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2012 Annual System Integrity Plan  
Self-Audit Report  
For  
Magellan Midstream Partners, L.P.  
Longhorn Pipeline  
February 28, 2014



## Table of Contents

1.0	Definitions.....	4
2.0	Introduction.....	5
3.0	Self-Audit Methodology .....	8
4.0	Significant System Developments in 2012.....	9
5.0	Summary of Findings from the Self Audit .....	10
5.1	A synopsis of the most important integrity issues being addressed on the Longhorn Pipeline System and the status of activities and programs used to manage these risks....	10
5.2	Important insights, results, and lessons learned from the previous year. ....	11
5.3	Insights from new integrity management processes or technologies, or innovative applications of existing technologies. ....	11
5.4	Performance measurement results. ....	13
5.5	New integrity management programs or activities that will be conducted or significant improvements to existing programs and activities.....	13
6.0	Findings for the LMP Management Commitments .....	15
6.1	MC1: Longhorn Pipeline System Integrity “Process Elements” .....	15
6.2	MC2: Data Gathering and Identification and Analysis of Pipeline System Threats .....	15
6.3	MC3: Integration of System-Wide Activities .....	16
6.4	MC4: Incorporation of Engineering Analysis.....	16
6.5	MC5: Integration of New Technologies .....	16
6.6	MC6: Root Cause Analysis and Lessons Learned.....	16
6.7	MC7: Industry-Wide Experience.....	17
6.8	MC8: Resource Allocation .....	17
6.9	MC9: Workforce Development .....	18
6.10	MC10: Communication to Longhorn and Operations Management .....	18
6.11	MC11: Management of Change.....	19
6.12	MC12: Performance Monitoring and Feedback .....	19
6.13	MC13: Self Audit.....	19
6.14	MC14: Longhorn’s Continuing Commitment .....	19
7.0	Findings for the 12 LPSIP Process Elements .....	20
7.1	PE1: Longhorn Corrosion Management Plan.....	20
7.2	PE2: In Line Inspection and Rehabilitation Program .....	20
7.3	PE3: Key Risk Areas Identification and Assessment .....	21
7.4	PE4: Damage Prevention Program .....	21
7.5	PE5: Encroachment Procedures .....	23
7.6	PE6: Incident Investigation Program .....	23
7.7	PE7: Management of Change .....	24
7.8	PE8: Depth of Cover Program .....	25
7.9	PE9: Fatigue Analysis and Monitoring Program .....	25
7.10	PE10: Scenario Based Risk Mitigation Analysis.....	25
7.11	PE11: Incorrect Operations Mitigation.....	25
7.12	PE12: System Integrity Plan Scorecarding and Performance Metrics Plan .....	26
8.0	Recommendations.....	27
8.1	MOCR Process.....	27



8.2	Damage Prevention.....	27
8.3	Rectifier Maintenance.....	27
9.0	Conclusions.....	28
10.0	Appendices.....	29
10.1	Summary of key metrics for 2012 .....	29
10.2	Key documents reviewed for the 2012 SIP self-audit .....	32
10.3	Personnel Interviewed.....	33
10.4	Statements of Qualifications for the Auditors .....	34
	<b>W.R. (Bill) Byrd, P.E.</b> .....	34
	<b>Deborah J. Brunt, P.E.</b> .....	36



## 1.0 Definitions

CMS: Compliance Management System

Longhorn: the entire pipeline system and all parties including LPP and MPL

LOPA: Layer of Protection Analysis

LMP: Longhorn Management Plan

LPP: Longhorn Partners Pipeline (the asset owner until August 27, 2009 and its direct employees / contractors, excluding MMP)

LPSIP: Longhorn Pipeline System Integrity Plan

MMP: Magellan Midstream Partners L.P. (the asset operator and owner as of August 27, 2009)

PHMSA: Pipeline and Hazardous Materials Safety Administration

PSSR: Pre-Startup Safety Review

SIP: Magellan Midstream Partners, L.P. System Integrity Plan

Operator: Magellan Midstream Partners, L.P. (MMP)

SBRMA: Scenario Based Risk Mitigation Analysis



## 2.0 Introduction

The Longhorn Pipeline System (Longhorn) was initiated in the mid-1990s, with the intent of converting an existing West Texas crude oil pipeline into refined products service, and reversing the flow to take refined products from the Houston Gulf Coast area to markets in West Texas and the Southwest US. The project encountered opposition from various groups, resulting in a lawsuit and eventual settlement as described in Table 1: History of the Longhorn System, below.

**Table 1: History of the Longhorn System**

1949 – 1995	Exxon constructed the 18"/20" pipeline, Crane to Baytown, to transport crude oil; operated and maintained / refurbished until pipeline was idled and purged with nitrogen.
Oct 21, 1997	Longhorn acquired the existing (idled) pipeline from Exxon.
April 1998	National Environmental Policy Act (NEPA) lawsuit filed in Federal Court in Austin.
1998/1999	<ul style="list-style-type: none"> <li>• Cleaning and refurbishment of the existing pipeline;</li> <li>• Construction of new pump stations (Galena Park, Satsuma, Cedar Valley, Kimble County, Crane, and El Paso)</li> <li>• Construction of El Paso Terminal</li> <li>• Construction of pipeline extensions: 18" Crane to El Paso; 8" Crane to Odessa; 20" GATX to Tie-In; and 8" and 12" pipelines from El Paso Terminal to tie-ins with other systems.</li> </ul>
March 1999	Settlement Agreement requires Environmental Assessment, which ultimately leads to the Longhorn Mitigation Plan.
November 2000	Finding of No Significant Impact issued and Longhorn Mitigation Plan published.
2001 – 2004	Pre-Startup Mitigation Commitment Activities Performed
January 27, 2005	Official startup date for the Longhorn pipeline system.
2006	High Resolution Magnetic Flux Leakage (HRMFL) in-line inspections completed for Galena Park to Crane.
August 2006	Flying J acquires Longhorn Partners Pipeline, L.P.
2008	High Resolution Magnetic Flux Leakage (HRMFL) in-line inspections completed for Crane to El Paso.
2008	Transverse Field MFL Inspection (TFI) in-line inspections completed on Galena Park to Crane.
December 22, 2008	Parent company Flying J Inc., Longhorn Partners Pipeline, L.P. and affiliated companies file for voluntary protection under Chapter 11 of the U.S. Bankruptcy Code, allowing for continued pipeline operation during financial reorganization.
August 27, 2009	Magellan Pipeline Company, L.P. purchased the Longhorn pipeline.
March 2013	Flow direction reversed and product transported changed to crude oil.



Longhorn agreed to implement a Longhorn Mitigation Plan (LMP) as part of the Environmental Assessment (EA) conducted. The LMP was supplemented twice, immediately after it was originally developed. The LMP includes 40 “Mitigation Commitments” that addressed various integrity issues on the Longhorn system both before and after startup. The LMP also committed Longhorn to implement the Longhorn Pipeline System Integrity Plan (LPSIP), which includes three main elements:

1. Management Commitments (14 total), addressing various integrity management programs for the pipeline system, including a commitment to conduct a self-audit of the LPSIP each year,
2. LPSIP Process Elements (12 total), addressing various risk management processes for the pipeline system, and
3. An Operational Reliability Assessment (ORA), providing an independent technical analysis of various integrity threats on the pipeline system.

