FLORIDA POWER & LIGHT COMPANY

TURKEY POINT PLANT UNITS 3 & 4

REPORT

ON

FRACTURE TOUGHNESS OF STEAM GENERATOR AND REACTOR COOLANT PUMP SUPPORTS

(RESPONSE TO NRC QUESTIONS)

PREPARED BY

BECHTEL POWER CORPORATION

GAITHERSBURG, MARYLAND

November, 1980

FRACTURE TOUGHNESS OF STEAM GENERATOR AND REACTOR COOLANT PUMP SUPPORTS

(RESPONSE TO NRC QUESTIONS)

I. INTRODUCTION

In May 1978, the Nuclear Regulatory Commission requested information concerning steam generator and reactor coolant pump materials used at the Turkey Point Plant Units 3 & 4. In November 1978, Florida Power and Light Company issued the "Report on Fracture Toughness and Potential for Lamellar Tearing of Steam Generator and Reactor Coolant Pump Supports." This report is submitted in response to additional questions in an NRC letter dated July 29, 1980, and supersedes in its entirety the previous document submitted to NRC by FPL letter L-80-332 dated October 3, 1980.

II. RESPONSE TO NRC CONCERNS AND REQUESTS

ITEM 1

CONCERN

Figures 6 and 7, (Bechtel Drawing Numbers 5610-C194 (Rev.3) and 5610-C196 (Rev.3), respectively) accompanying Florida Power and Light Company's letter of November 10, 1978 to NRC, show the S/G and RCP support columns are laterally braced, at the top, to compartment walls. No. 18 rebar extends out from embedment to act as studs to secure the bracing. These rebar are ordered to ASTM A-432, a specification that does not assure fracture toughness.

These rebar appear to be simultaneously:

1) Important to support structural integrity

2) Of relatively poor fracture toughness

3) Thick and notched by threads - two conditions individually notorious as promoters of brittle behavior, and

4) Not readily inspectable.

On the other hand, the rebar pattern (16 bars per support) provides considerable redundancy, and design stresses are not obviously excessive.

REQUEST

In order that the fracture toughness adequacy of these rebar may be evaluated, please provide:

a) Results of inspections of the rebar made to date and plans (if any) for future inspections. State how such inspections are performed and what region of the rebar is so inspected.

b) Provide evidence to assure that all thermal expansions are actually being fully accommodated by the mechanisms the design provides for this purpose. Results of past inspections of wear in and around thermal expansion slots may provide acceptable evidence on this point. Discuss such wear patterns in relationship to the possibility that rebar might be subjected to anticipated cyclic thermal loads during routine plant operations.

c) Mill test reports for the heat(s) for this rebar. Include also any special ordering requirements and results of any other tests indicative of fracture toughness that may have been performed.

If it is found that no relevant evidence is available under Items (a) and (c) above (i.e., if rebar fracture toughness is unknown and inspections are not made), testing of rebar samples may become necessary.

Preferred sources of samples are materials possibly retained at the plant from original construction or at the mill from the same heat. If not otherwise available, samples may have to be taken from the structure.

It is requested that a search for suitable sources of samples be made for this ASTM A-432 rebar and their availability be reported. If no source is found, please identify locations in the structure where material for coupons (see ASTM A-370, Section 18 and 19 for required size and number) can best be taken with least impact on structural integrity.

RESPONSE

1(a) A document search of the Architect-Engineer (A-E) files and Florida Power and Light General Office and Plant Site files has verified that inspection results for the rebar referenced were not maintained. No inspections are presently planned for these items.

1(b) No indications of inspections of wear in and around thermal expansion slots are available. There are no future plans for such inspections.

1(c) No documents were found to specify special ordering requirements or fracture toughness testing for the subject rebars. Mill test reports for ASTM A-432 rebars indicating chemical composition and tensile strength properties are attached. These mill test reports are assumed to be applicable to the subject rebar since they were filed with the documentation for the other support materials. Specific heat(s) for the subject rebar could not be determined.

A search was performed to locate samples of ASTM A-432 rebar at the plant site. It was determined that there are no samples available.

It is noted that there is no tensile stress in the rebar for operating loads (including seismic loads). For the accident load combination of dead load plus live load plus thermal load plus pipe break load, the tensile stress in the subject rebar in the steam generator supports at elevation 30'-6" is 18.0 ksi. For the same loading, the tensile stress in the rebar in the reactor coolant pump supports at elevation 25'-6" is 26.0 ksi. The minimum yield for this rebar material is 60 ksi. Because of the low stress levels in the rebar for all load conditions, additional testing of rebar for fracture toughness is not considered to be necessary. Since

the minimum rebar length required for testing is 7 1/2" at any one given location (i.e., for performing three tests from the same rebar), which would require disassembly of the support and possible concrete removal to expose a sufficient length to obtain test samples, we recommend that, if testing is still required, test specimens of rebar with similar metallurgical composition be used in lieu of in-place rebar.

