Heron, Teresa

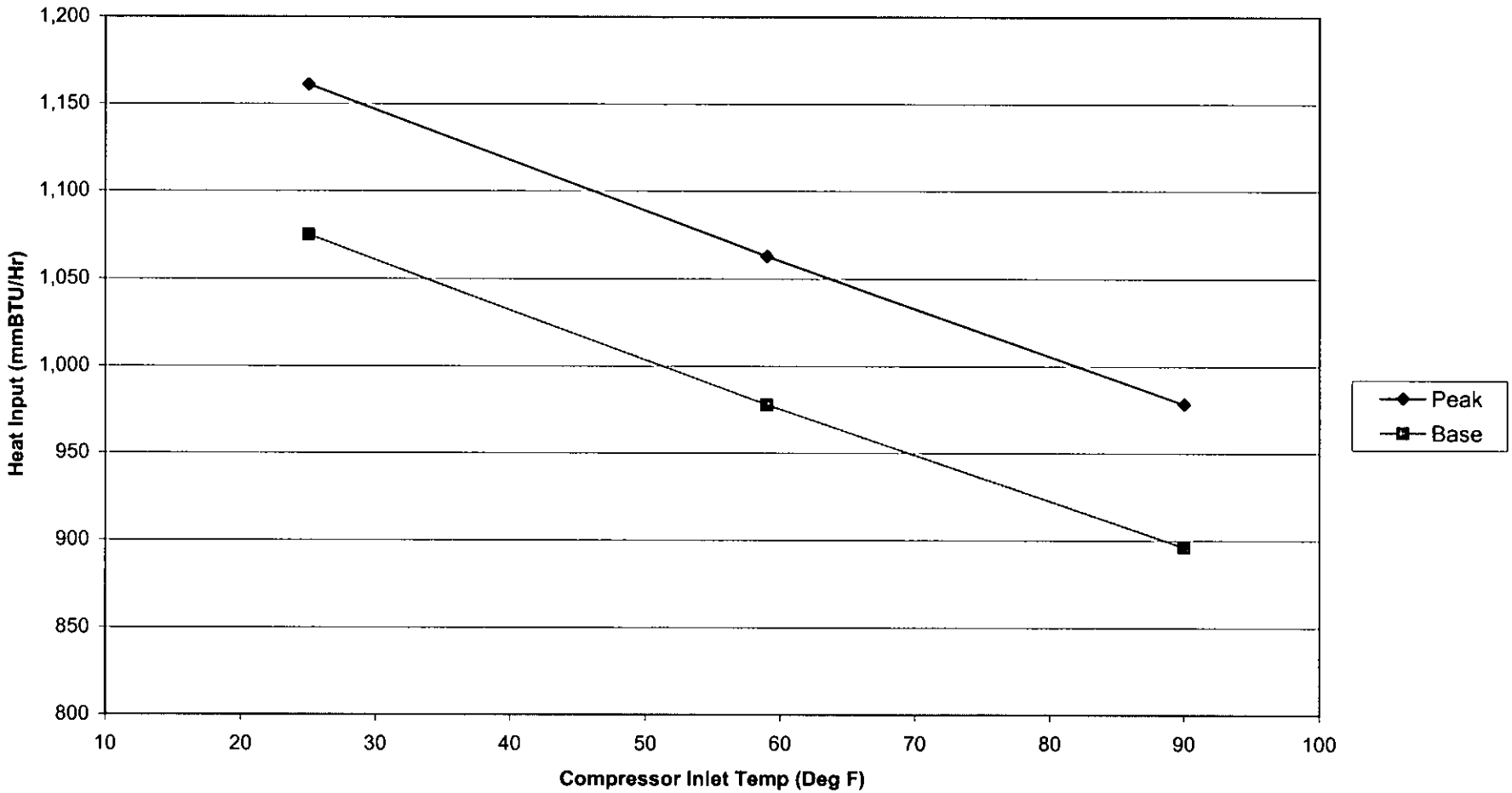
From: Kosky, Ken [KKosky@GOLDER.com]
Sent: Wednesday, August 27, 2003 1:33 PM
To: Heron, Teresa
Cc: Farzie Shelton (Farzie.Shelton@lakelandelectric.com)
Subject: Larsen Unit 8 - Heat Input Curves

Teresa: Attached are the heat input curves you requested. These contain the same information contained in the application but in graphical form. Let me know if you have any questions. Regards, Ken

---

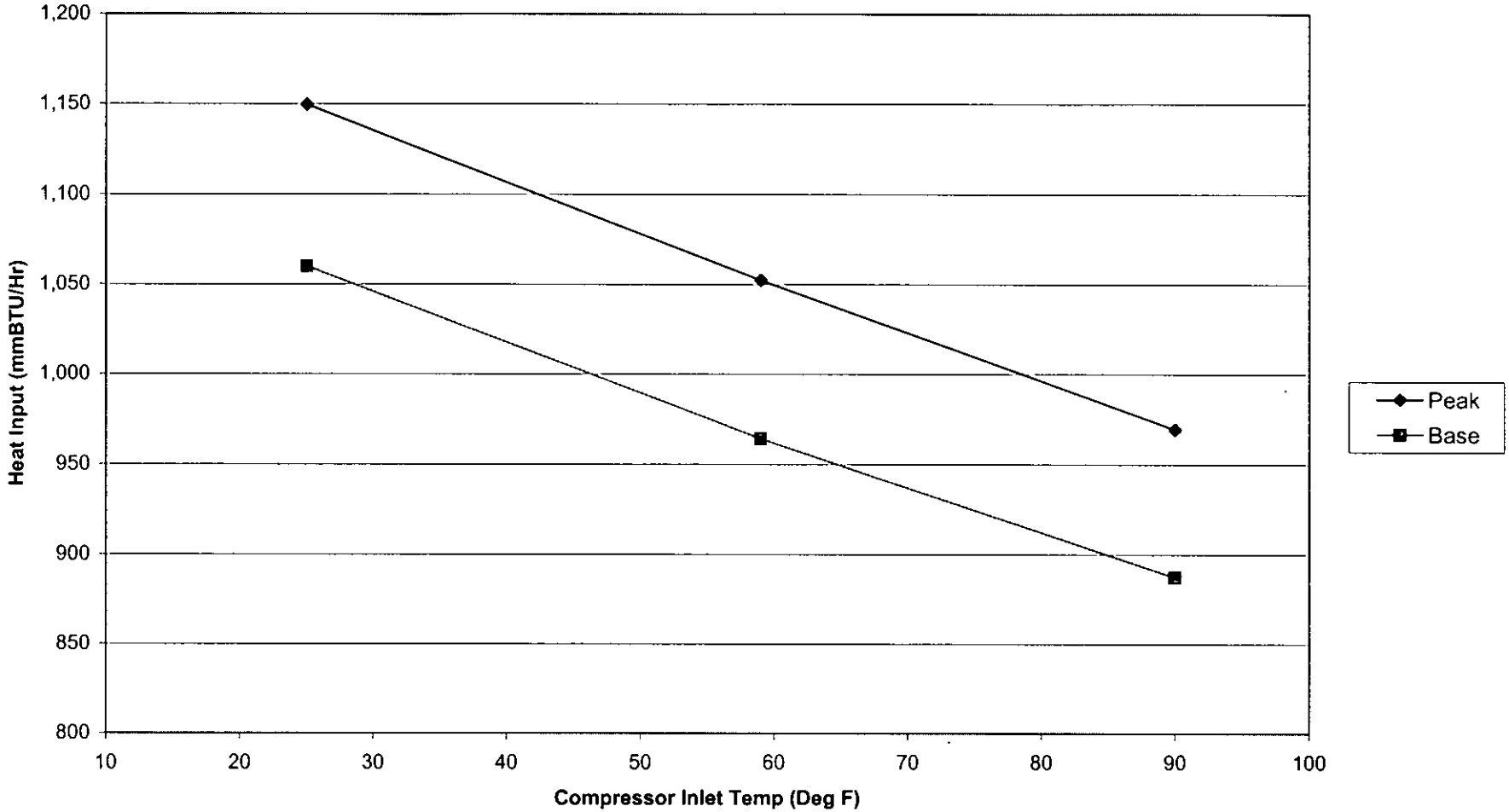
Attachments are virus free!

