



ATLANTIC DIVISION
NORFOLK, VIRGINIA

Prepared For:



Environmental and Engineering Consultants

2496 Old Ivy Road, Suite 300 Charlottesville, Virginia 22905
(804) 295-4446 Fax: (804) 295-5535

Prepared By:



3317 South Cherokee Drive Muskogee, OK 74403
(918) 683-8915 Fax: (918) 683-0888

Contract No. N62470-99-D-3251
High Antenna Tower System Inspection

Metallurgical Study
Corona Rings in the 1000' Guyed Tower
Grindavik, Iceland
Inspection Date: July 8-13, 2002

CONTENTS

	Page
EXECUTIVE SUMMARY	1
INSPECTION PHOTOS AND NOTES.....	3
WELD TEST RESULTS – DESCRIPTIVE PHOTOS	5
ESTIMATED MAINTENANCE COST.....	8
LOCATION MAP AND PARTIAL PLOT PLAN	9
APPENDIX A:	
TULSA GAMMA RAY INSPECTION REPORT	10

EXECUTIVE SUMMARY

During the week of July 8th, 2002, structural guy UG-3G of the 1000' tower at Grindavik, Iceland, was lowered after installation of a temporary guy. The damaged lower insulator was replaced with its associated corona rings. New corona rings were also installed on the middle insulator. During this time all members of the tower within one structural level above and below the guy connection were inspected by G. G. Lehman. No deficiencies were noted (Photos No. 1 and 2). Additionally, the guy and insulators were inspected after reinstallation with a Questar telescope. No deficiencies were noted.

For the four removed corona rings, radiographic tests were performed on all welds that had not broken. The results of those tests are included herein and they show inadequate penetration of a large percentage of welds.

A close-up visual inspection of the top insulator and corona rings of guy UG-3U was performed by D. Kaiser. One broken weld was noted in the lower corona ring of the top insulator (Photo No. 3). The other welds looked similar in appearance to those of the middle and lower insulators and we believe that similar results would be obtained if they were radiographically tested. It should be noted that during a recent tower inspection of this tower, all corona rings were thoroughly inspected through a Questar telescope. The inspectors were aware of the weld concerns and paid particular attention to the corona ring spoke connections. Unless there is significant separation between the spoke and the ring, identification of weld breaks such as the one noted in Photo No. 3 are impossible through the Questar telescope.

Conclusions — Inadequate weld penetration and the relatively small size of the corona ring spokes, combined with the vibration associated with the typically windy conditions at Grindavik resulted in the failure of these corona rings. We believe that there are additional broken welds that have not been identified and that radiographic testing of currently installed corona rings would produce similar results with many inadequate welds. The only long-term solution is to replace all corona rings throughout the tower. Consideration should be given to increasing the diameter of the corona ring spokes to provide additional weld area. In this event the sheds were the only damaged part of the insulator but that may not be the case next time. We recommend that this work be accomplished as soon a practical with a completion date of the summer of 2004.



