# EVALUATION REPORT OF LIQUID PIPELINE CONSTRUCTION

**Unless otherwise noted, all code references are to 49CFR Part 195. S – Satisfactory U – Unsatisfactory N/A – Not Applicable N/C – Not Checked**
**If an item is marked U, N/A, or N/C, an explanation must be included in this report.**

A completed **Standard Inspection Report** is to be submitted to the Director within 60 days from completion of the inspection. A **Post Inspection Memorandum (PIM)** is to be completed and submitted to the Director within 30 days from the completion of the inspection, or series of inspections, and is to be filed as part of the **Standard Inspection Report.**

| **Inspection Report** | | **Post Inspection Memorandum** | |
|---|---|---|---|
| **Inspector/Submit Date:** Southwest Region | | **Inspector/Submit Date:** | |
| | | **Peer Review/Date:** | |
| | | **Director Approval/Date:** | |

| **POST INSPECTION MEMORANDUM (PIM)** | | | |
|---|---|---|---|
| **Name of Operator:** | TransCanada Oil Pipeline Operations Inc. | **OPID #:** | 32334 |
| **Name of Unit(s):** | Keystone Gulf Coast Pipeline North / Keystone Gulf Coast Pipeline South | **Unit #(s):** | 74979,83245 |
| **Records Location:** | Transcanada Sharepoint site, Contractor offices, Transcanada Office | **Activity #** | 135840 & 140666 |
| **Unit Type & Commodity:** | Interstate Liquids (Crude) | | |
| **Inspection Type:** | Construction | **Inspection Date(s):** | 2011-2014 |
| **PHMSA Representative(s):** | Clint Stephens /Jon Manning /James Arnold / Noah Matthews/Barry Small/ Bill Lowry/ Basim Bacenty/ Joseph Elmer/ David Eng/ John Pepper | **AFO Days:** | 165.9 |


**Summary:**

**The final report consists of three parts:**

1. **Form 7**
2. **Appendix A: Construction Summary**
3. **Appendix B: Review of 57 Conditions**

Transcanada Keystone Pipeline LP, notified PHMSA in a letter dated September 30, 2011 of the construction of the Keystone Gulf Coast Pipeline starting in Q1 of 2012. The construction of the Keystone began in 2011 and was commissioned in 2014. Since 2011 until the commissioning of the pipeline on January 22, 2014, PHMSA, Southwest Region conducted onsite inspections and reviewed documents which include construction specifications, construction inspection reports, welding qualifications,etc.,, submitted by Transcanada. A total of 165.9 AFO days and 53.35 non-AFO days were spent on the Transcanada construction project.

In addition, Transcanada ran an in-line inspection caliper/deformation tool and conducted a DCVG survey of their entire Keystone Gulf Coast Pipeline to access any pipeline or coating damage during construction and backfilling activities. Transcanada completed the tool run and DCVG survey and found anomalies which were repaired. PHMSA witnessed part of the tool run and DCVG survey and reviewed the repair methods and records.

Transcanada submitted their Commissioning Plan to PHMSA for review before commencing commissioning/line fill activities. Line fill began in December 2014 and commenced on January 21, 2014. PHMSA engineers/inspectors were onsite to verify commissioning plan was being followed and to witness the testing of pump station alarms, valve operation and SCADA operations. On January 22, 2014 Transcanada commissioned the pipeline.

Daily reports were submitted by each engineer/inspector to document the daily construction activities observed during the inspections. The engineers/inspectors moved around the various construction activities throughout the day depending on the logistics and activities being performed. The primary focus for the engineer/inspector is to observe construction activities and gather and compile all pertinent documentation to assure regulatory compliance with 49 CFR Part 195.

All daily reports, specifications, maps, and any other information gathered by PHMSA is located in the PHMSA "P" drive Construction Folder under "Transcanada Keystone Gulf Coast Pipeline North Final Construction Report".

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**Findings:**
There were two Warning Letters, 4-2013-5017W and 4-2013-5021W, sent to Transcanada for non-compliance issues. The issues were:

.202- Warning letter 4-2013-5017W was sent to Transcanada on September 10, 2013 for not following their Construction Specifications to protect the coating from damage due to welding spatter.

.246(a) – Warning letter 4-2013-5017W was sent to Transcanada on September 10, 2013 for not following Construction Specifications when installing foam pillows to minimize external stresses on the pipe.

.214(a) and (b) -Warning Letter 4-2013-5021W was sent to Transcanada on September 26, 2013, for failing to perform welding on Spread 3 in accordance with a procedure qualified according to Section 5 of API 1104. Procedure KXL-SMAW-ML had revisions to essential variables which was not requalified.

.222(a) and (b) – Warning Letter 4-2013-5021W was sent to Transcanada on September 26, 2013, for failing to properly qualify welders on Spread 3 in accordance with Section 6 of API 1104. Procedure KXL-SMAW-ML had revisions to essential variables which the welders were not qualified to perform.

Transcanada responded to the Warning Letters and are located in the CPF Southwest Region files.

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| | | | |
|---|---|---|---|
| **Name of Operator:** | TransCanada Oil Pipeline Operations Inc. | | |
| **OP ID No.** [1] | 32334 | **Unit ID No.** [1] | 74979 and 83245 |
| **HQ Address:** | | **System/Unit Name & Address:** [1] | |
| 717 Texas Street<br>Houston, TX 77002 | | 717 Texas Street<br>Houston, TX 77002 | |
| **Co. Official:** | Mr. Vern Meier | **Activity Record ID No.:** | 140666 and 135840 |
| **Phone No.:** | 832-320-5505 | **Phone No.:** | 832-320-5462 |
| **Fax No.:** | 832-320-6462 | **Fax No.:** | 832-320-6462 |
| **Emergency Phone No.:** | 800-447-8066 | **Emergency Phone No.:** | 800-447-8066 |

| Persons Interviewed | Title | Phone No. |
|---|---|---|
| Dan Cerkoney | Manager Regulatory Compliance Major | 713-693-6466 |
| Transcanada Inspectors | | |
| Michels Pipeline Construction Personnel | | |
| Sunland Construction Personnel | | |
| Meera Kothari | Engineer | 713-693-6466 |
| | | |
| | | |
| | | |
| | | |

| | | | |
|---|---|---|---|
| **PHMSA Representative(s)** [1] | Jon Manning, Jim Arnold, Agustin Lopez, Clint Stephens, Noah Matthews, Barry Small | **Inspection Date(s)** [1] | 2011-2014 |
| **Company System Maps** (Copies for Region Files): | Maps are located in the PHMSA "P" Drive | | |

**Description of Construction** [1]

The Keystone Gulf Coast pipeline consists of 485 miles of 36 inch X70 pipe ranging in wall thickness (.465,.515,.572,.618, and .748). The pipeline starts at the TransCanada Keystone Cushing Terminal in Lincoln County Oklahoma and terminates at the Terminal Facilities in Nederland, Jefferson County Texas. The pipeline transports crude oil from Cushing, OK to Nederland, TX where it ties into the Sunoco Terminal.