Larson Unit 8 - Gas
Heat Input vs Compressor Inlet Temperature



Note: Curves based on GE data for 60% relative humidity, new and clean condition. Actual performance will vary depending upon turbine inlet conditions (e.g., fogging), NOx injection water and turbine backpressure.

Larson Unit 8 - Oil
Heat Input vs Compressor Inlet Temperature



Note: Curves estimated from GE data for 60% relative humidity, new and clean condition, gas firing. Actual performance will vary depending upon turbine inlet conditions (e.g., fogging), NOx injection water and turbine backpressure. Oil performacne estimated based on GE original curves used to adjust heat input for oil firing.

Heron, Teresa

From: Kosky, Ken [KKosky@GOLDER.com]
Sent: Tuesday, August 12, 2003 9:55 AM
To: Heron, Teresa
Cc: Farzie Shelton (Farzie.Shelton@lakelandelectric.com)
Subject: Lakeland Electric Larsen Unit 8

Teresa: The following changes are requested relative to the previous air construction permit (AC53-190437/PSD-FL-166).

Condition 1:
Table 1 referenced in this condition shall be replaced with the attached Table 1:

- Change SO2 from 8.6 tons/year to 12.9 tons/year for gas firing.

Condition 6:
From (the heat input condition only):

- Maximum heat input shall not exceed 1055 MMBtu/hr (gas) or 1040 MMBtu/hr No 2 fuel (oil)

To:

- Maximum heat input shall not exceed 1075 MMBtu/hr (gas) or 1060 MMBtu/hr No. 2 fuel (oil) on a lower heating value basis for baseload operation and an inlet temperature of 25 degrees F
- Maximum heat input shall not exceed 1161 MMBtu/hr (gas) or 1149 MMBtu/hr No. 2 fuel (oil) on a lower heating value basis for peak operation and an inlet temperature of 25 degrees F
- Peak operation is authorized for 2,500 hours/yr when firing natural gas and 500 hour/year when firing No. 2 fuel (oil); if fuel oil is not fired or not used for up to 500 hours in any consecutive 12-month period, peak operation on natural gas is authorized up to an additional 500 hours minus the number of hours when fuel oil was fired during that period

These are the only changes to the AC and PSD permit. Once these are issued we will file a revision of the Title V permit to include these changes as well as several others in the Title V permit. At this time we will include the new heat input curves. Let me know if you have any questions.

Regards, Ken

LAKELAND ELECTRIC

Farzie Shelton, chE; REM

Manager of Environmental Affairs

July 1, 2003

Ms. Trina Vielhauer, Chief
Bureau of Air Regulation
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Fl 32399-2400

Attention: Mr. A. A. Linero, P.E., Administrator New Source Review

RE: DEP File No. 105003-008-AC; PSD-FL-166(D)
Lakeland Electric, Charles Larsen Power Plant
Combined Cycle Unit 8 – Peak Operation and Turbine Upgrades

Dear Al:

Thank you for your letter of April 28, 2003 in reference to the above concerning our request to increase heat input for Unit No. 8 at Larsen Power Plant. In response to your letter and request for additional information, Mr. Ken Kosky P.E. of Golder Associate has responded to each request in the same format as your letter. Therefore, please find attached Mr. Kosky's response which has been P.E. signed and sealed.

As always, we appreciate your cooperation in this matter. If you should have any questions, please do not hesitate to call me.

Sincerely,

Farzie Shelton

Enclosures

cc: Ken Kosky P.E.

City of Lakeland • Department of Electric Utilities

501 East Lemon Street • Lakeland, Fl 33801-5050 • (863) 834-6603 • Fax (863) 834-8187 • Message System 834-6592

farzie.shelton@lakelandgov.net

Golder Associates Inc.

6241 NW 23rd Street, Suite 500
Gainesville, FL 32653-1500
Telephone (352) 336-5600
Fax (352) 336-6603

June 26, 2003

Ms. Farzie Shelton, Manager of Environmental Affairs
Lakeland Electric
501 East Lemon Street
Lakeland, FL 33801

RE: DEP File No. 105003-008-AC; PSD-FL-166(D)
City of Lakeland, Charles Larsen Power Plant
Combined Cycle Unit 8 – Peak Operation and Turbine Upgrades
Request for Information

Dear Farzie:

This correspondence provides the information requested in the Department's April 28, 2003 letter concerning the request to increase heat input for Larsen Unit 8. The information is being presented in the same format as the letter.

1. Contemporaneous Creditable Increases in Actual Emissons: The only contemporaneous increase in emissions at the Larsen Plant was the installation of the inlet foggers as noted in the Department's letter. The Department approved the installation of the foggers in May 2000 (DEP File No. 105003-007-AC; PSD-FL-166C), and the fogger system has been installed and included in the Title V Permit for the facility. Please find attached Table 10a that includes the emissions of the foggers with the potential emission increases resulting from increased heat input. As shown in this table, the emissions for the heat input increase plus the contemporaneous emission increases are less than the PSD review thresholds.
2. Modes of Operation: In the air permit application, the emission increases were based on the maximum number of hours anticipated for peak firing. The City of Lakeland requests that the hours of peak operation be limited to 2,500 hours per year when firing gas and 500 hours per year when firing oil.
3. Technical Upgrades: As stated in the air permit application, the upgrades involve a GE proprietary enhancement in the design of the high-pressure seals of the compressor discharge. A high-pressure brush seal has been added to the existing Labyrinth seal design to minimize air leakage from the compressor to the combustor (see attached figure). This allows more air into the combustor and exhaust turbine, which slightly increases the performance turbine. This change does not affect the combustion turbine's automatic control system, fuel system logic, or the water injection system for NO_x control. However, as stated in the air permit application, the increase in performance is theoretical and GE will not guarantee the performance since the turbine has been operated for about 10 years. The existing combustor uses water injection for NO_x control, and upgrade to the dry low-NO_x (DLN) combustor cannot be made.
4. GE Model PG 7111EA Specifications: The GE performance curves for the PG 7111EA combustion turbine operating in both baseload and peak mode are attached. As noted by the

dates of these curves, Peak Mode operation was included in the original design of Unit 8. The heat input limit in the original permit however reflected baseload operation.

Please call me if there are any questions on the information contained herein.

Sincerely,

GOLDER ASSOCIATES INC.

Kennard F. Kosky, P.E.
Principal
Professional Engineer Registration No. 14996

SEAL

KFK/nav

Enclosures

P:\Projects\2002\0237637 Lakeland 4\4.1\062603\L062603.doc

Table 10a. Maximum Annual Emissions of the City of Lakeland Larsen Plant Unit 8 - Combustion Turbine Peak Operation and Upgrades; includes Inlet Fogger Emissions

Pollutants	Annual Emissions (tons/year) for Upgrades and Peak				Annual Emissions (tons/year) Inlet Foggers[1]	Total Annual Emissions (tons/year)	PSD SERs[2] (tons/year)
	Peak Operation	Base w/Upgrades	Peak w/Upgrades	Total			
Hours:	3,000	5,760	3,000	8,760	8,760		
PM	1.15	0.64	0.27	2.06	1.32	3.38	15 & 25[3]
NO_x	13.92	6.40	3.29	23.61	13.21	36.82	40
SO_2	4.53	3.60	1.08	9.21	7.43	16.64	40
CO	6.92	2.90	1.63	11.46	5.99	17.45	100
VOC	0.37	0.21	0.09	0.67	0.44	1.11	40

[1] Inlet Foggers were approved in May 2000 in DEP File No. 1050003-007-AC(PSD-FL166C).

[2] PSD = Prevention of Significant Deterioration; SERs - Significant Emission Rates; Rule 62-212.400(2)(e)2.

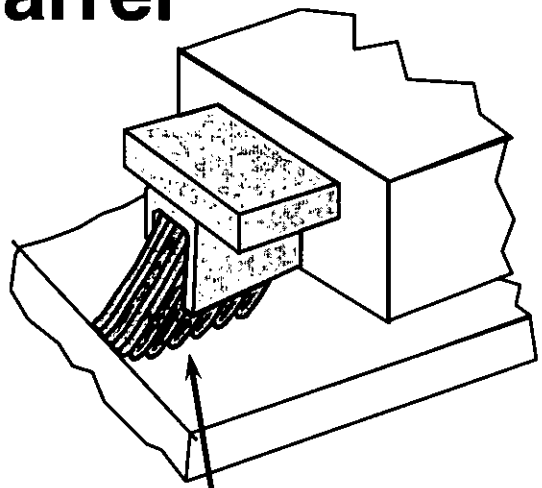
[3] 15 tons/year is for PM_{10} and 25 tons/year is for PM.