ITEM 2

CONCERN

NUREG 0577 ranks steel specifications according to the fracture toughness of products typically supplied under each specification when no additional material requirements are included in the procurement order. A Group II rating is assigned to specifications governing steel of intermediate fracture toughness.

NUREG 0577 also establishes NDT criteria to screen steels for their suitability for use in S/G and RCP supports. Certain Group II steels meet these screening criteria in applications where members are thin, but fail them if members are thick. Thus, although use of these steels in thin sections is acceptable, no outright sanction for thick section use is granted. In such cases fracture-toughness adequacy must be evaluated for each specific application. Guidance as to methods, acceptable to NRC, for making such evaluations is also supplied by NUREG 0577.

The design of the supports for the Turkey Point nuclear power station, Units 3 and 4, incorporates thick section use of the following Group II steels which do not meet the NDT screening criteria:

1.) ASTM A-302

2.) ASTM A-588

REQUEST

In order that the fracture-toughness adequacy of such applications may be evaluated, please submit the following information:

a) Identify all applications where these steels are used in thick sections. An acceptable procedure for making such determinations is to use the formula:

$$t_c = 2.5 \left(\frac{K_{ID}}{\sigma_{yD}}\right)^2$$

Where: σ_{yD} is the dynamic yield strength of the steel.

K_{ID} is the nominal minimum assured fracture toughness of the steel in accordance with values supplied by NUREG 0577.

t_c is the critical thickness. In members thicker than t_c, brittle (i.e., plane strain) behavior may be expected.

If adequately documented, other procedures may be employed in making this determination. For example, if other K_{ID} values specific to the steel used in the application are known from mill or other tests, these may be used in lieu of values taken from NUREG 0577.

b) For structural members found to be thick, please submit the following information:

1. Mill test records for these members. Any additional available information which may be indicative of fracture toughness (e.g., supplementary material specification requirements or other test results).

2. Identify which of the thick members is most highly stressed in tension on the thick section.* Report the most severe primary stress and the most severe primary-plus-secondary stress found, the station at which these occur, and the loading combination(s) that produces them.

c) Please furnish a fracture-toughness evaluation of the condition identified in Item (b,2) above. Guidance as to acceptable means for making this evaluation is provided by NUREG 0577.

*In making this determination, consider each thick member individually. For each, identify the loading combination which most highly stresses the thick material at its most critical station. For example, if the member is a thick Flange I-Beam, the most highly stressed location in the flange should be considered. Compare these stresses among all members. Only the results for the member found to be most highly stressed need be reported.

RESPONSE

2(a) All applications where steels SA-302 (Grade B) and ASTM A 588 (Grade A) are used in thick sections are identified in Table 1 and Table 2 for steam generator supports and in Table 3 for reactor coolant pump supports.

2(b)(1) Mill test reports for SA-302 support material are attached. Material test reports for the specific thick SA-302 materials could not be found; however, the attached mill test reports are considered representative of the SA-302 materials used for the thicker parts. Mill test reports for ASTM A-588 material or additional information indicative of fracture toughness (e.g., supplementary material specification requirements or other test results) could not be found.

2(b)(2) Primary stresses (which include dead loads, live loads, thermal loads, and seismic loads) for steam generator and reactor coolant pump support components are compressive. The most severe primary plus secondary stress for a steam generator support component (see Item No. 3 in Table 1) is 32.03 ksi in bending. The most severe primary plus secondary stress for a reactor coolant pump support component (see Item No. 3 in Table 3) is 49.74 ksi in bending. Primary plus secondary stresses indicated above are for the accident load condition which includes dead loads, live loads, thermal loads, and pipe break loads.

2(c) Primary stresses (which include dead loads, live loads, thermal loads, and seismic loads) produce only compressive stresses in the support components. Primary plus secondary stresses (which include dead loads, live loads, thermal loads, and pipe break loads) produce tensile stresses. NUREG 0577 provides a comparison of Nil Ductility Temperature (NDT) with an assumed 75° F minimum operating temperature for the assessment of fracture toughness properties. However, during the accident condition (i.e., pipe break), the temperature inside containment will be much higher than 75° F.

The data available for justification of an increase in K_{ID} (K_{ID} - nominal minimum assured fracture toughness of the steel as indicated in NUREG 0577) due to higher temperatures is of a limited nature. However, we have found no records of occurrences of brittle fracture taking place in plate or structural steel at temperatures of 100° F or higher. Additionally, since the thickened steel parts are in tension only in coincidence with high temperatures, it is considered that the fracture toughness properties of the structural steels used are adequate for their intended function. Removal of any test specimens from the existing supports would result in overstressing of members during accident load conditions. We therefore recommend that, if testing is still required, test specimens of material with similar metallurgical composition be used.