Spread 1 Contractor- Michels Pipeline Construction, MP 0.00 to 195.00
Spread 2 Contractor- Michels Pipeline Construction, MP 195.00 to 371.70
Spread 3 Contractor- Sunland Construction, MP 371.70 to 484.57

10 Pump Stations
PS-32, Cushing South, MP 0.00
PS-33, Cromwell, MP 49.21
PS-34, Tupelo, MP 95.70
PS-35, Bryan, MP 147.77
PS-36, Delta, MP 194.88
PS-37, Winnsboro, MP 238.96
PS-38, Lake Tyler, MP 284.62
PS-39, Lufkin, MP 338.74
PS-40, Corrigan, MP 380.9
PS-41, Liberty, MP 435.52

The Southwest Region inspected the pipeline in accordance with both the 57 Special Permit conditions and according to 49 CFR Part 195 regulations.

[1] Information not required if included on page 1.

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| PIPE SPECIFICATIONS | | |
|---|---|---|
| **.51** | .112 | Steel Pipe |
| | ▪ Manufacturer: | Welspun (Little Rock, AR) – spiral, llva (Taranto, IT) – long seam |
| | ▪ Manufacturing Standard: | API 5L PSL2 X70M 44th Edition |
| | ▪ Pipe Grade: | X70 |
| | ▪ Outside Diameter (D): | NPS 36 |
| | ▪ Wall Thickness (t): | • 0.465 – Line Pipe (FBE) (PMSA 57 Conditions 1-9)<br>• 0.515 – HCA (FBE)<br>• 0.572 – Downstream of Corrigan Pump Station (FBE)<br>• 0.618 – Road Bore (FBE/ARO)<br>• 0.748 – HDD (FBE/ARO) |
| | ▪ Type of Longitudinal Seam: | Long Seam and Spiral Seam |
| | ▪ Specified Min. Yield Strength (S): | 70,000 |
| | ▪ Joint Design - Bevel: | V groove |
| | ▪ External Coating: | FBE |
| | ▪ Internal Coating: | N/A |
| | ▪ Minimum Joint Length: | Minimum of 8' typical double joints 76' |
| | ▪ Footage or Miles: | 485 miles |

**Comments:**
Pipe was stamped with the specifications and was verified in the construction inspections. Mill test reports were submitted to PHMSA to verify pipe specifications.

| .100 | DESIGN REQUIREMENTS | | | S | U | N/A | N/C |
|---|---|---|---|---|---|---|---|
| | .102 | Check temperature rating (particularly if this is a CO2 line). | | X | | | |
| | .104 | All components are consistent with pressure rating. (consider MOP changes along PL) | | X | | | |
| | .106 | Pipeline design formula: **P = (2St/D) x F x E x T**<br>F = .72 most cases<br>F = other, Special Permit (typically 0.8)<br>F = 0.6 offshore platform, risers, inland navigable waters<br>F = 0.54 cold expanded to meet minimum SMYS | | X | | | |
| | .108 | External design pressure. | | X | | | |
| | .110(a) | Design pipeline system to anticipated external loads, e.g., earthquakes, vibration, thermal expansion, and contraction. Follow section 419 of ASME/ANSI B31.4 for expansion and flexibility. | | X | | | |
| | .110(b) | Pipe/components supported in a manner to minimize localized stresses. Compute and compensate for stresses to the pipe wall caused by attachments to the pipe. | | | | | |
| | .111 | CO2 lines must be designed to mitigate fracture propagation | | | | X | |
| | .112(b) | Pipe manufactured in accordance to API or ASTM. | | X | | | |
| | .112(c) | Mark each length of pipe **≥ 4½ inches OD** to indicate SMYS or grade, pipe size, and specification. | | X | | | |
| | .114 | Used pipe installed in a pipeline system must comply with **§195.112(a) and (b)** and the following: | | | | | |
| | | ▪ | Known API or ASTM specification, seam joint factor determined IAW .106(e), unknown yield or wall thickness IAW .106(b) or (c) as appropriate. | | | X | |
| | | ▪ | Free of buckles, cracks, grooves, gouges, dents, corroded areas, or other surface defects that exceed the maximum depth. | | | X | |
| | | ▪ | Depth of the corroded areas - is the remaining wall thickness equal to or greater than the minimum required by the tolerance in specifications, or MOP reduced. | | | X | |
| | .116 | Valves installed in the pipeline system must comply with the following: | | | | | |
| | | (a) | ANSI/API Spec 6D, 23rd edition April 2008, and errata 3 (2009) | X | | | |
| | | (b) | Compatible with the pipe or fittings to which the valve is attached. | X | | | |
| | | (c) | Compatible with carbon dioxide or each hazardous liquid the pipeline may carry. | X | | | |

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| .100 | DESIGN REQUIREMENTS | | | | | S | U | N/A | N/C |
|---|---|---|---|---|---|---|---|---|---|
| | | | (d) | | Both hydrostatically shell and seat tested without leakage.(Sect. 11 API 6D) | X | | | |
| | | | (e) | | Equipped with a means for clearly indicating valve position (open, closed, etc). | X | | | |
| | | | (f) | | Marked on the body or nameplate with the following: | | | | |
| | | | | (1) | Manufacturer's name or trademark. | X | | | |
| | | | | (2) | Class designation or maximum working pressure. | X | | | |
| | | | | (3) | Body material. | X | | | |
| | | | | (4) | Nominal size. | X | | | |
| | | .118(a) | Butt-welding type fittings meet marking, end preparation, and bursting requirements of **ANSI B16.9, (December 2007 edition)**, or **MSS SP-75-2004.** | | | X | | | |
| | | .118(b) | Fittings must be free of any buckles, dents, cracks, gouges, or other defects that might reduce strength. | | | X | | | |
| | | .118(c) | Fittings must suitable for the intended service and at least as strong as the pipe and other fittings in the pipeline system to which it is added. | | | X | | | |
| | | .120 | New and replaced line pipe, valve, fitting, or other line component designed and constructed to accommodate the passage of instrumented internal inspection devices. | | | X | | | |

