Selected Excerpts

Spectra Energy Transmission Integrity Management Program
Threat Response Guidance Section 440 – Manufacturing
Revision 3 – 09/06/2013

1.0 INTRODUCTION

This document is one of a series of Threat Response Guidance Documents (TRGD) which collectively address the nine categories of potential threats to the steel natural gas pipeline systems operated by the Company. These documents form part of the Company's overall Integrity Management Plan (IMP) and apply to "covered segments" of the Company's natural gas pipeline systems associated with High Consequence Areas (HCA) as described in CFR Part 192, Subpart O – Pipeline Integrity Management. This document applies to all "covered segments" of transportation piping systems for natural gas including: mainline piping, measurement and regulator stations, compressor stations, laterals, and cross-overs.

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2.0 SCOPE

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ASME B31.8S, "*Managing System Integrity of Gas Pipelines*"[1], has identified certain manufacturing items which pose a threat to pipeline integrity. Manufacturing imperfections are generally not considered to be a threat by themselves unless acted upon by changes in loading or in the case of hard spots, a source of atomic hydrogen…

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3. Hard Spots

"Hard Spots" are areas of susceptible materials that are considered stable unless acted upon by a source of atomic hydrogen which may result in the potential of hydrogen embrittlement. Conditions of hydrogen embrittlement involve:

- Pipe with susceptible material (high carbon / manganese steels),
- High-hardness zone most likely as the result of the formation of untempered martensite due to excessive localized cooling of the plate material during the manufacturing process,
- A source of atomic hydrogen (such as excessive cathodic-protection current).

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For pipelines constructed from the 1970's onward, material chemistry, manufacturing processes, inspection protocols, and pressure testing have for the most part eliminated the integrity threat associated with manufacturing.

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[i] AMSE identified this pipe in their B31.8S supplement as pipe greater than 50 years old. This was intended as a place holder until such time as specific pipes could be identified and discussed in the Vintage Pipe Report.

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Integrity Management Process for Manufacturing Threat in Covered Sections