TABLE 1

LOWER STEAM GENERATOR SUPPORT @ EL. 30'-6"

ITEM NO.	MEMBER TYPE (See Note 1)	MATERIAL TYPE	ta ACTUAL THICKNESS	tc (See Note 2)	STEEL USED IN THIN OR THICK SECTIONS (See Note 2)
1	COLUMNS W 10 x 77 (i) WEB (ii) FLANGE	A-588 GR. A	 0.535 0.868	 1.07 1.07	 THIN THIN
2	COLUMN CAP PLATE	SA-302 GR. B	3.5	0.74	THICK
3	VERTICAL BOLTED TO EMBEDDED ℄	SA-302 GR. B	3.0	0.74	THICK
4	EMBEDDED SHEAR ASSEMBLY a. WT 10.5 x 56 (i) WEB (ii) FLANGE b. VERTICAL ℄	 A-588 GR. A SA-302 GR. B	 0.527 0.865 1.00	 1.07 1.07 0.74	 THIN THIN THICK
5	BRACKET CONNECTING S. G. LUG & COL. CAP (i) VERT. ℄'s (ii) HORIZ. ℄	 SA-302 GR. B SA-302 GR. B	 3.5 4.0	 0.74 0.74	 THICK THICK
6	℄ BTWN. COL. CAP ℄ & BRACKET CONNECTING S. G. LUG & COL. CAP ℄	SA-302 GR. B	0.50	.74	THIN

NOTE 1: For location see Drawing 5610-C-196

NOTE 2: As defined in NRC request

$$tc = 2.5\left(\frac{K_{ID}}{\sigma_{YD}}\right)^2$$

where K_{ID} = Nominal minimum assured fracture toughness of steel per NUREG 0577

σ_{YD} = Dynamic yield strength of steel

when ta < tc - THIN SECTION
ta > tc - THICK SECTION

TABLE 2

UPPER STEAM GENERATOR SUPPORTS @ EL. 58'-0"

ITEM NO.	MEMBER TYPE	MATERIAL TYPE	ta ACTUAL THICKNESS	tc (See Note 1)	STEEL USED IN THIN OR THICK SECTIONS (See Note 1)
1	RING GIRDER (i) FLANGE (ii) WEB (DWG 5610-C-197)	SA-302 GR. B SA-302 GR. B	1.75 1.06	0.74 0.74	THICK THICK
2	STOP ASSEMBLY (2 NOS.) (DWG. 5610-C-197, DET. 2 & 3)	SA-302 GR. B	1.375	0.74	THICK
3	STOP ASSEMBLY (1 NO.) (DWG. 5610-C-197 DET. 5)	SA-302 GR. B	1.00	0.74	THICK

NOTE 1: As defined in NRC request

$$tc = 2.5\left(\frac{K_{ID}}{\sigma_{YD}}\right)^2$$

where K_{ID} = Nominal minimum assured fracture toughness of steel per NUREG 0577

σ_{YD} = Dynamic yield strength of steel

when ta < tc - THIN SECTION
ta > tc - THICK SECTION

TABLE 3

REACTOR COOLANT PUMP SUPPORT

ITEM NO.	MEMBER TYPE (See Note 1)	MATERIAL TYPE	ta ACTUAL THICKNESS	tc (See Note 2)	STEEL USED IN THIN OR THICK SECTIONS (See Note 2)
1	COLUMN CAP PLATE	SA-302 GR. B	5.25	0.74	THICK
2	COLUMN W 10 x 112 (i) WEB (ii) FLANGE	A-588 GR. A	 .755 1.248	 1.07 1.07	 THIN THICK
3	VERTICAL PLATE BOLTED TO EMBEDDED PLATE @ 25'-6"	SA-302 GR. B	3.0	0.74	THICK
4	EMBEDDED SHEAR ASSEMBLY (a) VERTICAL ℞ (b) COLUMN W12 x 190 (i) WEB (ii) FLANGE	 SA-302 GR. B A-588 GR. A	 1.0 1.06 1.736	 0.74 1.07 1.07	 THICK THIN THICK

NOTE 1: For location see Drawing 5610-C-194

NOTE 2: As defined in NRC request

$$tc = 2.5\left(\frac{K_{ID}}{\sigma_{YD}}\right)^2$$

where K_{ID} = Nominal minimum assured fracture toughness of steel per NUREG 0577

σ_{YD} = Dynamic yield strength of steel

when $ta < tc$ - THIN SECTION
$ta > tc$ - THICK SECTION

ITEM 3

CONCERN

Information relating to welding practices was deemed insufficient to enable evaluation of their fracture-toughness adequacy.

