) Pollutant per period (e.g. tons/year).
2) Pollutant per energy unit generated (e.g. gram/BHP–HR).
3) Pollutant per unit volume of exhaust (e.g. PPMV).
4) Pollutant per energy unit consumed (e.g. gram/Gigajoule).

Pollutant Per Period

On a site which will use gas engines there can be a limit on how much pollutant can be discharged for a given period. For example, in a Prevention of Significant Deterioration (PSD) area, The Federal Clean Air Act defines certain "major emitting facilities" as having the potential to emit 100 tons/year or more of any air pollutant. All other sources, usually, including IC engine installations, are classified as a major source if they exceed a 250 ton/year threshold. Being classified as a major source may necessitate permitting, modelling, offset, or control requirements not required for lower emitting sites.

The amount of horsepower which can be installed at a site without exceeding the 250 ton/year level can be determined from the engine exhaust emission levels (in weight/hp–hr) and the number of hours per year the engine will operate. For example, if an engine's emission rates are: 1.5 gram/hp–hr NO_x, 2.65 gram/hp–hr CO, 1 gram/hp–hr NMHC, and the engine will operate 8760 hours/year, the permissible power is determined based on CO.

$$Horsepower = \frac{250\ ton}{year} \times \frac{907,200\ grams}{ton} \times \frac{1\ year}{8760\ hours} \times \frac{hp\text{–}hr}{2.65\ grams} = 9770\ HP$$

Pollutant Per Energy Unit Generated

Some regions limit pollution from a source based on the amount of useful energy it is producing. For natural gas engines the useful energy is horsepower–hours of mechanical energy, therefore the engines are regulated in grams/hp–hr. Limits are set for the pollutants which are causing the air quality deterioration.

Pollutant Per Unit Volume Of Exhaust

This method of regulating exhaust emissions gives a limit for the amount of pollutant in a given volume of exhaust produced. The common unit is PPMV (Parts Per Million based on Volume). This limit is commonly based on a standardized exhaust oxygen content of 15% O_2.

Pollutant Per Energy Unit Consumed

This method involves regulating pollution based on the amount of fuel consumed. Common units for this are grams/gigajoule of fuel.

Efficiency Adjustment Factors

Many regions will consider the efficiency of the engine in the calculation to allow more efficient engines a higher emissions limit. This is accounted for by the formula:

$$Allowable\ Pollutant = Pollutant\ Limit \times \frac{Engine\ Efficiency}{Baseline\ Efficiency}$$

Baseline efficiency is determined by the governing agency.

Acronyms

Some common Acronyms used in emissions regulations are listed below:

PSD –**P**revent **S**ignificant **D**eterioration
NA –**N**on–**A**ttainment
SIP –**S**tate **I**mplementation **P**lan
NSPS–**N**ew **S**ource **P**erformance **S**tandard
BACT–**B**est **A**vailable **C**ontrol **T**echnology
LAER–**L**owest **A**chievable **E**mission **R**ate
RACT–**R**easonably **A**vailable **C**ontrol **T**echnology
MACT–**M**aximum **A**chievable **C**ontrol **T**echnology
HAP– **H**azardous **A**ir **P**ollutant
NESHAPs–**N**ational **E**mission **S**tandards for **H**azardous **A**ir **P**ollutants

A PSD area is one which meets **N**ational **A**mbient **A**ir **Q**uality **S**tandards (NAAQS) and in which the air quality is not to be significantly worsened. The regions are usually within one state.

An NA area is one which does not meet NAAQS and where a state must provide a plan to bring this region into compliance.

A State Implementation Plan is the plan by which a state must bring its NA areas into compliance with NAAQS. These are laws, programs, etc., which may be tighter than those spelled out in any New Source Performance Standard (NSPS).

New Source Performance Standards are specific rules that apply to over 60 emissions source categories such as power plants, steel mills, acid plants, gas turbines, etc., which are established by the EPA and apply throughout the nation.

Best Available Control Technology is defined by the United States Environmental Protection Agency and most other regulatory agencies as the maximum degree of reduction of a pollutant from an emitting facility, which the permitting authority, on a case–by–case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems and techniques. Note that the case–by–case criteria means that a facility in one area will not necessarily have an identical emission limit or process requirement as the same type of facility in another area.

Lowest Achievable Emission Rate control technology may be required on a new source locating in a non–attainment area. LAER is more stringent than BACT and NSPS and it is defined as the lowest emission rate allowed or achieved anywhere without regard to cost or energy use.

LAER can be based on technology transfer from one source type to another. However, there is latitude in negotiating control requirements only if specific control techniques can be shown not to be feasible for technical or process reasons, or for lack of suitable applicability.

Reasonably Available Control Technology is defined as that which would achieve the lowest emission limit applicable to a specific source using reasonably available and economically feasible control equipment.

Maximum Achievable Control Technology is defined as equipment which gives emission levels that are based on the best demonstrated control technology or practice in the same or similar sources. It applies to major air toxic sources affected under Title III of the Clean Air Act.

Hazardous Air Pollutants are a list of 189 specific substances given in Section 112 of the Clean Air Act which are reasonably expected to contribute to, or cause, irreversible illness or death. The list includes such pollutants as benzene, ethylene glycol, formaldehyde, hydrogen sulfide, and methanol.

The National Emission Standards for Hazardous Air Pollutants are standards governing the release into the air of any, or any combination, of the substances on the list of 189 HAPs. The NESHAPs program applies to any facility that emits any HAP and is administered by the states.