Photo No. 1

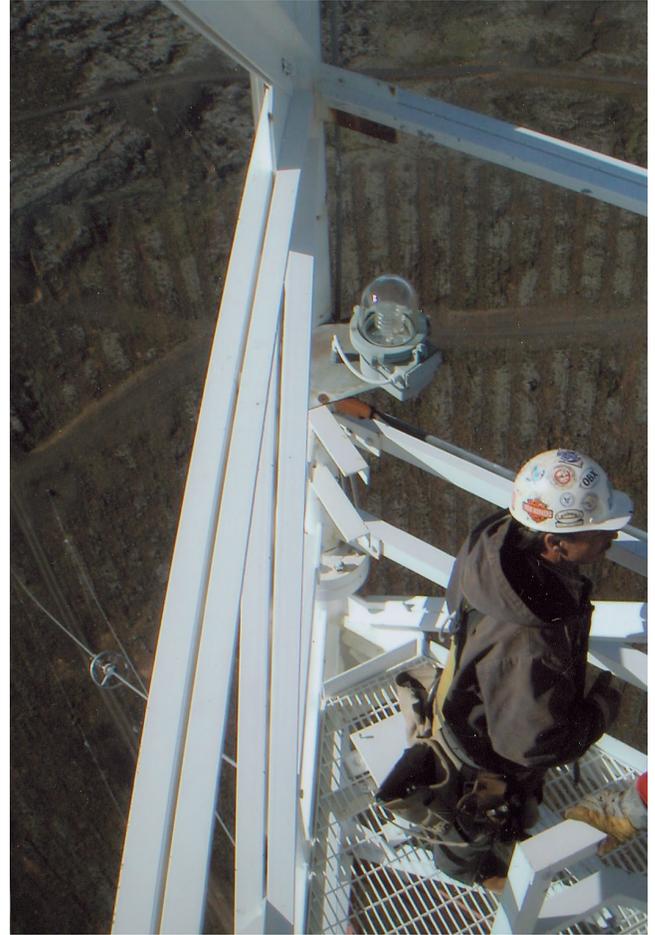


Photo No. 2

Photos No. 1 and 2 are representative of the good condition of the tower members at the upper guy level connection and one level above and below this point.



Photo No. 3

Photo No. 3 shows a broken weld in the lower corona ring of the top insulator of guy UG-3U.



Photo No. 4

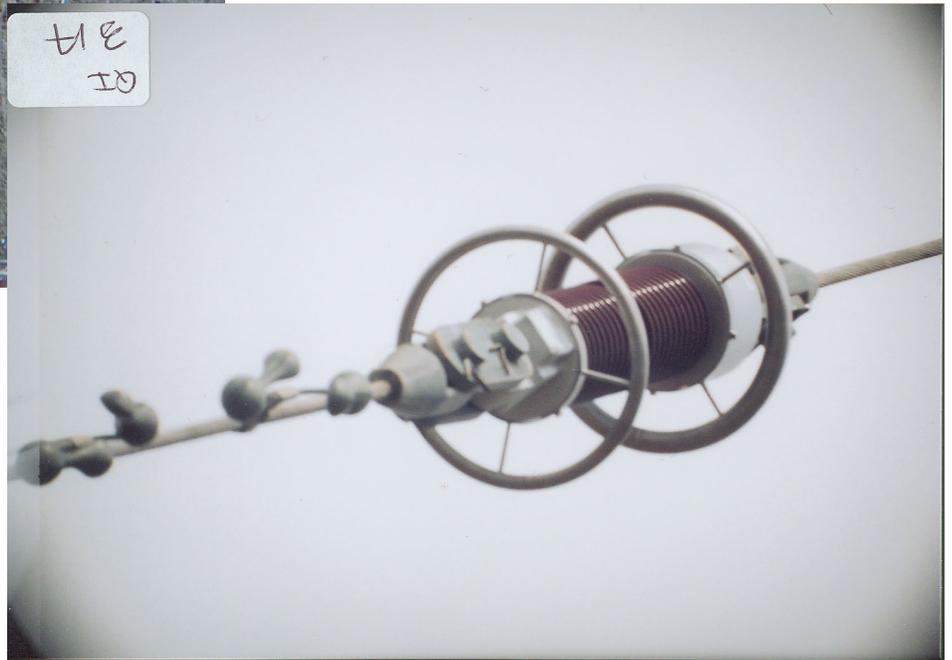
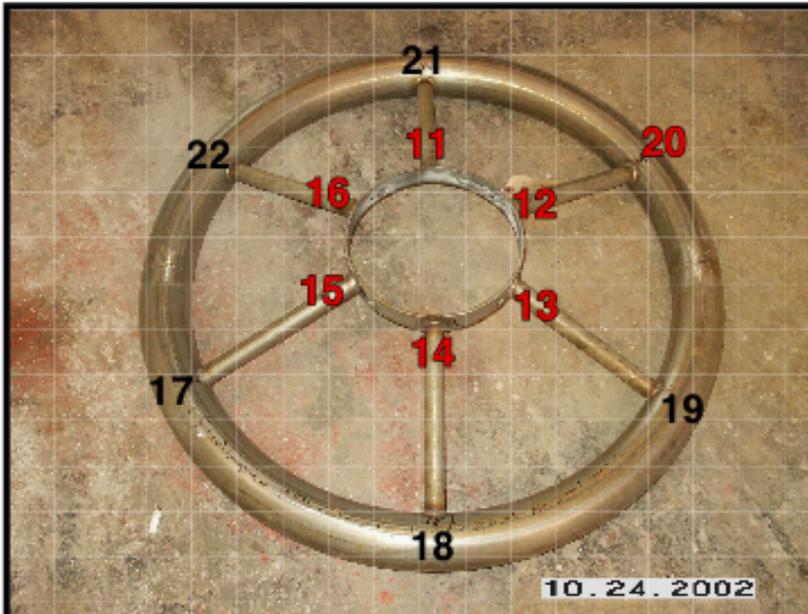


Photo No. 5

Photo No. 4 shows the crane and hoist in position and the upper third level guy UG-3U after installation of the new insulator and corona rings. Photo No. 5 shows the new insulator and corona rings as viewed through the Questar telescope.