REQUEST

For the following weld joints:

a. Pump support assembly plate-to-plate weld (MC 6 to MC 7 in Unit 3 shown in detail M in Fig. 24 (Dwg. 1428583))

b. Column web and flange welds to plate MC 6 in Units 3 of Fig. 24 (Dwg. 142858E)

c. Steam generator column web and flange welds to plate in Section G of Fig. 7

d. Steam generator plate-to-plate weld in Section C of Fig. 7 (similar to Item a above)

Please furnish the following information:

a. What specific welding materials were used (electrode type and diameter, and flux if applicable)

b. What welding conditions were used (position, current, and voltage)

c. What welding sequence was used (which sections or sides were welded first, last, etc., during welding?)

d. What post weld heat treatment was used (time, temperature) and how was this done? How was the temperature monitored?

RESPONSE

A document search of FPL files indicated that quality control information on the various welding practices was not maintained. However, with the exception of the welding sequences, we have verified to what specifications the welding was performed. Accordingly, we offer the following available information for your review as requested.

3(a) Welding of structural members was specified using the manual metal arc or the submerged arc welding processes. The filler metal for manual metal arc welding was specified to be Class E-XX10, E-XX15 and E-XX18. The filler metal for submerged arc welding was specified to be Oxweld No. 36 wire deposited with Linde No. 80 flux, particle size 48 X D or Lincoln L60 wire deposited with Lincoln No. 760 flux. Electrode diameters were specified to be 1/4", 7/32", 3/16", 5/32", 1/8" and 3/32" for manual metal arc welding and 3/16", 5/32", 1/8" and 3/32" for submerged arc welding.

3(b)(i) For the manual metal arc welding process, the following conditions were specified:

- Class E-XX10, E-XX15 and E-XX18 electrodes to be deposited with direct current, reverse polarity.

- Welding current ranges, based on electrode diameter and classification, to be as shown in the table below:

Electrode Diameter	TYPES OF ELECTRODES		
	E-XX10	E-XX15	E-XX18
3/32"	60-90 Amps	60-90 Amps	85-110 Amps
1/8 "	90-120 Amps	110-140 Amps	130-160 Amps
5/32"	125-175 Amps	150-190 Amps	180-210 Amps
3/16"	150-175 Amps	180-210 Amps	250-290 Amps
7/32"	-	-	-
1/4 "	-	-	350-410 Amps

(ii) For the submerged arc welding process, the following conditions were specified:

- Submerged arc welding to be performed with alternating current using the following characteristics for various sizes of weld wire:

DIA. OF WELD WIRE	WELDING CURRENT	VOLTAGE	TRAVEL SPEED
3/32"	350-400 Amps	30-33	26"-30" per Min.
1/8 "	400-500 Amps	30-33	26"-30" per Min.
5/32"	500-600 Amps	30-33	14"-20" per Min.
3/16"	700-800 Amps	30-33	12"-14" per Min.

3(c) A document search of the Architect-Engineer (A-E) files and Florida Power and Light General Office and Plant Site Files has verified that information concerning welding sequences (i.e. which sections or sides were welded first, last, etc.) during welding was not maintained.

3(d) Post weld heat treatment for the subject weldments was specified to be as follows:

Methods of post weld heat treatment were specified to involve heating the complete assembly as a unit in a furnace, or heating sections of the assembly by electric induction coils, resistance coils or gas burners. For components to be locally post weld heat treated, thermocouples were specified to be attached in order to ensure correct temperature. All areas of components to be subjected to post weld heat treatment were specified to be cleaned of oil, grease, dirt, etc. Post weld heat treatment of weldments was specified to be within the temperature range of 1100° F - 1150° F. Minimum temperature holding time was specified to be one hour per inch thickness of the greatest thickness of the weldments to be post weld heat treated. Temperature was specified to be controlled by butted thermocouples (directly in contact) or attached thermocouples. Temperature control was specified to be accomplished with the aid of automatic strip chart recording controllers in conjunction with manual control.

ATTACHMENT 1

MILL TEST REPORTS

FOR

ASTM A-432 REBAR

FLORIDA STEEL CORPORATION

FLORIDA ELECTRIC STEEL MILL DIVISION

METALLURGICAL DEPARTMENT

CHEMICAL AND PHYSICAL TEST RECORD ON BASIC ELECTRIC FURNACE STEEL

No. 67-02

Date 18 [illegible] 67

Furnished to All Divisions FSC

Chemical: C ___ Mn ___ .050 S ___ Specification A-432 Physical: Y.P. 60,000 T.S. 60,000

