

ROSEN USA

Inline Inspection Survey Report

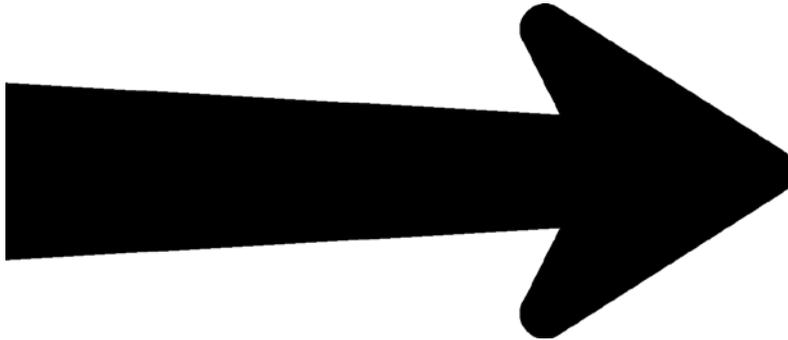
ROSEN USA Project Number 0-1000-11740

Shell Pipeline Company LP

36" Crude Oil Pipeline

Sugarland to Bayou Choctaw (Redstick Crude System)

AFD Survey Date: April 11, 2013



Client Shell Pipeline Co. LP
 ROSEN Project No 0-1000-11740
 ROSEN Line Name 36" SUG-BAY
 Inspection Type AFD
 Inspection Date April 11, 2013
 Report Date July 10, 2013
 Revision Number 0



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Table of Contents

1	 Introduction	5
<hr/>		
2	 Management Summary	6
2.1	Management Summary Statement	6
2.2	AFD Inspection Findings Summary	7
2.2.1	Specific Anomaly Reports	7
2.2.2	Deformation Anomalies	7
2.2.3	Summary and Statistical Data	8
2.2.4	Manufacturing/Construction/Girth Weld Anomalies	8
2.2.5	Anomalies Within Casings	9
2.2.6	Pipeline Appurtenances	9
2.2.7	Repairs	9
2.3	AFD Depth Distribution of All Metal Loss Anomalies	10
2.4	AFD O'clock Position of All Metal Loss Anomalies	10
2.5	Inspection Parameters	11
2.5.1	Pipeline Information	11
2.5.2	Line Questionnaire / Pipeline Information	11
2.5.3	Data Quality Summary	11
2.5.4	AFD Data Analysis Parameters	12
3	 Inspection Activities and Data Quality	13
<hr/>		
3.1	Pre-Inspection Activities	13
3.1.1	Cleaning and Gauging Pig Data Sheet	13
3.2	Axial Flaw Detection (AFD)	14
3.2.1	AFD Data Sheet and ILI - Tool Calibration Certificate	15
3.2.2	AFD Tool Velocity	15
3.2.3	AFD Tool Rotation	15
3.2.4	AFD Tool Temperature	15
3.2.5	AFD Magnetization Level	15
4	 Detailed Inspection Results	16
<hr/>		
4.1	AFD Special Graphs	17
4.1.1	Given MOP, Pdesign, and Theoretical Safe Pressure Graph	17
4.1.2	ERF Distribution Graph	17
4.1.3	Metal Loss Graphs	17
4.1.4	Anomaly Relative to Closest Weld Distance Graph	17
4.1.5	Longseam Position Graph	17
4.1.6	Anomaly Position to Seam Weld Seam Graph	17
4.2	Client List	18

Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0

Inspection Technologies
www.RosenInspection.net



5	 Attachments	19
5.1	Site Inspection Report/Survey Completion Report	19
5.2	Preliminary Inline Inspection Survey Report	19
5.3	Above Ground Marker Sheets	19
5.4	Inspection Verification Results	19
5.5	Electronic Data Discs	19



1 | Introduction

This inspection survey report describes the pipeline inspection carried out by ROSEN in the 36" Sugarland to Bayou Choctaw pipeline segment in April of 2013. This report has been distributed as follows:

Shell Pipeline Co. LP	Mr. Jimmie Kilgore	2 copies
	Mr. Brent Byrd	1 copy
ROSEN USA	Central File	1 copy

The inspection activities included the following:

- Metal Loss Inspection with the Axial Flaw Detection Pig (AFD)
- Preparation and Submission of the Preliminary Inline Inspection Survey Report
- Preparation and Submission of the Inline Inspection Survey Report

The data is automatically searched for pipeline anomalies using ROSEN Automated Feature Search Software (AFS). Thereafter, data evaluation personnel interactively verify the results utilizing proprietary software. All results are stored in database files (dbf). More information regarding this process can be found in the separate binder entitled Technical Reference.

This Inline Inspection Survey Report includes the results of all inspection runs performed by ROSEN in the pipeline during these inspection activities. The recorded AFD distance is used as the master distance for reporting all inspection results. All anomalies that meet or exceed the reporting thresholds established for this project are listed in this report.

A differentiation between internal and non-internal has been performed only for metal loss anomalies identified as being caused by corrosion.

All distances are given in imperial units. Upstream distances are designated with a minus sign (-). All anomalies are referenced to the upstream girth weld.

The AFD center distance of the first valve in the launcher station has been set to 0.00 feet to aid in field measurement efforts.

A Management Summary is provided in Section 2. Detailed inspection results are given in Section 4. All technical information, including Terms and Definitions, Performance Specifications, and Dig Procedures, are provided in the separate Technical Reference binder.

ROSEN USA thanks Shell Pipeline Co. LP for the assistance and cooperation received during the course of this project.

Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0

Inspection Technologies
www.RosenInspection.net



2 | Management Summary

This section describes the general condition of the inspected pipeline. For more detailed findings please refer to Section 4.

2.1 Management Summary Statement

The results of the inspection activities indicate this line segment is affected mostly by internal metal loss corrosion anomalies between 10-19%. No metal loss anomalies with a calculated wall loss of 80% or greater have been reported and no corrosion anomalies with an ERF (0.85dL) of 1 or greater have been reported.

One hundred eight (108) manufacturing related signals are individually affecting the pipe body or longitudinal seam weld have been reported from the AFD survey.

2.2 AFD Inspection Findings Summary

The findings of the inspection activities performed in this line segment are listed below.

2.2.1 Specific Anomaly Reports

The following were identified during the survey:

Quantity Total	Description
0	Group 1
0	Group 2
2	Group 3

Note: Please Refer to Shell Document 3TS-002 Rev. 08/20/2010 for the classifications of group 1 through group 3.

2.2.2 Deformation Anomalies

The following were identified during the survey:

Quantity	Description
0	Total number of deformation anomalies reported.
0	Number of deformation anomalies with a reported reduction \geq 6%.
0	Number of deformation anomalies with a reported reduction \geq 6% on top of pipe (8:00 clockwise to 4:00).
0	Number of deformation anomalies with a reported reduction \geq 3% but less than 6%.
0	Number of deformation anomalies with a reported reduction \geq 3% but less than 6% on top of pipe (8:00 clockwise to 4:00).
0	Number of deformation anomalies with a reported reduction \geq 2% but less than 3%.
0	Number of deformation anomalies with a reported reduction \geq 2% but less than 3% on top of pipe (8:00 clockwise to 4:00).
0	Number of deformation anomalies with a reported reduction $<$ 2%.
0	Number of deformation anomalies detected with metal loss.
0	Number of deformation anomalies at or on a girth weld or long seam (when detectable).