This report is the result of the annual LPSIP self-audit for 2012, and addresses the first two items listed above. Magellan contracted with RCP Inc., a regulatory and engineering consulting firm, to perform the 2012 self-audit. There is a separate reporting process for the Mitigation Commitments, and they are not addressed in this report. The ORA has its own reporting process which is conducted separately from this report.

The overall structure of the LMP, Mitigation Commitments, LPSIP, Management Commitments, Process Elements, and Operational Reliability Assessment are depicted in Figure 1: LMP Organization. In this report, the 14 Management Commitments will be referred to sequentially as MCxx. Likewise, the 12 LPSIP Process Elements will be referred to sequentially as PExx. The Table of Contents for this document provides an easy reference, as the section numbers for the Management Commitments and Process Elements correspond with the appropriate MCxx or PExx number. For example, MC13 refers to the Management Commitment to perform a self-audit, and is discussed in section 13 of “Findings for the LMP Management Commitments”. Likewise, PE7 refers to the Management of Change Process Element, and is discussed in section 7 of “Findings for the 12 LPSIP Process Elements”, and so forth.

# LONGHORN MITIGATION PLAN [LMP]

[INCLUDING SUPPLEMENTS 1 AND 2]

## Mitigation Commitments

40 very specific “to-do” activities to mitigate specific risks on the pipeline system

## System Integrity Plan [LPSIP]

### Management Commitments

14 Management-Level Commitments:

- Includes a commitment to implement the 12 System Integrity Process Elements (below)
- Includes a commitment to perform an annual self-audit of the LPSIP

### System Integrity Process Elements

12 programs designed to manage system integrity

### Operational Reliability Assessment (ORA)

A detailed, independent technical assessment of key risk management activities for the system

Figure 1: LMP Organization



### **3.0 Self-Audit Methodology**

The self-audit team was composed of 2 representatives from RCP Inc., both experienced auditors with over 50 years of combined experience in the industry. The auditors' statements of qualifications are given in the appendix to this report. They reviewed the LMP, the LPSIP, and the SIP as well as various documents from Longhorn as listed in the appendix, including policies and procedures, work activity reports, agreements with third parties, performance tracking spreadsheets, and other relevant documents. They also interviewed personnel from MMP in Austin, Houston, Tulsa, and El Paso, including personnel in field operations up through corporate executives, and inspected the facilities at the El Paso terminal. The complete list of personnel interviewed is given in an appendix to this report. If more than one person had held the same position during 2012, the auditors generally interviewed all those personnel at once. All the field activities for the audit were performed in May and June 2013. The auditors developed the opinions and findings in this report based on the interviews and documentation, using their best professional judgment and experience. Interim audit findings were reviewed with MMP to ensure that they were factually correct and considered all appropriate information – but the findings and conclusions in this report are the independent work of the audit team.





## **4.0 Significant System Developments in 2012**

During 2012, Magellan continued to implement system integrity activities as required by Federal Pipeline Safety regulations and the LMP.

Phase I of the Longhorn Reversal Project was started in 2012 and the Longhorn Pipeline was out-of-service from August 2012 to March 2013 as part of this project. The purging of the pipeline was conducted in 2012 and all employees interviewed indicated that the project was very successful. Employees stated that communication throughout the project was excellent and the project was completed successfully due to this communication and the use of experienced personnel in the field.

## 5.0 Summary of Findings from the Self Audit

As mentioned above, the LMP requires that Longhorn conduct a self-audit of the LPSIP each year. The LMP specifically requires that the self-audit address 5 “core areas” of system integrity. Each of the 5 listed core areas is addressed below. Subsequent sections of this report address each of the 14 Management Commitments and the 12 Process Elements in the SIP.

### 5.1 A synopsis of the most important integrity issues being addressed on the Longhorn Pipeline System and the status of activities and programs used to manage these risks.

The activities and programs used to manage risk on the Longhorn system are addressed individually in the Management Commitments and Process Elements sections of this report. The activities and programs used to manage risk on the Longhorn system are mature, and the audit revealed that these programs are functioning and are effective. Areas for improvements in the programs are described in the Recommendations section of this report.

Many employees indicated that numerous integrity issues were addressed while the Longhorn Pipeline was out of service during the Reversal Project. Issues identified included removal of Kerotest valves, removal of stopple fittings, casings and repair of lamination anomalies.

Employees interviewed indicated that third party damage is the most important integrity issue for the Longhorn pipeline. In 2012, there were two instances where digging occurred after a One Call but before the required 48 hours or before MMP personnel arrived on the job site. Encroachments by individual landowners were also identified as an important integrity issue and are adequately managed through the existing encroachment procedures. No changes in the encroachment procedures were identified. Development in the El Paso area is being closely watched as it moves closer to the pipeline.

The pump vibration and pipe movement issues at the El Paso terminal were corrected in 2012.

The purging required to take the line out of service for the Reversal Project was identified as a potential integrity issue. However, the purging was successfully completed without any issues.

The change in product transported has resulted in new potential integrity issues – internal corrosion and the potential impact on laminations. Changes have been made in the operating procedures to increase the pigging frequency to every two weeks and to add inhibitor based on corrosion coupon monitoring results. In addition, one employee has been designated as responsible for monitoring only internal corrosion.



## 5.2 Important insights, results, and lessons learned from the previous year.

Most of the POE digs had lower corrosion growth rates than predicted.

MMP issued 7 “Lessons Learned” bulletins in 2012, addressing diverse issues such as proper handling of asbestos-containing materials, cracked tire valve stems, monitoring during third party excavation, and security of tools and equipment. None of the Lessons Learned bulletins were initiated by incidents on the Longhorn System.

Using the Layer of Protection Analysis (LOPA) has resulted in a new focus on individual pieces of equipment when analyzing potential hazards. Also, lessons from the Process Hazard Analyses (PHAs) and LOPAs are being used on non-Longhorn assets.

As a result of a requirement for the Environmental Assessment from the Reversal Project, data and record keeping for the materials used in the Longhorn pipeline has improved. A Material Documentation Plan was produced and material information is now being retained and will be implemented into the PODS database.

Good communication, planning, and the use of experienced personnel led to a successful decommissioning project. Trusting that all steps were taken but still verifying that the steps were completed led to a higher level of safety and no leaks.

The change in product has resulted in the need to focus on internal corrosion. Experience with AC corrosion issues has led to increased focus on AC corrosion and changing procedures to address it at a lower voltage level.

## 5.3 Insights from new integrity management processes or technologies, or innovative applications of existing technologies.

New line locating equipment (RD8000s) was purchased in 2012. All employees watched a training video and practiced with the new equipment.

To address third party damage, a new sign (see Figure 1) is being installed on the right-of-way where third parties are working. The sign informs contractors of the need to contact Magellan prior to starting work.

