Appendix D:

MANUFACTURER EMISSION GUARANTEES FOR NO_X AND AMMONIA SLIP

MITSUBISHI HEAVY INDUSTRIES AMERICA, INC.
Power Systems Division / Los Angeles Office
660 Newport Center Drive, Suite 1000
Newport Beach, CA 92660

FACSIMILE MESSAGE

DATE: August 5, 1998

TO: Ms. Fox
Phone : 510-843-1126
Fax : 510-845-0983

COPY TO:

FROM: Ricardo Yoshida
Senior Project Engineer
Phone : 949-640-5941
Fax : 949-640-6945 / 6947
e-mail : ryoshida@mhia.com

MHIA REF. #: LA- **MHIA Project #:** N/A

SUBJECT: SCR Guarantees

REFERENCE: Combined Cycle / Conference call

Number of pages including cover sheet:

As per our phone conversation based on an inlet NOx of 25 ppmvd, we can guarantee Outlet NOx of 2.0 ppmvd and NH_3 slip of 5.0 ppmvd.
The guarantees are valid from 0 to 100% load as long as the SCR operating temperature is above the minimum required.

Sincerely,

R. Yoshida

If you did not receive all pages correctly, please notify us by phone: 714-640-4664 or fax: 714-640-6945 / 6947.

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PEERLESS MFG. CO.

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

FACSIMILE MESSAGE

TO: Dr. Phyllis Fox
ATTN:
FAX: (510) 845-0983
RE: **SCR for GE Frame 7FA variable load**
Your Reference:
Peerless Reference: PMC-2134

DATE: August 13, 1998
PAGES: One (1)
CC: TTS/PMC-2134

Dear Ms. Fox,

Regarding our recent conversations, Peerless Mfg. Co. can supply and guarantee an SCR system to operate at the following conditions for the referenced GE Frame 7FA:

25 ppmvd NO_x inlet
2 ppmvd NO_x outlet
5 ppmvd NH_3 slip
NG operation (back up #2 oil acceptable)
Variable load changes limited by temperature range below
3-hr averaging
Absolute temperature range 400-785°F (Optimal 650-700°F for 100% load)

Based on the stringent design requirements of this system, care must be taken in the overall design. The CEM analyzers must be extremely accurate. This will directly affect the performance of the SCR. A one (1) ppm error on the NO_x analyzer means a 33% error. If the analyzer is reading 3.5ppm (actual is 2.5ppm), it will relay a signal to the Ammonia Flow Control Unit (AFCU) to inject more ammonia, thinking it needs more to reach 2.5ppm. Since more ammonia will be injected than needed, the ammonia slip requirement may be exceeded. So, you can see the importance of the accuracy of the analyzers, especially with low outlet requirements.

Also, the ammonia distribution becomes more stringent. Therefore, the system requires optimum design of the Ammonia Injection Grid (AIG). Peerless specializes in AIG design. We have approximately 100 units installed at more than 65 facilities in the U.S.

We are obtaining heat up time required for the catalyst and will forward the information soon. If you have any questions or need any additional information, please call.

Best Regards,

Tim T. Shippy

J:\SCR\SALES\QUOTES\2100-215.0\2134\PF8-13.FAX

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"Equal Opportunity Employer M/F"

FAX COVER SHEET

ENGELHARD

ENGELHARD CORPORATION
2205 CHEQUERS COURT
BEL AIR, MD 21015
PHONE 410-569-0297
FAX 410-569-1841
E-Mail Fred_Booth@ENGELHARD.COM

DATE: August 13, 1998 NO. PAGES 2 (INCLUDING COVER)

TO: J. Phyllis Fox

FROM: Fred Booth Ph 410-569-0297 // FAX 410-569-1841

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RE: Your request of August 12, 1998
Guaranteed SCR Performance

We have summarized data provided for our review and illustrate herein.

Engelhard can indeed provide Guaranteed Performance as noted. Please note that we have assumed temperature at the catalyst. We have assumed the SCR Catalyst to be within the HRSG. Actual catalyst volume may vary as a result of actual temperature at the catalyst inside the HRSG.