2.2.3 Summary and Statistical Data

	Total	Internal	External	N/A
Metal Loss	10589	10561	5	23
Axial Grooving	2267	2257	4	6
Axial Slotting	7969	7953	0	16
Circumferential Grooving	0	0	0	0
Circumferential Slotting	0	0	0	0
General	22	21	1	0
Pinhole	0	0	0	0
Pitting	331	330	0	1
10%-19%	7353	7340	4	9
20%-29%	2905	2890	1	14
30%-39%	310	310	20	0
40%-49%	19	19	0	0
50%-59%	2	2	0	0
60%-69%	0	0	0	0
70%-79%	0	0	0	0
≥ 80%	0	0	0	0
Total Deformations	0			
Deformations w/Metal Loss	0			
Deformations < 2%	0			
Deformations 2% - 3%	0			
Deformations > 3%	0			

2.2.4 Manufacturing/Construction/Girth Weld Anomalies

The following have been identified during the survey:

Description	Number of Indications
Manufacturing Indications	99
Girth Weld Indications	0
Long Seam Weld Indications	9
Close Metal Objects	0



2.2.5 Anomalies Within Casings

Description	Number of Casings
Casings identified	25
Eccentric casings	0
Casings containing $\geq 50\%$ metal loss	0
Casings containing 20% - 50% metal loss	13
Casings containing deformation anomalies	0

2.2.6 Pipeline Appurtenances

The following have been identified during the survey:

Description	Number of Appurtenances
Valves	9
Tees	4
Taps	25
Flanges	2
Stopples fittings	0
Pipe support	0

2.2.7 Repairs

The following have been identified during the survey:

Description	Number of Repairs
Full Encirclement Sleeves	23
Half Wrap Repairs	0
Patch Repairs	0
Marked Composite Repair Wraps	0
Other Existing Repairs	0

Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0

Inspection Technologies
www.RosenInspection.net



2.3 AFD Depth Distribution of All Metal Loss Anomalies

This graph includes all metal loss anomalies that meet or exceed the reporting threshold. It displays the number of anomalies versus pipeline length in increments of 20000 feet.

The metal loss anomalies are grouped into four (4) categories as follows:

- depth 10 – 19 %
- depth 20 – 39 %
- depth 40 – 59 %
- depth \geq 60 %

2.4 AFD O'clock Position of All Metal Loss Anomalies

This plot shows the o'clock orientation of all reported metal loss anomalies versus pipeline length. The o'clock position is given as the leading upper corner of the anomaly rectangle looking in the downstream direction of the pipeline.



2.5 Inspection Parameters

This section summarizes the parameters applicable to the in-line inspection activities carried out on this pipeline section in July of 2013.

2.5.1 Pipeline Information

nominal diameter (NPS) [inches]	36.00
type of pipe	Not Provided
grade	X-52, X-60
nominal wall thickness [inches]	0.312", 0.438", 0.500"
MAOP [PSI]	335
design pressure [PSI]	649, 911, 1200
SMYS [PSI]	52000, 60000
minimum bend radius	1.5D
length [miles]	37.23
built in	Not Provided
pipeline product	Crude Oil
inspection history	TDW

2.5.2 Line Questionnaire / Pipeline Information

Pipeline information as received from the client can be found on the following pages.

2.5.3 Data Quality Summary

The data recorded during the AFD inspection survey, performed on April 11, 2013, was accepted and used for evaluation purposes. During the AFD inspection survey, there were seven (7) areas of incomplete data totaling 247.41 ft. due to tool stops. The largest continuous area of incomplete data, totaling 218.72 ft., occurred between Rosen log distance 42132.12 ft. and 42350.83 ft. This was coincident with the tool stopping for 34 hours and 26 minutes. The overall resulting tool coverage was 99.92%. The tool velocity achieved during the AFD inspection survey was mainly within the pre-agreed range. During the AFD inspection survey, the standard magnetization values of 126 - 503 Oe were achieved over the entire line length. Please refer to Section 3 for more information.

Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0



2.5.4 AFD Data Analysis Parameters

The following parameters were observed during the analysis activities. A recording threshold of 1% wall loss was achieved during the AFD inspection. The reporting thresholds applied to this line segment are as follows:

- indications affecting the *pipe body* (joint anomalies [J]): $\geq 10\%$ wall loss
- indications affecting the *seam weld seam*: $\geq 10\%$ wall loss

Due to the number of suspect signals in the pipe body, all metal loss anomalies $> 30\%$ were manually validated. All remaining pipe body metal loss anomalies $< 30\%$ were subject to automatic feature analysis. An interaction rule was applied to individual corrosion anomalies in the event they were in close proximity to one another. The interaction rule applied was 1" axially by 6t circumferentially, as per Shell Pipeline Co. LP criteria. Additionally, a pressure based corrosion assessment has been performed on the findings based on the RStreng Case 2 (0.85dL) Code. These results have been expressed in the form of an Estimated Repair Factor (ERF) and Rupture Pressure Ratio (RPR) and have been calculated only for anomalies with a calculated wall loss of $> 10\%$ to $< 80\%$ as per client request. Please refer to the Technical Reference for more information regarding this calculation.

Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0

Inspection Technologies
www.RosenInspection.net



3 | Inspection Activities and Data Quality

3.1 Pre-Inspection Activities

Not Applicable.

3.1.1 Cleaning and Gauging Pig Data Sheet

Not Applicable.

Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0



3.2 Axial Flaw Detection (AFD)

The pipeline was inspected with the ROSEN Axial Flaw Detection Pig (AFD). One (1) AFD run was performed during the inspection.

ROSEN USA Inspection Survey Technicians Matthew Amador and Greg Rosenbaum performed the field activities.

Please note the following AFD run information:

Inspection Conditions

Inspection Direction	Sugarland to Bayou Choctaw
Launching Date/Time	April 2, 2013 / 03:23 PM
Receiving Date/Time	April 11, 2013 / 12:32 PM
Duration	213 hours, 9 minutes
Average Tool Velocity	1.92 feet per second
Maximum Tool Velocity	3.02 feet per second
Propellant	Crude Oil
Pressure (max.)	239 PSI
Temperature	77°F

Tool Condition after the Run

Cup Wear	None
Debris	Liquid
Damage	None

Recorded Data

Start of Data Recording	-49.64 feet
End of Data Recording	196540.97 feet (37.23 miles)
Recorded Tool Rotation	Acceptable

Marker Information (Above Ground Markers)

Two (2) markers were set and two (2) were successfully established for this line segment.

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Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0

Inspection Technologies
www.RosenInspection.net



3.2.1 [AFD Data Sheet and ILI - Tool Calibration Certificate](#)

The standard tool data sheet and ILI – Tool Calibration Certificate for the ROSEN AFD used during this survey is attached hereafter.

3.2.2 [AFD Tool Velocity](#)

The AFD tool used during this survey was programmed to operate within a velocity range of 1.64 feet per second to 6.56 feet per second. During the inspection, the velocity of the tool is constantly monitored. Based on this data, the following graph displays the minimum and maximum velocity of the tool during the survey, in per joint intervals.

3.2.3 [AFD Tool Rotation](#)

The following graph displays the rotation of the AFD tool during the survey. The rotational position, provided in degrees, is measured counter-clockwise looking in the downstream direction.

3.2.4 [AFD Tool Temperature](#)

The AFD Tool Temperature graph displays the recorded temperature encountered during the survey. Because the temperature probe is housed inside the tool, it takes approximately 30 minutes for the probe to register the actual product temperature.

3.2.5 [AFD Magnetization Level](#)

The AFD Magnetization Level graph displays the recorded magnetization level on the pipe wall during the inspection in per joint intervals. Please refer to the Technical Reference for further information.

Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0



4 | Detailed Inspection Results

The detailed results of the inspection activities are presented in the following formats:

- Graphs
- Client List

All distances are expressed in feet [ft]. Upstream distances are designated with a minus (-). All pipeline anomalies are referenced to the upstream girth weld.