THE 1990 CLEAN AIR ACT AMENDMENTS (CAAA) AND THE TITLE V OPERATING PERMIT PROGRAM

The Clean Air Act is, arguably, the most comprehensive federal environmental law. As amended in 1990 it now contains, in Title V, the framework of a national operating permit system, which is administered by the states, for many existing and new emissions sources. Under the requirements of Title V, any source with the potential to emit more than 100 tons/year of an individual criteria pollutant, such as NO_x, any source with the potential to emit more than 10 tons/year of a hazardous air pollutant (HAP) or 25 tons/year of any combination of HAPs, or meets certain other criteria must obtain a "Title V" permit for operation of the facility. This program is designed to ensure that all sources subject to Title V meet, and continue to meet, their emissions requirements.

NATURAL GAS ENGINE EMISSIONS

In the past natural gas engines were commonly operated at an air/fuel ratio which provided the most horsepower for the amount of air being consumed. This air/fuel ratio is fuel rich of "Stoichiometry". Stoichiometry is defined as: The chemically correct air/fuel ratio where all the fuel and all the oxygen in the mixture will be consumed.

Another way in which air/fuel ratio is represented is with an excess air ratio referred to as "Lambda" (λ). Excess air ratio is determined with the following formula:

$$\lambda = \frac{\textit{Operating air/fuel ratio}}{\textit{Stoichiometric air/fuel ratio}}$$

$$\lambda = \mathbf{1.0}\ \textit{at the stoichiometric air/fuel ratio}$$

In recent years, engines which operate at a much leaner air fuel ratio have been utilized because of their low emissions and low fuel consumption characteristics. With a lean air/fuel ratio ($\lambda > 1.0$) there is more oxygen in the combustion chamber than is required for combustion which leaves a high concentration of oxygen in the exhaust. Fuel consumption in a lean combustion engine is typically 5–12% lower than in a similar stoichiometric combustion engine.

Figure 1 illustrates exhaust NO_x output compared to the air/fuel ratio.

To the rich side (left side on the graph) of stoichiometry, NO_x decreases significantly due to the lack of oxygen in the combustion chamber and lower combustion temperatures. On the lean side (right) of stoichiometry the NO_x reaches a peak because combustion temperature remains high and there is an abundance of oxygen. At increasingly lean air/fuel ratios, the combustion temperature continues to fall and NO_x levels fall even though excess oxygen exists in the cylinder. As stated earlier, NO_x formation requires the presence of oxygen and nitrogen in a high temperature environment, therefore less NO_x is formed at lower temperatures.

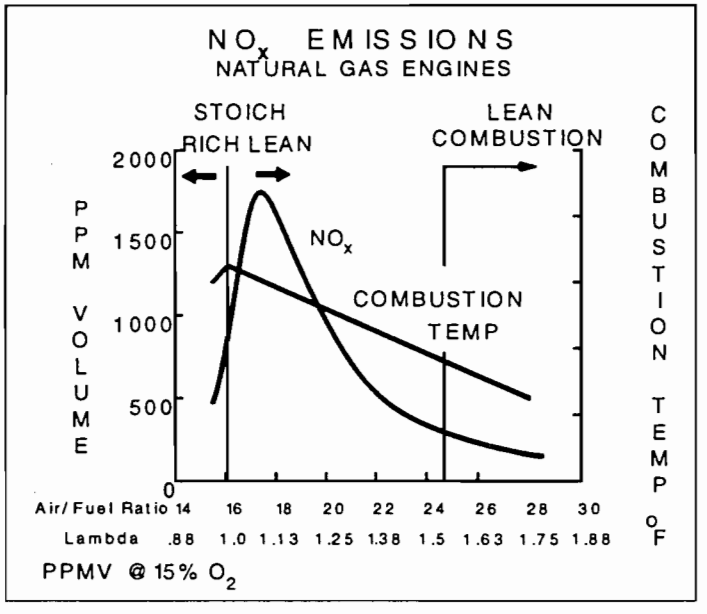

Figure 1

Carbon Monoxide levels are also lower in a lean combustion engine than in a stoichiometric engine because there is now plenty of oxygen for the fuel molecules to react with. Figure 2 illustrates CO levels compared to air/fuel ratio.

Operating to the rich side of stoichiometry causes a significant increase in CO because of the lack of sufficient oxygen to complete combustion of the fuel molecules. At a point slightly lean of stoichiometry, CO output hits a minimum because there is sufficient oxygen and high combustion temperatures. At leaner combustion air/fuel ratios, CO increases due to poorer combustion from low combustion temperatures and lower flammability of the fuel mixture. Emissions of CO, however, are still lower at this point than at stoichiometry.

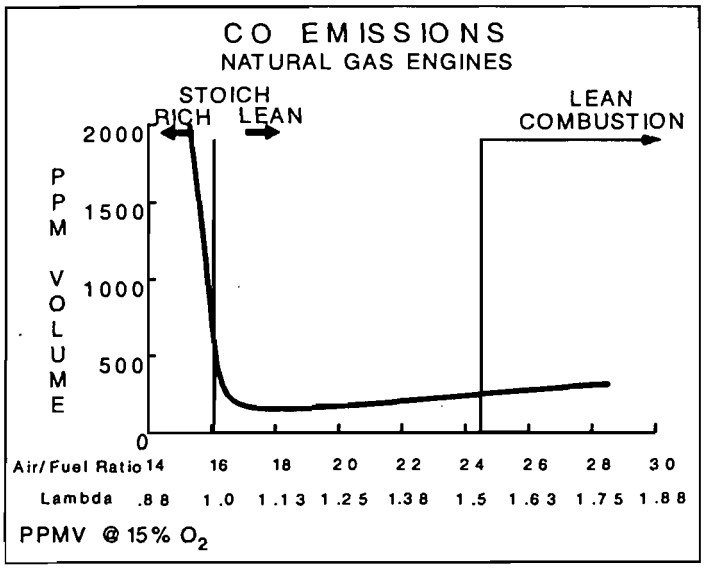

Figure 2

Levels of NMHCs also vary with air/fuel ratio as shown in Figure 3.