Sincerely yours,

ENGELHARD CORPORATION

Frederick A. Booth
Senior Sales Engineer

ENGELHARD

J. Phyllis Fox
August 13, 1998

GIVEN // CALC. DATA			
CASE	1	2	3
AMBIENT	20	20	20
FUEL	NG	NG	NG
LOAD	BASE	75%	50%
TURBINE EXHAUST FLOW, lb/hr	3,604,162	2,981,003	2,879,624
TURBINE EXHAUST GAS ANALYSIS, % VOL.	1001.16	828.06	799.90
N_2	74.78	74.79	75.32
O_2	12.42	12.24	13.73
CO_2	3.88	3.97	3.29
H_2O	7.98	8.06	6.72
Ar	0.94	0.94	0.94
CALCULATED GAS MOL. WT.	28.45	28.45	28.53
GIVEN: TURBINE NOx, ppmvd @ 15%O_2	25	25	45
CALC.: TURBINE NOx, lb/hr	168.2	142.5	204.2
GAS TEMP. @ SCR CATALYST, F (+/-20)	650	650	600
DESIGN REQUIREMENTS			
NOx OUT, ppmvd@15%O_2	2	2	2
NH_3 SLIP, ppmvd@15%O_2	5	5	5
SCR PRESSURE DROP, "WG - Max.			
GUARANTEED PERFORMANCE DATA			
NOx CONVERSION, % - Min.	92.0%	92.0%	95.6%
NOx OUT, ppmvd@15%O_2 - Max.	2	2	2
NOx OUT, lb/hr - Max.	13.5	11.4	9.1
EXPECTED 28% AQUEOUS NH_3 FLOW, lb/hr	249	211	287
NH_3 SLIP, ppmvd@15%O_2 - Max.	5	5	5
SCR PRESSURE DROP, "WG - Max.			

FAX COVER SHEET

ENGELHARD

ENGELHARD CORPORATION
2205 CHEQUERS COURT
BEL AIR, MD 21015
PHONE 410-569-0297
FAX 410-569-1841
E-Mail Fred_Booth@ENGELHARD.COM

DATE:	August 13, 1998	NO. PAGES	4	(INCLUDING COVER)
TO:	J. Phyllis Fox			
FROM:	Fred Booth	Ph 410-569-0297 // FAX 410-569-1841		

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We illustrate additional data to consider control of NOx during initial start-up.

Please note base design for 3,600,000 lb/hr gas flow, 2 ppm NOx out with 5 ppm ammonia slip. Please note that design ammonia flow is 287 lb/hr.

Assume that ammonia system is provided with capability of 300 lb/hr - per system. Considering using dual ammonia system during initial start-up - 600 lb/hr capability. We illustrate expected performance with both one and two ammonia systems.

Sincerely yours,

ENGELHARD CORPORATION

Frederick A. Booth
Senior Sales Engineer

ENGELHARD

August 13, 1998

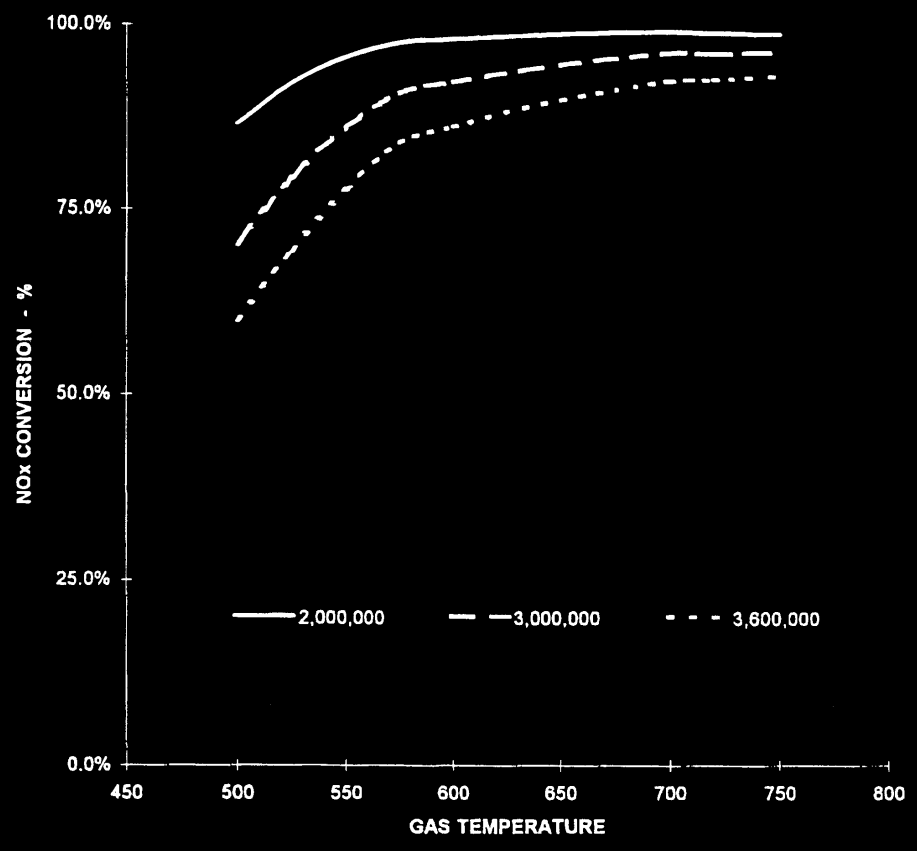
The SCR Catalyst was sized based on the following:

GIVEN // CALC. DATA			
CASE	1	2	3
AMBIENT	20	20	20
FUEL	NG	NG	NG
LOAD	BASE	75%	50%
TURBINE EXHAUST FLOW, lb/hr	3,604,162	2,981,003	2,879,624
TURBINE EXHAUST GAS ANALYSIS, % VOL.	1001.16	828.06	799.90
N_2	74.78	74.79	75.32
O_2	12.42	12.24	13.73
CO_2	3.88	3.97	3.29
H_2O	7.98	8.06	6.72
Ar	0.94	0.94	0.94
CALCULATED GAS MOL. WT.	28.45	28.45	28.53
GIVEN: TURBINE NOx, ppmvd @ 15%O_2	25	25	45
CALC.: TURBINE NOx, lb/hr	168.2	142.5	204.2
CALC.: NOx - ppmv	28.9	29.6	44.0
GAS TEMP. @ SCR CATALYST, F (+/-20)	650	650	600
DESIGN REQUIREMENTS			
NOx OUT, ppmvd@15%O_2	2	2	2
NH_3 SLIP, ppmvd@15%O_2	5	5	5
SCR PRESSURE DROP, 2.5"WG - Max.			
GUARANTEED PERFORMANCE DATA			
NOx CONVERSION, % - Min.	92.0%	92.0%	95.6%
NOx OUT, ppmvd@15%O_2 - Max.	2	2	2
NOx OUT, lb/hr - Max.	13.5	11.4	9.1
DESIGN INLET ALPHA - NH_3:NOx	1.12	1.12	1.07
EXPECTED 28% AQUEOUS NH_3 FLOW, lb/hr	249	211	287
NH_3 SLIP, ppmvd@15%O_2 - Max.	5	5	5
NH_3 SLIP, ppmv	5.8	5.9	4.9
SCR PRESSURE DROP, "WG - Max.			

ENGELHARD

August 13, 1998

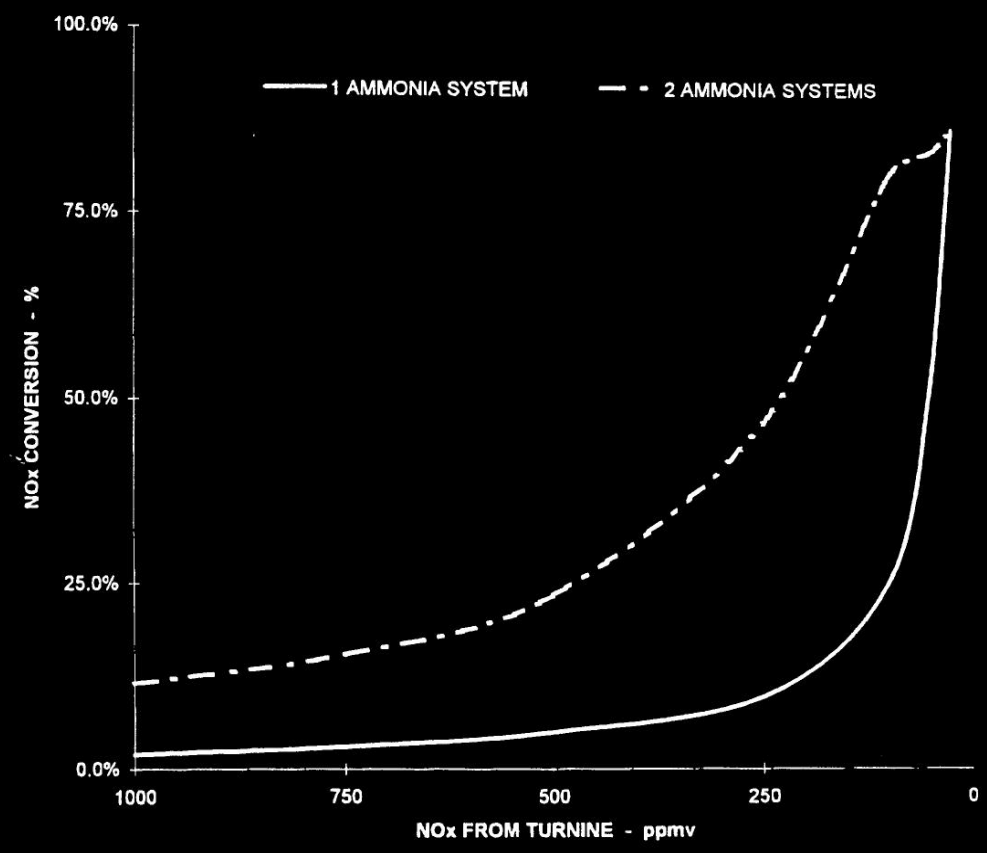
SCR Catalyst Performance
Varying Gas Flow and Gas Temperature
Ammonia Slip - 5 ppmv