**Comments:**
**.111- Pipeline is not a CO2 line.**

**.112(b) - Pipe was manufactured to API 5L 44th edition (PSL 2). A portion of the Gulf Coast Pipeline was manufactured at the Welspun facility in Little Rock, AR., and was inspected by PHMSA/Southwest.**

**.114 – There will be no used pipe installed on the Gulf Coast Pipeline.**

**Design of fittings and valves were verified during the field inspections. PHMSA examined the fitting and valves in the field at the pipe yard and after installation of the valves.**

| .200 | CONSTRUCTION REQUIREMENTS | | | | S | U | N/A | N/C |
|---|---|---|---|---|---|---|---|---|
| | **SPECIFICATIONS** | | | | | | | |
| | .202 | | | Comprehensive written construction specifications. | | X | | |
| | .204 | | | Qualified inspector performing inspections. | X | | | |
| | .206 | | | Materials visually inspected at site of installation for damage or service impairment | X | | | |
| | .207 | | | Pipe transported in accordance with API RP 5L1 (6th edition, July 2002), or 5LW (2nd edition effective March 1, 1997), as applicable | | | | X |
| | .208 | | | Supports and braces not welded to the pipe operating above 100 p.s.i. | X | | | |
| | .210(a) | | | Pipeline ROW selected to avoid areas containing private dwellings, industrial buildings, and places of public assembly. | X | | | |
| | .210(b) | | | Pipeline located within **50 feet** of any private dwelling, industrial building, or place of public assembly provided with at least an **additional 12 inches of cover**. | X | | | |
| | .212(b) | | | Field bends cannot be wrinkle bends and made in compliance with: | | | | |
| | | (1) | | Not impair serviceability. | X | | | |
| | | (2) | | Smooth, free from buckles, cracks, or mechanical damage. | X | | | |
| | | (3) | | Longitudinal weld near neutral axis unless - an internal bending mandrel is used; or pipe is **≤ 12 ¾ inches** or **D/t ratio is less than 70%**. | X | | | |
| | **INSTALLATION OF PIPE** | | | | | | | |
| | .246(a) | | | Pipe installed to minimize stresses and protect the pipe coating from damage. | | X | | |
| | .248(a) | | | Installed with appropriate cover and below cultivation (refer to table below) | X | | | |

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| .200 | CONSTRUCTION REQUIREMENTS | | | S | U | N/A | N/C |
|---|---|---|---|---|---|---|---|

| Location | Cover (inches) For Normal Excavation | Cover (inches) For Rock Excavation[1] |
|---|---|---|
| Industrial, commercial, and residential areas | 36 | 30 |
| Crossings of inland bodies of water with a width of at least 100 ft from high water mark to high water mark | 48 | 18 |
| Drainage ditches at public roads and railroads | 36 | 36 |
| Deepwater port safety zone | 48 | 24 |
| Gulf of Mexico and its inlets in water less than 15 ft deep as measured from the mean low tide. | 36 | 18 |
| Other offshore areas under water less than 12 ft deep as measured from the mean low tide. | 36 | 18 |
| Any other area | 30 | 18 |
| Additional cover required by 195.210. | As Above + 12 | As Above + 12 |

[1] Rock excavation is defined as any excavation that requires blasting or removal by equivalent means.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | .248(b) | | If minimum cover prescribed above cannot be attained because it is impracticable to do otherwise additional protection being provided as required | X | | | |
| | .250 | | **12 inches** of clearance between the pipeline and any other underground structure. | X | | | |
| | .252 | | Backfilling performed in a manner that provides firm support for the pipe and does no damage to the coating | X | | | |
| | .256 | | Pipe at each railroad or highway crossing installed so as to adequately withstand the dynamic forces exerted by anticipated traffic loads. | X | | | |
| | | | **VALVES** | | | | |
| | .258(a) | | Install valve in a location, accessible to authorized employees and protected from damage or tampering. | X | | | |
| | .258(b) | | Each submerged valve located offshore or in inland navigable waters must be marked, or located by conventional survey techniques, to facilitate quick location when operation of the valve is required. | | | X | |
| | .260 | | Valves installed at each of the following locations: | | | | |
| | | (a) | On the suction end and discharge end of a pump station in a manner that permits isolation of the pump station equipment in the event of an emergency. | X | | | |
| | | (b) | On each line entering or leaving a breakout storage tank area in a manner that permits isolation of the tank area from other facilities. | X | | | |
| | | (c) | On each mainline at locations along the pipeline system that minimizes damage or pollution from accidental hazardous liquid discharge, as appropriate for the terrain in open country, for offshore areas, or for populated areas. | X | | | |
| | | (d) | On each lateral takeoff from a trunk line in a manner that permits shutting off the lateral without interrupting the flow in the trunk line. | X | | | |
| | | (e) | On each side of a water crossing that is more than 100 feet wide from high-water mark to high-water mark unless a waiver has been granted for a particular case where valves not are justified. | X | | | |
| | | (f) | On each side of a reservoir holding water for human consumption. | X | | | |

**Comments:**

**.202- Warning letter 4-2013-5017W was sent to Transcanada on September 10, 2013 for not following their Construction Specifications to protect the coating from damage due to welding spatter.**

**.204 – The qualification records were checked for Chief Welding Inspector Ron Green.**

**.207 - TransCanada procedures for transporting pipe by rail is outlined in Condition 6 of the 57 Conditions, based on the Association of American Railroads (AAR) standard not API RP 5L1.**

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**Comments:**

**.246(a) – Warning letter 4-2013-5017W was sent to Transcanada on September 10, 2013 for not following Construction Specifications when installing foam pillows to minimize external stresses on the pipe.**