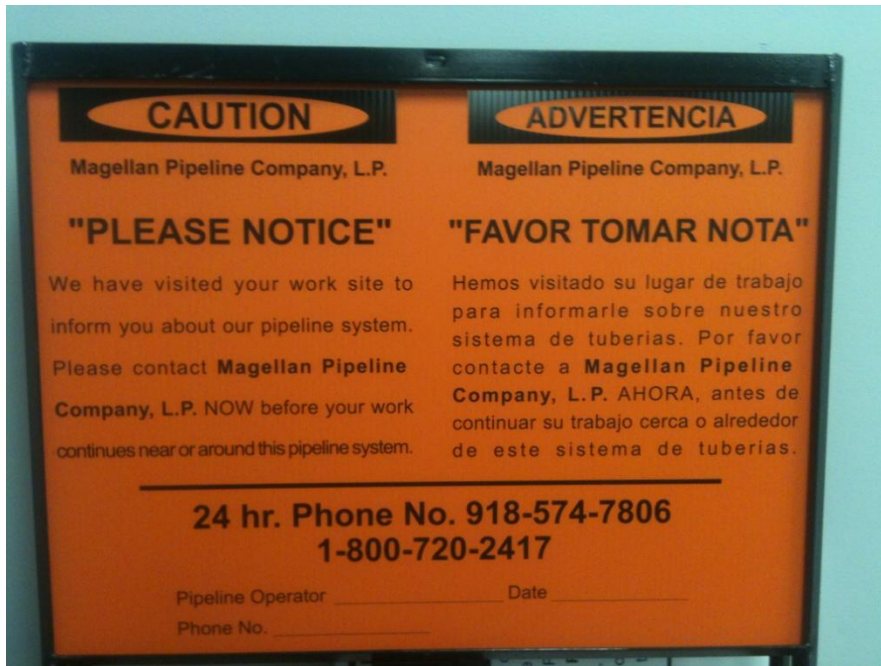


Figure 1. ROW Sign

As a result of the Reversal Project, the risk model for the Longhorn Pipeline was updated to a probabilistic model as opposed to the old model which was a relative risk model. The new model uses significantly more data and the data can now be imported rather than manually entered into databases.

El Paso is now using an infrared camera for monitoring switchgear.

The El Paso area also implemented a new safety coin program.

Magellan used the LOPA process in addition to the PHA for the Reversal Project. Action items from LOPAs and PHAs are tracked in the Compliance Management System (CMS).

Pump station design standards have been changed to include some of the items identified in LOPAs. The design now includes redundancy in high pressure shutdown, Multilin devices for pump protection, changes in drain systems, a “pump saver” for detecting vibration and resistance temperature detectors (RTDs) for temperature problems. These design changes originated with Longhorn stations and in some cases are now incorporated into non-Longhorn designs.

When Bullhorn devices fail, they are replaced with newer designs which are less susceptible to surges, thus improving reliability.

Because of the change in product transported, crude sampling systems and additional corrosion coupons were installed and the leak detection system was modified.



Integrity issues such as casings, stopple fittings, and Kerotest valves were addressed while the line was out of service.

#### **5.4 Performance measurement results.**

The “scorecard” for 2012 is given in an appendix to this report. There was 1 release in 2012 on the pipeline right-of-way due to a vehicle hydraulic hose. It was not DOT-reportable.

There was one One Call violation when the excavator did not wait for 48 hours before digging. In addition, there was a second near miss when the excavator notified MMP that they would be excavating but did not wait for MMP to arrive on the job site. No damages occurred as a result of these instances. One of these resulted in an unauthorized encroachment, which was later removed.

The applicable government agencies also exercise oversight over the Longhorn system.

#### **5.5 New integrity management programs or activities that will be conducted or significant improvements to existing programs and activities.**

As a result of the change in product transported, additional monitoring and maintenance to mitigate internal corrosion is now conducted on the Longhorn Pipeline. Maintenance pigging is now done every two weeks. In addition, crude sampling systems were installed.

MMP developed a new probabilistic risk model in 2012 and is looking at new ILI analysis software offered by Dynamic Risk. Also, using the PODS system, additional data on materials has been integrated for the Longhorn Pipeline.

A hard spot tool will be run on the Crane to East Houston pipeline in 2013.

Several new training initiatives are planned. In the El Paso Operations, additional cross-training of technicians has been implemented. All of the controllers are scheduled for a Longhorn Pipeline field visit in 2013. The training matrix for new engineers was implemented and will continue in 2013.

The procedure for AC corrosion was changed in the SIP to address AC corrosion when AC is greater than 5V as opposed to the prior version where the level indicating investigation was 10V. In addition, corrosion technicians will take AC readings at each test point in 2013.

A close interval survey (interrupted and native) will be conducted in 2013 and will be repeated every five years.

El Paso Operations purchased a thermal camera to use in checking switchgears.



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In Phase II of the Reversal Project, additional pump stations and new remote-operated valves will be installed and additional personnel will be hired.

The Safety Department is changing their process for origination and communication of Incident Investigations, Lessons Learned and Hazard Near Misses throughout Magellan. Hazard Near Miss reports are now in Livelink and communication is sent electronically to personnel. This process results in less manual entry and facilitates trending.



## 6.0 Findings for the LMP Management Commitments

The 14 Management Commitments described in the LMP are addressed below.

### 6.1 MC1: Longhorn Pipeline System Integrity “Process Elements”

The first of the 14 Management Commitments addressed in this section of this report commits Longhorn to implement a System Integrity Plan (SIP) consisting of 12 “process elements” that are “over and above” the federal and state regulatory requirements. The 12 SIP elements are addressed in the next section of this report.

### 6.2 MC2: Data Gathering and Identification and Analysis of Pipeline System Threats

There is a significant program in place to accumulate and integrate a wide array of information related to the operation and integrity of the Longhorn system, as described in LMP section 3.2.2. MMP has dedicated a full time person to this task, who receives information from many different data sources that is compiled and entered into the Longhorn risk model on a monthly basis. This information is also forwarded to the ORA contractor, who performs their own evaluation of the data. MMP has also dedicated a full time Risk Engineer for the Longhorn system to work with all SMEs related to the Longhorn system to evaluate risks and ensures compliance with the SIP, DOT and the LMP. Additional material information was collected and organized into the PODS database to comply with a requirement of the Reversal Project’s Environmental Assessment.

MMP continued to perform Incident Investigations during 2012. There were 5 incident investigations completed in 2012. These investigations are not limited to incidents that are reportable to government agencies, and include other types of operational incidents such as near misses. The results of these incident investigations are shared broadly throughout LPP and MMP. Likewise, Longhorn captures information concerning Incorrect Operations (IOs), and summarizes this information on a spreadsheet on a quarterly basis to identify trends and potential areas for improvement. Incorrect Operations data is drawn from Abnormal Operations (AOs), incident investigations (IIs), and Hazard / Near Miss (HNM) cards (described in item 11 of the SIP process elements). MMP manages changes to the Longhorn system through SIP process Element 11 – Change Management. Management of Change Requests (MOCR) are listed on a report which is widely distributed throughout MMP to personnel responsible for Longhorn operations. This report provides a quick reference as to whether the MOCR is either open or closed.