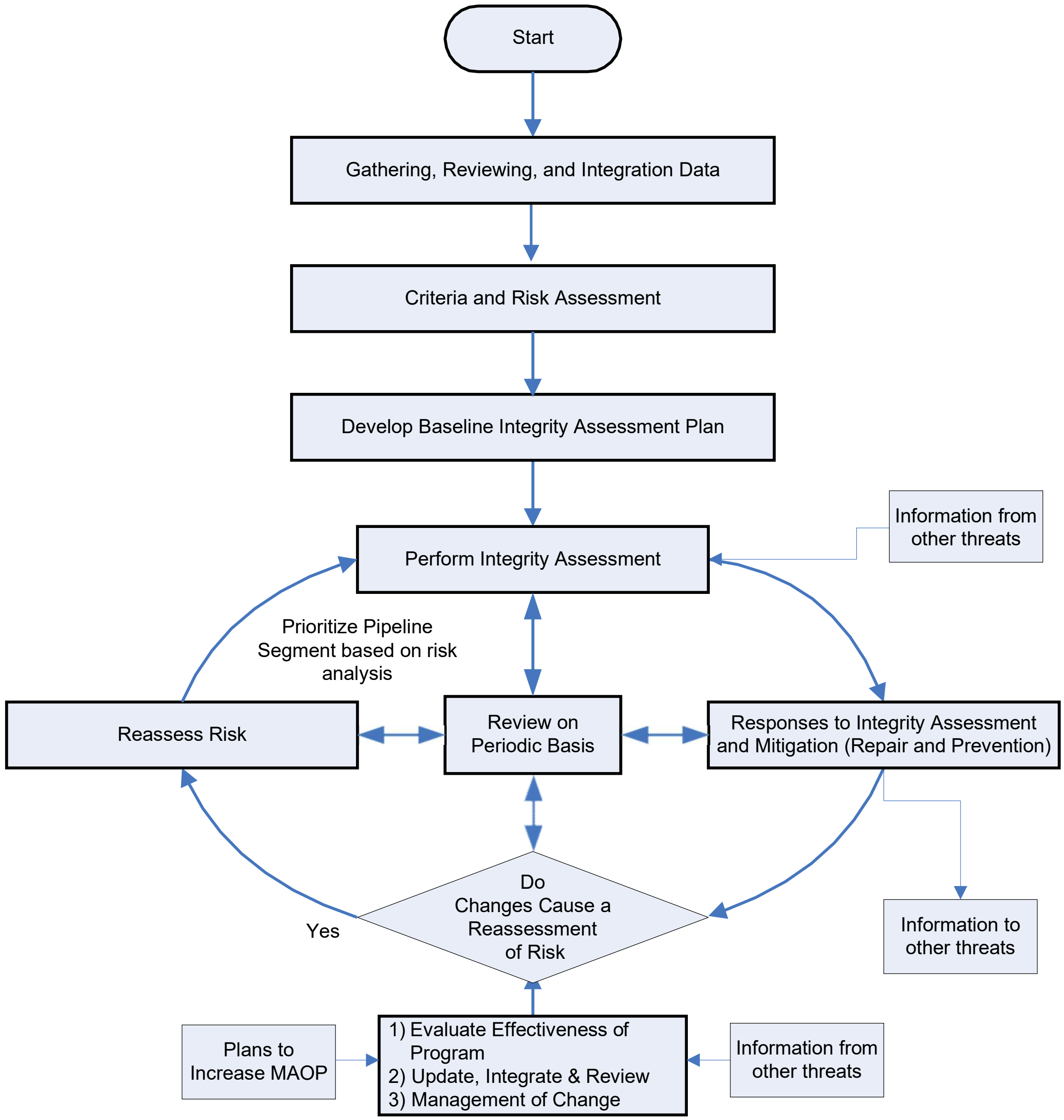

Figure 1: Process Flow Diagram

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2.1.4 Potential Threat Of Hydrogen Embrittlement Of "Hard Spots"

Hard Spots may pose a threat to pipeline integrity as a result of hydrogen embrittlement. A "hard spot" is an area of pipe that is excessively hard with a susceptible material. Hard spots typically occurred during the steel plate rolling process before it was formed into a pipe.

The existence of a hard spot be itself is not a threat. The following elements are required and/or contributing factors for a potential threat of hydrogen embrittlement:

- A susceptible material, (high carbon / manganese steels),
- High-hardness zone most likely as the result of the formation of untempered martensite due to excessive localized cooling of the plate material during the manufacturing process,
- A tensile stress,
- A source of atomic hydrogen (hydrogen gas is comprised of the molecule H_2 and will not cause this phenomenon), this generation of hydrogen may result on the outside surface of the pipe as the result of cathodic-protection current or on the inside surface from sour crude oil. Reference 2 indicates that the propensity for hydrogen cracking from atomic hydrogen generated at coating holidays increases dramatically as the pipe-to-soil potential becomes increasingly more negative than–1,200 mV relative to a Cu, $CuSO_4$ half cell,
- Coating disbondment at the location of the hard spot if CP is the source of atomic hydrogen,
- A stress-concentrator such as a lamination or other imperfection within the pipe material,
- Reference 1 indicates that a threshold level of hardness for cracking to occur from atomic hydrogen generated by cathodic protection is equivalent to 33 Rockwell C (310 Brinell).

Note: The first 2 bullets can be tied historically to certain vintage pipe. Knowledge of these vintage pipes provides a basis for assigning risk to specific pipeline segments.

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As indicated in Reference 1, the three elements that must be present for a hard spot to be a threat are: a tensile stress, a susceptible material, and a source of atomic hydrogen (hydrogen gas is comprised of the molecule H_2 and will not cause this phenomenon). Since the threat only exists when atomic hydrogen is present, the threat can be categorized as hydrogen cracking.

Technical articles on hydrogen cracking such as References 5 and 6 imply that the phenomenon is time-dependent at least in terms of atomic hydrogen exposure time. They do not, in fact, however, suggest that the cracking proceeds steadily at some observable rate. One scenario for the cracking is that it may occur in a manner analogous to an earthquake. An earthquake is the sudden release of stored energy built up through gradual strain accumulation at a fault zone. Hydrogen cracking may be the sudden release of energy associated with micro-strain accumulated in the hard, brittle material.

The scenario described above is supported by the evidence in the form of the cracks that occur within minutes or hours in the heat-affected zones of girth welds. If this scenario is accurate, the phenomenon is unpredictable in the same sense that earthquakes are unpredictable. The unpredictable timing of the occurrences means that one cannot depend on eliminating hydrogen cracks by means of performing periodic integrity assessments such as hydrostatic testing or the running of a crack-detection tool at a specified interval.

The unpredictable nature of the hydrogen cracking phenomenon limits the options that a pipeline operator can do to validate the fitness of the pipeline for service. The options are: (1) eliminate or reduce the tensile stress, (2) eliminate the susceptible material, (3) eliminate or reduce the availability of atomic hydrogen, or employ an appropriate combination of the three approaches. The benefits and limitations of each of these potential actions are discussed below.