**.258(b) - There are no offshore or submerged valves installed in the entire pipeline system.**

| .200 | WELDING | | S | U | N/A | N/C |
|---|---|---|---|---|---|---|
| | .214(a) | Welding must be performed by qualified welders using qualified welding procedures. | | X | | |
| | | Welding procedures are qualified in accordance with Sec. 5 of API 1104 or Section IX of ASME Boiler & Pressure Code | | X | | |
| | | Welding procedures must be qualified by destructive testing. | | X | | |
| | .214(b) | Each welding procedure must be recorded in detail, including results of qualifying tests. | | X | | |
| | .222(a) | Welders must be qualified in accordance with **Section 6 of API Standard 1104 (**20th edition 2007, including errata 2008**)** or **Section IX of the ASME Boiler and Pressure Vessel Code** (2007 edition), except that a welder qualified under an earlier edition than listed in **' 195.3** may weld, but may not requalify under that earlier edition. | | X | | |
| | .222(b) | Welders may not weld with a particular welding process unless, within the preceding 6 calendar months, the welder has – (1) Engaged in welding with that process; and (2) Had one weld tested and found acceptable under Section 9 of API 1104. | | X | | |
| | .224 | Welding operations protected from weather conditions. | X | | | |
| | .226(a) | Arc burns require repair. | X | | | |
| | .226(b) | If a notch is not repairable by grinding, a cylinder of the pipe containing the entire notch must be removed. Do arc burn repair procedures require verification of the removal of the metallurgical notch by nondestructive testing? **(Ammonium Persulfate)**. | X | | | |
| | .226(c) | Ground not welded to pipe. | X | | | |
| | .228(a) | Welding must be inspected to insure compliance with the requirements of this subpart (line-up, pipe not in a bind, API 1104 requirements, welding procedures followed, etc). Visual inspections must be supplemented by nondestructive testing. | X | | | |
| | .228(b) | Except for cracks, acceptability of welds per **Section 9 or Appendix A, API 1104.** | X | | | |
| | .230(a) | Remove or repair cracks **≤ 8%**, remove cracks longer than **8%**. | X | | | |
| | .230(b) | Welds repaired, remove defect down to clean metal, preheat pipe, and assure acceptability. | X | | | |
| | .230(c) | Repairs in a previously repaired area must be in accordance with qualified written welding procedures and mechanical properties of the repaired weld equal to those specified for the original weld. | X | | | |

**Comments:**
**.214(a) and (b) -Warning Letter 4-2013-5021W was sent to Transcanada on September 26, 2013, for failing to perform welding on Spread 3 in accordance with a procedure qualified according to Section 5 of API 1104. Procedure KXL-SMAW-ML had revisions to essential variables which was not requalified.**

**.222(a) and (b) – Warning Letter 4-2013-5021W was sent to Transcanada on September 26, 2013, for failing to properly qualify welders on Spread 3 in accordance with Section 6 of API 1104. Procedure KXL-SMAW-ML had revisions to essential variables which the welders were not qualified to perform.**

**Welding qualifications, welder qualifications, and welding activities were reviewed by PHMSA either at the office or during the field inspections. Many locations were inspected during the construction of the pipeline in which welding was being performed.**

| .200 | NONDESTRUCTIVE TESTING OF WELDS | | S | U | N/A | N/C |
|---|---|---|---|---|---|---|
| | .228/.234 | Detailed written procedure established and qualified for nondestructive testing. | X | | | |
| | .234(b) | Nondestructive testing of welds must be performed: | | | | |
| | | (1) In accordance with written procedures for **NDT.** | X | | | |

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| .200 | NONDESTRUCTIVE TESTING OF WELDS | | S | U | N/A | N/C |
|---|---|---|---|---|---|---|
| | | (2) Radiographer trained and qualified. (Level II or better). | X | | | |
| | | (3) By a process that will indicate any defects that may affect the integrity of the weld | X | | | |
| | .234(c) | Procedures established for proper interpretation. | X | | | |
| | .234(d) | Nondestructively test **10%** of each welder's welds per day. | X | | | |
| | .234(e) | Test **100%** or **90%,** if impractical. | | | | |
| | | (1) Stream, river, lake, reservoir, or other body of water. | X | | | |
| | | (2) Within railroad or public road ROWs. | X | | | |
| | | (3) Overhead road crossings and within tunnels. | X | | | |
| | | (4) Within the limits of any incorporated subdivision. | X | | | |
| | | (5) Within populated areas such as residential subdivisions. | X | | | |
| | .234(f) | **100%** of all girth welds nondestructively tested on used pipe. | | | X | |
| | .234(g) | Test **100%** of girth welds at tie-ins. | X | | | |

**Comments:**
**.234(f) There is no used pipe being installed.**
**All welds were NDT. PHMSA inspected the NDT of many welds during the field inspections. Records were also reviewed during field inspections, office visits, and in the office.**

| | CORROSION PROTECTION REQUIREMENTS | | | S | U | N/A | N/C |
|---|---|---|---|---|---|---|---|
| | | .557 | Buried or submerged pipelines (constructed, relocated, replaced, or changed) must be externally coated prior to placing in service. See code for exceptions. | X | | | |
| | | **.561(a)** | All external pipe coating inspected just prior to lowering the pipe into the ditch | | X | | |
| | | **.561(b)** | Repair any coating damage discovered. | X | | | |
| | | .563(a) | Adequate cathodic protection of the system. | X | | | |
| | | | Cathodic protection system installed **1 year**. (refer. ADB note below) | X | | | |
| | | .567 | Sufficient number of test leads properly installed. | X | | | |

**Comments:**
**Transcanada reported to PHMSA that there were some pipe sections that may have had coating damage due to welding spatter when the pipe was lowered into the ditch. Transcanada became aware of the problem by reviewing Transcanada inspector reports. Transcanada excavated the approximately 23 identified pipe sections which may have had the damage and were examined. Transcanada examined the pipe sections and made appropriate repairs to the coating in accordance to their specifications. PHMSA witnessed some of the excavations and repairs. PHMSA issued Warning Letter-4-2013-5017W for not following their specifications.**

| .266 | CONSTRUCTION RECORDS | S | U | N/A | N/C |
|---|---|---|---|---|---|
| | Complete records showing the following: | | | | |
| | (a) Number of girth welds and number of nondestructively tested welds, including number and disposition of each rejected weld. | X | | | |
| | (b) The amount, location, and cover of each size of pipe installed | X | | | |
| | (c) The location of each crossing of another pipeline | X | | | |
| | (d) The location of each buried utility crossing | X | | | |
| | (e) The location of each overhead crossing | X | | | |
| | (f) The location of each valve and corrosion test station | X | | | |

**Comments:**
**PHMSA reviewed Transcanada's welding records and witnessed the NDT of many girth welds. Transcanada submitted documents and maps which displayed any pipe crossings, utilities and the size of pipe installed. Test stations are installed in accordance with Specification TES-CP-CS and standard drawings.**