Like CO emissions, NMHC emissions also are higher at points rich of stoichiometry because of the lack of oxygen for combustion. NMHC emissions are also minimum at a point slightly lean of stoichiometry and increase at further lean air/fuel ratios. The amount of NMHCs are higher at the lean combustion air/fuel ratio than at stoichiometry.

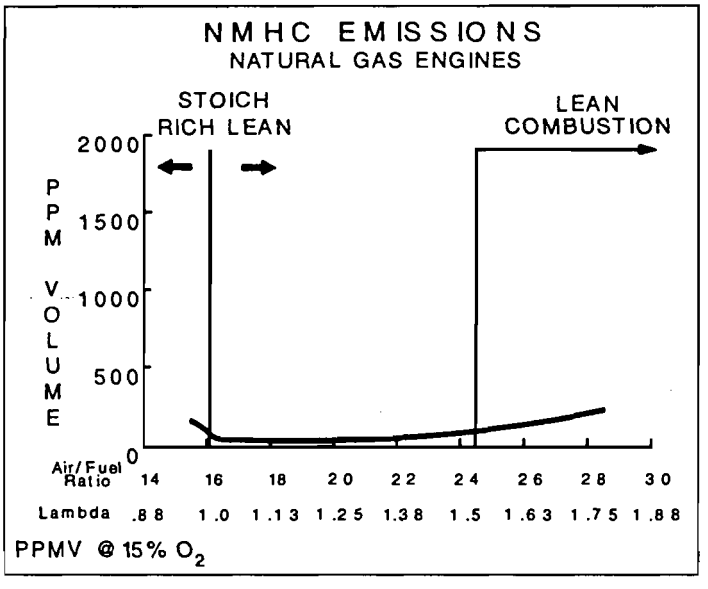

Figure 3

Figure 4 sums up the emission levels for typical natural gas engines at various air/fuel ratios.

Overall (with the exception of NMHCs) we can see that a lean combustion engine provides much lower levels of pollutants than a stoichiometric engine. The lean combustion engine does this without the aid of exhaust after–treatment (catalytic converter) and without the need for electronic air/fuel ratio control.

Lean combustion engines have demonstrated low emission levels consistently because these emissions are not affected by deterioration of a catalyst or failure of electronic oxygen sensing devices.

Ignition of the high air/fuel ratio in a lean combustion engine can be obtained fairly well with a high turbulence open chamber design. Utilizing a pre–chamber with a stoichiometric mixture to ignite a lean main chamber can produce better combustion at leaner air/fuel ratios. Open chamber and pre–chamber configurations are shown in Figure 5.

Waukesha VGF–GL models are open chamber, lean burn engines, running at λ= 1.53 to 1.67. The larger bore VHP and AT–GL engines utilize a prechamber combustion chamber for leaner operation at λ=1.68 to 2.0. (Refer to the current WED Product Bulletins for emission levels on all models.)

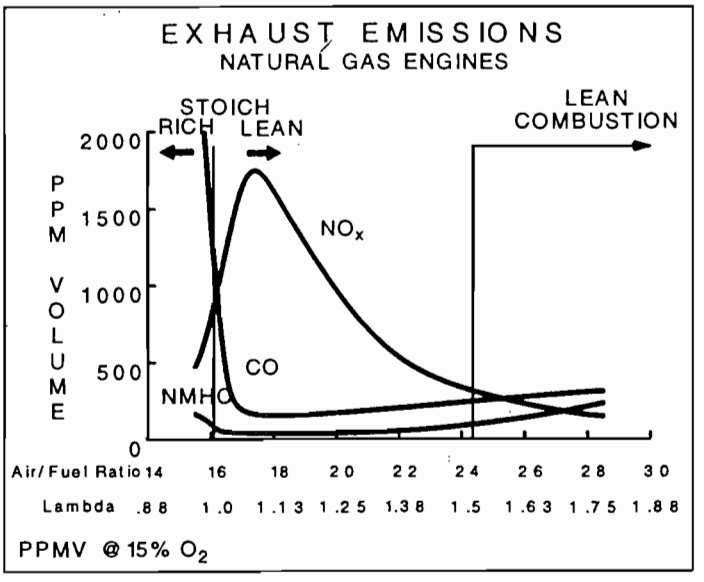

Figure 4

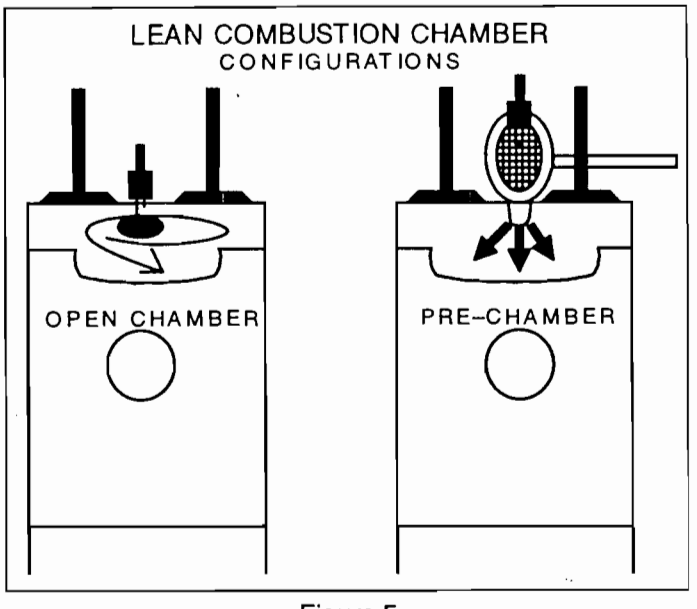

Figure 5

The pollutants in exhaust gas comprise only a small percentage of the total exhaust gas. The remainder of the exhaust gas consists of harmless, naturally occurring gases. Some of these gases are formed in the combustion process while others are simply passing through the combustion chamber without chemically reacting. The composition of air, and some typical compositions of exhaust gas, are given in the chart below.