1) <u>Eliminating or Reducing Tensile Stress</u>

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The elimination of the tensile stress in the pipeline is not considered a viable solution for the following reasons; residual stresses in the pipe wall as a result of manufacturing present significant stresses, small imperfection in the pipe wall create stress risers, and a natural gas pipeline, to be useful at all, must be pressurized. One could postulate that there may be a threshold tensile stress below which the phenomenon of hydrogen cracking will not occur. Reference 2, for example, shows tests of a 230,000-psi-tensile-strength material where the apparent threshold stress is about 20,000 psi. This level of stress would correspond to 38 percent of SMYS in a pipeline comprised of X-52 material. What the actual threshold stress might be for these hard areas is unknown, and would be difficult to ascertain.

2) Eliminating Susceptible Material

The elimination of susceptible material is only possible if the material containing at risk hard spots can be identified. Relatively few hard spots exceed 33 Rockwell C (310 Brinell) [typical minimum hardness required to be a threat] and the means to reliably locate the susceptible pieces does not currently exist. However, the industry has knowledge of vintage pipe with a history of hard spots and thus this information provides for a means of identifying potential pipeline segments that may be susceptible to hard spots.

3) Eliminating or Reducing Availability of Atomic Hydrogen

The elimination or reducing the availability of atomic hydrogen would further reduce the potential threat. Reference 2 indicates that the propensity for hydrogen cracking from atomic hydrogen generated at coating holidays increases dramatically as the pipe-to-soil potential becomes increasingly more negative than -1,200 mV relative to a $Cu\text{-}CuSO_4$ half cell. Satisfactory cathodic protection in most cases can be achieved at less negative potential levels; changes in the cathodic protection system could be effective in minimizing the locations having excessively high potential levels, thereby reducing the availability of atomic hydrogen.

Also, another method to eliminate or reduce available atomic hydrogen is the existence of good coating. Little, if any, cathodic protection current will reach a surface protected by a well-bonded, non-conducting coating. Therefore, the generation of sufficient atomic hydrogen to cause cracking at a hardened heat-affected zone depends on a coating deficiency allowing a sufficient amount of current to reach the susceptible material.

3.0 GATHERING, REVIEWING, AND INTEGRATING DATA

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3.1 Data Collection, Review and Analysis

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A comparison of the data to actual results of the assessment will be performed as a quality control check. If the assessment corroborates anticipated pipe condition based on the data assessment, the data and process shall be deemed to be of sufficient quality. If the data analysis does not substantiate the condition of the pipe during the assessment, the data and process shall be reviewed to determine where improvements need to be made. Changes or improvements shall be subsequently implemented to ensure the data quality for the segment of pipe being reviewed as well as subsequent segments.

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- 3.5 Data Integration
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Data shall be maintained and integrated in an electronic database where several data elements can be analyzed concurrently. As stated in ASME B31.8S "A major strength of an effective IMP lies in its ability to merge and utilize multiple data elements obtained from several sources to provide an improved confidence…".

In assessing the integrity of the pipeline segment, it is not only necessary to determine whether an isolated manufacturing anomaly represents an integrity concern but also the interaction with other potential threats. Each manufacturing anomaly alone may not pose a threat; however, certain combinations of threats could contribute to an integrity concern.

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4.0 CRITERIA AND RISK ASSESSMENT

The goal of risk assessment is to identify and prioritize covered segments with respect to risk so that the pipeline operator can determine how, where, and when to allocate risk mitigation to improve pipeline system integrity. The risk assessment process is dependent upon the quality of the data input into the risk assessment model and the SME knowledge, which are both used to make decisions.

Manufacturing / material threats are considered to be stable unless acted upon by changes in functional loads such as an increased internal pressure, pressure cycling, or external load influences.

4.1 Risk Assessment Objectives

The risk assessment process as it pertains to manufacturing involves the following:

- Identification of locations where the manufacturing threat has either a high or low threat potential.
- Determination of the type of loading conditions (internal pressure increases or outside force susceptibility or other- Figures 3-1, 3-2, 3-3, 3-4).

4.2 Risk Assessment Approach

The risk assessment process will be implemented and managed by the Director, Pipeline Integrity - Houston. His responsibilities will include:

- Supervising the risk assessment process;
- Approving the risk assessment model;
- Ensuring the competence of all the persons (staff and contractors) engaged in implementing the risk assessment process;
- Developing, maintaining and auditing a database of information relevant to the manufacturing threat;
- Ensuring appropriate experienced personnel assign relative probabilities in risk model;
- Ensuring SME review and concurrence or modification of assigned relative probabilities and/or relative risk rankings;
- Analyzing the results and review of trends compared to the performance metrics;

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- Modifying this document in order to achieve continued improvement, and
- Reporting the results to senior management and the regulatory authorities (as appropriate).