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| .300 | PRESSURE TESTING | | | | S | U | N/A | N/C |
|---|---|---|---|---|---|---|---|---|
| | | .302(a) | Hydrostatic testing required: | | | | | |
| | | | 1. | The entire buried portion tested without leakage for **8 hours** | X | | | |
| | | | 2. | The above ground portion tested for at least **4 hours** (if visually inspected) | X | | | |
| | | .304 | Test pressure at least 4 continuous hours at a pressure equal to 125 percent, or more, of the MOP. If not visually inspected, at least an additional 4 hours at 110 percent of MOP. | | X | | | |
| | | .305 | Hydrostatically test all pipe and attached fittings, including components, (unless - if a component is the only item being replaced or added - manufacturer certifies hydrostatically tested at the factory) | | X | | | |
| | | .306 | Appropriate test medium | | X | | | |
| | | .308 | Pipe associated with tie-ins either pretested or hydrostatically tested in place | | X | | | |
| | | .310(a) | Hydrostatic test records retained for the life of the facility tested | | X | | | |
| | | .310(b) | Do the hydrostatic test records include the following: | | | | | |
| | | | (1) | Pressure recording charts | X | | | |
| | | | (2) | Test instrument calibration data | X | | | |
| | | | (3) | Operator's name, name of the person responsible for making the test, and the name of the test company used, if any | X | | | |
| | | | (4) | Date and time of the test | X | | | |
| | | | (5) | Minimum test pressure | X | | | |
| | | | (6) | Test medium | X | | | |
| | | | (7) | A description of the facility tested and the test apparatus | X | | | |
| | | | (8) | An explanation of any pressure discontinuities, including test failures, that appear on the pressure recording charts | X | | | |
| | | | (9) | Where elevation differences in the test section exceed **100 feet**, a profile of the pipeline showing the elevation and test sites over the entire length of the test section | X | | | |
| | | | (10) | Temperature of the test medium or pipe during the test period | X | | | |

**Comments:**

**Pressure testing was conducted in accordance with Specification TES-PROJ-LPCS-US. PHMSA inspected the hydrostatic testing during the field inspections and reviewed records at the Transcanada office.**

| .501-.509 | OPERATOR QUALIFICATION (OQ) FIELD VERIFICATION | S | U | N/A | N/C |
|---|---|---|---|---|---|
| | Operator Qualification - Use PHMSA Form 15 OQ Field Inspection Protocol Form if applicable. | X | | | |

# Appendix A  Construction Summary Report.

# Contents

**CONSTRUCTION SUMMARY**

TransCanada Keystone Pipeline LP, notified PHMSA in a letter dated September 30, 2011 of the construction of the Keystone Gulf Coast Pipeline starting in Q1 of 2012. PHMSA's construction oversight of the Keystone began in 2011 and the pipeline was commissioned in 2014. The Keystone Gulf Coast pipeline consists of 485 miles of 36 inch X70 pipe ranging in wall thickness .465, .515, .572, .618, and .748. The pipeline begins at the TransCanada Keystone Cushing Terminal in Lincoln County, Oklahoma and terminates at the Terminal Facilities in Nederland, Jefferson County Texas. The pipeline transports crude oil from Cushing, OK to Nederland, TX.

Since 2011 until the commissioning of the pipeline on January 22, 2014, PHMSA Southwest Region conducted onsite inspections and inspected documents which include: construction specifications, construction inspection reports, welding qualifications, pipe mill reports, hydrostatic test results, etc., submitted by TransCanada. A total of 165.9 AFO days and 53.35 non-AFO days were spent on the TransCanada construction project.

Daily reports were submitted by each engineer/inspector to document the daily construction activities observed during the inspections. The engineers/inspectors moved around the various construction activities throughout the day depending on the logistics and activities being performed. The primary focus for the engineer/inspector is to observe construction activities and gather and compile all pertinent documentation to assure regulatory compliance with 49 CFR Part 195.

All daily reports, specifications, maps, and any other information gathered by PHMSA are located in the PHMSA "P" drive Construction Folder under "TransCanada Keystone Gulf Coast Pipeline North Final Construction Report".

TransCanada submitted their Commissioning Plan to PHMSA for review prior to commencing commissioning line fill activities. Line fill began in December 2014 and concluded on January 21, 2014. PHMSA engineers/inspectors were onsite to verify that the commissioning plan was being followed and to witness the testing of pump station alarms, valve operation and SCADA operations. On January 22, 2014 TransCanada commissioned the pipeline.

## CONSTRUCTION OVERVIEW

The Southwest Region performed a construction inspection of the TransCanada Keystone Gulf Coast Pipeline from 2011 to 2014. The construction inspection consisted of multiple visits to TransCanada's office for review of specifications, procedures, records and to discuss ongoing construction activities. TransCanada provided a link to their external SharePoint to PHMSA to review records and specifications. In addition, the construction inspection consisted of onsite field inspections of ongoing construction activities. Several SW Region Engineers/inspectors visited the pipeline construction from Cushing, OK to Nederland, TX.

### Design Requirements

The pipeline used for the construction of the Keystone Gulf Coast project was manufactured by ILVA and Welspun in India and Little Rock, AR. PHMSA engineers/inspectors visited the Welspun pipe mill in Little Rock, AR to verify that the pipe was manufactured in accordance with API 5L and TransCanada's specifications. The inspection included a review of TransCanada's specifications and procedural QA/QC for pipe materials from the vendor (Welspun) at the mill location. Specifications, procedures & records were reviewed for completeness and compliance to pertinent regulatory and/or industry requirements/guidelines. TransCanada's specifications for coating, submerged arc welded pipe and double joined pipe were reviewed. The inspection team met with and directly observed TransCanada personnel and their assigned agents conducting third party monitoring on their behalf (D M Professional Services), who provided QA/QC for pipe materials being produced at the mill for the Keystone Gulf Coast project.

During the field inspections, the pipeline was verified for design specifications by examining the pipe for manufacturer stamping and reviewing manufacturer test reports (MTRs). Each pipe joint was marked with length, grade, pipe size, and specification. See Figures 1 and 2 for examples.