ENGELHARD

August 13, 1998

Start-Up Performance
2,000,000 lb/hr Gas Flow
500°F Gas Temperature
One and Two Ammonia Systems
Ammonia Slip - 5 ppmv Max.



HITACHI AMERICA, LTD. 660 White Plains Road Tarrytown, NY 10591

Fax

Date: 8/13/1998

Number of pages including cover sheet: 1

To:	Environmental Management
Attn:	Phyllis Fox
Regarding:	Catalyst Information
Phone:	510-843-1126
Fax phone:	510-845-0983
CC:	D. Brozek (HAL)

From:	
	John Calvello
	Sales Engineer
	Power and Industrial Division
Phone:	(914) 524-6631
Fax phone:	(914) 332-5388

REMARKS: ☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please comment

In response to your talks with David Brozek on Thursday, 8/12, following is some information I can provide in regards to your request. It would take me additional time to gather additional information from Japan and prepare details as you have requested.

In regards to efficiency levels you are requesting we have a plant in Japan that is running at a 93% efficiency level, NOx out of 3ppm, and an ammonia slip of 3ppm. The plant is Yokohama 8, which consists of 4units, frame 9 gas turbines. I have attached some design data on this plant for your reference.

There are two plants going under construction in the southeast U.S.. The first plant is schedule to go online in August/September 1999. The outlet requirements for this plant are 2ppm with an ammonia slip of 10ppm. The second plant is scheduled for 2000. The outlet NOx has not been confirmed yet. The options for this plant are for 2, 3.5, and 4ppm. I should have confirmation on the required level by the end of September.

In general, there is no problem in supplying guarantees to meet both a 2ppm NOx outlet and an ammonia slip of 5ppm. The only consideration is the overall capital cost. These levels can be met by increasing the catalyst volume. I will try to gather additional information on temperature thresholds and operating temperatures for you.

We have recently quoted a confidential project that is to occur in the Northeast. It will be approximately 2000MW facility. I believe they will utilize Westinghouse 501G GT. The requirements quoted were a 3.5 and 2ppm outlet NOx with an ammonia slip of 5ppm or less. Budgetary equipment and catalyst cost are as follows;

Catalyst, Ammonia Injection Grid, Ammonia flow control skid, Catalyst support structure, Outer reactor housing:
3.5ppmvd - $1,700,000. OR 2.0ppm - $1,950,000.

ONE SYSTEM

I hope this current information is helpful. If there are any questions please feel free to contact me.