Weld Test Results:

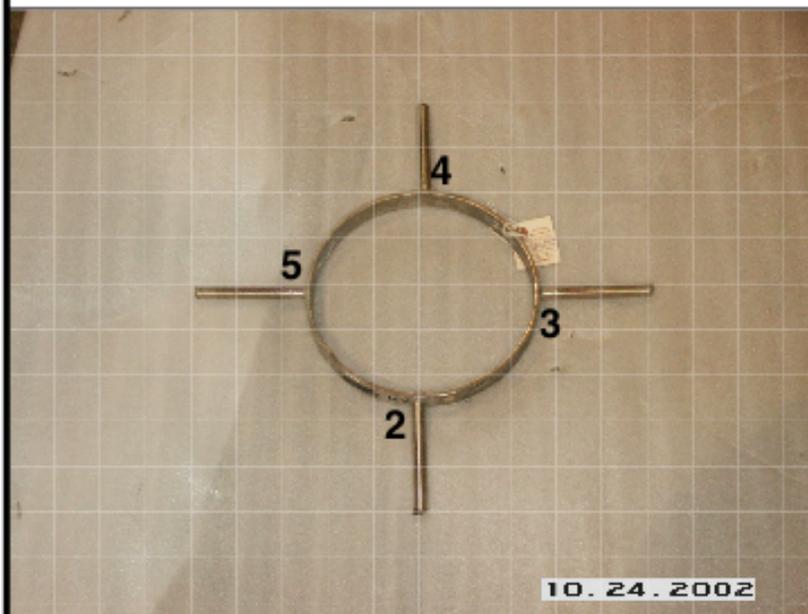
Photo No. 6

Failures: 7 (in red)

Type: Inadequate Penetration

Locations: #11-#16, #20

Third Guy Level - Middle Insulator - Top Ring



Weld Test Results:

Photo No. 7

Failures: 0

Third Guy Level - Middle Insulator - Lower Ring

Drawn By: PEN

Date: 10/25/2002

1000' Guyed LF Grindavik
Corona Ring Study

Sheet 1 of 3

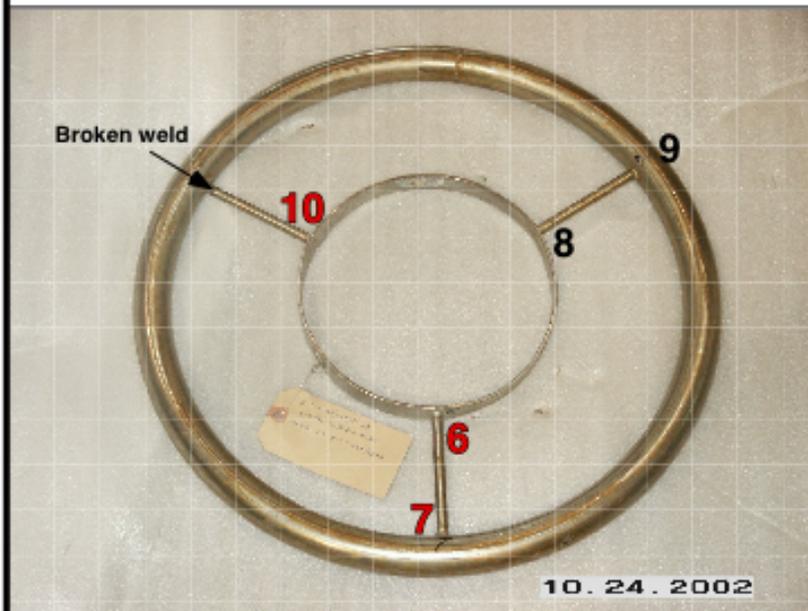


Weld Test Results:

Photo No. 8

Failures: 0

Third Guy Level - Lower Insulator - Top Ring



Weld Test Results:

Photo No. 9

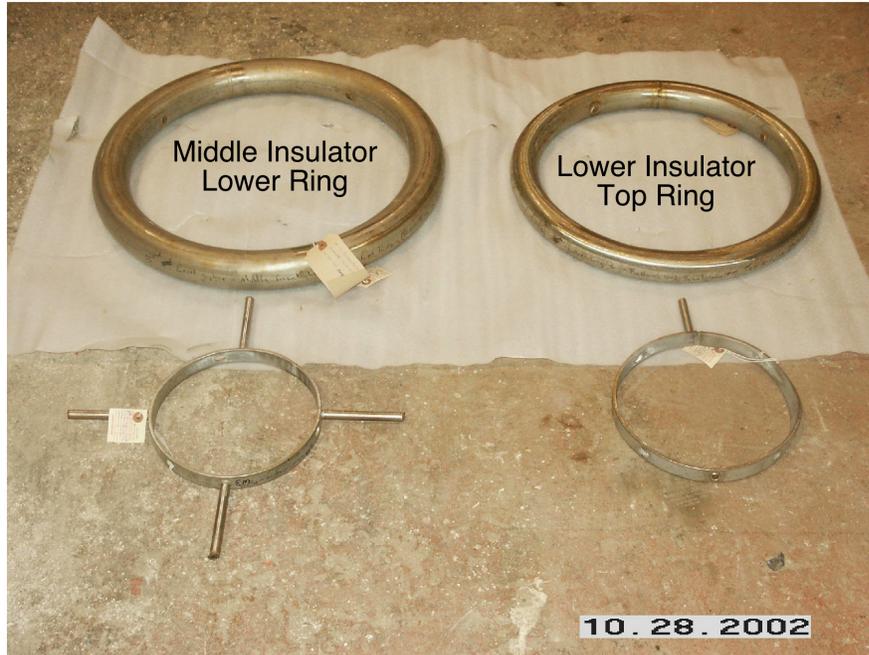
Failures: 3 (in red) not including broken weld

Type: Inadequate Penetration

Locations: #6, #7, #10

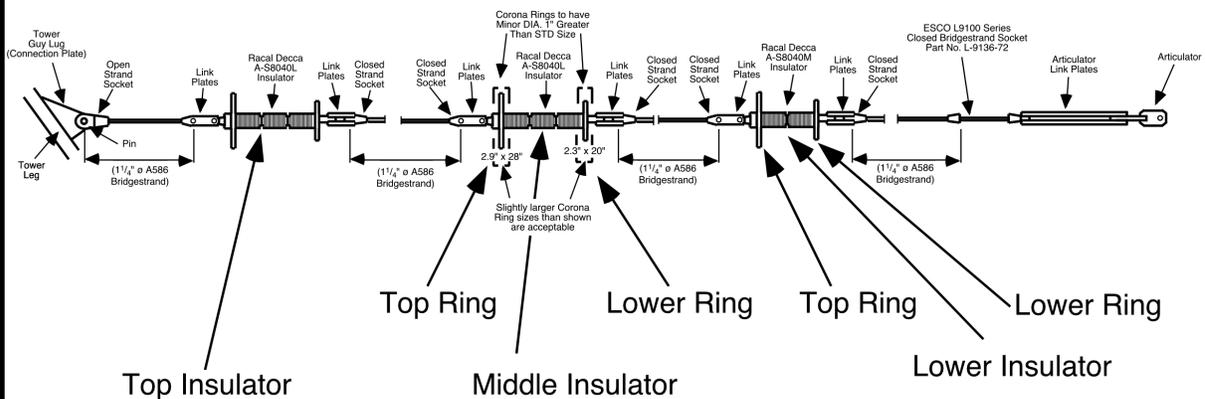
Third Guy Level - Lower Insulator - Lower Ring

Drawn By: PEN	Date: 10/25/2002	1000' Guyed LF Grindavik Corona Ring Study	Sheet 2 of 3
---------------	------------------	---	--------------



Third Guy Level - Middle and Lower Insulator Separated Corona Rings

Upper Guy (Third Level Guy) Construction



Drawn By: PEN

Date: 10/25/2002

1000' Guyed LF Grindavik
 Corona Ring Study

Sheet 3 of 3

ESTIMATED MAINTENANCE COST

A. LABOR

1.	Project Management - Overall Project Manager	120 hrs.	@	\$34.12 =	\$4,094
2.	Maintenance, Report Writing, Drawings and Cost Estimates				
	a.) Travel				
	Supervisor	3 Days =	27 hrs.	@ \$30.00 =	\$810
	Ironworkers	21 Days =	189 hrs.	@ \$28.00 =	\$5,292
	b.) On Site Service				
	Supervisor	63 Days =	567 hrs.	@ \$43.00 =	\$24,381
	Ironworkers	315 Days =	2835 hrs.	@ \$41.00 =	\$116,235
	d.) Office Service				
	Tool Prep, Load and Unload	40 hrs.	@	\$25.00 =	\$1,000
LABOR SUBTOTAL:					\$151,812