The LMP also commits Longhorn to conduct an annual Third Party Damage Prevention Program Assessment. The assessment for 2012 was conducted and the assessment was reviewed.



### 6.3 MC3: Integration of System-Wide Activities

Using information from the data gathering processes mentioned above and the data tracking and scorecard processes mentioned in PE 12, Longhorn conducts system-wide reviews of activities to ensure that all relevant information about the operation and integrity of the system is considered and evaluated on a routine basis.

A Mitigation Plan Scorecarding and Performance Metrics document is prepared and reviewed quarterly. Incidents are reviewed on a quarterly basis by Operations Directors, VP of Operations, and VP of Technical Services.

Lastly, the Operational Reliability Assessment (ORA) provides a comprehensive, independent technical review of all types of threats to the Longhorn system on an annual basis.

### 6.4 MC4: Incorporation of Engineering Analysis

Longhorn consistently obtains the assistance of engineering experts (both inside the organization, and from third parties) to help identify, manage, and resolve potential integrity issues on the pipeline system. The results of each in-line inspection are reviewed by independent pipeline assessment experts who perform an independent analysis and identification of any additional areas for physical inspection of the pipe based on statistical analysis of the results (known as the probability of exceedance, or POE, review). The results of ILI tool runs are also sent to a third party to conduct seam or girth weld assessments, depending on the type of assessment tool used.

### 6.5 MC5: Integration of New Technologies

Longhorn continues to incorporate new technologies for the operation of the system, and to evaluate the use of additional technologies as appropriate. New line locating equipment (RD8000s) were purchased in 2012. The Bullhorn continuous CP monitoring system is still being used and updated as needed.

### 6.6 MC6: Root Cause Analysis and Lessons Learned

This Management Commitment refers to the implementation of a formal incident investigation program for actual and near miss events, and for repairs that are made to correct deficiencies in system integrity. This program is described in PE6.

MMP uses a “Lessons Learned” program to share information and key learnings throughout the company. MMP issued 7 “Lessons Learned” bulletins in 2012, addressing various issues.





MMP conducts monthly SIP meetings in Austin, El Paso, Houston, and Crane / Odessa, where SIP procedures, HNM cards, other accidents and lessons-learned are reviewed with operating personnel.

## 6.7 MC7: Industry-Wide Experience

Longhorn continues to benefit from the industry-wide sharing received by participation in industry and governmental committees. The Sr. Vice President, Operations and Technical Services is a member of the API/AOPL Pipeline Performance Excellence Team (PET), which investigates liquid pipeline issues and develops programs and recommendations for improvements throughout the industry. He also was a former chairman of the API Operations Technical Committee (OTC), the primary US industry forum for technical issues for liquid pipelines. From 2002 through 2012, he held a US Department of Transportation appointment to the Technical Hazardous Liquid Pipeline Safety Standards Committee (THLPSSC), which is the primary governmental forum for all types of liquid pipeline issues. He was formerly on the planning committee for the Pipeline Information Exchange (PIX) workshop for years one through three. Since 2011, he has served on the joint API / AOPL Pipeline Leadership organization. In 2012, he spoke at the API Cybernetics Conference on the topic of leak detection.

Employees also participate in various internal and external meetings and events. The VP, Technical Services participates in the API Operations & Technical Committee and is on the planning committee for the Pipeline Information Exchange (PIX) workshop for the second year. The Director of Asset Integrity presented at the PIX workshop. The Director of Engineering and Construction also attended the PIX workshop. The Supervisor of Asset Integrity attended the PIX workshop and the Pipeline Pigging and Integrity Management Conference.

The Director of Environmental Health and Safety continued to serve as a member of API's Environmental Health and Safety Group. Magellan is also a member of the Independent Liquid Terminal Association. Either the director or a member of the Environmental Health & Safety group participates in ILTA sponsored meetings.

The Operations Control Supervisor presented at the API Cybernetics Symposium. The supervisor of One Call serves on the NE Oklahoma Damage Prevention Council. The Supervisor of Asset Integrity attended the Pipeline Information Exchange (PIX) and the Pipeline Pigging and Integrity Management Conference.

All MMP land representatives have meetings and share information concerning land and landowner issues throughout the Magellan system. The Safety Specialist is a member of the American Society of Safety Engineers.

## 6.8 MC8: Resource Allocation

Funds and personnel are made available as required to implement the requirements of the SIP. Allocation of resources is now done on an MMP-wide basis. Discretionary expenditures are



reviewed and approved by the Maintenance Capital Expense Management Team (MCEMT), composed of the VP of Technical Services and the VP of Operations. Proposed projects are classified into one of four categories:

- Break / Fix (evaluated to see if repairs are economically justified)
- Regulatory / SIP (non-discretionary unless the asset is shut in)
- Discretionary
- Obsolescence

MMP uses a Project Assessment Tool (PAT) to risk-rank proposed projects for health, safety, environmental, and commercial risks. Longhorn projects completed in 2012 included the modifications of tank pumps #6, 7, 9, and 13 at El Paso Terminal (to address vibration issues) and Phase I of the Reversal Project. While the line was out of service for the Reversal Project, additional funds were allocated to address numerous integrity issues. Work completed included removal of Kerotest valves, and removal of stopple fittings, laminations, casings and sleeves. While there are no dedicated funds for Longhorn discretionary expenditures, all personnel who were interviewed during the auditing process expressed their belief that Longhorn has adequate resources from a financial standpoint. The Longhorn system still has dedicated resources, including a full time integrity engineer and a full time risk model and data / ORA coordinator. There was some personnel turnover for Longhorn in 2012 due to attrition.

#### **6.9 MC9: Workforce Development**

MMP continues to use their new employee “on-boarding” process, which continues to evolve as feedback is received from the participants. This process now includes an orientation on the SIP. Engineers participated in monthly presentations on various topics. A training matrix was developed for skill progression for engineers. In 2012, engineers attended training on ASME Standard B31.4.

All Longhorn controllers receive annual training on the simulator for leaks, startups/shutdowns, and overpressure situations. Controllers also receive annual leak detection training.

A consultant provided a four hour training course on H<sub>2</sub>S safety to all Operations employees prior to the startup of Phase I of the Reversal Project.

#### **6.10 MC10: Communication to Longhorn and Operations Management**

This commitment is no longer relevant, since MMP both owns and operates the Longhorn pipeline system and there is no separate Longhorn management structure with which to communicate outside of MMP itself.



#### **6.11 MC11: Management of Change**

This management commitment refers to the implementation of a Management of Change Program. The LMP requires that all documents and files affected by the change be identified and modified in a timely basis. MMP's management of change process is described in SIP Element 11 and is addressed in section PE7 of this report.

#### **6.12 MC12: Performance Monitoring and Feedback**

This management commitment is addressed in PE12.