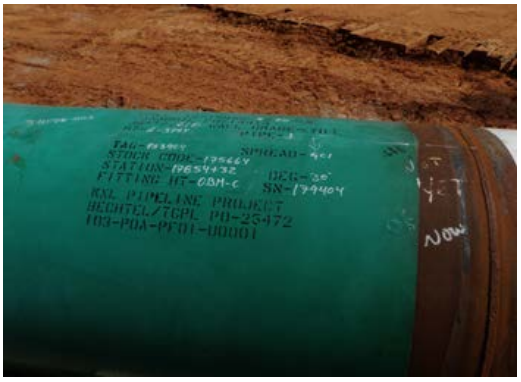


**Figure 1: Pipe Specification Markings**


**Figure 2: Pipe Specification Markings**

Pipe used for the construction had different wall thicknesses for different application locations such as: 0.465” for line pipe, 0.515” for HCAs, 0.572” downstream of pump station, 0.618” for road bores, and 0.748” for HDDs. HDD and road bore pipe also had abrasion resistant overcoat (ARO) which was verified during the field inspections as seen in Figure 3. Pipe joints were marked with the appropriate specifications, for example, API 5L PSL2 36”, 0.465”, X70.


**Figure 3: ARO Pipe with specification markings.**

Valves and other pipeline components were also verified in the field. Valves were manufactured in accordance with API 6D and were stamped with manufacturer’s name, maximum pressure rating, temperature rating, nominal size and body material. Fittings were


**Figures 4, 5, 6: Manufacturer Stamp on Valve, and Flange**

examined for damage such as buckles, dents, gouges, cracks or other defects that might reduce the strength. Pipe joints were tracked by a labeling system with a bar code. See Figures 4-6.

Labels were checked in the field for damage or non-readable labels. See Figure 7. All components inspected were consistent with the pressure rating and in accordance with the established MOP.

**Figure 7: Pipe Label**

## Construction Requirements

Written Specifications

PHMSA SW Region reviewed TransCanada's construction specifications throughout the construction project. Specifications were reviewed in PHMSA's or TransCanada's offices, through the SharePoint site, and during the field inspections. The field inspections focused on verification that the specifications were being applied and followed during the construction of the pipeline. These field verifications help assure PHMSA that the pipeline was being construction according to Part 195 and the operators specifications.

During the onsite construction inspections there were some potential non-compliance issues identified by PHMSA. The first involved TransCanada not following their specification dealing with backfilling and sand padding of the ditch/trench which was in violation of §195.246. This will be further discussed later in the report.

Installation of Pipe

During the field inspections, PHMSA inspected the pipeline ROW for any private dwellings, industrial buildings, and places of assembly. The ROW of the pipeline avoided and was not in close proximity to any of these structures or locations. The inspection of soil cover and depth of pipe was in compliance with the regulations. The pipeline had a cover of at least the minimum cover required at all locations inspected during the field inspections. Figure 8 shows the depth of the pipe. The Figure demonstrates the cover and depth of the pipeline and the remoteness of the pipeline ROW. Figure 9 shows the depth of pipeline is verified with a GPS system.

**Figure 8: Typical Right of Way depicting Depth of Cover.**

**Figure 9: Depth of Cover check with GPS**

To avoid many road and railroad crossings, other pipeline, bodies of water and any other encroachments, TransCanada horizontally directional drilled (HDD) the pipeline at these locations. The depth of the HDDs well exceeded the depth of cover required by the regulations. PHMSA witnessed and inspected HDD construction activities for any issues and to assure specifications were followed. The Figures demonstrate the inspection of the HDDs. Figure 10 shows pipe is being supported by a boom as it is being pulled into the drill.

**Figure 10: Boom holding Pipe**

Field pipe bends were observed by PHMSA during many field inspections. There were no wrinkle bends identified during these inspections. Pipe bends were performed by a bending machine which utilized an internal bending mandrel to achieve smooth and undistorted bends. PHMSA witnessed pipe bending activities which are shown in Figures 11 and 12. There was no mechanical damage identified during the pipe bending activities.

**Figure 11: Bending Machine**

**Figure 12: Bent Pipe**

Valves

Federal regulations require that valves be installed "… at locations along the pipeline system that will minimize damage or pollution …". PHMSA raised an issue with TransCanada concerning its valve spacing as to whether or not they were being placed to minimize the environmental impact in case of a release. TransCanada submitted additional studies and records which included a Pipeline Assessment and Environmental Consequence Analysis, Keystone Gulf Coast Valve Siting Rationale and Gulf Coast Corridor Schematic. In addition, TransCanada installed remotely operated valves, with back- up generators at all locations mentioned in their study. PHMSA reviewed and met with TransCanada to discuss the locations of the valves which resolved the issue with the valve spacing.

Valve locations and automation equipment were verified during the field inspections by PHMSA.

**Figure 13: Typical Valve location**


**Figure 14: Remote Operation Equipment at Valve site.**

Valves were inspected at the pipe yard on several occasions to verify the rating and condition of the valves. Figure 15 shows valves inspected at the pipe yard. Valves were stored away from the pipe to protect from any damage.

**Figure 15: Valve Storage at Pipe Yard**

Topography maps were submitted to PHMSA showing all water crossings and location of valves. Valves were located at every water crossing and in locations along the pipeline to minimize pollution and damage in populated areas.

There were also valves located at each discharge and suction side of the pump stations. Figure 16 depicts an example of a pump station valve installation.

**Figure 16: Valve at Pump Station**

All valves are motorized and remotely operational through SCADA. All valves had concrete foundation poured to handle any stresses the weight may put on the pipeline. Figure 17 is an example of concrete supports. Figure 18 demonstrates the protection from unauthorized personnel and vandalism. In addition, the photos show the satellite, electric power and generators for backup needed to operate the valves.

**Figure 17: Concrete Pads for Valves.**

**Figure 18: Typical Fencing around Valve site**

Welding

Throughout the construction project, PHMSA reviewed welding procedures, specifications and conducted field observations of welding activities. In addition, PHMSA witnessed the qualification of procedures and welders to assure welding was being performed to a qualified procedure and by qualified welders.

Welding was performed in accordance with API 1104, the federal regulations and TransCanada's specifications. TransCanada utilized automatic welding on spreads 1 and 2 and manual welding on Spread 3. Both automatic and manual welding was being performed while PHMSA was on site.

**Figure 19: Welder Qualification Test**

**Figure20: Automatic Welding Shack**

**Figure 21: Automatic Welding Set up**

Welding inspections also included the inspection of nondestructive testing of all welds. In the field PHMSA observed NDT of the welds and assured that NDT specifications were followed. TransCanada utilized both AUT and X-ray methods for testing welds.