Summary of Products of Combustion with Natural Gas Fuel*

Excess Air Ratio Setting=λ

Gases	0.97	1.00	1.06	1.53	1.74	2.00	Air
N_2	69.6%	71%	72%	73.8%	74.5%	75.1	79%
H_2O	21%	19%	17%	12.8%	10.9%	9.5	Trace
CO_2	8.4%	9%	9.2%	6.4%	5.7%	4.9	Trace
O_2	Trace	0.25%	1.15%	6.8%	8.8%	10.3	21%
CO	0.9%	0.3%	Trace	Trace	Trace	Trace	—
NO_x	Trace	0.25%	0.5%	Trace	Trace	Trace	—
HC	Trace	Trace	Trace	Trace	Trace	Trace	—

*Trace indicates less than 0.2%.

EXHAUST EMISSIONS FOR ALTERNATE FUELS

Gaseous fueled engines are often operated on fuels other than natural gas. Propane and waste recovery fuels are the most popular of these: propane as a standby fuel and waste recovery fuels, such as digester gas and landfill gas, as primary fuels. These fuels produce a noticeable difference in exhaust gas emissions when compared to natural gas. Before we discuss the emissions levels of these fuels we should have a better understanding of the fuels' content. The chart below summarizes typical gas concentrations in the fuel.

Gas	Natural	Propane	Digester	Landfill
Methane	95%	—	65%	55%
Ethane	3%	4%	—	—
Propane	1%	95%	—	—
Butane+	1%	1%	—	—
CO_2	—	—	35%	45%

Figure 6 illustrates NO_x and CO output vs excess air ratio for natural gas, propane, and landfill gas. Note that air/fuel ratio has been removed.

Stoichiometry for propane, digester gas, and landfill gas are at different air/fuel ratios than for natural gas, therefore we only use the "excess air ratio" designation for this graph.

NO_x emissions for natural gas and propane are nearly the same while emissions for landfill gas are much lower. This is because of the high concentration of inert gas (CO_2) in landfill gas which cools the peak combustion temperature, reducing NO_x.

Propane combustion at lean air fuel ratios is not as complete as methane. Therefore, CO concentration is higher at lean air/fuel ratios, λ= 1.2 and above, than with natural gas or landfill gas.

Concentration of NMHCs also vary with the type of fuel an engine is operated with. Figure 7 illustrates NMHC concentration for the three fuels.

Propane NMHCs are the highest since propane fuel is 100% non–methane hydrocarbon. Natural gas contains about 5% non–methane hydrocarbon in the fuel, therefore it has a lower level in the exhaust. Landfill gas and digester gas contain no non–methane hydrocarbons in the fuel, therefore their NMHC emission levels are much lower. The NMHCs which do exist in landfill gas and digester gas exhaust are from combustion of lubricating oil in the engine.

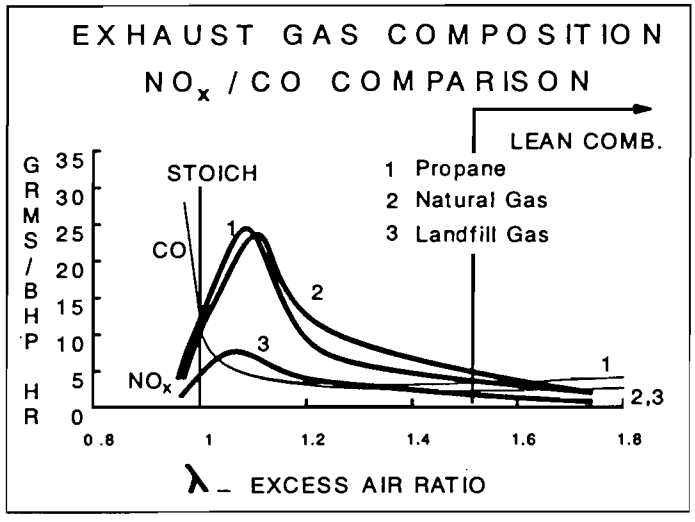

Figure 6

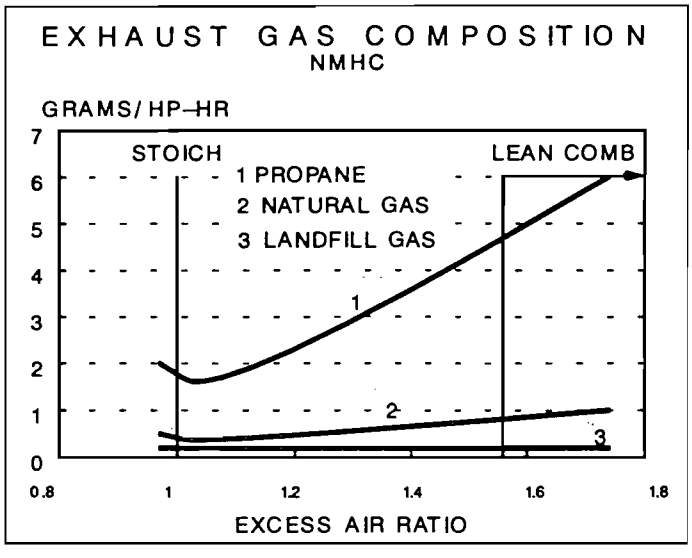

Figure 7

EXHAUST GAS TREATMENT

The following discussion briefly covers commonly available after treatment technologies and is not meant to be all inclusive.