4.2.1 Subject Matter Experts

The Company's Subject Matter Experts (SMEs) will evaluate the conditions of the manufacturing threat by utilizing material, construction, and operational information provided through various sources to identify the conditions of the threat. The SMEs will review each covered segment that has been identified as a potential threat. They will utilize their knowledge of the pipeline system along with pertinent information to develop a risk assessment of the covered segments throughout the pipeline system.

4.3 Risk Assessment Factors

The following factors have been determined through experience to provide results that support actual field conditions. The factors which are considered by the SMEs include:

- Year pipe was installed
- Nominal pipe diameter
- Pipe wall thickness
- Specified minimum yield strength
- Normal operating pressure
- MAOP
- 5 year highest historical operating pressure
- Pipe manufacturer
- Longitudinal seam type
- Longitudinal joint factor
- Hydrostatic pressure test history
- Number of in-service manufacturing / material leaks
- Number of in-service manufacturing / material ruptures
- Potential for land movement
- Length of Covered Segment applicable to HCA determined by pipeline diameter

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and pressure.

- Coating Condition
- CP History

4.4 Risk Assessment/Threat Assessment Level Determination

As part of the analysis by the SME, a determination of the threat level will be made. These threat levels, high or low, will dictate the appropriate course of action in regards to how the manufacturing threat is addressed.

4.4.1 Determination Of Manufacturing Threat

As part of the analysis by the SME, a determination of the threat level will be made. These relative threat levels are classified as "Not a Threat", "Low", or "High". The conclusion of "Low" or "High" will dictate the appropriate course of action in regards to how the construction threat is addressed.

The process flow diagrams (Figures 3-0, 3-1, 3-2, 3-3, 3-4) in Appendix A have been developed to identify if there is a potential for a manufacturing threat, and if so, to determine whether the threat level is high or low. Figure 3-0 is a first pass filter to determine the threat level and if further assessment is required. When further threat assessment is required, Figures 3-1, 3-2, 3-3, 3-4 need to be used to evaluate the threat. If, for any covered segment, the determination is "low potential threat", then no other action will be required for that segment unless new data relating to the threat of manufacturing causes a re-evaluation of the risk factors. In the event of a re-evaluation, updating of the program will occur through a defined process. Otherwise, if conditions exist that create a "High" potential manufacturing threat it is necessary to follow the processes defined in the applicable figure(s). The process diagrams identify the risk, assessment method and mitigation actions necessary to remove or minimize the threat.

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4.4.1.5 Potential Threat Due To Hard Spots

When the process flow chart in Figure 3-0 indicates a threat may exist, the process flow diagram in Figure 3-4 in Appendix A is used to determine if

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the material poses a potential threat in terms of operational seam failures. If the material poses a potential threat, the flow diagram also indicates the assessments and/or mitigative actions to be performed.

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5.0 INTEGRITY ASSESSMENT

When the risk assessment of a covered segment indicates that there is a "high" relative threat potential due to manufacturing imperfections, then these segments will be identified and subjected to an Integrity Assessment. An integrity assessment will be conducted for each covered segment where the manufacturing threat has been identified as a "high" relative risk and the threat is not effectively mitigated.

5.1 Assessment Methods

5.1.1 In-Line Inspection

In-line inspection (ILI) is an integrity assessment method used to locate and preliminarily characterize indications in a pipeline. The effectiveness of the ILI tool used depends on the condition of the specific pipeline section to be inspected and how well the tool matches the requirements set by the inspection objectives. ILI tools capable of assessing material defects (including, seam integrity and seam corrosion) consist of the following:

- Magnetic Flux Leakage, High Resolution Tool (has the potential to identifying corrosion along seam)
- Magnetic Flux Leakage, Dual magnetization Tool (for identifying hard spots)
- Ultrasonic Shear Wave Tool (for identifying seam defects, including cracking)
- Transverse Flux Tool (for identifying groove corrosion and potentially seam weld defects and seam weld cracks)
- EMAT (for identifying groove corrosion and potentially seam weld defects and seam weld cracks)

The effectiveness of ILI depends upon the technology that the tool employs. The amount of information available from each tool will vary. Therefore, it is important

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to select the appropriate tool for the type and amount of information sought. SOP #9-2010, "In-line Tool Pipeline Inspection", is utilized for guidance in tool selection, inspection procedures, data handling and investigation time frames.

Screening of the information from the ILI tools is required in order to determine the time frame for examination and evaluation. The indications will be classified as immediate response, scheduled response or monitored.

- Immediate response indications are those that might be expected to cause immediate or near–term leaks or ruptures based on their known or perceived effects on the strength of the pipeline.
- Scheduled response indications are suitable for continued operation without immediate response provided that they are not expected to grow to critical dimensions prior to the scheduled response.
- Monitored indications do not require examination before the next integrity assessment provided that they are not expected to grow to critical dimensions prior to the scheduled date of that assessment.