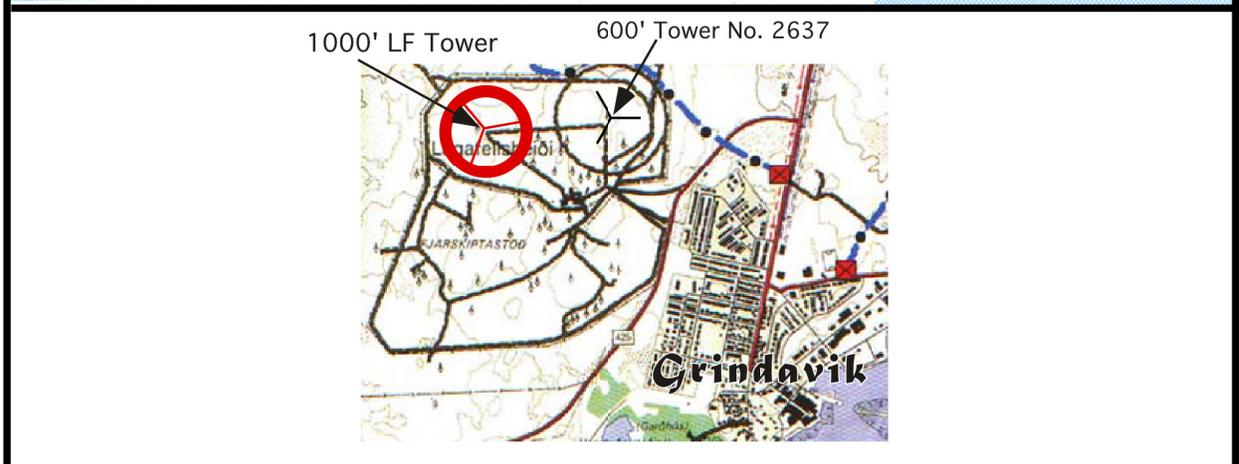
B. DIRECT JOB COSTS:

1.	Air and Ground Transportation				
	Tulsa/Reykjavik/Tulsa	8 EA	@	\$3,000.00 =	\$24,000
	Muskogee/Tulsa Airport/Muskogee	330 Miles	@	\$0.35 =	\$116
	Rental Trucks	63 Days	@	\$250.00 =	\$15,750
					\$0
	Front End Loader Rental	63 Days	@	\$460.00 =	\$28,980
	Crane Rental	63 Days	@	\$1,050.00 =	\$66,150
	Container Freight MKO to Reykjavik	1 LS	@	\$7,500 =	\$7,500
	Container Freight Reykjavik to MKO	1 LS	@	\$7,500 =	\$7,500
	Customs clearance charges (MKO and Reykjavik)	2 EA	@	\$1,000 =	\$2,000
	Transportation Port to Job Site & Return	1 LS	@	\$750.00 =	\$750
TOTAL FOR ITEM 1:					\$152,746
2.	Material:				
	Miscellaneous tools, temp guy, rigging supplies	1 LS	@	\$2,000.00 =	\$2,000
	A-S8040L Corona Ring Sets	36 EA	@	\$850.00 =	\$30,600
	A-S8040M Corona Ring Set	18 EA	@	\$490.00 =	\$8,820
	Corona ring Set for Radials	36 EA	@	\$490.00 =	\$17,640
	Freight, customs, etc. for corona rings	1 EA	@	\$10,000.00 =	\$10,000
				Subtotal =	\$69,060
				Markup @ 10.00% =	\$6,906
TOTAL ITEM 2 =					\$75,966
3.	Owned Equipment	3 Months	@	6000 =	\$18,000
4.	Substance Allowance: Grindavik	402 Days	@	\$264.00 =	\$106,128
TOTAL ITEM 4 =					\$106,128

C. SUMMARY:

	Labor	\$151,812
	Overhead @115% of Labor Cost	\$174,584
	Subtotal	\$326,396
5 days per pair of guys = 5x9=45 crew days for structural guys	Profit @10% of Labor & Overhead =	\$32,640
1 day per radial = 12 crew days	Direct Job Costs =	\$345,934
plus 6 days rig/derig etc.	GRAND TOTAL FEE PROPOSAL =	\$704,970





Drawn By: PEN	Date: 10/30/2002	1000' Guyed LF Grindavik Location Map / Partial Plot Plan	Sheet 1 of 1
---------------	------------------	--	--------------

APPENDIX A: TULSA GAMMA RAY INSPECTION REPORT



TULSA GAMMA RAY, INC.