Catalyst

Emissions from an engine can be reduced by chemically converting these pollutants into harmless, naturally occurring compounds. The most common method for achieving this is through the use of a catalytic converter. A catalyst is a substance which promotes a chemical reaction without being chemically changed itself. In a catalytic converter, the catalyst will either oxidize (oxidation catalyst) a CO or fuel molecule or reduce (reduction catalyst) an NO_x molecule. The general (not balanced) reducing reactions are shown below:

$$NO_x + CO \Rightarrow N_2 + CO_2$$
$$NO_x + CH_4 \Rightarrow N_2 + CO_2 + H_2O$$
$$NO_x + H_2 \Rightarrow N_2 + H_2O$$

These reactions are reducing the NO_x to nitrogen and oxidizing the fuel and CO molecules. These reactions oxidize some of the CO and NMHC molecules, however further conversion is accomplished with an oxidizing catalyst. The oxidizing reactions take place as shown here:

$$CO + O_2 \Rightarrow CO_2$$
$$CH_4 + O_2 \Rightarrow CO_2 + H_2O$$
$$CnHm + O_2 \Rightarrow CO_2 + H_2O$$
$$H_2 + O_2 \Rightarrow H_2O$$

Three Way Catalyst

A 3–way catalyst contains both reduction catalyst materials and oxidation catalyst materials and will convert NO_x, CO, and NMHCs to N_2, CO_2, and H_2O. A catalyst process which causes reactions of several pollutant components is referred to as **N**on **S**elective **C**atalyst **R**eduction (NSCR). Typical emission conversion efficiencies for a three–way catalyst operating on a near stoichiometric engine are:

90+% decrease in NO_x
80+% decrease in CO
50+% decrease in NMHC

The efficiency of a three way catalyst is highly dependent on the percentages of NO_x, CO, O_2, and NMHCs in the reaction. A very narrow air/fuel ratio operating range is necessary to maintain these percentages. Electronic air/fuel ratio controls are often necessary to maintain this range.[2]

Dual bed catalyst

Another method for treating stoichiometric engine exhaust emissions is with a dual bed catalyst. A dual bed catalyst utilizes separate reduction and oxidation sections with air introduced after the reduction catalyst and before the oxidation catalyst. Figure 8 illustrates a Dual Bed Catalyst.

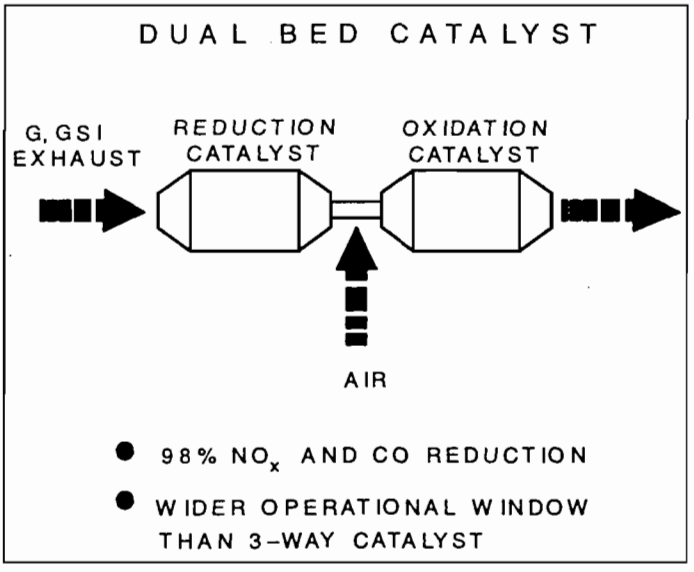

Figure 8

Exhaust from the engine first travels through the reduction catalyst where the following reactions take place.

$$NO_x + CO \Rightarrow CO_2 + N_2$$
$$NO_x + H_2 \Rightarrow H_2O + N_2$$
$$NO_x + CH_4 \Rightarrow CO_2 + H_2O + N_2$$

Air is added to the exhaust stream before it enters the oxidation catalyst where these next reactions take place.

$$CO + O_2 \Rightarrow CO_2$$
$$H_2 + O_2 \Rightarrow H_2O$$
$$C_n H_m + O_2 \Rightarrow CO_2 + H_2O$$
$$CH_4 + O_2 \Rightarrow CO_2 + H_2O$$

A "Dual Bed" catalyst can convert up to 98% of both NO_x and CO and does not require the very narrow air/fuel ratio operating range required for the 3–way catalyst.[2] Dual bed catalysts are losing popularity, however, because 3–way catalysts are now approaching the same efficiencies.

Oxidation Catalyst

An oxidation catalyst is often used on lean combustion engines to oxidize CO and hydrocarbon molecules in the exhaust. The lean combustion principle produces very low NO_x emission so this pollutant usually does not require further reduction. Since an oxidation catalyst eliminates CO and HC emissions it is considered an NSCR.

Radian Duct Burner Method

This duct burner method uses a combination of two catalytic converters, an afterburner, and heat exchangers to reduce emissions. Figure 9 illustrates the Radian process.