Once the anomalies have been characterized, the pipe will be scheduled for examination in accordance with the SOPs.

5.1.2 Pressure Test

Pressure testing is another integrity assessment method while also serving as a strength test and a leak test. The effectiveness of the method depends on the test pressure. Pressure testing can identify immediate failures and also establish the maximum remaining flaw size. SOP #5-3050, "Pressure Testing" contains details for conducting pressure test. Any section of pipe that fails a pressure test shall be examined in order to evaluate the nature of the failure and whether a material related defect contributed to the failure. If the failure was due to another threat, the test failure information must be integrated with other information relative to the other threats and the covered segment re-assessed for risk. The data gathered during this process will be stored electronically and utilized in the applicable pipeline integrity assessment.

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5.1.4 Other Integrity Assessment Methodologies

For prescriptive based integrity management programs, the alternative integrity assessment shall be an industry recognized methodology and be approved and published by an industry consensus standard organization. These other integrity assessment methods may include the use of in-line inspection technology utilizing dual magnetization levels to discriminate localized hard spots in the pipe body…

5.2 Selecting Assessment Method

The selection of the appropriate assessment methodology(s) to verify the integrity of the Company pipeline system will be dependent upon the integrity threat of concern and the physical limitations of the particular section of pipeline.

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5.2.4 Potential Threat Due To Hard Spots

For hard spot threats, as per the process flow diagram (Figure 3-4), the assessment will be performed utilizing one of the following methods:

- ♦ Pipeline In-line Inspection (capable of assessing hard spots)
- ♦ Pressure Testing
- ♦ Direct NDE Examination (100% of segment length)

6.0 RESPONSE AND MITIGATION (REPAIR AND PREVENTION)

Examination, evaluation, and mitigation (i.e., repair and prevention) actions shall be selected and scheduled to achieve risk reduction where appropriate in each covered segment and be in compliance with the Company's Standard Operating Procedures (SOPs). Analyses of completed, existing, and newly implemented mitigation measures will be carried out to evaluate their effectiveness and justify their use in the future.

Remediation techniques are case specific and dependent on the results of an integrity assessment. Examples of possible remediation techniques include:

- Remediation of the outside force as detailed in Threat Response Guidance Documents - Section 490, "Weather and Outside Forces".
- Lowering of operating pressure in accordance with SOP #9-4020, "Defect Assessment & Repair Options for External Corrosion" and repair of the defect by grinding, welded encirclement sleeve, Clock Spring®, direct deposit welding techniques, or replacement of a

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section of pipeline, as appropriate.

- Removal and replacement of facilities.

In some situations, additional assessments such as pressure testing or in-line inspection may be determined to be necessary.

The Defect Assessment & Repair Options SOPs are to be followed in the determination of the most appropriate remediation technique(s) on a case by case basis. The repair options are "general" guidelines designed to be applicable over a broad range of defects. Specific situations may exist where alternative repair methods are appropriate. Region Technical Management should contact Houston Pipeline Integrity for authorization when alternative repair methods are being considered.

All integrity assessment and mitigation activities shall be documented for performance measurement and retained in the event future re-assessments are required. Data gathered from the response and mitigation activities will be incorporated into the risk assessment process. If the data confirms that the manufacturing threat is stable then the Region Pipeline Integrity group should identify the conditions that would prompt re-evaluation.

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6.1 Threat Management

Since manufacture threat is influenced by many aspects from the steel production process to cathodic protection of the in-service pipeline, the manufacturing threat has to be managed considering the specific anomaly being addressed. The manufacturing threat is managed by:

- Material specifications that meet or exceed international consensus standards
- Material selection that is appropriate for the environment
- Vendor approval process
- Material inspection process during manufacturing, prior to shipping, when received, and prior to installation
- Construction pressure testing procedures
- Minimization of movement for susceptible pipe segments

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- Pressure testing or other integrity testing when raising MAOP or when raising operating pressure above the 5-year highest historical operating pressure
- Minimization of frequent cyclic stresses

There are regulatory requirements that help define the management of the manufacturing threat which include:

- 49 CFR 192, Subpart B – Materials
- 49 CFR 192, Subpart C – Pipe Design
- 49 CFR 192, Subpart D – Design of Pipeline Components

In addition to the regulatory requirements, there are industry codes and standards that provide guidance to the Company:

- ASME B31.8 – Gas Transmission and Distribution Piping Systems
- ASME B31.8S – Managing System Integrity of Gas Pipelines
- Various consensus standards and recommended practices issued by Standards Development Organizations such as AGA, API, ASME, ASTM, MSS, NACE, NFPA, etc.