Heat Number	C	Mn	P	S	[illegible]	[illegible]	Lb or Sq	Grade	[illegible]	Yield Pt. PSI	Tensile PSI	% Elong.	[illegible]
67-1341	45	100	034	043		186	0.18	A-432		65,960	103,550	10.0	3/4
67-7640	48	104	023	034		"	0.31	"		65,370	111,[illegible]	7.5	"
67-1353	46	107	060	045		"	1.64	"		69,930	115,960	7.5	"
67-1442	45	110	020	049		"	0.92	"		67,720	102,000	9.0	"
67-7704	48	108	035	048		"	0.78	"		67,070	112,400	8.5	"
67-1334	45	109	036	041		"	0.92	"		64,150	105,650	11.0	"
67-1337	44	110	036	046		"	0.39	"		62,310	105,500	11.0	"
67-1335	43	111	030	047		"	0.41	"		63,450	107,070	7.5	"
67-7262	49	108	033	033		"	0.86	"		[illegible]	[illegible]	[illegible]	"
67-7700	42	97	024	050		"	0.91	"		63,430	103,610	10.0	"
67-7705	45	103	026	044		"	1.64	"		64,600	102,520	7.5	"
67-3202	45	105	030	041		"	2.51	"		62,620	109,620	9.0	"
67-1354	45	108	025	050		"	1.02	"		66,800	114,020	9.0	"
67-7707	40	112	030	049		"	2.01	"		64,000	108,930	10.0	"
•67-3472	33	124	032	041		"	1.21	"		62,230	104,160	9.0	"
67-1352	47	110	032	037		"	1.21	"		65,020	109,500	9.5	"
•67-3347	44	92	028	050		"	1.31	"		60,830	98,210	11.5	"
67-7492	48	108	047	041		"	0.31	"		61,[illegible]	101,[illegible]	10.0	"
67-7[illegible]	47	102	027	044		"	1.31	"		60,860	103,160	8.0	"
• 67-7669	41	98	027	036		"	1.78	"		62,600	98,220	11.5	"
67-34[illegible]	47	108	038	[illegible]		"	1.31	"		[illegible],600	109,130	8.0	"
67-1175	46	112	028	036		"	0.14	"		67,800	111,860	7.5	"
67-7451	48	112	035	034		"	0.64	"		60,[illegible]	111,500	8.0	"
67-7777	46	91	022	030		"	1.71	"		67,520	115,130	8.0	"
67-772[illegible]	47	126	021	032		"	0.64	"		65,630	110,330	9.0	"

The physical Testing of heats marked • was witnessed by Mr. N.P. Westcott, from Bechtel Corporation.

Sworn to and subscribed before me this
____ day of ______________ 19____

Notary Public

[illegible] being duly sworn according to law deposes and says that the figures set forth above are correct, as contained in the records of the company

We hereby certify that the above figures are correct as contained in the records of the company

R. E. Shedwick [signature]

[illegible] 11/10/60

FLORIDA STEEL CORPORATION

FLORIDA ELECTRIC STEEL MILL DIVISION

METALLURGICAL DEPARTMENT

CHEMICAL AND PHYSICAL TEST RECORD ON BASIC ELECTRIC FURNACE STEEL

No. 67-6

Date 26 Jan 66

Mill Order No.

Purchase Order

Furnished to

Requirements:

Chemical: C ___ Mn ___ P 050 S ___

Specification: A-432

Physical: Y.S. 90,000 T.S. 60,000

Heat Number	C	Mn	P	S	Pcs	Size		Grade	Area	Yield Pt. per sq. inch	Tensile	% Elong.	
67-6953	44	97	036	021		185		A-432		66,650	107,[illegible]	8.8	N/A
67-0779	46	108	032	032		"		"		64,630	107,410	10.0	"
67-0780	43	105	033	.030		"		"		64,830	103,510	9.5	"
67-5955	47	110	050	.052		"		"		65,030	107,010	7.0	"
67-5952	46	105	031	027		"		"		65,300	[illegible]	11.3	"
67-0777	46	134	018	017		"		"		71,060	[illegible]	7.0	"
67-5951	44	[illegible]	[illegible]	030		"		"		[illegible]	[illegible]	[illegible]	"
67-5950	46	108	023	019		"		"		64,490	111,930	9.8	"
[illegible]	44	106	045	033		"		"		65,650	110,353	7.5	"
67-0778	47	95	030	023		"		"		60,300	103,110	7.8	"
67-0781	43	120	045	040		"		"		68,450	115,160	9.5	"
[illegible]	45	103	040	033		"		"		64,770	111,010	5.0	"
[illegible]	45	120	027	036		"		"		70,350	109,530	7.3	"
[illegible]	45	109	039	040		"		"		64,970	109,270	10.3	"
67-5958	45	103	037	027		"		"		67,600	115,840	8.1	"
67-0762	46	112	024	036		"		"		60,840	[illegible]	7.3	"
67-5957	44	100	041	033		"		"		60,440	105,200	8.8	"
67-0766	46	105	032	037		"		"		67,200	107,140	7.5	"
67-0765	45	100	024	028		"		"		64,930	108,110	7.8	"
67-0767	45	105	030	032		"		"		64,220	109,450	7.0	"
67-5961	46	[illegible]	035	032		"		"		63,600	[illegible]	7.3	"
67-0755	45	92	027	031		"		"		61,060	101,500	8.0	"
67-6959	46	[illegible]	026	028		"		"		62,050	102,240	7.0	"

FLORIDA STEEL CORPORATION

FLORIDA ELECTRIC STEEL MILL DIVISION

METALLURGICAL DEPARTMENT

CHEMICAL AND PHYSICAL TEST RECORD ON BASIC ELECTRIC FURNACE STEEL

Date: 25 Jan 67

To: Bol. Wil...