Frame 7 Advance Technology Uprate

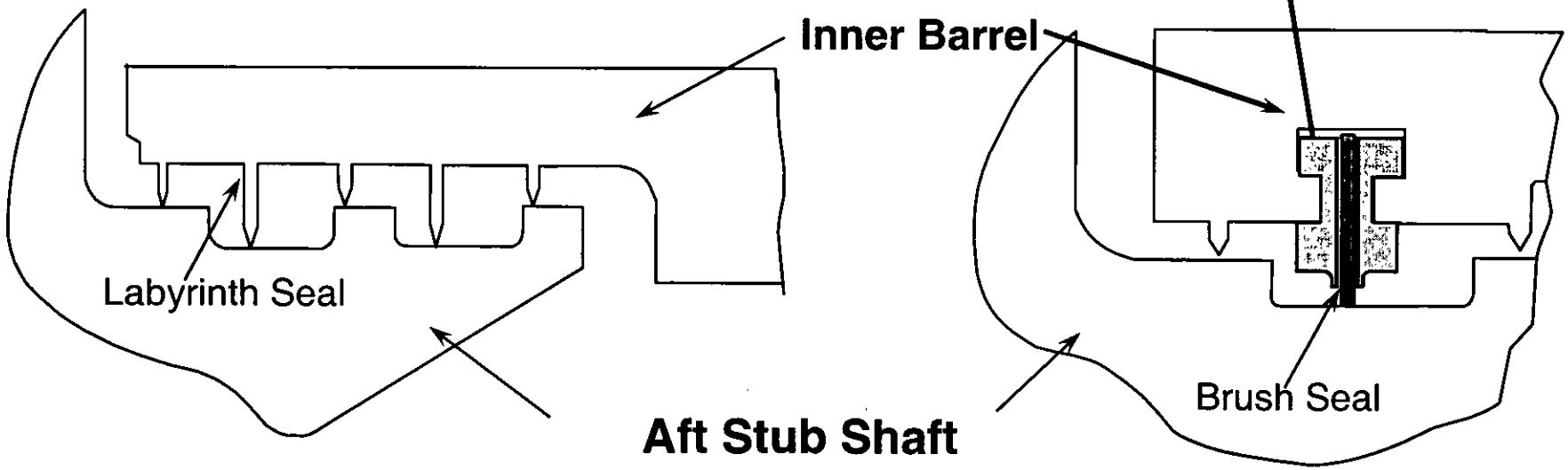
High-Pressure Packing / Inner Barrel

■ Brush Seals

- Minimize Air Leakage
- Tolerant of Misalignments
- More Durable than Labyrinth Seals



NOTE: New unit production 71EAs have a honeycomb seal on the inner barrel with labyrinth teeth on the aft stub shaft. For this configuration, a new inner barrel is supplied with a brush seal in addition to the honeycomb seal.



GE PERFORMANCE DATA FOR
PG7111(EA) GAS TURBINE

GENERAL ELECTRIC MODEL PG7111 (EA) GAS TURBINE
ESTIMATED PERFORMANCE - CONFIGURATION: NATURAL GAS / DISTILLATE OIL
Compressor Inlet Conditions 59 F (15.0 C), 60% Rel. Humidity
Atmospheric Pressure 14.7 psia (1.013 bar)

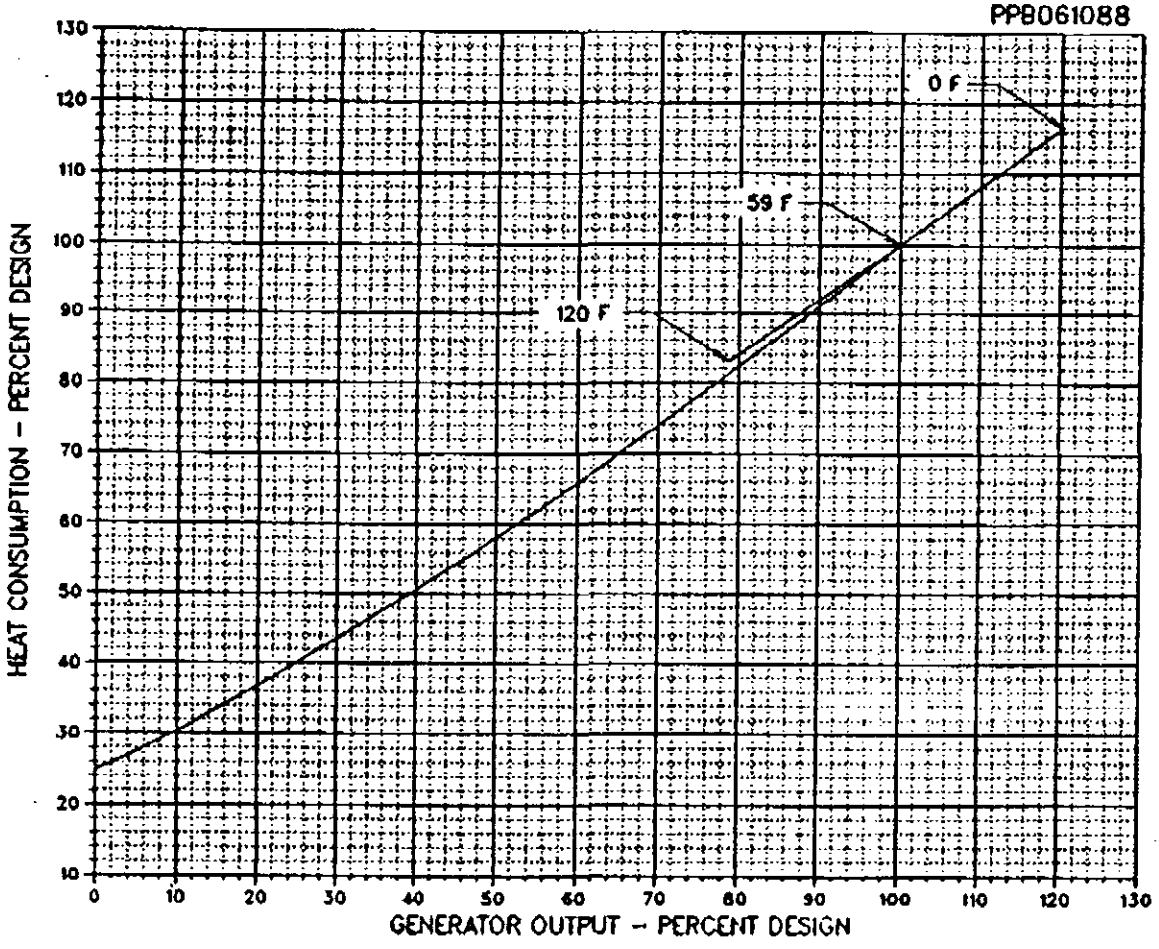
FUEL				NATURAL GAS		DISTILLATE	
DESIGN OUTPUT		kW		83340		81940	
DESIGN HEAT RATE (LHV)		Btu	(kJ)/kWh	10500	(11080)	10580	(11160)
DESIGN HEAT CONS (LHV)	X10-6	Btu	(kJ)/h	875.1	(923.3)	867	(914.6)
DESIGN EXHAUST FLOW	X10-3	lb	(kg)/h	2351	(1066)	2358	(1069)
MODE: BASE LOAD							

NOTES:

1. Altitude correction on curve 416HA622 REV A
2. Ambient temperature correction on curve 499HA734
3. Air cooled generator
4. Humidity correction on curve 498HA697 – all performance calculated with specific humidity of .0064 or less so as not to exceed 100% relative humidity.
5. Plant performance is measured at the generator terminals and includes allowances for excitation power, shaft driven auxiliaries, and 2.5 in. H20 (6.25 mbar) inlet and 5.5 in. H20 (13.75 mbar) exhaust pressure drops.
6. Additional pressure drop effects:

		%Effect on Output	%Effect on Heat Rate	Effect on Exhaust Temp.
4.0 In. H20 (10.0 mbar)	Inlet	-1.42	0.45	1.9 F (1.1 C)
4.0 In. H20 (10.0 mbar)	exhaust	-0.42	0.42	1.9 F (1.1 C)