Any anomaly that does not qualify for ROSEN Metal Loss Performance Specifications due to its geometry, location, or run conditions is provided for informational purposes only. Please refer to the Technical Reference for more information.



4.1 AFD Special Graphs

ROSEN provides several anomaly graphs to present a quick overview of the reported anomaly distribution over the length of the pipeline.

4.1.1 Given MOP, Pdesign, and Theoretical Safe Pressure Graph

This graph shows the Theoretical Safe Pressure (P_{burst}), calculated on the basis of the RStreg Case 2 (0.85dL) code, and together with the client specified Maximum Operating Pressure (MOP) and Design Pressure (P_{DESIGN}). Please refer to the Technical Reference for more information regarding the Theoretical Safe Operating Pressure calculation.

4.1.2 ERF Distribution Graph

Following the RStreg Case 2 (0.85dL) code, an ERF calculation has been performed for those locations identified as being caused by corrosion with a calculated wall thickness loss of 10% – 80%. For all other metal loss anomalies, no ERF values have been calculated. This plot indicates all metal loss anomalies for which an ERF has been calculated. For values where the $P_{safetheo}$ lies below the MAOP, the ERF value is greater than one (1).

In this graph, the anomalies are displayed versus line distance in six (6) different groups:

	ERF_085	< 0.60
0.60	≤ ERF_085	< 0.80
0.80	≤ ERF_085	< 0.90
0.90	≤ ERF_085	< 1.00
1.00	≤ ERF_085	< 1.30
	ERF_085	> 1.30

4.1.3 Metal Loss Graphs

These graphs show metal loss anomalies, for which an internal/non-internal distinction was made, versus pipeline distance. The o'clock position is given as looking downstream.

- Depth Distribution of Internal Metal Loss Anomalies
- Depth Distribution of External Metal Loss Anomalies
- O'clock Position of Internal Metal Loss Anomalies
- O'clock Position of External Metal Loss Anomalies

4.1.4 Anomaly Relative to Closest Weld Distance Graph

This plot shows the relative distances of all reported anomalies to the closest circumferential girth weld versus pipeline length.

4.1.5 Longseam Position Graph

This plot displays the orientation of all seam weld seams.

4.1.6 Anomaly Position to Seam Weld Seam Graph

This plot displays the reported anomaly position as compared to seam weld seam orientation.

Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0

Inspection Technologies
www.RosenInspection.net



4.2 Client List

The Client List, found on the accompanying CD, contains all anomalies, installations, welds, and markers that were identified during the evaluation process. All anomalies above the reporting threshold of greater than or equal to 15% for AFD are included.

In case of close proximity to other anomalies, several single anomalies have been summarized into clusters. The coordinates of the cluster refer to the start point of the cluster, and the depth of the cluster refers to the maximum anomaly depth in the cluster.

Client Shell Pipeline Co. LP
ROSEN Project No 0-1000-11740
ROSEN Line Name 36" SUG-BAY
Inspection Type AFD
Inspection Date April 11, 2013
Report Date July 10, 2013
Revision Number 0

Inspection Technologies
www.RosenInspection.net



5 | Attachments

5.1 Site Inspection Report/Survey Completion Report

The Site Survey has been attached hereafter.

5.2 Preliminary Inline Inspection Survey Report

ROSEN USA Data Analyst Brandon Bandoni submitted the Preliminary Inline Inspection Survey Report was to Mr. Jimmie Kilgore on May 16, 2013. A copy of this report is attached hereafter.

5.3 Above Ground Marker Sheets

The onsite marker location sheets are attached hereafter.

5.4 Inspection Verification Results

Inspection verification results have not been received as of the submission of this report.

5.5 Electronic Data Discs

The Clientlist.xls disc, and the ROSOFT Client Software data for this line are included. Please refer to the ROSOFT Manual for information regarding installation of this data and operation of the ROSOFT Data Management Software.