Specification: A-408 THE; A-432

Requirements: Chemical: .050 Max. — Physical: 75-90,000; 60,000 ...

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
67-6988	47	90	020	037		1ks	A-432		62,150	108,480	7.5
67-0792	49	117	023	039		"			70,460	114,070	7.0
67-0793	44	109	023	031		"	"		62,850	106,340	8.0
67-6969	44	103	022	029		"	"		63,610	112,320	7.8
67-0531	44	110	023	032		"	"		67,640	116,300	11.0
67-6560	45	98	027	040		"	"		67,750	111,070	7.8
67-6659	46	92	029	041		"	"		[illegible]	[illegible]	[illegible]
67-6645	43	97	032	034		"	"		65,950	112,110	[illegible]
67-6644	44	95	030	034		"	"		[illegible]	[illegible]	[illegible]
67-0516	45	100	027	029		"	"		65,030	110,250	10.3
67-0794	45	109	020	[illegible]		"	"		63,560	[illegible]	[illegible]
67-6970	45	102	026	034		"	"		61,310	[illegible]	9.0
67-0795	44	95	027	034		"	"		59,330	[illegible]	11.0
67-6972	44	96	018	034		"	"		60,120	[illegible]	10.0
67-6971	46	113	019	039		"	"		67,580	114,560	7.3
67-6508	43	99	039	044		"	"		64,570	[illegible]	[illegible]
67-6536	45	96	031	031		"	"		64,980	112,840	8.0
67-5922	34	53	023	040		"	A-432		50,600	75,600	[illegible]

[illegible]

R. E. [illegible] (signature)

FLORIDA STEEL CORPORATION

FLORIDA ELECTRIC STEEL MILL DIVISION

METALLURGICAL DEPARTMENT

TAMPA, FLORIDA

CHEMICAL AND PHYSICAL TEST RECORD ON BASIC ELECTRIC FURNACE STEEL

Date: 19 May 67

Furnished to: All Divisions FSC

Chemical: P .050

Specification: A-432

Physical: T.S. 90,000 Y.P. 60,000 El. Varies

	Analysis												
							Lt or Hvy						
[illegible]	[illegible]	110	021	034		185	0.41	A-432		62,960	109,110	9.5	N/A
67-3450	46	111	036	031		"	1.11	"		64,930	112,650	8.5	"
[illegible]-7775	48	107	023	036		"	1.61	"		65,830	111,760	8.0	"
[illegible]	46	103	032	042		"	1.04	"		63,250	104,[illegible]30	10.5	"
[illegible]	50	104	030	035		"	0.21	"		68,150	113,450	7.5	"
67-1427	40	110	032	042		"	1.41	"		64,000	102,770	8.5	"
67-1325	44	116	[illegible]	044		"	0.96	"		66,000	109,400	7.5	"
[illegible]	49	113	025	047		"	1.57	"		63,900	111,630	8.0	"
67-1325	42	114	030	[illegible]		"	0.44	"		67,200	110,420	8.5	"
67-1324	43	103	029	040		"	1.37	"		65,260	109,650	11.0	"
[illegible]	44	104	032	041		"	0.27	"		63,780	106,040	12.5	"
67-1322	47	120	030	045		"	0.54	"		63,730	108,250	10.0	"
67-2377	39	104	030	045		"	2.31	"		67,760	114,300	8.0	"
[illegible]	45	104	024	043		"	1.56	"		66,450	104,500	11.0	"
67-2355	46	111	025	041		"	0.44	"		64,040	111,410	9.0	"
[illegible]	40	114	026	040		"	1.64	"		65,900	114,920	8.5	"

The physical testing of heats marked " was witnessed by Mr. J.F. Westcott, from Bechtel Corporation.

Sworn to and subscribed before me this ____ day of ____ 19__

Notary Public

We hereby certify that the above figures are correct as contained in the records of the company.

[signature]

FLORIDA ELECTRIC STEEL MILL DIVISION

FLORIDA STEEL CORPORATION

METALLURGICAL DEPARTMENT

CHEMICAL AND PHYSICAL TEST RECORD ON BASIC ELECTRIC FURNACE STEEL

NO. 57-6

DATE 26 Jan 66

MILL ORDER NO.