PP8061088



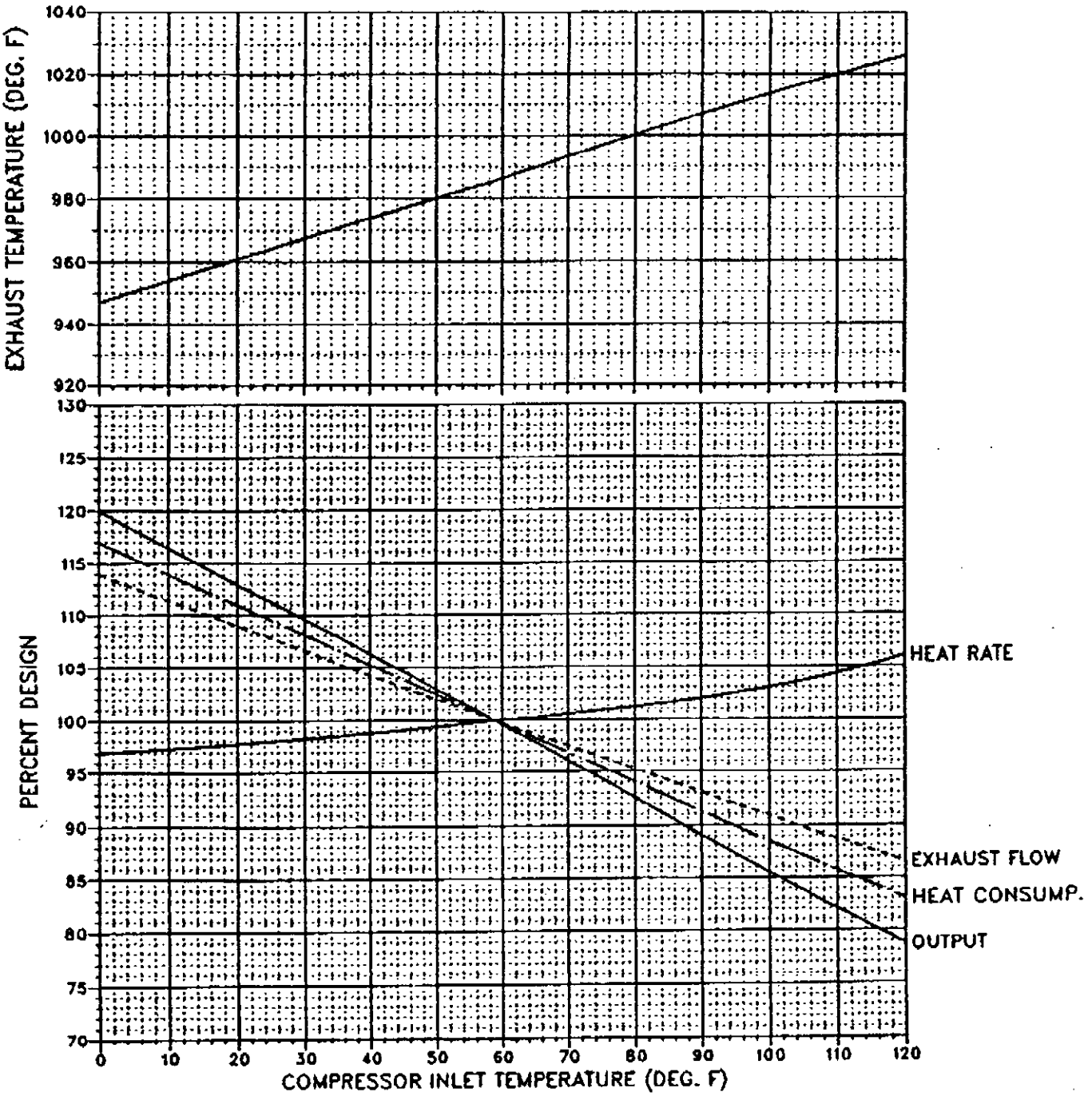
DATE: 07/08/88
C.N. MULLER
C.N.M

499HA733

GENERAL ELECTRIC MODEL PG7111(EA) GAS TURBINE

EFFECT OF COMPRESSOR INLET TEMPERATURE ON OUTPUT, HEAT RATE, HEAT CONSUMPTION, EXHAUST FLOW AND EXHAUST TEMPERATURE AT 100% SPEED

FUEL: NATURAL GAS AND DISTILLATE OIL
MODE: BASE LOAD



DATE 07/06/88

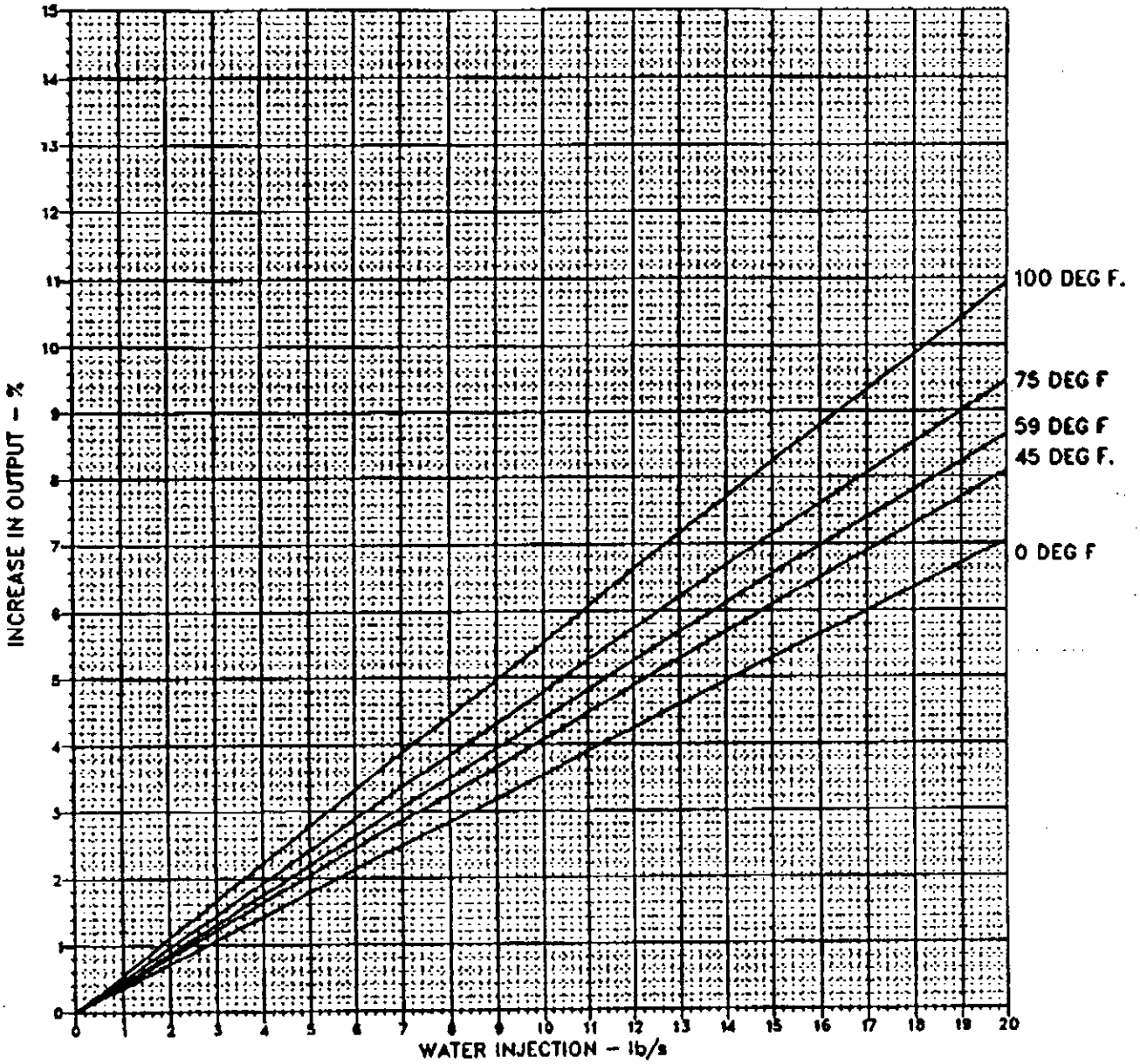
499HA734

C.N. MULLER

CNM

GENERAL ELECTRIC MODEL PG7111EA GAS TURBINE
EFFECT OF WATER INJECTION ON OUTPUT
BASE LOAD - Distillate/Natural Gas
DESIGN VALUES on curve 499HA733 Rev.A

Based on a constant specific humidity of 0.0064 lbs of water per pound of dry air, except for temperatures below 45 deg F, where fully saturated air results in a lower specific humidity.