In addition to regulations, codes, and standards, the Company has policies and procedures addressing manufacturing threat and are described in the following manuals:

- Engineering Standards
- Operations and Maintenance Manual
- Stock pipe specifications
- Approved vendors
- Material specifications

Other operations and maintenance practices that have been used to gain manufacturing threat information about the pipeline include:

- Annual review of actual operating pressures compared to MAOP for pre-1970 pipe to ensure pressure of HCA susceptible HCA segments is not raised above "5 year highest historical operating pressure".
- Uprating process to ensure that pressure testing will be used when uprating MAOP

of certain pipe vintages.

- Process for determining susceptibility of certain pre-1970 pipe to movement or low temperature.
- Process for raising operating pressures above the 5-year highest historical operating pressure.

6.2 Schedule Of Responses To Indications – All Assessment Methods

The Company will take prompt action to evaluate all anomalous conditions and remediate those that could reduce the pipeline's integrity. Upon review of the data, the SME will determine the appropriate response time to any hazards identified along the pipeline right-of-way.

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6.3 Schedule For Evaluation And Remediation

When an assessment is conducted, the Company will follow the guidance in ASME B31.8.S Section 7.

6.3.1 Immediate Repair Conditions

For the following conditions, the operating pressure must be temporarily reduced or the pipeline shut down until the operator completes the repair:

- Predicted failure pressure < 1.1 MAOP
- "Any anomaly that in the judgment of the person designated by the operator to evaluate the assessment results requires immediate action."

6.3.2 One Year Conditions:

The Company will remediate any of the following within one year of discovery of the condition:"

- Any condition in the opinion of the SME that requires remediation within a year.

6.3.3 Monitored Conditions:

The Company will record and monitor the conditions during subsequent risk assessments and integrity assessments for any change that may require remediation:

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- Any condition in the opinion of the SME that requires additional monitoring.

6.3.4 Excavation And Direct Examination Schedule

The schedule for excavation and direct examination of indications found during assessments will comply with the above requirements listed and will be based on the following:

- Characterization of defect indications.
- The level of mitigation required.
- The mitigation and prevention methods to be used.
- The useful life of the data.

6.4 Response to In-Line Inspection

Any manufacturing related anomaly identified during an in-line inspection should be evaluated to determine an appropriate response. The evaluation should be documented along with the response to be performed. The severity of the anomaly needs to be considered along with the method of in-line inspection used that identified the anomaly.

6.5 Response To Pressure Testing

Any anomaly that fails a pressure test shall be replaced in accordance with Company SOPs. A determination of the failure mechanism will be completed before pressure testing is resumed. In addition, a determination will be made as to whether or not pressure testing is the appropriate assessment technique for the threat in this segment.

6.6 Repair Methods

All defects requiring remediation will be repaired in accordance with SOP #9-5010, “Pipeline Repair Procedures”. An appropriate repair method shall be selected by Region Technical Staff and approved by a SME.

6.7 Prevention Options

The best preventive measures for minimizing the potential threat of manufacturing defects is through the development of standards, specification and Quality Control programs to ensure they do not exist. In addition, the ongoing operation and maintenance activities that the Company employs have provisions for dealing with line pipe vintage and other manufacturing issues when encountered.

7.0 ASSESSMENT INTERVAL

ASME B31.8 Section A, 4-7 states: "Periodic assessment is not required. Changes to the segment or changes in land use may drive re-assessment." After the annual review of HCAs, any new or extended HCA will be accessed to determine if a manufacturing threat exists. The review will be documented and if a HCA is identified as being susceptible to a manufacturing threat, a risk assessment will be performed.

Conditions that potentially could warrant additional assessment include:

- A plan to increase the MAOP of the pipeline.
- A plan to operate at a pressure higher than the five (5) year highest historical operating pressure.
- A change in aggressiveness of pressure cycles.
- A manufacturing related in-service failure.
- New threat related information.
- Outside Force conditions change requiring additional assessment.
- Monitoring methods found to be in-effective.
- Any other change in the opinion of the SME that requires additional assessments.

8.0 PERFORMANCE MEASURES

Evaluations shall be performed semi-annually to provide a continuing measure of the integrity management program effectiveness over time with respect to manufacturing threats.

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8.2 Audits

The Company will conduct periodic audits to validate the effectiveness of the integrity management program and ensure compliance with this written plan. The auditors will include Company personnel or consultants not directly involved in implementing the integrity management program. The results from these audits shall be documented as described in the QA/QC plan.

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8.4 Continuous Performance Improvement

The results of the performance measurements and audits will be utilized to modify the integrity management program as part of a continuous improvement process. Recommendations for changes and/or improvements to the integrity management program will be based on the performance measures and audits. The results, recommendations, and resultant changes made to the integrity management program will be documented.