PURCHASE ORDER

FURNISHED TO

REQUIREMENTS: 050

SPECIFICATION: A-432

50,000   60,000   7[illegible]

Heat Number	Analysis											
67-6953	44	97	036	021		183	A-432		66,650	107,030	9.8	S/A
67-0779	46	108	032	032		"	"		64,[illegible]	[illegible],810	[illegible]	"
67-0780	43	105	033	030		"	"		[illegible],830	105,910	9.5	"
67-6955	47	110	050	052		"	"		65,030	107,010	7.0	"
67-6952	46	105	031	027		"	"		65,3[illegible]	107,560	[illegible].3	"
67-0777	46	134	018	017		"	"		[illegible],350	111,560	7.0	"
67-6951	44	106	034	030		"	"		[illegible]	[illegible],510	[illegible]	"
67-6950	46	108	023	019		"	"		64,150	111,930	9.8	"
67-6954	44	106	045	039		"	"		65,660	[illegible],353	7.5	"
67-0778	47	95	020	023		"	"		60,300	103,310	7.8	"
67-0781	43	120	045	040		"	"		68,400	[illegible],160	9.6	"
67-6956	45	103	040	033		"	"		64,970	111,010	5.0	"
67-0784	45	120	027	036		"	"		70,350	109,530	7.3	"
67-0783	45	109	039	040		"	"		64,970	[illegible],270	10.3	"
67-6958	45	108	037	027		"	"		67,600	115,840	8.1	"
67-0782	46	112	024	036		"	"		60,840	104,[illegible]	7.3	"
67-6957	44	100	041	033		"	"		60,440	105,200	8.8	"
67-0786	46	105	032	037		"	"		67,700	107,140	7.5	"
67-0780	45	100	024	028		"	"		64,930	108,110	7.8	"
67-0787	46	108	030	032		"	"		64,220	109,450	7.0	"
67-6961	46	106	035	031		"	"		63,800	110,020	7.3	"
67-0785	45	92	027	031		"	"		61,060	101,500	8.0	"
67-6959	45	100	026	028		"	"		63,050	102,240	7.0	"

SWORN TO AND SUBSCRIBED BEFORE ME THIS

_____ DAY OF _____ 19__

NOTARY PUBLIC

Attachment 1
Page 5 of 5

FLORIDA ELECTRIC [illegible]

ATTACHMENT 2

MILL TEST REPORTS

FOR

SA-302 SUPPORT MATERIAL

TEST CERTIFICATE

[illegible]

CHEMICAL ANALYSIS

[illegible]

PHYSICAL PROPERTIES

HEAT NO.	SLAB NO.	[illegible]	[illegible]	% ELONG. IN 8"							DESCRIPTION.
[illegible]55	7A	657	901	16							2-104-1/2 x 80 x 1-3/4"
"	7B	652	904	15							2- "
[illegible]235	5B	844	991	16							2-104-3/4 x 80 x 1-3/4"
[illegible]269	2B	702	985	15							{1-104-3/4 x 80 x 1-3/4" - MK 68 {1-132 x 80 x 1-3/4" - MK 65
[illegible]	1D	729	991	17							2-114 x 79 x 1-1/16" - MK 66
"	1C	760	983	17							2- " MK 159
[illegible]	1A	755	965	16							1-[illegible] x 63-1/4 x 1-1/2" MK-98
[illegible]918	3A	838	999	16							1-116 x 61-1/4 x 1-3/8" MK-71

USED IN BARBERTON [illegible]

TO MAKE MK 81 DWG 142 [illegible]

[illegible signature]

We hereby certify the above figures are correct as contained in the records of the company.

F. H. Kline

Attachment 2
Page 1 of 5

LUKENS STEEL COMPANY

COATESVILLE, PA.

TEST CERTIFICATE

Babcock & Wilcox Co.
Mr. R.G. Hall

Mill Order No.	Customer P.A.	
40894-5	31021AAL, 79611214619	OE 112068 SR

Date: 18-4-68 Page No. 605

Consignee: Same, West Point, Miss.

Specifications: SA-302-67 Gr. B

Bend Test: O.K.

CHEMICAL ANALYSIS

Melt No.	C	Mn	P	S	Cu	Si	Ni	Cr	Mo	V	Ti	Al	B		
9097	18	1.33	014	014		19			46						F.G.P.

PHYSICAL PROPERTIES

Melt No.	Slab No.	Yield PSI	Tensile PSI	% Elong. in 8"	% R.A.	BHN	Impacts	Description
9097	5B	794	987	18	To cut MK 117, To cut MK 118, To cut MK 126		DWG 142867 B, DWG 142867 B, DWG 142867 B	1-150 x 101-3/4 x 1"
"	50	763	1000	17	To cut MK 119, To cut MK 136, To cut MK 151		DWG 142867 B, DWG 107155 D, DWG 142859 B	1-175 x 107 x 3/4" — MK 119

MK-119

WEB

We hereby certify the above figures are correct as contained in the records of the company.