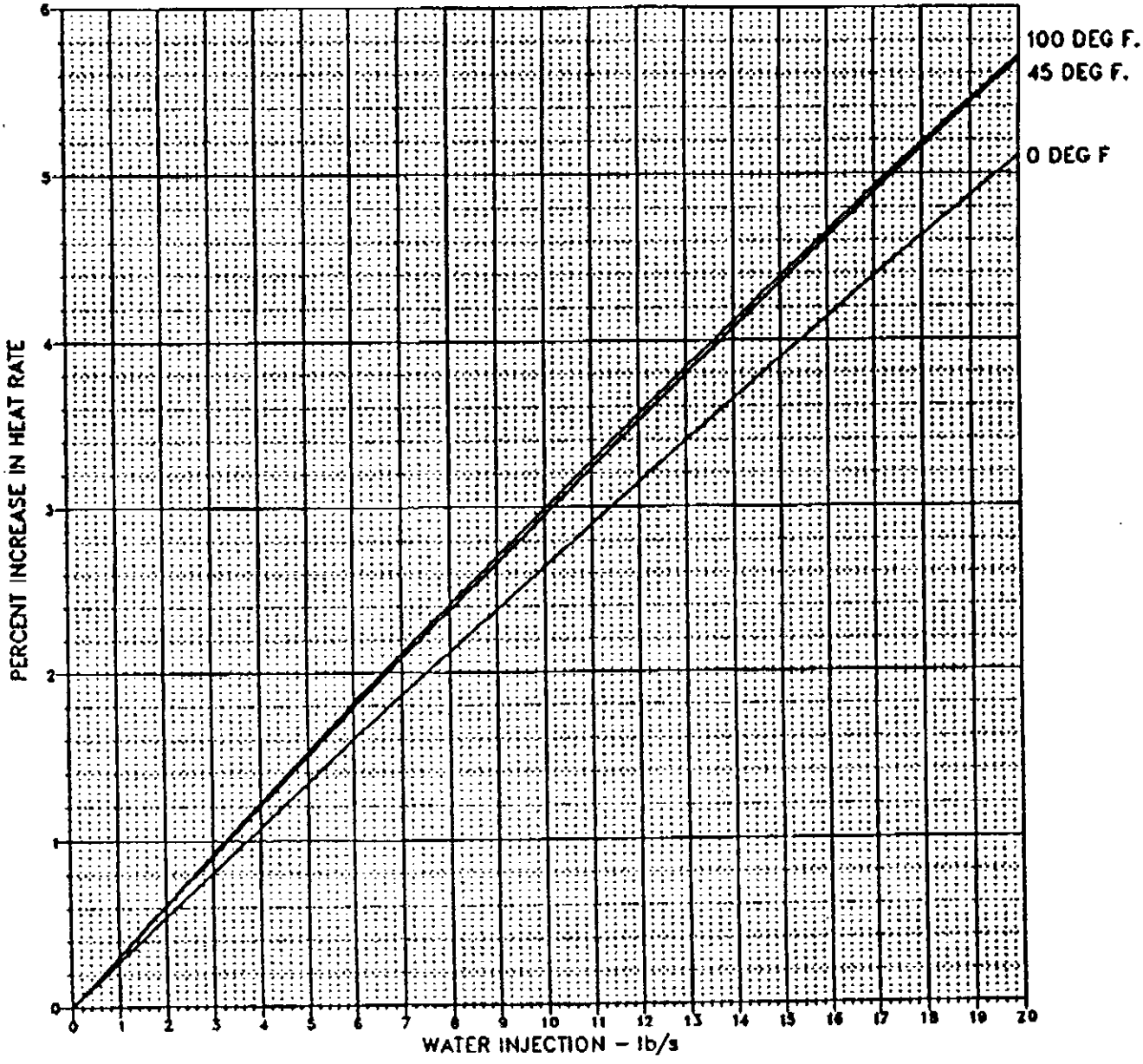


5/13/91
SK DRAPALA

499HA928 Rev.B
supersedes 7/13/89

GENERAL ELECTRIC MODEL PG7111EA GAS TURBINE
EFFECT OF WATER INJECTION ON HEAT RATE
BASE LOAD - Distillate/Natural Gas
DESIGN VALUES on curve 499HA733 Rev.A

Based on a constant specific humidity of 0.0064 lbs of water per pound of dry air, except for temperatures below 45 deg F, where fully saturated air results in a lower specific humidity.



5/13/91
SK DRAPALA

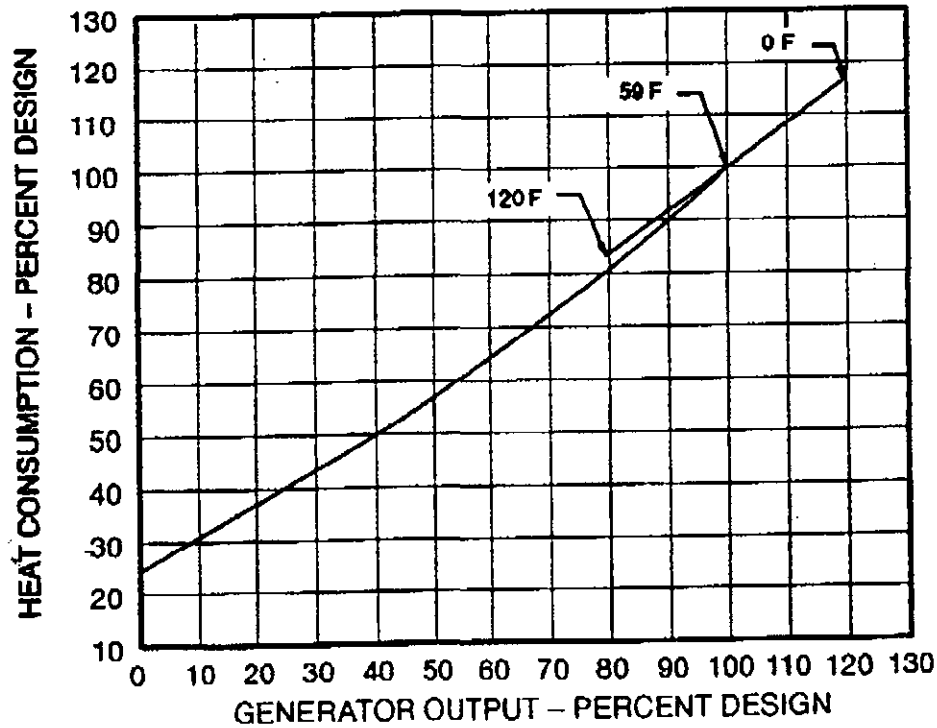
499HA929 Rev.A
supersedes 4/12/89

GENERAL ELECTRIC MODEL PG7111(EA) GAS TURBINE
ESTIMATED PERFORMANCE – CONFIGURATION: NATURAL GAS & DISTILLATE
Compressor Inlet Conditions 59 F (15.0 C), 60% Rel. Humidity
Atmospheric Pressure 14.7 psia (1.013 bar)

FUEL		NATURAL GAS	DISTILLATE
DESIGN OUTPUT	kW	90200	88720
DESIGN HEAT RATE (LHV)	Btu (kJ)/kWh	10450 (11020)	10520 (11100)
DESIGN HEAT CONS (LHV) X10–6	Btu (kJ)/h	942.6 (994.4)	933.3 (984.7)
DESIGN EXHAUST FLOW X10–3	lb/h (kg)/h	2353 (1067)	2359 (1070)
MODE: PEAK LOAD			PPB 040486

NOTES:
1. Altitude correction on curve 416HA662 REV A
2. Ambient temperature correction on curve 516HA137
3. Effect of modulated IGV's on exhaust flow and temp. on curve 516HA129
4. Air cooled generator 7A6
5. Humidity correction on curve 498HA697 REV B – all performance calculated with specific humidity of .0064 or less so as not to exceed 100% relative humidity.
6. Plant performance is measured at the generator terminals and includes allowances for excitation power, shaft driven auxiliaries, and 2.5 in. H2O (6.25 mbar) inlet and 5.5 in. H2O (13.75 mbar) exhaust pressure drops.
7. Additional pressure drop effects:

	%Effect on Output	%Effect on Heat Rate	Effect on Exhaust Temp.
4 in. H2O (10.0 mbar) inlet	–1.42	0.45	1.9 F (1.1 C)
4 in. H2O (10.0 mbar) exhaus	–0.42	0.42	1.9 F (1.1 C)



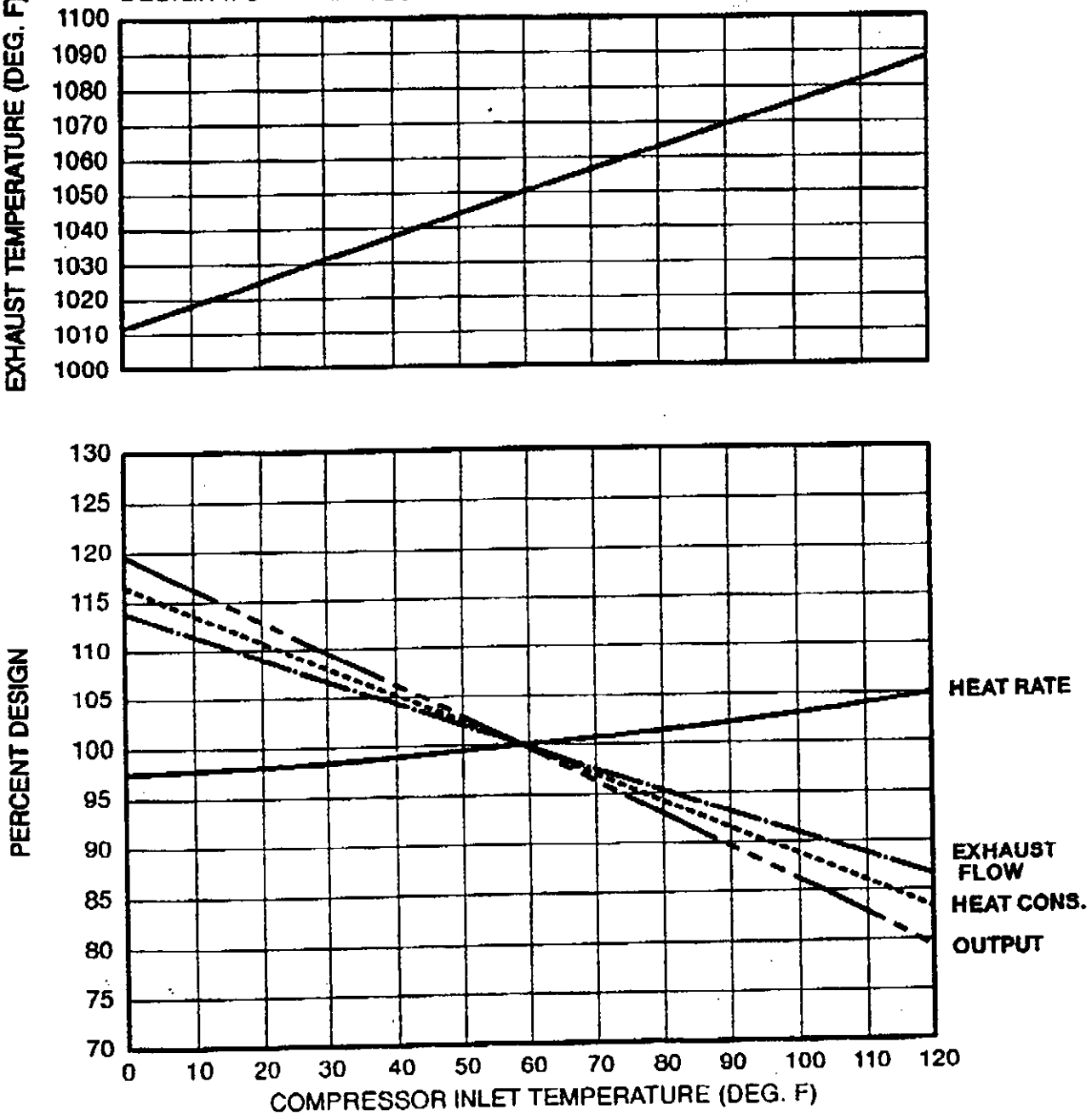
516HA136

DATE: 10/25/89
DA JAQUEWAY

GENERAL ELECTRIC MODEL PG7111(EA) GAS TURBINE

Effect of Compressor Inlet Temperature on Output, Heat Rate, Heat Consumption, Exhaust Flow And Exhaust Temperature at 100% Speed

FUEL: NATURAL GAS & DISTILLATE OIL
DESIGN VALUES ON CURVE 516HA136
DESIGN MODE: PEAK LOAD

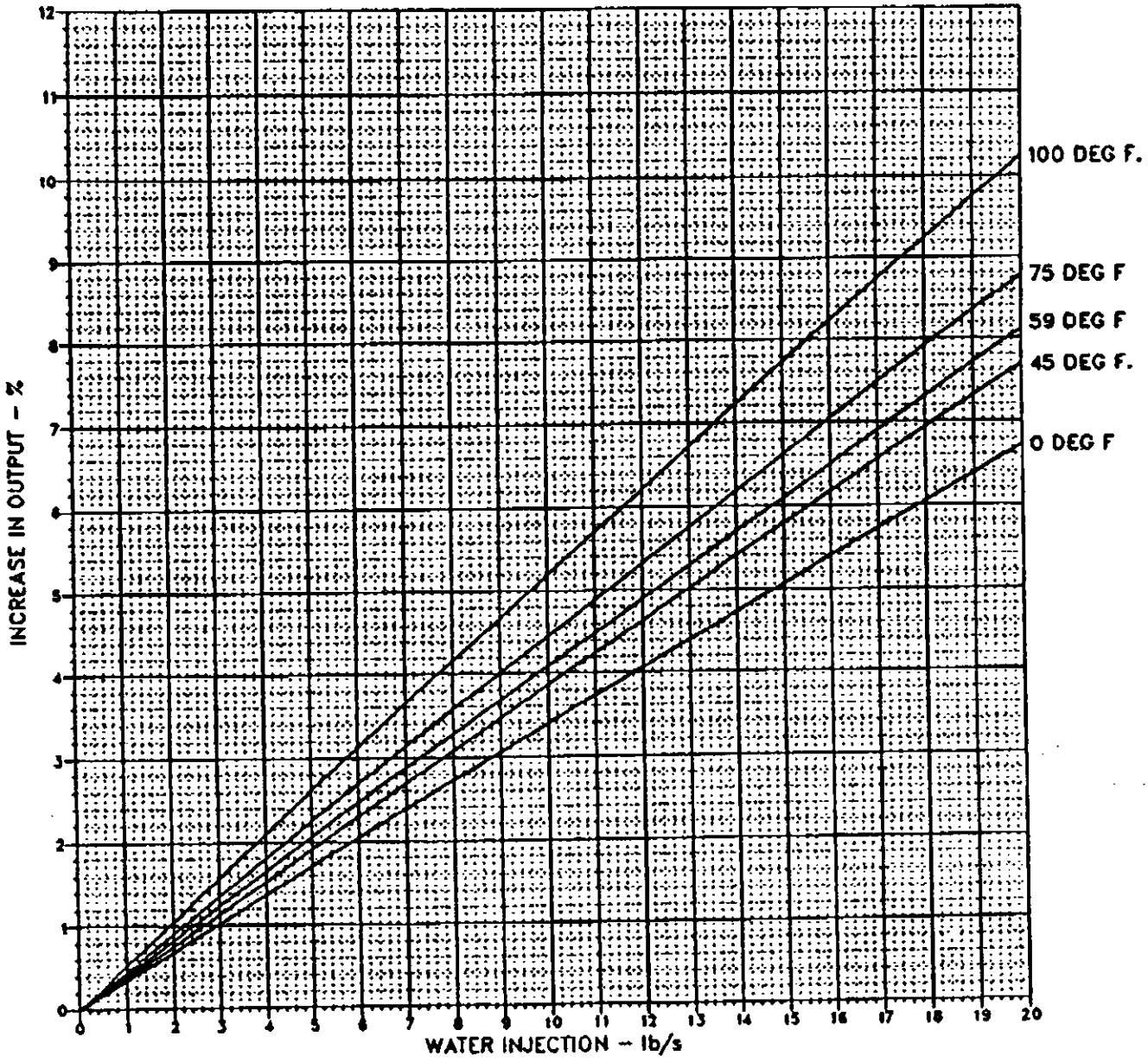


DATE 10/25/89
DA JAQUEWAY

516HA137

GENERAL ELECTRIC MODEL PG7111EA GAS TURBINE
EFFECT OF WATER INJECTION ON OUTPUT
PEAK LOAD - Distillate/Natural Gas
DESIGN VALUES on curve 516HA136

Based on a constant specific humidity of 0.0064 lbs of water per pound of dry air, except for temperatures below 45 deg F, where fully saturated air results in a lower specific humidity.