#### **6.13 MC13: Self Audit**

The LPSIP self-audit has been prepared each year as required. This report is the result of the 2012 LPSIP self-audit. The auditors' recommendations are given in the "recommendations" section of this report.

#### **6.14 MC14: Longhorn's Continuing Commitment**

Longhorn continued to implement the programs required by the LMP in 2012. All personnel interviewed by the auditors indicated that financial and personnel resources were adequate to ensure the integrity of the Longhorn pipeline.

## 7.0 Findings for the 12 LPSIP Process Elements

The 12 process elements described in the LMP are addressed below.

### 7.1 PE1: Longhorn Corrosion Management Plan

In two instances, problems were not resolved within one month but were resolved as soon as practical. The LMP states that “Deficiencies will be resolved within one (1) month of discovery, except deficiencies of such a nature they present a more urgent threat to pipeline integrity, in which case corrections will be done immediately.”

Close interval surveys were performed as needed in the higher-tier areas, including 100% of the tier III locations. Results of the tier II locations were that 100% of the pipeline mileage surveyed had “ON” potentials more negative than  $-850\text{mV}$  and 99.02% of the pipeline mileage surveyed had polarized (“Instant OFF”) potentials more negative than  $-850\text{mV}$ . Results for the tier III locations were that 99.97% of the pipeline mileage surveyed had “ON” potentials more negative than  $-850\text{mV}$  and 99.25% of the pipeline mileage surveyed had polarized (“Instant OFF”) potentials more negative than  $-850\text{mV}$ . All locations met at least one industry-accepted criteria for adequate cathodic protection.

Atmospheric corrosion inspections were performed as required and ten (10) locations identified as needing repairs. Repairs have been scheduled for all locations to meet the SIP requirement of repair within one year of discovery.

No API 653 internal inspections were completed at the El Paso terminal during 2012.

Internal corrosion is monitored through the use of corrosion coupons, which are inspected three times a year. The coupon results have not indicated any internal corrosion problems. Corrosion inhibitors are used to ensure minimal internal corrosion. The Reversal Project also involved a change in product transported in the Longhorn Pipeline, from refined products to crude oil. As a result of this change, MMP has implemented an increased focus on internal corrosion. One corrosion technician now has responsibility solely for internal corrosion. Maintenance pigging frequency has increased to once every two weeks.

### 7.2 PE2: In Line Inspection and Rehabilitation Program

Three (3) rehabilitation and eighteen (18) Probability of Exceedance (POE) digs were performed in 2012 for the 2011 EGP/MFL run and the 2009 and 2010 UT tool runs. Longhorn applies HCA remediation timeframes even to pipe segments outside of HCAs. All rehabilitation was conducted in the necessary timeframe.

MMP follows recent industry standards to ensure the quality of ILI runs, and uses conservative methods to re-calibrate ILI results when determining what ILI indications to dig. The ORA contractor performs a statistical analysis of the ILI data to identify any additional areas for



physical inspection, beyond those that would normally be inspected, as an extra precaution. The ORA process provides a detailed, independent analysis of all ILI data. The schedule for recent ILIs has been driven by the mitigation commitments, and has not been altered by ORA technical analysis.

A “hard spot” tool will be used in 2013 on the Crane to East Houston portion of the Longhorn Pipeline.

### **7.3 PE3: Key Risk Areas Identification and Assessment**

The risk model was updated in 2012 to a probabilistic model. The tier-based segmentation of the pipeline was also revised in 2012. It should be noted that the Longhorn system is regulated under the PHMSA pipeline integrity management regulations in 49 CFR 195.452, which includes requirements for the identification and management of High Consequence Areas, including populated areas. The populated area information and resulting pipeline integrity management programs are periodically updated as required by this regulation.

### **7.4 PE4: Damage Prevention Program**

In 2012, there was one instance where digging occurred with a One Call but prior to waiting 48 hours and one instance where the contractor notified MMP that they would be starting work but started excavating prior to the arrival of the MMP technician. The technician had previously told the contractor that he needed to be onsite prior to any excavation. In the first instance (H brace installed at MP 409.16), Magellan sent the excavator a letter regarding the incident and the importance of following One Call laws and procedures. In the second instance, the technician stopped the work and reminded the contractor of the requirement for MMP to be onsite.

The 2012 Third Party Damage (TPD) Prevention Program Assessment indicated that One Call notifications increased by 23% in 2012. No third party damage indications were found in the 2012 inline inspections.

Six (6) exposures were identified by aerial patrol and three (3) of these were repaired in 2012. One was a previously identified site that had been repaired by adding a concrete cap, which was still present. The remaining two (2) were on other company’s lines. There were two exposures identified by personnel during maintenance activities that were not visible by aerial patrol.

In 2012 Magellan developed a Pilot Effectiveness Checklist and implemented it into the inspection of right of way procedure. The checklist must be completed and approved for all new pilots. It is also completed annually and then as often as necessary to confirm the effectiveness of the pilot in the performance of duties. The checklist will aid in communication and is used as a training guideline by Magellan field employees.



Longhorn has committed to install and maintain a high number of pipeline markers. The aerial patrol program is well organized, and surveillance occurs more frequently than required. Flights are conducted in both directions (up the pipeline one day, and back in the other direction the next). That gives the aerial patrol observer the ability to spot potential issues from both perspectives on a regular basis. An operations person flies with the pilot annually to make sure the flight is taking the correct path. Because there were 2 exposures that the aerial patrol missed, there may be a need for additional training for pilots or some monitoring of flights to ensure that pilots understand their responsibilities and are reporting all issues.

Longhorn spends about 5 times more money per mile for ROW maintenance (\$1MM for 700 miles of pipe) than the average for MMP.

An aerial photo survey is conducted every 5 years to look for scouring of 13 water crossings. The last survey was conducted in 2010.

There are locations of shallow pipe in agricultural areas, and no-till agreements are obtained when possible for those areas. These agreements give a financial incentive to farmers to not use the ROW for farming activities. COMs (Coordinators of Operations and Maintenance) are reminded on an annual basis about the no-till agreements in their area, and they confirm and document that the land use has not changed. The agreements are renewed every 5 years. There are a total of 11 no-till agreements, and 6 areas where they have been pursued but not obtained. There were no new no-till agreements obtained in 2012. The revised aerial patrol reporting process includes a review for observations in areas of shallow pipe and / or no-till agreements.

Execution of the public awareness program for Longhorn was implemented as required by the LMP. An annual mailing was conducted for residents and other establishments within 2 miles of the pipeline in rural areas and ¼ mile of the pipeline in metropolitan areas, excavators and farmers within 10 miles of the pipeline, and emergency responders and public officials within the county plus 20 miles. A supplemental mailing was sent to all parties involved in unauthorized encroachments. Response cards have been included in the mailings since 2007. Since 2011, the mailings have been in envelopes which have resulted in a larger number of returned response cards. In 2010, there were 81 responses, in 2011, there were 638 and in 2012, responses were received from 824 mailings. The percentage of replies that state that they have seen or heard information about pipeline safety in the past year had remained very consistent (about 55%), however, it dipped to 44% in 2011 but was back up to 57% in 2012. Those who claim that they were aware of the need to call One Call before digging increased again slightly from about 77% to 80%. In 2012, the percentage of respondents who claimed that they were aware of the Longhorn pipeline before they received the brochure increased from 51% to 64%. It is reassuring to note that each year a larger percentage of respondents claim to be aware of the “811” system, the nationwide number for One Calls, and that this percentage increased in 2012 to 54% over the previous year of 46%.

