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PUBLIC SERVICE COMMISSION

July 3, 2012

Mr. Patrick Fahn  
North Dakota Public Service Commission  
600 E. Boulevard, Dept 408  
Bismarck, ND 58505-0780

VIA ELECTRONIC DELIVERY AND COURIER



**TransCanada**  
*In business to deliver*

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Dear Mr. Fahn:

As discussed during our meeting on June 12, 2012, TC Oil Pipeline Operations Inc. submits the enclosed information, which summarizes our March, April, May, and June monthly reports, submitted to the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) as required under the Amended Corrective Action Order (CAO) issued on June 23, 2011. As Ms. Sacco requested in her May 17th, 2011 email, we are providing documents that do not require FOIA protection.

Additionally, as requested, we are providing a list of the procedures that were provided along with the purpose of each procedure. These procedures are confidential proprietary information and contain security sensitive information and therefore cannot be provided in their entirety. Also, as discussed in our meeting, an updated copy of the Emergency Response Plan should have already been received by the North Dakota Public Service Commission. The Emergency Response Plan is also confidential proprietary information and meets the exemptions provided under North Dakota statutes.

If you have any questions regarding the enclosed documents, please contact me.

Sincerely,

A handwritten signature in black ink that reads "Ken Crowl".

Ken Crowl  
Manager, U.S. Regulatory Compliance  
TransCanada U.S. Pipelines  
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Houston, TX 77002

751 PU-06-421 Filed: 7/3/2012 Pages: 24  
Summary of March, April, May, June 2012 monthly  
reports submitted to PHMSA

CPF No. 3-2011-5006H – Keystone Pipeline Corrective Action Order  
March 2012 Monthly Report

## Executive Summary

In accordance with the Corrective Action Order (CAO) issued by PHMSA on June 3, 2011 and amended on June 23, 2011, TC Oil Pipeline Operations, Inc. (Keystone) submits the following information in a report format.

The scope of the bracing program defined within the Work Plan submitted to PHMSA on September 1, 2011 and approved on October 21, 2011 was completed as planned. As a result of validation testing in 2011 and 2012 additional improvements were identified. As a result of the additional scope of work, final completion of modifications and final validation testing and reporting to ensure long term integrity will be delayed until September 30<sup>th</sup>, 2012 to allow for system wide implementation.

The following remaining scopes of work within the Work Plan submitted to PHMSA on September 1, 2011 and approved on October 21, 2011 was completed as planned:

### Mechanical/Technical

- *Complete an evaluation of modifying or supplementing large bore piping supports. Completion no later than March 31, 2012*

### Management System/Process

- *Develop and implement a standard design review process to verify that all design specification requirements have been identified and adequately addressed in the design documentation. Completion no later than March 31, 2012.*
- *A review of the Keystone Pipeline design will be conducted to determine if the specified design loads in the DBM were considered in the design. Completion no later than March 31, 2012.*
- *A formal design review oversight process (third party oversight) for the external engineering companies will be developed and implemented. This will include the accountability for final sign-off (outside of the engineering supplier) within the project engineering team. Completion no later than March 31, 2012.*
- *Develop a design standard for small bore piping attachments for LVP liquid pipelines. Completion no later than March 31, 2012.*
- *Develop an inspection and testing plan for LVP liquid pipelines that encompasses the range of expected conditions post-start up for future pipeline projects. Completion no later than March 31, 2012*
- *Updated the Incident Management Process to include both the steps for managing an incident and the steps for managing issues. These changes will detail the relationship between incidents and issues and include RACI Chart(s) for managing equipment incidents and issues. Completion no later than March 31, 2012.*
- *Update the incident & Issue Tracking (IIT) application to require the entry of cause and potential severity on issues. Completion no later than March 31, 2012.*

### Management of Change

- *Develop and implement a process to manage project design changes. Completion no later than March 31, 2012.*
- *Review and update Incident and Issue Management Guides to identify changes required to track and report component failures associated with the Oil Pipeline line of business. Completion no later than March 31, 2012.*
- *Develop and implement changes to the IIT application that will require the accountable person to determine if it is appropriate to initiate a root cause investigation, and if initiated, assure the completion of the investigation. Completion no later than March 31, 2012.*

### Continuing Operations

- *Develop a long term program to provide for periodic non-destructive testing of selected small bore piping components. Completion no later than March 31, 2012.*
- *Develop a piping inspection and testing procedure that encompasses the range of operating conditions expected post start up for future pipeline projects. Completion no later than March 31, 2012.*

The remaining Pigging Barrel Pressure Safety Valve modifications have been completed at all facilities, including the Cushing Delivery Terminal (one barrel), and the Salisbury (two barrels) and Steele City (three barrels) VFD pump stations. This completes the work scope originally defined within the Work Plan submitted to PHMSA on September 1, 2011 and approved on October 21, 2011.