1127 SOUTH LEWIS AVENUE
 TULSA, OKLAHOMA 74104-3900
 918 / 585-3228 • FAX 918 / 584-5598
 1 - 800 - 625-9288

TECHNIQUE/INSPECTION REPORT

CUSTOMER DATA	
NAME <u>Tower Inspection / National Steel Erectors</u>	
ADDRESS _____	
PHONE _____	ATTN: _____
W.O. # <u>16776</u>	P. O. # _____
JOB LOCATION <u>TGR</u>	
DESCRIPTION _____	MATERIAL TYPE: <u>FE</u>

DATE 10/17/02 DAY Thursday

DEFECT CODE

AD - ACCUM. DISCONTINUITIES
 AB - ARC BURN
 BT - BURN THROUGH
 CH - CHILLS
 CS - COLD SHUTS
 CON - CONCAVITY

CRACK - CRACK
 HT - HOT TEAR
 IF - INADEQUATE FUSION
 IP - INADEQUATE PENETRATION
 PIN - PINHOLE
 POR - POROSITY

SI - SAND INCLUSION
 SLI - SLAG INCLUSION
 SLL - SLAG LINE
 UCE - UNDERCUT EXTERNAL
 UCI - UNDERCUT INTERNAL
 O - OTHER

WELD/FILM NUMBER	JOB/HEAT NUMBER	SIZE & THICKNESS	WITHIN STD'S		NO. FILM	SIZE/TYPE FILM	SFD	P'TRAM-ETER-FS	# EXP	DEFECT, LOCATION & REMARKS
			YES	NO						
1 W-1	16776	1/4" - 3/8"	/		1	3 1/2 x 7 1/2 x 50 12"		12	1	
2 W-2			/							
3 W-3			/							
4 W-4			/							
5 W-5			/							
6 W-6			/							IP
7 W-7			/							IP
8 W-8			/							
9 W-9			/							
10 W-10			/							IP
11 W-11			/							
12 W-12			/							
13 W-13			/							
14 W-14			/							
15 W-15			/							
16 W-16			/							
17 W-17			/							
18 W-18			/							
19 W-19			/							
20 W-20			/							IP
21 W-21			/							
22 W-22			/							
23										
24										
25										
26										
27										
28										
29										
30										

METHOD <u>RT</u>	SOURCE SIZE <u>.10 x .08</u>	ISOTOPE <u>IR-192</u>	NO. CURIES <u>103</u>	DEV. TIME <u>8:00</u>	DEV. TEMP. <u>81°</u>	DENSITY <u>2.0-4.0</u>
NO. OF WELDS <u>22</u>	FT. LONG SEAMS	STANDARDS <u>ASME</u>	NO. OF FILM <u>22</u>	FILM/50 CASSETTE	EXPOSURE: DBL WALL <u>x</u> S. WALL	MR <u>4.5</u> SCREENS
TRUCK NO. / SHOP <u>TGR</u>	REPORT NO. OF <u>1</u>	PAGE NO. OF <u>1</u>	TECH. HOURS	ASST. HOURS	TRAVEL HOURS	TOTAL HOURS
FILM INTERPRETER <u>UPB</u>			ASST. NAME <u>Bramelton Baugliman</u>			ASNT LEVEL <u>II</u>
COMPANY REPRESENTATIVE <u>UPB</u>			NDT TECHNICIAN <u>Casey Kirby</u>			ASNT LEVEL <u>II</u>

SIGNATURE CERTIFIES TIME & MATERIAL CORRECT

TULSA GAMMA RAY, INC. ASSUMES NO RESPONSIBILITY FOR LOSSES OF ANY KIND DUE TO INTERPRETATION

No. 24071

FORM 88-1



voice: 918-683-8915
 fax: 918-683-0888
 sales@towerinspection.com