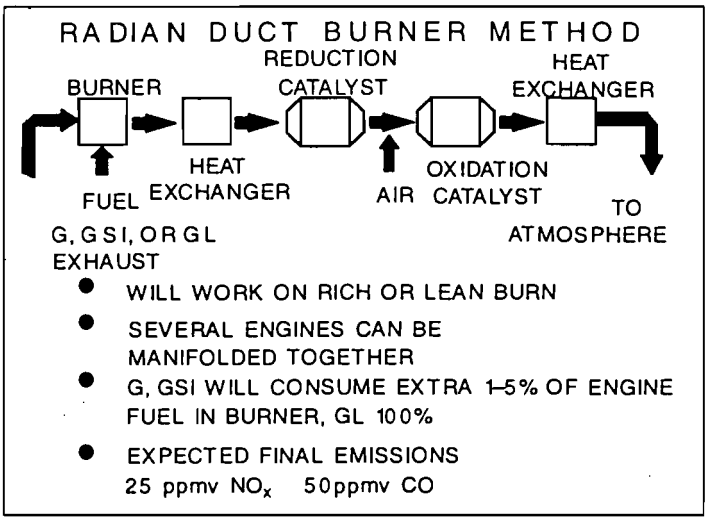

Figure 9

Engine exhaust enters the afterburner section where additional fuel is added. This fuel consumes any remaining oxygen and produces CO and H_2 which will reduce NO_x. The exhaust then enters a heat exchanger or boiler which will cool the exhaust to 700° to 800° F to protect the reduction catalyst from overheating damage. In this catalyst the reduction reactions discussed earlier take place. Next air is injected into the exhaust stream for the reactions in the oxidation catalyst. Finally, the exhaust enters another heat exchanger or boiler to recover the additional heat.

This exhaust treatment is intended for a plant which will use the excess heat developed in the afterburner and catalyst. For a stoichiometric engine an extra 1% to 5% of engine fuel will be required for the afterburner. A lean combustion engine would require an extra 100% fuel to satisfy afterburner requirements. The expected final emissions from this process are near 25 PPMV NO_x and 50 PPMV CO.[3]

Selective Catalytic Reduction

As discussed earlier, lean combustion engines have a very low NO_x output when compared to the stoichiometric engine without a catalyst. NO_x from a lean combustion engine can sometimes be reduced further with engine adjustments which will lower NO_x output but compromise other performance such as other emissions, fuel economy and power output. If even further reduction is required, it may be necessary to use a Selective Catalytic Reduction (SCR) system. A "selective catalyst" reacts with a single type of pollutant component in a reduction reaction. In this case it reacts with the NO_x components. This SCR system injects ammonia (NH_3) to react with the exhaust NO_x in a reduction reaction as shown in Figure 10.

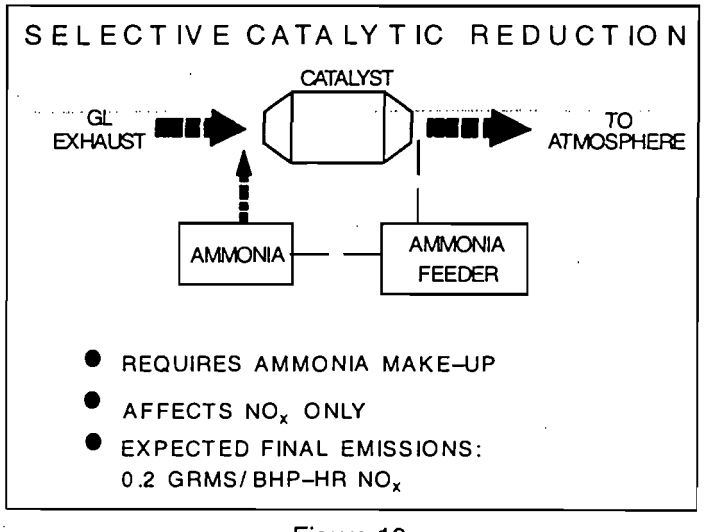

Figure 10

In this process, ammonia is injected into the exhaust stream before entering a reduction catalyst. The ammonia selectively reacts with the NO_x in the following reaction:

$$NO_x + NH_3 \Rightarrow N_2 + H_2O$$

Ammonia is consumed in the reaction, therefore a supply of ammonia must be contained on site to support the reaction.

This process can result in NO_x emissions as low as 0.2 grams/HP–HR.

Ammonia, however, is a hazardous chemical and must be contained per local codes. Some ammonia passes through the catalyst without reacting and is discharged to the atmosphere. This is referred to as "ammonia slip". Ammonia in the exhaust is often considered as another pollutant and must be accounted for.

ELECTRONIC AIR/FUEL RATIO CONTROL

Stoichiometric Combustion Engine

Maintaining low emissions in a stoichiometric combustion engine using exhaust gas treatment often requires a very closely regulated air/fuel ratio. Many control devices are available for this and most use exhaust gas oxygen sensing to determine air/fuel ratio. The Waukesha Custom Catalyst Control® is featured in Figure 11.

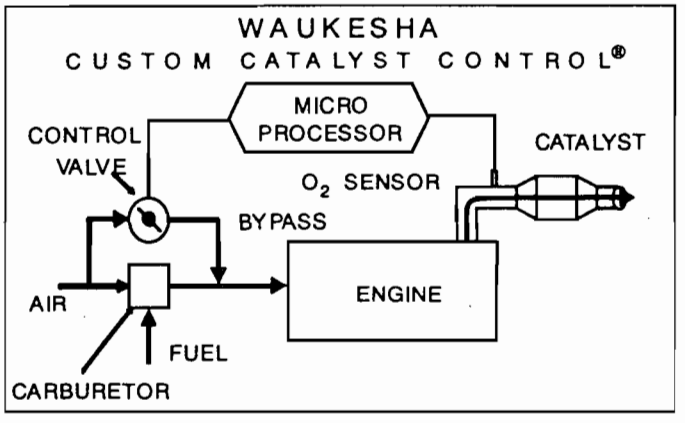

Figure 11

With this system, combustion air enters the carburetor where a slightly rich mixture is produced. After passing through the carburetor, additional air is blended in to create an optimum air/fuel ratio for catalyst operation. After combustion in the engine, the exhaust gas passes by an oxygen sensor, then through the catalyst. Air/fuel ratio is determined by the oxygen sensor output. The microprocessor uses the signal from the oxygen sensor to adjust the control valve for proper air bypass.