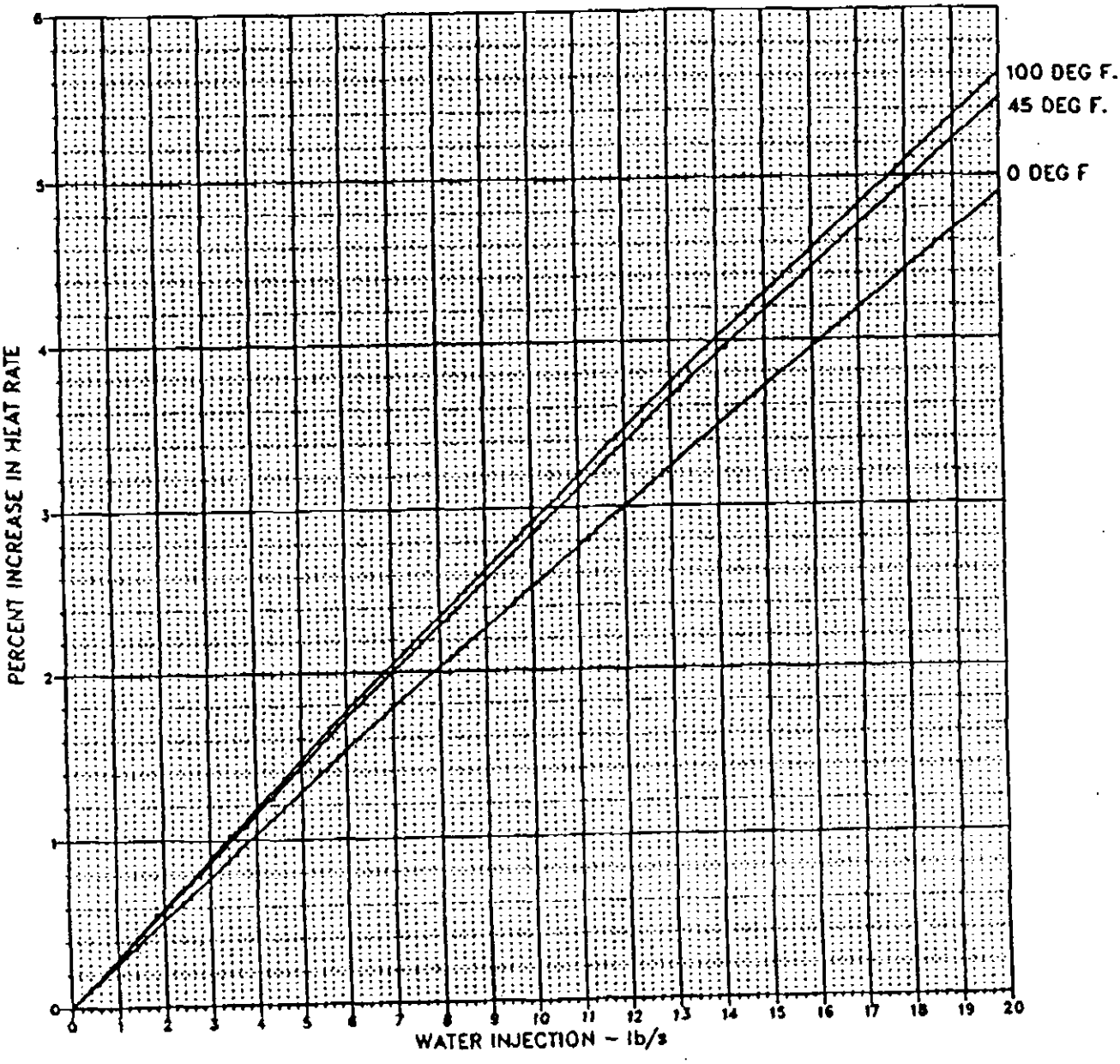


5/13/91
SK DRAPALA

499HA930 rev B
supersedes 7/13/89

GENERAL ELECTRIC MODEL PG7111EA GAS TURBINE
EFFECT OF WATER INJECTION ON HEAT RATE
PEAK LOAD - Distillate/Natural Gas
DESIGN VALUES on curve 516HA136

Based on a constant specific humidity of 0.0064 lbs of water per pound of dry air, except for temperatures below 45 deg F, where fully saturated air results in a lower specific humidity.



5/13/91
SK DRAPALA

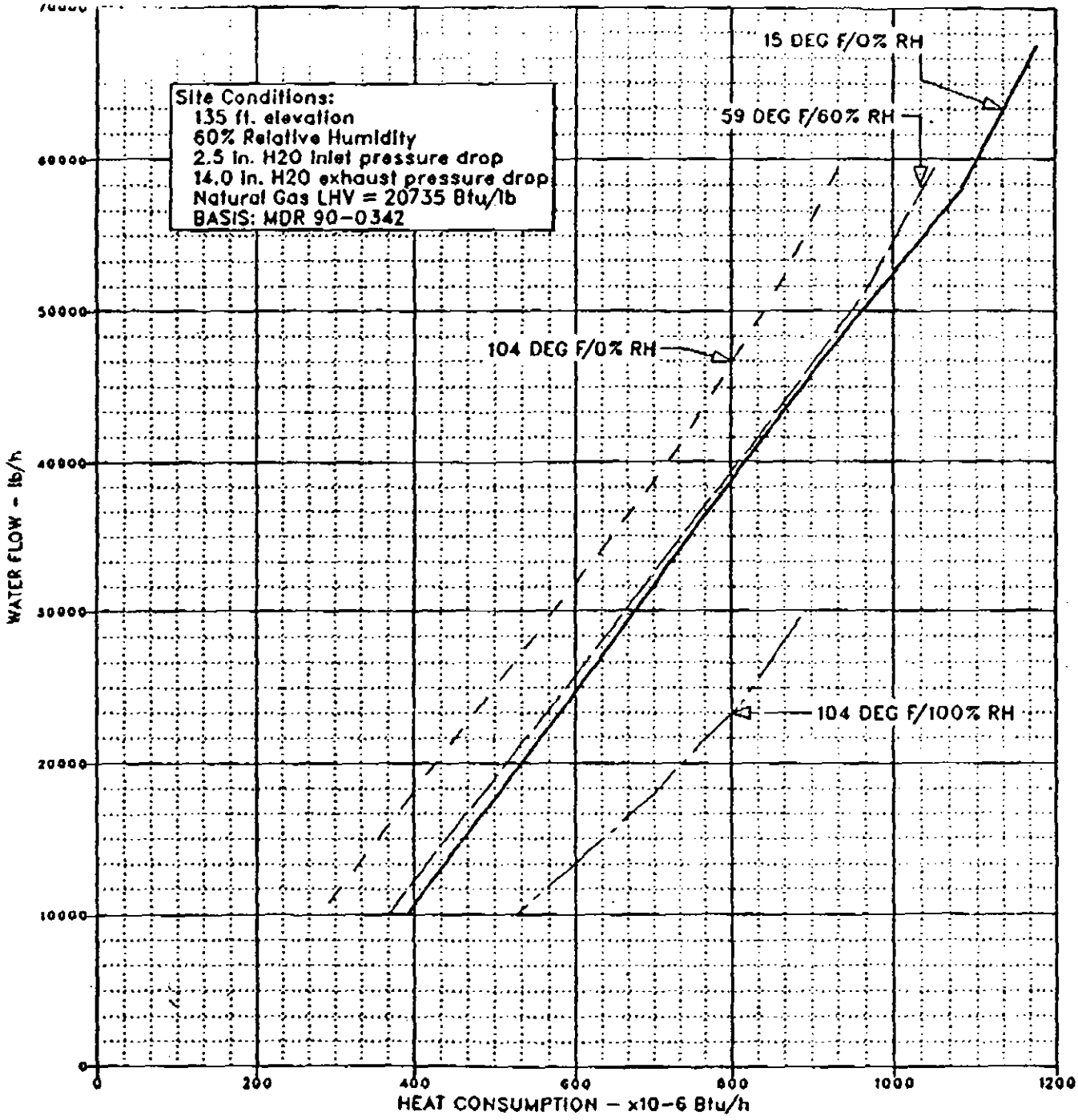
499HA931 rev B
supersedes 7/13/89

GENERAL ELECTRIC MODEL PG7111EA GAS TURBINE

ESTIMATED WATER SCHEDULE - CITY OF LAKELAND DM-GR0212

Water Injection at 250 psia/70 F to limit NOx to 25 ppmvd

@ 15% O2 on Natural Gas Fuel.