Additional testing and evaluation of various bracing designs for the TV-0052 drain line adjacent to the Pressure Control Valve (single plane configuration) was completed at Freeman station. Two bracing designs were optimized to achieve the acceptable stresses both in the drain piping and in the main piping shell. The bracing is being implemented at all Fixed Speed Stations with single plane drains adjacent to the Pressure Control Valve.

### Introduction

Keystone oil pipeline system operates from Hardisty, Alberta to delivery terminals in Wood River and Patoka, Illinois and Cushing, Oklahoma. On May 7, 2011, the system experienced a reportable oil release of approximately 400 barrels at the Ludden, ND pump station. On May 29, 2011, a second reportable oil release of approximately 10 barrels occurred at the Severance, KS pump station.

A Corrective Action Order (June 3, 2011) and subsequent Amended Corrective Action Order (June 28, 2011) were issued to TC Oil Pipeline Operations, Inc. A series of Monthly Reports have been submitted beginning in July of 2011 to document TC Oil Pipeline Operations, Inc.'s progress regarding the work undertaken to ensure the reliable operation of the Keystone Pipeline.

The following Monthly Report is submitted per Item 11 of the CAO.

## **Work Plan**

The Work Plan submitted September 1, 2011 outlined the following development and/or modification of procedures, documents, systems or completion of studies and reviews.

### **Design Processes, Procedures and Standards:**

The following design procedures will be implemented on new oil pipeline capacity capital projects or the requirements will be met through equivalent project specific procedures. A procedure for allowing the use of alternate procedures will be managed through the CPMS Variance and Exceptions Procedure to ensure an equivalent or greater standard is met.

- *Develop and implement a standard design review process to verify that all design specification requirements have been identified and adequately addressed in the design documentation. Completion no later than March 31, 2012.  
Status: Complete. CPMS Design Review and Verification Procedure*
- *A formal design review oversight process (third party oversight) for the external engineering companies will be developed and implemented. This will include the accountability for final sign-off (outside of the engineering supplier) within the project engineering team. Completion no later than March 31, 2012.  
Status: Complete. CPMS Third Party Design Oversight Procedure*
- *Develop and implement a process to manage project design changes. Completion no later than March 31, 2012.  
Status: Complete. CPMS Design Change Management Procedure*

The following work plan elements related to design were completed as follows:

- *A review of the Keystone Pipeline design will be conducted to determine if the specified design loads in the DBM were considered in the design. Completion no later than March 31, 2012.  
Status: Complete.*
- *Develop a design standard for small bore piping attachments for LVP liquid pipelines. Completion no later than March 31, 2012.  
Status: Complete.*

### **Mechanical/Technical Modifications**

- *Complete an evaluation of modifying or supplementing large bore piping supports. Completion no later than March 31, 2012  
Status: Complete.*

## **Testing and Inspection**

- *Develop an inspection and testing plan for LVP liquid pipelines that encompasses the range of expected conditions post-start up for future pipeline projects. Completion no later than March 31, 2012*  
*Status: Complete.*
- *Develop a piping inspection and testing procedure that encompasses the range of operating conditions expected post start up for future pipeline projects. Completion no later than March 31, 2012.*  
*Status: Complete.*
- *Develop a long term program to provide for periodic non-destructive testing of selected small bore piping components. Completion no later than March 31, 2012.*  
*Status: Complete.*

## **Incident and Issue Management**

- *Updated the Incident Management Process to include both the steps for managing an incident and the steps for managing issues. These changes will detail the relationship between incidents and issues and include RACI Chart(s) for managing equipment incidents and issues. Completion no later than March 31, 2012.*  
*Status: Complete.*
- *Update the Incident & Issue Tracking (IIT) application to require the entry of cause and potential severity on issues. Completion no later than March 31, 2012.*  
*Status: Complete.*
- *Review and update Incident and Issue Management Guides to identify changes required to track and report component failures associated with the Oil Pipeline line of business. Completion no later than March 31, 2012.*  
*Status: Complete.*
- *Develop and implement changes to the IIT application that will require the accountable person to determine if it is appropriate to initiate a root cause investigation, and if initiated, assure the completion of the investigation. Completion no later than March 31, 2012.*  
*Status: Complete.*

## **Large Bore Piping**

Testing of the Large Bore Piping support modifications was completed at the Severance Fixed Speed Station in accordance with the Work Plan submitted to PHMSA on September 1, 2011 and approved on October 21, 2011. Evaluation of the piping support modification's effect on Station and Unit component vibrations was completed.