During the PHMSA field inspections and welding qualifications review, there were two issues and concern identified by PHMSA. One concern raised was the high welding repair/rejection rate. From the start of welding, TransCanada experienced a high weld rejection rate on Spread 3. A second issue identified by PHMSA was that TransCanada failed to properly qualify welders on Spread 3 of the


**Figure 22: Manual Welding Set up**

Keystone Gulf Coast Pipeline project. TransCanada performed welder qualifications using a welding procedure that had not been properly qualified and then allowed these welders to weld on a Part 195 regulated pipeline. These issues will be furthered discussed alter in the report.

Corrosion Protection

During the field inspections by PHMSA, the installation of corrosion control measures was verified. TransCanada provided corrosion control specifications which were reviewed by PHMSA. PHMSA witnessed the installation of many joints of pipe to assure that the coating was in good condition and was inspected (jeeped) for coating damage before burying the pipe. Any damage identified by this inspection technique was repaired. Each weld joint was coated and is seen in Figure 23. PHMSA also verified that there were a sufficient number of test leads installed throughout the pipeline.

**Figure 23: Coating of field Joint**


**Figure 24: Typical Test Station**

TransCanada conducted a Direct Current Voltage Gradient (DCVG) survey of the entire Keystone Gulf Coast Pipeline to check for any coating damage. After the survey, TransCanada submitted the findings of any coating damage found along with repairs made on anomalies. There were a total of 127 anomalies on Spread 1, 83 anomalies on Spread 2, and 43 anomalies on Spread 3 found by the survey. None of the anomalies found met the repair criteria of 35% IR, the highest was 32%. TransCanada performed verification digs on the highest IR readings on all three spreads to assure accuracy of the DCVG Survey. They made 8 digs in Spread 1, 8 digs in Spread 2, and 4 digs in Spread 3 and made repairs accordingly. The reports were reviewed by PHMSA to assure compliance with their procedures and the regulations. PHMSA conducted field inspections to verify dig sites identified by the DCVG survey. Figures 25 and 26 depict two locations identified by the DCVG survey during a PHMSA field inspection.



**Figure 25 and 26: DCVG dig site (recoated)**

Pressure Testing

Pressure testing of the TransCanada was performed in accordance with their Specification TES-PROJ-LPCS-US and with CFR 195. The specification and records of all hydrostatic pressure tests conducted by TransCanada were reviewed by PHMSA. In addition, PHMSA conducted field inspections of the hydrostatic testing on various locations of the pipeline.

**Figure 27: Hydrotest in Progress**

**Figure 28: Hydrotest in Progress**

The entire pipeline was hydrotested to at least 8 hours for all buried pipelines. In addition, TransCanada conducted a one hour pressure test on all HDD piping before pulling the pipe section. The one hour test is part of TransCanada's procedures to verify the integrity of the HDD pipe before pulling it through the drilled hole. The test medium used for all testing was water. All records reviewed had documented the appropriate pressure of 125% or more of MOP, test medium, instrument calibration, pressure recording charts, temperature, date and time and description of the facility being tested. TransCanada also provided elevation profiles of all test sections with hydraulic pressure profiles. There were no leaks or failures detected in the records review and during the field inspections.

**Figure 29: Drying process after hydrotest**

Commissioning

TransCanada notified PHMSA in December 2013 of the intent to start line fill and commissioning of the Keystone Gulf Coast Pipeline from Cushing, OK to Nederland, TX. TransCanada submitted their Commissioning Plan for approval from PHMSA to commence commissioning activities. PHMSA reviewed the commissioning plan and had no objections to start the commissioning process.

On December 7, 2013, TransCanada started line fill activities starting from the Cushing facility to their Nederland facility. TransCanada followed their commissioning plan and coordinated with personnel to monitor the line-fill to ensure the pipeline was operating safely and reliably. The plan included the commissioning of 485 miles of pipe, six pump stations and the Nederland Delivery Station. Product was tracked utilizing three batch pigs to assure the location of the product. Each pig was tracked by Corrpro personnel and predetermined above ground markers (AGM). During the commissioning phase, each mainline valve was operated to assure no leaks and satisfactory operation of the valve. In addition each pump station was started up in stages. Each stage consisted of testing each leak detection system and alarms per pump before starting up the next pump(4 pumps per station) at each station. On January 21, 2014 TransCanada notified PHMSA of the completion of the line-fill activities and the intent to start in-service operations. On January 22, 2014 TransCanada commissioned the pipeline and started in-service operations.

**Figure 30: Pigs used during commissioning.**

PHMSA received daily updates throughout the commissioning phase of all ongoing activities. In addition, PHMSA engineers/inspectors were onsite during the commissioning phase to witness and assure procedures were being followed by TransCanada personnel. PHMSA witnessed the line fill, testing of pump alarms and leak detection, valve testing and pig tracking operations. The Figures demonstrate the observations of the activities witnessed during the commissioning. The Figure 43 shows the pigs used to track the product while filling line. Figure 44 shows how the pigs were tracked from above ground.

**Figure 31: Commissioning at Pump Station**

**Issues identified during Construction**

Welding

TransCanada performed welder qualifications using a welding procedure that had not been properly qualified and then allowed these welders to weld on a Part 195 regulated pipeline.

During the first weeks of construction of spread 3 significant welding issues were noted. Approximately 26.8% of the welds required repairs in one week, 32.0% the second week, 72.2% the third week, and 45.0% the fourth week. On September 25, 2012, TransCanada stopped the Spread 3 welding after 205 of the 425 welds, or 48.2% required repairs. Through the welding procedure review, PHMSA found that TransCanada failed to perform welding on construction Spread 3 of the Gulf Coast Pipeline project in accordance with a procedure qualified according to Section 5 of API 1104.

A comparison of the procedure being used to weld the pipe on Spread 3 (KXL-SMAW-ML, revised February 10, 2011) with the PQR revealed inconsistencies between at least two essential variables as defined by API 1104, the Joint Design and the Speed of Travel. The joint design on the document KXL-SMAW-ML being used to weld the pipe on construction Spread 3 specified a Root Opening of 1/16" ± 3/32" between pipe joints at the girth weld and the welding Speed of Travel for the Cap Pass to be 8.6 – 16.2 inches per minute. The PQR for the procedure that was actually qualified by destructive testing (PQR# KPS-RMS-SMAW-ML-PQR Rev 2) showed the root opening to be 1/16" to 3/32" and the Speed of Travel for the Cap Pass to be 6.6 – 16.2 inches per minute. The difference between the PQR and the welding procedure constituted a change in essential variables.