Door-to-door visits were conducted at 5,142 locations adjacent to the ROW over the entire Longhorn Pipeline, from Harris to El Paso counties. This program will now be conducted every two years over the entire pipeline.



Longhorn COMs participated in group emergency responder and excavator meetings in 25 counties. Face-to-face meetings were conducted with 121 emergency responder locations, covering all 25 counties. There were an additional 28 group meetings with emergency responders along the ROW. Over 2,400 emergency responders and public officials were targeted by fall and winter postcards on pipeline safety issues.

Longhorn continues to operate a school outreach program targeted at 4<sup>th</sup> and 5<sup>th</sup> grade students, but has had difficulty getting schools to participate. In the Austin area, 17 schools were targeted, 5 participated, reaching 992 students. In the Houston area, 6 schools participated in the “Safe at Home” program, reaching 668 students.

Longhorn ran an 811 radio ad in Kimble County where there are a lot of farmers, ran an ad in the Spanish language newspaper “El Mundo”, and participated with a collaborative group on an 811 media day on 8/11/2012. The farm store kiosk program was continued in 2012, and an effectiveness survey was conducted with store owners and managers. Magellan also hung a “Call Before You Dig” banner on the fence at Satsuma Station.

## **7.5 PE5: Encroachment Procedures**

Operations personnel are keenly aware of the need to prevent unauthorized encroachments and to properly manage authorized encroachments. An encroachment agreement is executed for every authorized encroachment. MMP uses two different encroachment agreements: a “short form” that is used for routine activities (such as installing utility lines across the ROW), and a “long form” that is used for more complex situations such as land development. The land representative is informed of every encroachment agreement, and reviews them to ensure that they are appropriate. These are retained permanently in the TRACT land files.

There were a total of 90 encroachments in 2012, 88 of which were documented using the “short form” for encroachments. There were two unauthorized encroachments, as compared to 3 in 2009, one in 2010, and none in 2011. MMP gathers ROW near miss and unauthorized encroachment data in the Mitigation Plan Scorecarding & Performance Metrics report. Although unauthorized encroachments are not uncommon for any pipeline, near misses and unauthorized encroachments reinforce the need for an active ROW patrol program, in addition to the public awareness programs. Two parties who participated in unauthorized encroachments were sent letters regarding safe digging practices.

## **7.6 PE6: Incident Investigation Program**

To promote awareness of hazards and to ensure “near misses” are identified, MMP uses a hazard / near miss (HNM) card (note that these operational “near misses” are not the same as the ROW “near misses” described in PE4). All operations employees are encouraged to complete these



cards (a lot of HNM cards is better than just a few). There were 3 HNM reports for 2012, versus 7 in 2011.

The LPSIP requires that incident investigations (IIs) be performed for accidents, incidents, repairs, and near misses (“close calls”). The Incident Data Report form (13-FORM-1301) includes checkboxes to identify the event as Minor, Serious, or Major. Longhorn did 9 Incident Investigations in 2012, versus 13 in 2011. Four of these were for non-operational events. None of the Incidents in 2012 were considered “serious.” Note that IIs for the Longhorn system are reviewed on a monthly basis. In 2012, MMP sent several employees to formal Root Cause Analysis training, which addresses a prior audit concern.

Incident Investigations and Hazard / Near Miss reports are analyzed and Lessons Learned bulletins (see MC7) are generated if any lessons learned can be applied globally.

MMP conducts a quarterly review of all incident data with the VP of Operations, the Operations Directors, and the VP of Technical Services. The auditors did not investigate the level of detail or trending that is reported to management or the outputs that may come from these reviews.

MMP has an action item (AI) tracking process that tracks IIs, HNM cards, and SIP meeting action items. The AI tracking process excludes action items that are performed immediately. The Safety Specialists participate in Hazard Near Miss Action Item meetings with the Manager of Operations, Area Supervisors, Asset Integrity personnel, and the Compliance Coordinator. They modify the Action Items as needed and trend Hazard Near Misses company-wide.

## 7.7 PE7: Management of Change

MOCRs for the Reversal Project were tracked separately.

Longhorn performed six HAZOP and Layer of Protection Analysis (LOPA) analyses in 2012 for pre-construction of the Reversal Project.

MMP’s management of change process is described in SIP Element 11. The LMP requires that all documents and files affected by the change be identified and modified in a timely basis. Upon review of the 2012 completed MOCR’s, the auditors found instances of incomplete supporting documentation and extended periods of time between completion of the project and completion of the MOCR paperwork.

The LMP requires that all changes on the Longhorn system “be evaluated using an appropriate hazard analysis (HAZOP, what-if, LOPA etc.)” The MMP MOCR form includes a yes / no checkbox to indicate whether a Process Hazard Analysis is required, and MMP’s procedures provide that the asset integrity engineer should determine the appropriate PHA methodology for change requests. MMP changed their SIP / PHA procedure in 2008 to specify that PHAs were required for all changes “on a Longhorn Pipeline System”, and the PHA process was updated to provide two options: a what-if/checklist, or a full HAZOP. In most instances, when changes are





small or minor, MMP is currently using the Facility Integrity Checklist as the primary method to perform PHA's.

The SIP requires that Pre-Startup Safety Reviews (PSSR's) occur prior to bringing new equipment into operation or prior to bringing modified equipment back online. The MOCR form includes a signature line in the MOCR Closure Approvals section that confirms whether a PSSR was completed.

#### **7.8 PE8: Depth of Cover Program**

The depth of cover program is tracked as part of the Asset Integrity (AI) report. The last depth of cover survey was conducted in 2007.

In-line inspections to-date have not identified any correlation between shallow pipe and excavation damage, which indicates that this threat is being adequately managed.

#### **7.9 PE9: Fatigue Analysis and Monitoring Program**

The fatigue analysis and monitoring program is conducted as part of the ORA, which is functioning as planned. The results of this program are described in the ORA report.

#### **7.10 PE10: Scenario Based Risk Mitigation Analysis**

The scenario based risk mitigation analysis (SBRMA) is conducted annually, after the results of the Annual Third Party Damage Prevention Program Assessment (ATPDPPA) and the results of the relative risk model are available. The SBRMA for the 2011 operating year was performed as required and identified two locations that required additional analysis. Depth of Cover was investigated at MP 2.47 and was found to be adequate. At MP 35.61, the SBRMA Index Score had dropped due to the time since the last ILI. However, this will be addressed through Magellan's integrity program.