Sincerely,

John Calvello

○ー(1) 現在、計画、試運転中の脱硝装置計画仕様

REV-A '92-8-5

	No.	項目	単位	CONFIDENTIAL 計画	CONFIDENTIAL 実績	CONFIDENTIAL 計画	CONFIDENTIAL 実績	YOKOHAMA 8 計画	YOKOHAMA 8 実績	CONFIDENTIAL 計画	CONFIDENTIAL 実績	CONFIDENTIAL 計画	CONFIDENTIAL 実績
CAPACITY	1	ボイラ型式 (出力)	(MW)	700 (4軸)		670 (3軸)		1400 (4軸)		1650 (7軸)		168 (1軸)	
FUEL	2	燃料 (S分)	(wt%)	LNG (0) (0℃)		LNG (0) (4℃)		LNG (0) (0℃)		LNG (0)		都市ガス (7ppm)	
GAS FLOW RATE	3	処理ガス量	Nm³/h	1,050,410×4基		1,259,300×3基		1,827,000×4基		1,272,840 (0℃)		1,230,260 (0℃)	
GAS TEMP.	4	処理ガス温度	℃	354		337		359		354			
OPERATION START	5	運転開始	-	1994-1.3 (1.2軸)		1995-12~ 1996-7		1996-7~ 1998-7		1996-7~ 1997-1		1993-6	
	6												
INLET NOx	7	入口NOx濃度	ppm	62.5(16%O₂)		64.3(16%O₂)		43(16%O₂)		50(16%O₂)		62.5(16%O₂)	
OUTLET NOx	8	出口NOx濃度	ppm	12.5(16%O₂)		9.7(16%O₂)		3(16%O₂)		6(16%O₂)		6.25(16%O₂)	
EFF.	9	脱硝率	%	>80		85		93		88		90	
MOLE RATIO	10	NH₃/NOxモル比	-	0.9082		0.9096		1.0					
	11	Slip NH₃	ppm	10(0%)		5 (0%)		3(16%O₂)		5(16%O₂)		10(16%O₂)	
	12	SOx (SO₂)	ppm	0		0		0		0		0.2(0.32)	
DUST	13	ダスト	mg/Nm³	0		0		0		0		0	
	14	O₂ (H₂O)	%	13.6 (7.5)		14.0 (7.4)		13.9 (7.3)		13.8 (7.2)		14.8 (6.4)	
	18	LV (LVA)	m/SEC	7.2(8.7)		6.2(8.1)		7.0(8.4)		5.8(8.2)		9.7(11.7)	
	20	H Cata	m	2.5		2.0		2.5		2.75		3.3	
	21	全ΔP (Cata全)	mmAq	<100		<120		<75		<100		<120	
	22	ΔP Cataのみ	mmAq										
	23	SO₂酸化率	%										
	24	ΔSO₂	ppm										
	25	運転条件	-										
	27	ユニット巾数×長行数×段数	個/基	(16"×28")×5L=2080		(20"×28")×4L=2240		(20"×38")×5L=3800		(18"×30")×5L=2700		(10"×37")×6L=2220	
	28	ユニット総数	個	2080×4=8320		2240×3=6720		3800×4=15200		2700×7=18900		2220×1=2220	
	28-1	流れ方向のユニット配列	個	1. 2. (1)		2. 2. (1)		3. 2		3. 2. (1)		3. 3	
	29	脱硝装置の運用	℃										
	30	R/C サイズ	m	(8.9"×14.8")×7L		(11.2"×15.0")×7.5L		(13.5"×18.6")×7L		(14.1"×16.6")×7.5L		(5.5"×18.9")×7.5L	
	31	重量:CATA+R/C	TON										
	32	製造番号DENOx-100-	-										
FRAME TYPE	33	備考		F7F		F7FA		F9F		F7FA		F9EA	

(E15003)

MITSUBISHI HEAVY INDUSTRIES AMERICA, INC.
Power Systems Division / Los Angeles Office
660 Newport Center Drive, Suite 1000
Newport Beach, CA 92660

FACSIMILE MESSAGE

DATE: April 30, 1998

TO: Patch Incorporated
Attn. Mr. Patch
Phone : 707-435-9994
Fax : 707-435-9988

COPY TO: Mr. Taki, Mr. Onishi

FROM: Ricardo Yoshida
Senior Project Engineer
Phone : 714-640-5941
Fax : 714-640-6945 / 6947

MHIA REF. #: LA- 1202S MHIA Project #: LA-223

SUBJECT: SCAQMD BACT

REFERENCE: NOx Levels

Number of pages including cover sheet: 19

Dear Mr. Patch,

1. Below table shows the budget price of one (1) SCR System for different requirements. All pricing is based on conventional SCR System. DeNOx Efficiency above 92% would require an optimization using CFD and Cold Flow Model Test which were not used at this time therefore our prices for cases 3 & 4 are conservative.

Case	NOx Removal	Outlet NOx	SCR Material Cost
1	88 %	3.0 ppm	$1,251,000.00
2	90 %	2.5 ppm	$1,314,000.00
3	92 %	2.0 ppm	$1,449,000.00
4	94 %	1.5 ppm	$1,782,000.00

2. For clarification on the scope of work and supply, please refer to our technical specification.
3. We assumed and recommend the electric heater type skid for this application. This system has less restriction during start up.
4. With regard to experience, MHIA has supplied the SCR System for Simpson Paper. This unit has a gas turbine with retrofitted low NOx combustors. The Inlet NOx is around 14-15

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ppmvd and the Outlet NOx is less than 2 ppmvd. Based on this, we confirm that the 2.5 ppmvd will be met with the current SCR technology.

5. Our experience in Japan can not be disclosed in details at this moment because there is no licensee agreement between MHI and MHIA for this technology. The current units operating in Japan at very low NOx levels were co developed with other companies therefore it will take a time until an agreement is in place. However MHI is building a Combined Cycle Unit in Japan (Shin Chiba) with 2.5 ppm NOx outlet, this plant will start operation next year.

Sincerely,