Supervisor-Testing: H. F. Kline

Attachment 2
Page 2 of 5

LUKENS STEEL COMPANY
COATESVILLE, PA. 19320
TEST CERTIFICATE

Purchaser:
Babcock & Wilcox
Mr. R. G. Hall
P.O. Box 71
Barberton, Ohio 44203

Date: 11-20-68
File No. 605

Mill Order No.	Customer Order No.	
40894-3,5	31021AAL 7961 127/6019	M031168 NK

Consignee: Same
West Point, Miss.

Specification: SA-302-?? Gr. B

Type Test: O.K.

CHEMICAL ANALYSIS

Melt No.	C	Mn	P	S	Cu	Si	Ni	Cr	Mo	V	Ti	Al	B	
B9097	.18	1.33	.014	.014		.19			.46					F.G.P.

PHYSICAL PROPERTIES

Melt No.	Slab No.	Yield	Tensile	% Elong.	% R.A.	Bend	Remarks	Description
B9097	3C	825	996	16	To cut MK. 10 DWG. 142857E			2- 157-1/2 x 91-3/4 x 1-1/8"
"	6E	836	998	17	To cut MK. 32 DWG. 142864E			2- 129-3/4 x 61-1/4 x 1-3/8"
"	4A	823	984	16	To cut MK. 20 DWG. 142863E			2- 129-3/4 x 73-1/4 x 1-3/8"
"	3B	852	999	16	To cut MK. 24 DWG. 142864E			2- "
"	6D	830	988	16	To cut MK. 28 DWG. 142857E			3- 157-1/2 x 61-1/2 x 3/4"
"	5D	663	991	16	To cut MK. 125 DWG. 142867E; To cut MK. 78 DWG. 142863E			1- 202 x 74-1/4 x 1"

WRG [initials]

We hereby certify the above figures are correct as contained in the records of the company.

Supervisor Testing: John [signature]

Attachment 2
Page 3 of 5

PURCHASER
Babcock & Wilcox Co.
Mr. R.C. Hall

LUKENS STEEL COMPANY

COATESVILLE, PA.

TEST CERTIFICATE

84004-5	31020917-70511014619	[illegible] 111365 [illegible]

DATE 11-19-68 NO. 602

SPECIFICATIONS
SA-302-[illegible] Gr. B
O.F.

CHEMICAL ANALYSIS

MELT NO.	C	Mn	P	S	Cu	Si	Ni	Cr	Mo	V	Ti	Al	B		
6h580	19	1.36	010	026		26			46						F.G.P.

PHYSICAL PROPERTIES

MELT NO.	SLAB NO.	YIELD PSI	TENSILE PSI	% ELONG. IN 2"	% R.A.	BHN	IMPACTS			DESCRIPTION
6h580	5B	609	851	30						1-134-1/2 x 61 x 4" MK-92

Above to cut
MK. 75 DWG. MR 860E
[illegible signature]

Plate and tests norm. 1650-1700°F.,
held 1 hr. per inch min. and air cooled.

We hereby certify the above figures are correct as contained in the records of the company.

John Burns

Attachment 2
Page 4 of 5

LUKENS STEEL COMPANY

[illegible]

TEST CERTIFICATE

Date: 12-19-68 | No.: 602

Purchaser: [illegible] & [illegible] Co., [illegible]

[illegible]	[illegible]	
[illegible]-2	[illegible]- [illegible]	GR [illegible]

Specification: [illegible] Gr. B, C.E., [illegible]

CHEMICAL ANALYSIS

HEAT NO.	C	Mn	P	S	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
39097	18	1.33	013	014		19			46						F.G.P.

PHYSICAL PROPERTIES

HEAT NO.	SLAB NO.	[illegible]	[illegible]	% ELONG. IN 8"	% R.A.	BHN	BENDS			DESCRIPTION
39097	2A	795	906	27	USED IN BARBERTON					2-106-1/2 x 46 x 2" {MK-67 / MK-69
"	6G	848	990	18						2-847 x 86 x 1/2"

MK-75
MK-72
MK-73

MK-70
MK-74

TO MAKE MK. 152 AND 153
DWG. 142859E
ALSO
MK. 25 AND 26 WK Byrd
DWG. 142857E

We hereby certify the above figures are correct as contained in the records of the company.

[illegible] John Bunis

Attachment 2
Page 5 of 5

FLORIDA POWER & LIGHT COMPANY

INTER-OFFICE CORRESPONDENCE

TO	R.E. Uhrig	LOCATION	Power Resources
		DATE	November 13, 1980
FROM	A.D. Schmidt	COPIES TO	R.J. Acosta S.G. Brain D.W. Haase D.W. Jones H.N. Paduano/910.19TP C.O. Woody H.E. Yaeger/J.K. Hays PRN-LI-80-483
SUBJECT:	TURKEY POINT UNITS 3 & 4 LOW FRACTURE TOUGHNESS		

The subject information is attached for your review and forwarding to the NRC. This report was prepared by Power Plant Engineering.

A.D. Schmidt

PLP/md

Attachment