A more universal Custom Engine Control® Air/Fuel Module (AFM) is now offered by Waukesha. The AFM system is designed to funciton with all types of gaseous fueled engines that Waukesha manufactureres including near stoichiometric and lean burn, naturally aspirated and turbocharged.

Theory Of Operation

The AFM system controls engine air/fuel ratio and consists of three basic components: an oxygen sensor, actuator, and AFM module. The AFM system is a closed–loop process that looks at system outputs and adjusts system inputs according to preprogrammed instructions.

The AFM system functions by monitoring oxygen levels in the exhaust gases with an oxygen sensor located in the engine's exhaust stream (see Figure 12). The oxygen level, detected by the sensor, is then fed to the AFM module through an electrical signal. If the oxygen level detected by the sensor is different than the programmed oxygen set–point, the AFM module directs the actuator to adjust the gas over air pressure of the fuel regulator.

The actuator adjusts the fuel regulator setting, within programmed limits, by increasing or decreasing the spring pressure acting on the regulator diaphragm. The design gives very accurate positioning capability. The regulator adjustment richens or leans out the air/fuel ratio.

A thermocouple is used to assure that temperatures are high enough for correct operation of the sensor. A programmed minimum temperature must be achieved before "closed–loop" control is enabled. A programmed maximum temperature is also incorporated as a safety to shut down operation on high exhaust temperature conditions.

The oxygen sensor provides continuous feedback of oxygen levels to the AFM module. The AFM module makes the necessary actuator adjustments to correctly control the engine's air/fuel ratio.

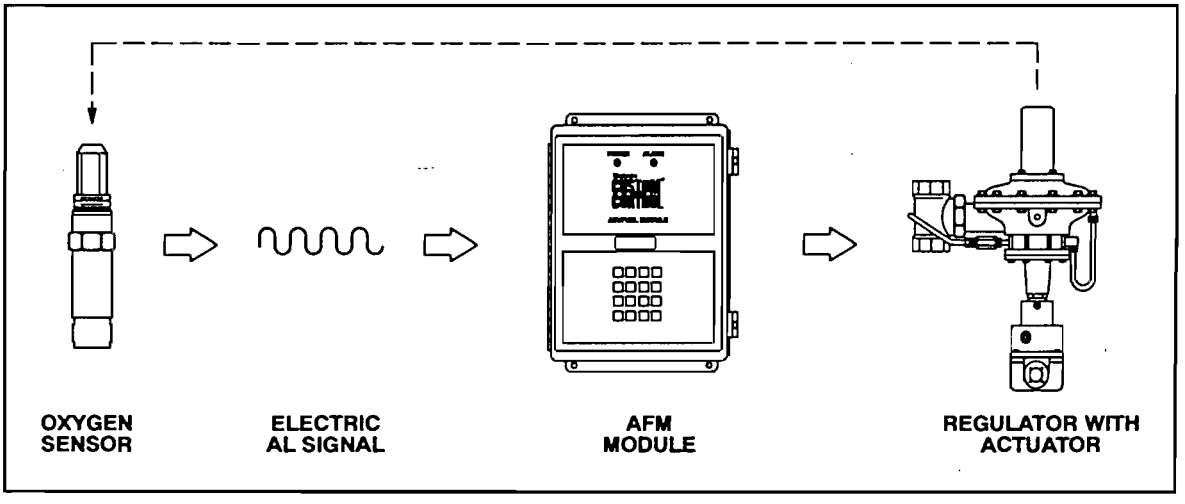

Figure 12. AFM System's Closed–Loop Process

Lean Combustion Engines

Electronic control of air/fuel ratio is not required on many lean combustion engines because small changes in air/fuel ratio have very little effect on the exhaust emissions. Figure 13 again illustrates emissions levels vs. Air/fuel ratio. The boxes around "Stoich" and "Lean Combustion" indicate the air/fuel ratio drift that might occur during operation of an engine without an air/fuel ratio control. At stoichiometry it is apparent that a small change in air/fuel ratio can cause a large change in NO_x and CO which, when used with a 3–way catalyst, can cause low conversion efficiency. At the lean combustion air fuel ratio a small change in air fuel ratio causes very little effect on the emissions levels. Efficiency of an oxidation catalyst operating on a lean combustion engine is unaffected by these small air/fuel ratio changes.

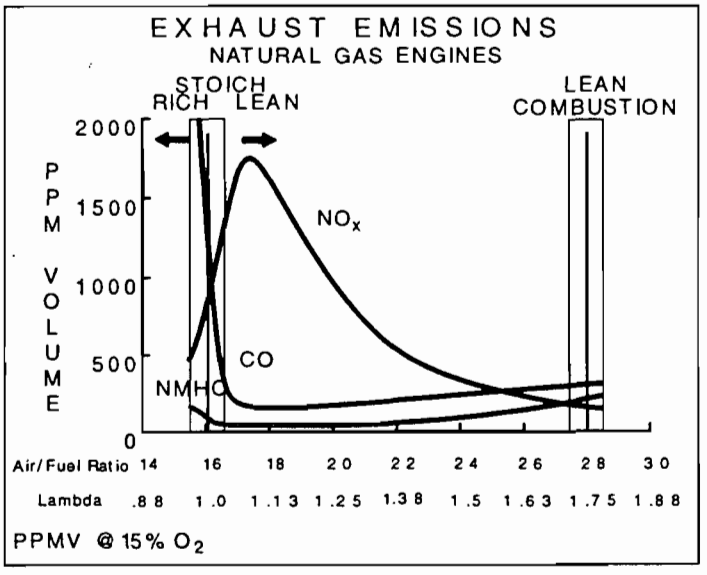

Figure 13

Electronic controls for air/fuel ratio on lean combustion engines are often used for fuels which can have a wide variance in heating value, such as some landfill gas applications.