#### **7.11 PE11: Incorrect Operations Mitigation**

MMP has found that, in the past, operator error has been a significant contributing factor to incidents and near misses on the Longhorn system. Longhorn has taken steps to address that issue, and uses an incorrect operations (IO) tracking spreadsheet which is updated monthly and reviewed monthly. IOs include Abnormal Operations (AOs), IIs, and Hazard / Near Miss (HNM) cards. There were 11 AOs in 2012, as compared to 13 AOs in 2011. Action Items are also reviewed monthly.

MMP has an operations control center simulator specifically for the Longhorn Pipeline, which is used to train and to re-qualify board operators in the Tulsa control center. This helps to ensure



that they can rapidly recognize and effectively respond to abnormal operating conditions on the Longhorn pipeline system.

#### **7.12 PE12: System Integrity Plan Scorecarding and Performance Metrics Plan**

This element commits Longhorn to establish and track general program performance measures, specific program performance measures, and to conduct an annual system integrity plan audit. These measures have been established and are being tracked as required, and the annual system integrity plan audit has been conducted each year as required. Longhorn has also established several other performance measures and tracking systems, including the Mitigation Plan Scorecarding & Performance Metrics report and incorrect operations scorecard. The scorecard metrics are reviewed monthly. Longhorn no longer tracks all calls to their 800 number, as many of these calls were not related to system integrity (i.e. job inquiries, etc.), and now only tracks integrity-related calls. The Longhorn website has been incorporated into the MMP website.

Longhorn system performance metrics are now contained in a “share drive” accessible to both Austin and Tulsa, which facilitates timely sharing of information and reduces double-entry of data. There were two unauthorized encroachments in 2012. There were no DOT-reportable releases in 2012. See appendix 10.1 for a description of key metrics on the system in 2012.

## 8.0 Recommendations

While the LPSIP is being implemented effectively, there are several opportunities for continued process improvement in the opinion of the auditors. These have been grouped into the following categories (in no particular order of importance):

### 8.1 MOCR Process

Review of MOCRs shows numerous instances of incomplete documentation. In addition, some MOCRs were not closed in a timely manner. Projects were completed but the MOCRs were still open several months later. Although the current MOCR process is in compliance with the LPSIP, we recommend that MMP place additional emphasis on MOCR compliance and establish a defined time limit after project completion for closure of MOCRs. Magellan is currently reviewing the MOCR process.

### 8.2 Damage Prevention

In 2012 there was one instance of a contractor not waiting the required 48 hours prior to digging and a second instance where MMP was notified but the excavator did not wait for MMP personnel to be on site prior to digging. Contractors are apparently aware of the need to call 811 but may not be aware of the requirements of the Texas One Call Law or the need to wait for MMP personnel prior to digging. We recommend that in the future, Magellan's public awareness program focus on the requirements of the law (e.g. wait 48 hours prior to digging) and the requirement to wait for MMP personnel when requested to do so.

### 8.3 Rectifier Maintenance

The SIP requires that rectifier deficiencies be resolved within one month of discovery. There were two instances in 2012 where deficiencies were not resolved in one month although the deficiencies were resolved as soon as practical. We recommend that MMP stock spare parts for rectifiers and Bullhorns in order to ensure compliance with the SIP when these parts need replacing.



## **9.0 Conclusions**

The SIP was effectively implemented in 2012, and served its function of managing risks on the Longhorn system. Personnel at all levels of the organization are aware of and committed to comply with the requirements of the SIP. Comprehensive programs are in place to manage risks on the pipeline system and to implement the commitments in the SIP. These programs are mature, and are being improved on a continual basis. Several recommendations for additional improvement have been identified for further consideration by Magellan.

## 10.0 Appendices

### 10.1 Summary of key metrics for 2012

Category	Measure	2012 Results
Incident Data	Releases in each Tier (DOT Reportable only)	Tier 1 = 0
		Tier 2 = 0
		Tier 3 = 0
	Releases in sensitive & hypersensitive areas (DOT Reportable only)	0
	Releases by cause (DOT Reportable only)	TPD = 0
		Corrosion = 0
		Design = 0
		Incorrect Operations = 0
	Releases by volume (BBL) (DOT Reportable only)	Tier 1 = 0
		Tier 2 = 0
Tier 3 = 0		
Near Misses	Tier 1 = 2	
	Tier 2 = 0	
	Tier 3 = 1	
Risk Awareness	Identification of new and/or previously unrecognized risks	0
	Number & type of projects completed that are not required by prescriptive code	1
Public Customer Service	Number of validated complaints on safety or environmental issues	1
	Number of landowner contacts related to pipeline safety and land use	27
Operator Resources and Innovation	Number of new technologies, alternative methodologies and innovative approaches to control risk	1
Damage Prevention Program	Number of third party damage incidents due to One-Call Process not being practiced (One-Call Violations)	0
Unauthorized Encroachments	Number of unauthorized encroachments	2
Facility Inspections	Number of facility inspections	2
Corrosion Management Plan – Smart Pig Results	Dents with any of the following: metal loss, corrosion, exceeds 6% of the outside diameter, or located on the longitudinal seam or girth weld	0

Remaining strength of the pipe results in a safe operating pressure that is less than the current MOP at the location of the anomaly using a suitable pressure calculating criterion (e.g. B31 G, modified B31 G, RSTRENG or LAPA)	0
Casing shorts with associated metal loss	0
Girth weld anomalies	0
Corrosion with 3" of either side and/or across girth welds	See ORA Report
Preferential corrosion of or along seam welds	See ORA Report
Gouges or grooves greater than 50% of nominal wall thickness	0
Cracks located in the pipe body, girth weld, and longitudinal seam that are determined to be injurious to the integrity of the pipe	See ORA Report



Leading Measure	Definition	Standard	Score
Number of Releases	Number of Releases from company assets or projects that are managed by area employees in quantities exceeding 1 Gallon.	Zero (0)	0
Number of Recordable Releases	Number of DOT Reportable releases experienced on the Longhorn system.	Zero (0)	0
Number of Line Hits	Number of contacts with pipeline by first, second or third parties. Contact with pipeline includes coating contact or damage.	Zero (0)	0
Number of Near Misses	Number of events that in slightly different circumstances could have resulted in damage to the pipeline by first, second or third parties.	Zero (0)	3
Number of Markers Repaired or Replaced		Actual Number	72
Number of Unauthorized Encroachments	Number of activities that resulted in a structure being placed on the ROW that was not authorized by Longhorn Pipeline.	Zero (0)	2
Number of Emergency Drills Conducted			6
Number of Facility Inspections Completed			2