9.0 MANAGEMENT OF CHANGE

In order to implement any changes to the Company damage prevention plan, the changes must be communicated to the appropriate personnel. This is done to ensure that there is the appropriate level of awareness throughout the organization. The persons who will need to be informed of these actions are the following:

- Area Manager
- Area Supervisor
- Director, Technical Operations
- Manager, Pipeline Integrity - Region
- Director, Pipeline Integrity - Houston

It is also essential that any information gained related to third party risks or damage prevention within a particular operating location be shared throughout the Company. This will be done through the Data Management Plan.

If changes to any SOP are required, the appropriate Area or Region personnel will follow the Management of Change Plan (MOC) to request that a change needs to be made. The Pipeline Integrity Oversight Committee will be responsible for assigning the appropriate personnel to make the change. Area specific changes are also detailed in the MOC Plan.

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REFERENCES

1 ASME B31.8S

2 Clark, E. B., Leis, B. N., Eiber, R. J., "Integrity Characteristics of Vintage Pipelines," Battelle Report to the INGAA Foundation, October, 2004.

3 Dealing with Low Frequency Welded ERW Pipe and flash welded pipe with respect to HCA related Integrity Assessments. By: John F. Kiefner, ETCE 2002, ASME Engineering Technology Conference on Energy, 2002

4 Kiefner, J. F., and Rosenfeld, M. J., "Effects of Pressure Cycles on Gas Pipelines," GRI Report-04/0178, September, 2004.

5 Kim, C. D., "Hydrogen-Damage Failures", Metals Handbook, Ninth Edition, Volume 11, Failure Analysis and Prevention, p 245.

6 Groeneveld, T. P., "Hydrogen Stress Cracking", 5th Symposium on Line Pipe Research, American Gas Association, Inc., Catalogue No. L30174, p X-1 (1974).

7 Warman, D. J., Rosenfeld, M. J., "Effects of Pressure Cycles on Duke Energy Gas Transmission System," Kiefner and Associates, Inc., June, 2006.