D. E. Kessler
1/2/91

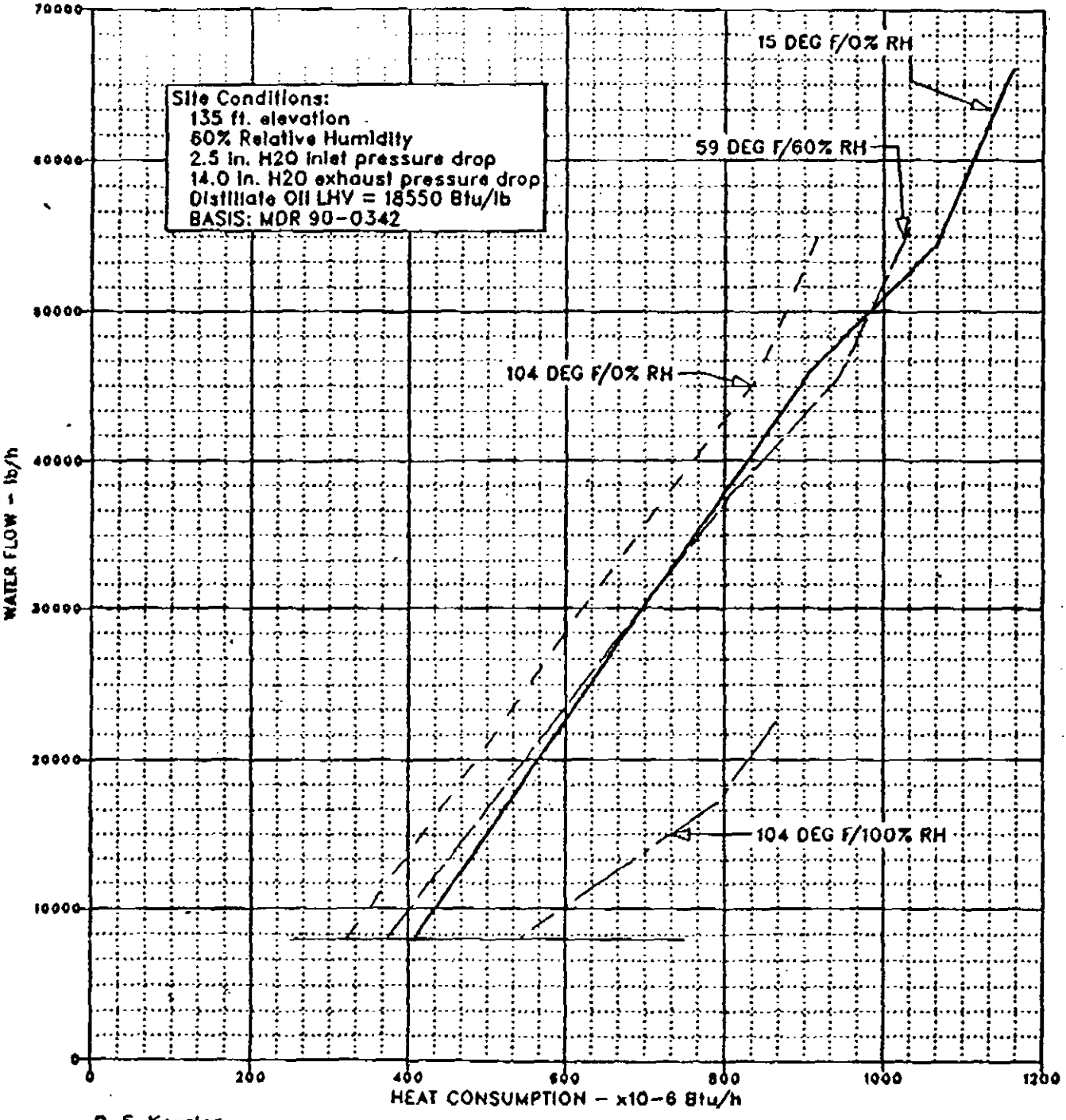
516HA585, REVISION A

GENERAL ELECTRIC MODEL PG7111EA GAS TURBINE

ESTIMATED WATER SCHEDULE - CITY OF LAKELAND DM-GR0212

Water Injection at 250 psia/70 F to limit NOx to 42 ppmvd

@ 15% O2 on Distillate Oil Fuel.



D. E. Kessler
1/2/91

516HA586, REVISION A

Department of Environmental Protection

Jeb Bush
Governor

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

David B. Struhs
Secretary

April 28, 2003

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Timothy Bates
Director of Energy Supplies
Lakeland Electric
501 E. Lemon Street
Lakeland, Florida 33801-5079

Re: DEP File No. PSD-FL-166(D) and 1050003~~-008-~~012-AC
Charles Larsen Memorial Power Plant – Combined Cycle Unit 8
Increase of Heat Input Rate and Peak Mode Operation Request

Dear Mr. Bates:

The Department received your application for the modification to Unit 8 to reflect performance enhancements and peak mode operation. Based on a technical review, the application is incomplete. Please submit the following information, including all assumptions, reference materials and calculations:

1. Please recalculate the net emission increases (sum of all 5 year contemporaneous creditable increases and decreases in the actual emissions of the facility) for all affected PSD pollutants listed in Table 62-212.400-2, F.A.C., to determine PSD applicability. Our records show an increase of emissions (TPY) due to the foggers installation project in the year 2000. Rule 62-212.400 (2)(e), F.A.C.
2. Under what different modes of operation is this unit currently operating? Please recalculate the emission rates under the different scenarios this unit will be operating. It is not clear from the information submitted, if this unit will be operating 3000 hr/yr (Table 10) or few hours per year (page 1 of Part II of application) on peak mode. Would this unit be operating on peak mode during simple or combined cycle operation or both? Natural gas or fuel oil burning? Please explain.
3. Expand the technical information regarding the upgrade of this unit, the information in the application states that the upgrade "involve enhancements to the compressor discharge (high pressure brush seal) that limit the amount of air leakage". Please submit GE technical documents that explain this issue. Is the Low NOx burner (LNB) system being upgraded? Could it be possible to upgrade the LNB system along with the proposed upgrade?
4. Please supply the manufacturer's specifications for the GE Model PG 7111EA.

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. Please note that per Rule 62-4.055(1): *"The applicant shall have ninety days after the Department mails a timely request for additional information to submit that information to the Department.... Failure of an applicant to provide the timely requested information by the applicable date shall result in denial of the application."*

If you have any questions regarding this matter, please call Teresa Heron (Review Engineer) at (850) 921-9529.

Sincerely,

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

AAL/th

Cc: Farzie Shelton, Lakeland Electric
Ken Kosky P.E., Golder Associates
Gerry Kissel, DEP SWD
Gregg Worley, EPA

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Timothy Bates
Director of Energy Supplies
Lakeland Electric
501 E. Lemon Street
Lakeland, FL 33801-5079

COMPLETE THIS SECTION ON DELIVERY

A. Received by *(Please Print Clearly)* Bonnie Brennan B. Date of Delivery 4-30-03

C. Signature
X Bonnie Brennan ☐ Agent ☐ Addressee

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

7001 0320 0001 3692 6174

PS Form 3811, July 1999 Domestic Return Receipt 102595-99-M-1789

U.S. Postal Service
CERTIFIED MAIL RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

Postage	$
Certified Fee	
Return Receipt Fee (Endorsement Required)	
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$

Postmark Here

Sent To: Timothy Bates
Street, Apt. No.; or PO Box No.: 501 E. Lemon St.
City, State, ZIP+4: Lakeland, FL 33801-5079

PS Form 3800, January 2001 See Reverse for Instructions

7001 0320 0001 3692 6174