## 10.2 Key documents reviewed for the 2012 SIP self-audit

### 2012 LPSIP Self Audit Backup Docs - Appendices

#	Doc. Name
	Magellan Organization Chart
	2012 Mitigation Plan Scorecarding & Performance Metrics
	2012 Mitigation Plan - Commitment Implementation Status Report
	2011 Self Audit Recommendations & Action Plan
	Incorrect Operations Mitigation Report & Data
	Hazard Near Miss (HNM) - Closed List
	Hazard Near Miss (HNM) - Open/New List
	Closed Action Items (AI)
	Open Action Items (AI)
	Abnormal Operating Condition (AOC) Report
	Incident Investigation Reports
	Summary Report of 2011 ORA Developments
	Summary of ILI results and planned inspections
	Asset Integrity Report - 2012
	Public Awareness Summary Report - 2012
	Management of Change Data, including <ul style="list-style-type: none"><li>- Example MOCR Reports</li><li>- Open MOCR list</li><li>- Closed MOCR list</li></ul>
	Encroachment Report Date - 2012
	Valve Inspection Report data - 2012
	Corrosion Control Records – 2012, including: <ul style="list-style-type: none"><li>- MPL Longhorn Rectifier Maintenance Activity Report</li><li>- MPL Longhorn Test Point Exception Report</li><li>- Atmospheric Maintenance Report</li><li>- Close Interval Survey Results for Tier III</li></ul>
	PHMSA / Longhorn correspondence - 2012
	2012 Third Party Damage Prevention Program (TPDPP) Annual Assessment
	System Integrity Plan - 2012

Note: The auditors have performed this audit for many years, and also relied upon program descriptions and documentation from prior years when they also apply to this year's audit. Those documents are described in our prior audit reports.





### 10.3 Personnel Interviewed

#### Austin Interviews:

Tommy Adams – Area Supervisor - Crane / Odessa Area  
Jim Griffin – Landman  
Darcy Madsen – Field Records, Compliance Coordinator  
Randy Hermes – Area Supervisor – Longhorn East

#### Tulsa Interviews

Melanie Little – VP Operations  
Joe Strief - Director of Operations  
Chad Cole – Supervisor - Longhorn console  
Mike Pearson – VP Technical Services  
Doug Chabino – Director, Asset Integrity  
Matt Argo – Supervisor, Pipeline Integrity (Data Analysis / Risk Model)  
Jamie Graves – Facility Integrity Engineer  
Rick Wooldridge – Mgr Asset Integrity (Corrosion & Tanks)  
Dennis Vasicek – Supervisor Asset Integrity (Pipeline)  
Deandra Chancellor – Regulatory Compliance Coordinator  
Dyan Gillean - Supervisor One Call  
Bob Jackson –Manager of Engineering and Construction  
Greg Peck - Safety

#### El Paso Interviews

Cole Ballard – Area Supervisor - El Paso Area  
Roy Van Tine – Operations Supervisor - El Paso  
Greg Melton – El Paso COM  
David Licon – Corrosion Tech  
Brad Martin – El Paso Senior Tech

#### Houston Interviews

Ed Fuchs –Manager Texas Operations  
Rusty Holman – Area Supervisor – East Houston



## 10.4 Statements of Qualifications for the Auditors

### W.R. (Bill) Byrd, P.E. President

#### Executive Summary

As founder and principal of RCP, Mr. Byrd enjoys a solid reputation for working with the public, corporate executives, legal representatives, and regulatory agencies to resolve complex regulatory, integrity management, safety, and compliance management issues. He combines exceptional analytical and communication skills with a broad background in engineering, operations, management, economics, and regulatory affairs, yielding excellent professional judgment and capabilities that can be applied to intractable problems. He is a widely respected public speaker, and is routinely called upon to make presentations to industry associations and other groups at the national level. He is a licensed Professional Engineer in five states, and graduated with honors from Georgia Institute of Technology for both his M.S. and B.S. in Mechanical Engineering.

#### Accomplishments/Experience

- Serving as the consulting expert to the API / AOPL Pipeline Performance Excellence Team, a permanent team composed of pipeline executives dedicated to improving the safety of the liquid transmission pipeline industry.
- Serving on the INGAA Foundation with other pipeline company and contractor executives to identify, prioritize, and fund research projects for the gas transmission industry.
- Serving as a consulting expert during the first criminal prosecution under the Pipeline Safety Act.
- Serving as an expert witness during the first class action lawsuit brought against a pipeline company under the citizen suit provisions of the Pipeline Safety Act.
- Serving as an expert witness / consulting expert on several other pipeline accidents and lawsuits, including those of national significance.
- Chairing the Offshore Corrosion Surveillance Subcommittee for a major pipeline company.
- Leading the development and implementation of a corrosion control strategy for oil and gas operations on the North Slope of Alaska in response to congressional investigations.
- Leading the development of a multi-skill progression program for a major pipeline company with a unionized workforce.
- Developing a new approach for H<sub>2</sub>S contingency planning in large sour oil and gas production areas, and co-authored two papers based on that work at the first annual EPA/SPE Joint Exploration and Production Environmental Conference. This revised planning approach has since been adopted throughout the oil and gas industry for use in production operations.
- Developing solutions for produced water toxicity issues on the Outer Continental Shelf, NORM sampling and testing procedures for oil field wastes, and asbestos exposure issues.

#### Associations/Affiliations

- American Gas Association
- American Petroleum Institute
- American Society of Safety Engineers
- American Society of Mechanical Engineers
- Interstate Natural Gas Association of America Foundation
- Texas Gas Association
- Houston Pipeliners Association
- Gulf Coast Environmental Affairs Group



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**Deborah J. Brunt, P.E.**  
**Executive Consultant**

**Executive Summary**

Deborah Brunt has 25+ years of experience in natural gas utility operations and engineering. Her expertise is focused on gas distribution and transmission engineering, operations, and compliance with DOT Part 192 regulations, and MAOP. She is experienced in testifying before the New Mexico Public Regulation Commission (NMPRC), National Labor Relations Board (NLRB), and representing the Company to the community and local governments.

**Accomplishments/Experience**

In Ms. Brunt's career in the natural gas industry, she has held the positions of: Director of Operations, Engineering, Gas Engineering & DOT compliance; member of a gas asset sale transition team; and manager for various operations functions. Some of her accomplishments in these roles, and as a Distribution Engineer, include:

- Directed/coordinated measurement, compression operations, environmental, right-of-way and GIS functions for gas transmission and distribution systems throughout New Mexico.
- Directed/coordinated engineering functions for gas transmission and distribution systems throughout New Mexico.
- Directed/coordinated the operation, maintenance, and construction of electric and gas distribution systems for Santa Fe, Las Vegas, Espanola and Taos, NM.
- Project management for new SCADA system installation.
- Worked on preparation of Descriptive Memorandum to describe assets to potential buyers of natural gas assets of Company. Assisted in presentations to potential buyers, prepared written responses to questions about the gas assets and provided tours of facilities. Once buyer was selected, work shifted to separating gas functions from electric functions, identifying all needs for stand-up gas-only company, and planning for physical moves.

**Education**

Bachelor of Science – Mechanical Engineer, Oregon State University, Corvallis, OR, 1986

- B.S. Mechanical Engineering with Honors
- Tau Beta Pi Engineering Honor Society
- Pi Tau Sigma Mechanical Engineering Honor Society

**Professional Awards and Accomplishments**

- Registered Professional Engineer, New Mexico (#11369), 1991
- YWCA “Woman on the Move” Award, 1992
- Society of Women Engineers “Distinguished New Engineer” Award, 1996
- New Mexico Society of Professional Engineers “Engineer of the Year” Award, 2003