As a result, the welding procedure being used by TransCanada on Spread 3 of the Keystone Gulf Coast Pipeline project (KXL-SMAW-ML) had changes to essential variables that caused it to be different than the Procedure Qualifying Record. Because the procedure used to weld Spread 3 pipe was not re-qualified, TransCanada was using an unqualified procedure to weld Part 195 regulated pipeline.

A second issue identified by PHMSA was that TransCanada failed to properly qualify welders on Spread 3 of the Keystone Gulf Coast Pipeline project. TransCanada performed welder qualifications using a welding procedure that had not been properly qualified and then allowed these welders to weld on a Part 195 regulated pipeline. Paragraph 6.1 of API 1104, incorporated by reference states "the purpose of the welder qualification test is to determine the ability of welders to make sound butt or fillet welds using previously qualified procedures." Procedure KXL-SMAW-ML, Revised February 10, 2011 had changes to the essential variables of Joint Design and Speed of Travel from the Procedure Qualification Record, KPL-RMS-SMAW-ML-PQR Rev 2 but had not been re-qualified. Consequently, the welder qualification was not performed using a previously qualified procedure as required by Section 6 of API 1104.

PHMSA issued Warning Letter 4-201305021W for both issues identified during the construction inspection. TransCanada responded to the Warning Letter stating that after more than twelve months of extensive meetings and discussion, comprehensive supplemental destructive testing and exhaustive records reviews, on November 25, 2013 a meeting held between PHMSA and TransCanada resulted in confirmation that the welder qualifications and manual welding procedures. In addition, The results of a root cause analysis performed by TransCanada to identify the cause of the high weld rejection rate on Spread 3 were documented in a paper titled "Girth Weld Repairs Due to Lack of Fusion in Root Pass," dated November 15, 2012. This analysis identifies the criticality of the essential variables of Joint Design and Speed of Travel by stating, "Weld fit up was increased to 3/32" which allowed the welders to decrease their travel speeds and welding amperages which is a key factor in reducing internal under cut and lack of fusion defects during the welding process. This modification improved the weld quality and reduced the overall weld defects. PHMSA witnessed the re-testing of the welding procedure to verify the modification of the procedure reduced the internal under cut and lack of fusion defects, at the RMS lab in Edmonton, Alberta, Canada.

Dents

TransCanada did not assure that its Keystone Pipeline was installed in the ditch in a manner that minimizes the possibility of damage to the pipe. The deformation tool identified dents on the pipe that appear to be caused by secondary stresses on the pipe. The ILI tool identified a total of 421 anomalies which required investigation per the specifications. There were a total of 236 dents, 56 pipe ovality and 129 anomalies with both dent and ovality. TransCanada verified the locations by excavating the anomalies and made repairs in accordance with their specifications. After excavating and examining the anomalies, there were a total of 350 anomalies within the specifications, 37 anomalies which required being cut-out and 34 anomalies with no indications of a dent or ovality. During the field inspections, PHMSA witnessed and examined anomaly investigations being conducted by TransCanada due to the results of the deformation tool run. In this report you can see examples of the types of dents identified with the inspection tools. Each dent was examined


**Figure 32, 33, 34 Examples of dents found with inspection tool.**

and measured and nondestructively tested with ultrasound testing equipment to check for cracks. All dents were either cutout or were below the repair criteria. Several anomaly reports stated that foam pillows and rocky terrain were present at the dig sites which may

attribute to the dents on the pipe. During the field inspections the PHMSA inspector verified the locations of several dents which were located in the same vicinity as the foam pillow supports.

TransCanada's TES-PROJ-LPCS-US Onshore Liquid Pipeline Construction Specification, Section 22.4 states "when foam pillows are installed, approved fill will be supplied to provide a uniform support along the underside of the pipe." Assuring a uniform fill underneath the pipe at all foam pillow locations will minimize external stresses on the pipe. In addition, Section 22.5 states that "rock, stone laden soil, or frozen material shall not be backfilled into the trench until the pipe has been surrounded by stone free soil."

In reviewing the anomaly reports and PHMSA inspections it demonstrated that TransCanada was not following their Construction Specifications, Section 22.4 and 22.5. PHMSA SW Region issued a Warning Letter, CPF 4-2013-5017W warning TransCanada to follow their procedures/specifications and assure that backfill is free of large rocks and have sufficient support at the foam pillows to minimize the external stresses on the pipe to be in compliance with 195.246.

Coating Damage

Another issue identified involved TransCanada not following their specifications during welding of the pipeline.

TransCanada did not follow its written specification, specifically, protecting existing coating from damage due to welding. In an email dated June 7, 2013, TransCanada notified PHMSA of a non-conformance issue involving coating damage on Spread 3 which TransCanada was in the process of investigating. The problem only occurred in Spread 3 due to the manual welding process with stick rods being utilized. Manual welding was used mainly due to the terrain and the number of water crossings. Spread 1 and 2 utilized the semiautomatic welding process. There were several locations in which the contractor did not follow TransCanada's coating specifications. Specifically, weld blankets were not being utilized to protect the existing coating on the pipe to prevent weld splatter from damaging the coating. TransCanada's specification TES-WELD-PL- US Welding of Pipelines and Tie-ins, Section 8.11 states that "existing coatings on piping shall be protected to minimize damage that may result from the welding operations" which was not being followed by the contractor. After investigating 23 suspected locations, TransCanada confirmed the coating damage and repaired the coating per the specifications.

**Figure 35: Repair of coating due to weld splatter.**

During the field inspections, PHMSA observed several girth welds had coating damage due to weld splatter. Figure 35 shows the coating repair on the girth welds due to damage of the weld

splatter. The coating repair was made after the pipeline was exposed and examined. The pipe was coated and backfilled per the specifications. There were a total of 130 identified locations excavated in which TransCanada examined for damage and made repairs were necessary. All discovered damage was inspected and repaired to original specification criteria.

PHMSA issued a Warning Letter, CPF #4-2013-5017W, warning TransCanada to follow their specifications/procedures and assure that specification 8.11 is followed to be in compliance with 195.202.

TransCanada responded to the Warning Letter and assured that they were taking steps to enhance its design, specifications and inspection practices, by conducting a thorough review of their inspection practices, design, and construction specifications, and would implement changes to try to reduce the number of inspection digs that are required after the pipeline has been backfilled going forward, which included, but not limited to restricting the use of foam pillows, increased use of bedding material in rocky or hard pan conditions, and specifying the minimum size of weld splatter protection devices.