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Appendix A

Process Flow Diagrams

Process to Determine if there is a Potential Manufacturing Threat

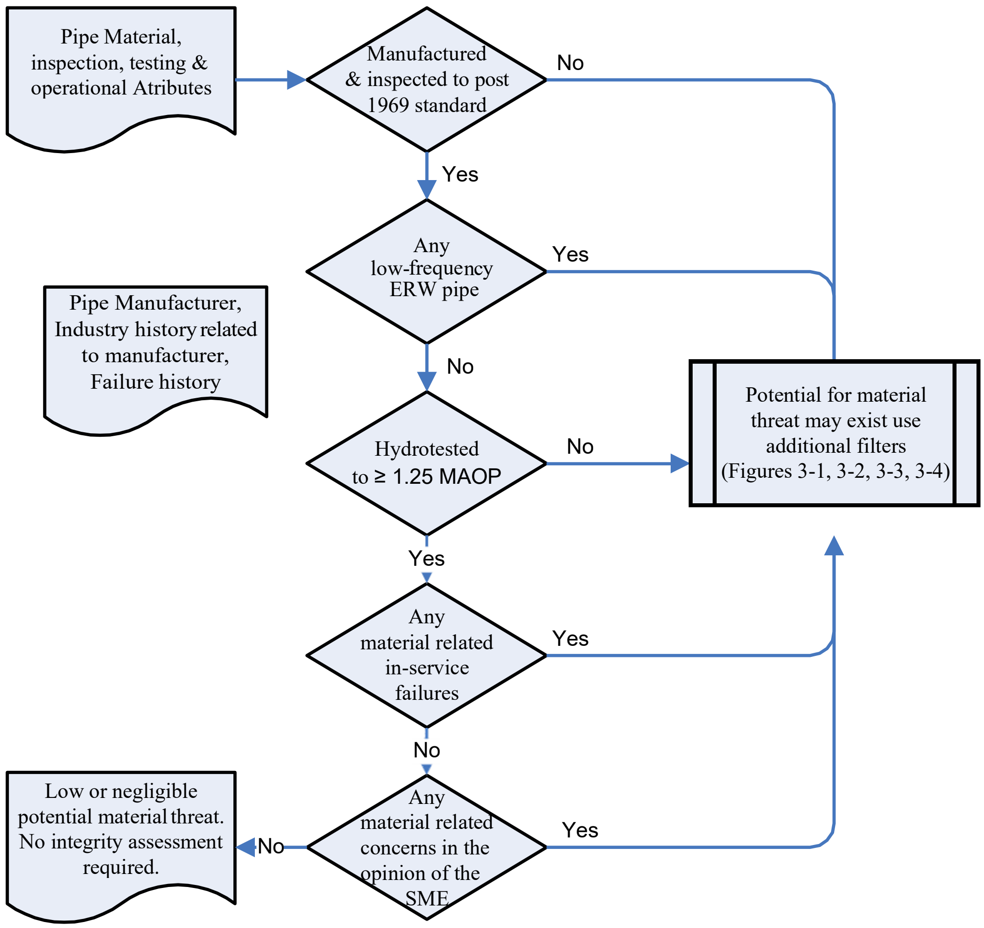

Figure 3-0

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Revision Date: May 13, 2013

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Process Flow Diagram for Identifying Hard Spots Threats and Subsequent Action Plan in HCA Covered Segments

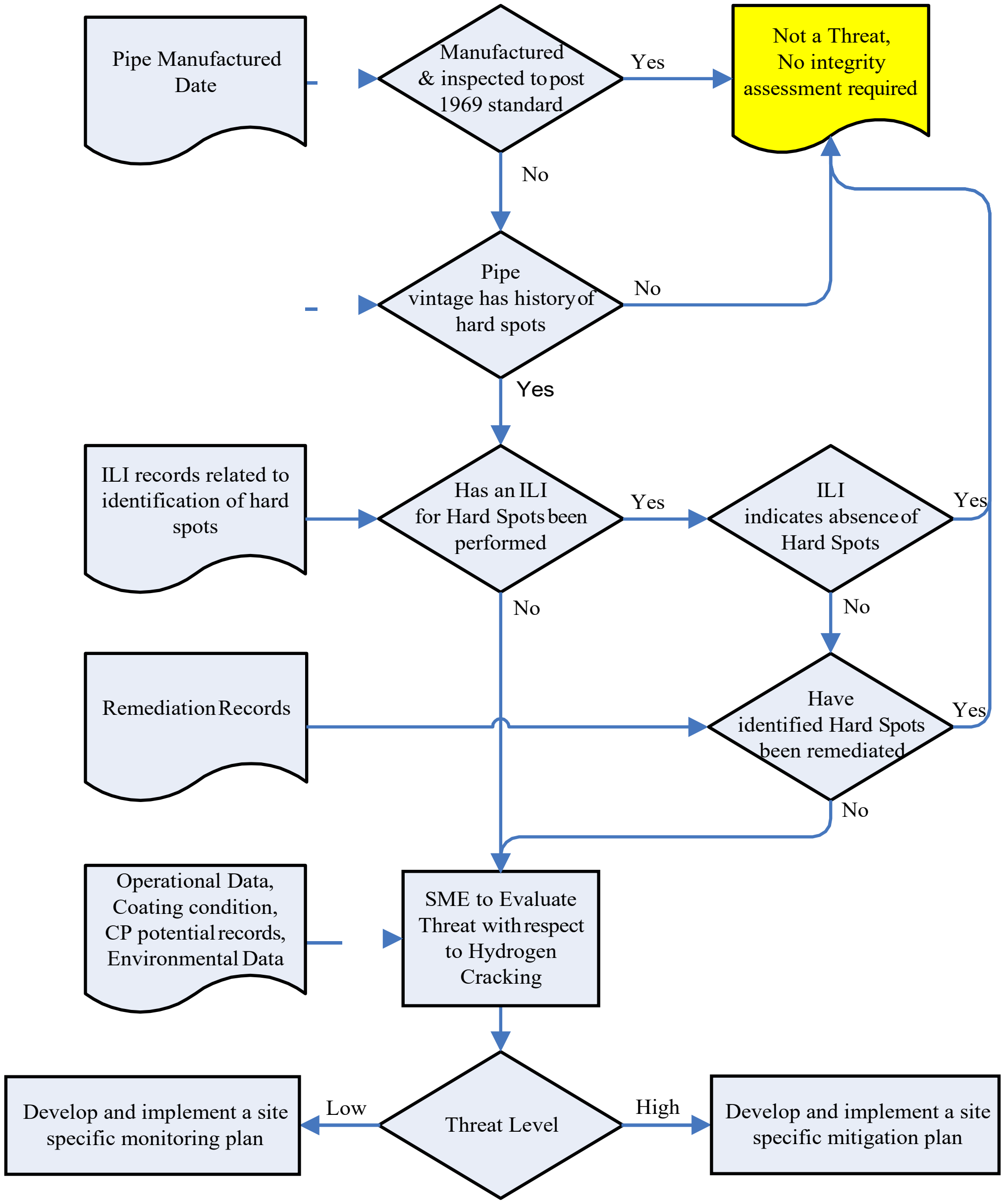

Figure 3-4

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