## **Pigging Barrel Pressure Safety Valves**

The Pigging Barrel Pressure Safety Valve modifications have been completed at all facilities, including the Cushing Delivery Terminal (one barrel), and the Salisbury (two barrels) and Steele City (three barrels) VFD pump stations, as shown below. This completes the work scope originally defined within the Work Plan submitted to PHMSA on September 1, 2011 and approved on October 21, 2011.



Cushing pig receiver PSV piping and bracing modification



Salisbury pig receiver PSV piping and bracing modification.



Salisbury pig launcher PSV piping and bracing modification.



Steele City pig receiver PSV piping and bracing modification.



Steele City pig launcher PSV piping and bracing modification.



Steele City Cushing Extension pig launcher PSV piping and bracing modification.

### **Final Vibration Report**

The scope of the bracing program defined within the Work Plan submitted to PHMSA on September 1, 2011 and approved on October 21, 2011 was completed as planned. As a result of validation testing in 2011 and 2012 additional improvements were identified. As a result of the additional scope of work, final completion of modifications and final validation testing and reporting to ensure long term integrity will be delayed to allow for system wide implementation.

Keystone will continue to report on the progress of additional component modifications, testing and evaluation within the Monthly Report format until such time as all modifications and evaluations have been completed. A final Vibration Report encompassing all final vibration related modifications and the results of testing and evaluation will be submitted after the conclusion of this iterative process that will be finished no later than September 30<sup>th</sup>, 2012.

### **Single plane TV-0052 drain line adjacent to Pressure Control Valve**

As reported in the February 2012 Monthly report, extensive vibration and strain testing of several different drain bracing designs was carried out at Freeman Fixed Speed station at 3000 kW energy dissipation across the station Pressure Control Valve. Two designs shown below were optimized to minimize stress levels in the drain piping and the main pipe shell. An FEA analysis was completed to verify that the bracing provides acceptable stress levels. Depending on the local piping arrangement, one of the bracing designs is being installed at all Fixed Speed stations with single plane drains adjacent to the station Pressure Control Valve.

Vibration and Strain testing of the single plane drain adjacent to the Pressure Control Valve carried out at Wilber VFD station at 1000 kW energy dissipation across the station Pressure Control Valve determined that piping stresses are acceptable without bracing. Based on the Wilber testing results and subsequent FEA analysis summarized in Figure 3 below, no bracing of the single plain drains at the VFD stations are required.



Single plane TV-0052 drain line brace. Design #1 based on the NPS 20 pipe clamp.



Single plane TV-0052 drain line brace. Design #2 based on the Pressure Control Valve flange grab.

## **Pump Station Unit Drains**

There are up to 25 unit drains at each Fixed Speed and VFD station, depending on the number of units at a station. Each unit has drains located upstream and downstream from the unit suction and discharge valve, and a drain adjacent to the unit check valve. Review of the unit drains at the Fixed Speed stations identified several drain configurations that may require bracing to minimize stresses in the drain piping and/or in the main pipe shell. Vibration and strain testing of four typical drain configurations was carried out at Freeman Fixed Pump Station at 3000 kW energy dissipation across the station Pressure Control Valve in order to determine the requirement for bracing. The testing determined that multi-elbow horizontal U-shaped unit drains require bracing at Fixed Speed stations in order to reduce stresses in the main pipe shell to acceptable levels. Piping stresses associated with the remaining three drain configurations are acceptable without bracing.

As a result of the testing, the U-shaped unit drain at Freeman station was braced and re-tested to verify the effectiveness of the brace. The re-test and subsequent FEA analysis determined that bracing was effective in reducing the piping stresses to acceptable levels. The bracing program for multi-elbow horizontal U-shaped unit drains at the Fixed Speed Stations is currently being developed and will be implemented no later than September 30, 2012.

Vibration and strain testing of unit drains was also completed at Stanton VFD station. The testing results are currently being analyzed to determine if any drain bracing at VFD stations is required.

## **Next Steps and Timelines**

### **O1 2012 Vibration Remediation Work**

As a result of validation testing in 2011 and 2012 the following additional improvements were identified:

#### **VFD Stations:**

- Brace long 4" nozzles adjacent to the unit discharge MOV (required at Pierron station only)
- Support injection pump piping (only required at David City pump station)
- Install new Station PSV test port design and refine bracing
- Install bracing on pump suction piping vents
- Brace high point vents on the unit expansion loops
- Excavate and install foam around station discharge piping drain lines by Station Pressure Control PCV and Station PSV
- Vibration testing of all small bore attachments.