Using air/fuel ratio controls on lean combustion engines which operate on steady heating value fuels can add unnecessary complication and expense.

COST COMPARISON OF EMISSIONS REDUCTION TECHNOLOGIES

Thus far this paper has discussed several options for lowering exhaust emissions. This portion will compare costs and emission reduction efficiencies of each system, and the final level of exhaust emission when applied to an L7042 GSI/GL engine. The engine is rated 1500 HP (1050 KW generator) @ 1200 RPM and utilizes commercial quality natural gas as fuel. The L7042GSI will be used as a cost factor=100 and all other prices will be compared to this factor. Check with manufacturers of the equipment for actual prices and efficiencies at the time of purchasing.

As mentioned earlier, fuel consumption of a lean combustion engine is typically 5–12% lower than a comparable stoichiometric engine. In this particular comparison, where the stoichiometric engines are equipped with catalytic converters, we are approaching the upper end of the fuel consumption difference. Since fuel cost is the single most expensive portion of life cycle costs, this is an important consideration in a gas engine feasibility study.

Stoichiometric Combustion

Method	Emissions in/out gram/HP–HR			Engine	Engine Air/Fuel Control	Exhaust Treatment	Total
	NO_x	CO	NMHC				
3–Way Catalyst	9	13	.2	100	3.67	7.33	111 + Fuel
	.45	1.3	.04				
Premium 3–Way Catalyst	9	13	.2	100	3.67	12.33	116 + Fuel
	.18	.65	.03				
Dual Bed Catalyst	8	15	.2	100	0	15	115 + Fuel
	.16	.30	.03				
Radian	13	10	.2	100	0	42	142 + Fuel
	.26	.50	.01				

Lean Combustion

Method	Emissions in/out gram/HP–HR			Engine	Engine Air/Fuel Control	Exhaust Treatment	Total
	NO_x	CO	NMHC				
Standard	1.5	2.65	1	104	0	0	104
Adjust Low NO_x	0.8	3	1	104	0	0	104 + Fuel
Oxidizing	0.8	3	1	104	0	5	109 + Fuel
	0.8	.45	.4				
Premium Oxidizing	0.8	3	1	104	0	10	114 + Fuel
	0.8	.22	.2				
SCR	1.5	2.65	1	104	0	81	185 + Ammonia
	.15	2.65	1				
SCR+Prem Oxidizing	1.5	2.65	1	104	0	90	194 + Ammonia
	.15	.265	.2				
Radian	1.5	2.65	1	104	0	50	154 + 100% Fuel
	.26	.50	.05				

The "Premium 3–Way" and "Premium oxidizing" catalysts produce lower emissions at a higher cost. The lower emissions are from treatment with more catalyst material and thus the price is higher (premium). Adding more catalyst material decreases emissions to a point, but after that conversion improvement is minimal.

It's apparent from the information presented in this paper that most of the extremely low emissions levels are obtained using some type of exhaust gas treatment. These levels can be misleading however, because they rely on very strict maintenance of the treatment catalyst. Efficiency of catalytic converters will decrease if they are coated with contaminants from the fuel, or from lube oil additives. They can also be damaged by overheating, or poisoning from fuel contaminants or operating at an incorrect air/fuel ratio on stoichiometric engines. With this in mind we might expect a lean combustion engine's emissions to match closely to a catalyst type engine over a long period of time.

References

1. DeYoung, Richard, "*GL and Emissions–Air Pollution*", Waukesha Engines Service Training Center.

2. Mayer, Charles, *"AT–GL Sales & Application–Gas Engine Exhaust Emissions Overview"*, Waukesha Engines Application Engineering, 1990.

3. Radian Corporation, Austin, TX.

4. Obert, Edward F., "*Internal Combustion Engines and Air Pollution*", Harper & Row, Publishers, Inc., 1973.

5. Stachowicz, Robert, "*Near Term Emission Reduction Technologies For Stationary, Natural Gas Fuel Engines*", Air & Waste Management Association, SP–83, 1992.

MIAMI-DADE WATER AND SEWER DEPARTMENT
POOLED CASH FUND
P.O. BOX 330316 • MIAMI, FLORIDA 33233-0316

CHECK NO.
143556

DATE	PAYEE NAME			
09/01/98	STATE OF FLORIDA DEPARTMENT OF			
INVOICE DATE	INVOICE NUMBER	AMOUNT	PURCHASE ORDER NUMBER	DESCRIPTION
08-27-98	PERMIT 14685	750.00	DP003184	
	TOTAL	750.00		

The attached check represents the amount due you from
Dade County as shown on file in the Clerk's Office. For additional information Contact (305) 665-7471

METRO-DADE

METROPOLITAN DADE COUNTY, FLORIDA 143556

63-643
670

MIAMI-DADE WATER AND SEWER DEPARTMENT-POOLED CASH FUND

VOID AFTER SIX MONTHS
FIRST UNION NATIONAL BANK
OF FLORIDA
MIAMI, FLORIDA 33131

Date	Control Number	Amount of Check
09/01/98	00143556	$750.00

PAY EXACTLY ******750 DOLLARS AND 00 CENTS

To
The
Order
Of

STATE OF FLORIDA DEPARTMENT O
ENVIRONMENTAL PROTECTION
2600 BLAIR STONE ROAD
TALLAHASSEE, FL 32399

METROPOLITAN DADE COUNTY

COUNTY COMMISSIONERS DADE COUNTY FLORIDA

MAYOR

Harvey Ruvin
CLERK

[redacted]