#### **Delivery Terminals**

- Install new Station PSV test port design and refine bracing
- Replace Pressure Transmitter manifolds (required at Hartford and Patoka Terminals only)

#### **Fixed Speed Stations**

- Replace unit suction MOV bypass drain valve with a bleed plug
- Install new Station PSV test port design and refine bracing
- Brace station discharge piping drain lines by Station Pressure Control PCV and Station PSV
- Replace pump 4 Pressure Transmitter manifolds

The scope of work above (with the exception of the replacement of pump 4 pressure transmitter manifolds at the Fixed Speed stations) is complete at Edinburg, Niagra, Luverne, Ft Ransom, Ludden, Ferney, Carpenter, Roswell, Freeman, Hartington, Stanton, David City, Wilber, Steel City, Seneca, Severance, Turney, Tina, Salisbury and Centralia pump stations. Replacement of the pump 4 pressure transmitter manifolds at the Fixed Speed stations was delayed due to long delivery lead times for the new manifolds. The program and associated validation testing and reporting will be finished at all Fixed Speed, VFD stations and Delivery Terminals no later than September 30, 2012.

The following is a list of procedures that were provided to PHMSA under protection from release in accordance with FOIA Confidentiality Exemptions:

**CPMS Variance and Exceptions Procedure**

This procedure describes how exceptions or changes to Capital Projects Management System (CPMS) documents can be approved on an individual project basis for the CPMS.

**CPMS Design Review and Verification Procedure**

The purpose of this procedure is to describe the steps that the Design Oversight Team needs to conduct, so that, at suitable stages of the project design reviews occur and designs are verified

**CPMS Third Party Design Oversight Procedure**

This procedure describes the technical aspects of outsourcing design work (engineering, design, and drafting) to a third-party engineering contractor.

**CPMS Design Change Management Procedure**

This document describes how potential design changes to authenticated documents are identified, evaluated, approved, documented, and implemented.

CPF No. 3-2011-5006H – Keystone Pipeline Corrective Action Order  
April 2012 Monthly Report

## **Executive Summary**

In accordance with the Corrective Action Order (CAO) issued by PHMSA on June 3, 2011 and amended on June 23, 2011, TC Oil Pipeline Operations, Inc. (Keystone) submits the following information in a report format.

Extensive vibration and strain testing of unit drains at Stanton and Luverne VFD stations was completed. These two stations were selected for the testing as representative stations based on risk evaluation of the unit drain configurations at all VFD stations. All vibration and strain levels for all drains are acceptable and therefore no unit drain bracing is required at any of the VFD stations.

Validation testing of PT-201 and PT-203 pressure transmitter manifolds at VFD stations revealed that installed bracing did not reduce vibration of the manifolds to acceptable levels. Subsequent attempts to further modify the bracing did not provide the expected improvement. As such, a modification of the manifolds was developed and will be implemented at all VFD stations no later than September 30, 2012.

## **Introduction**

Keystone oil pipeline system operates from Hardisty, Alberta to delivery terminals in Wood River and Patoka, Illinois and Cushing, Oklahoma. On May 7, 2011, the system experienced a reportable oil release of approximately 400 barrels at the Ludden, ND pump station. On May 29, 2011, a second reportable oil release of approximately 10 barrels occurred at the Severance, KS pump station.

A Corrective Action Order (June 3, 2011) and subsequent Amended Corrective Action Order (June 28, 2011) were issued to TC Oil Pipeline Operations, Inc. A series of Monthly Reports have been submitted beginning in July of 2011 to document TC Oil Pipeline Operations, Inc.'s progress regarding the work undertaken to ensure the reliable operation of the Keystone Pipeline.

The following Monthly Report is submitted per Item 11 of the CAO.

## **Q1 2012 Vibration Remediation Work**

Q1 2012 Vibration Remediation Work scope reported in the March 2012 Monthly report was completed at all facilities with the exception of St Paul, Hartford, Pierron, Patoka, Hope, Rock and Burns. In addition, replacement of the pump 4 pressure transmitter manifolds at the Fixed Speed stations was not yet completed due to long delivery lead times for the new manifolds. The additional program and associated validation testing and reporting will be finished at all Fixed Speed, VFD stations and Delivery Terminals no later than September 30, 2012.

## **Pump Station Unit Drains**

As reported in the March 2012 Monthly report, extensive strain and vibration testing of unit drains was completed at Stanton VFD station. Similar testing of the unit drains was also completed at Luverne VFD station. Stanton and Luverne were selected for the tests based on a risk evaluation of unit drain configurations at all VFD stations. All vibration and strain levels for all drains are acceptable and therefore no unit drain bracing is required at any of the VFD stations.

## **PT-201 and PT-203 Manifolds at VFD Stations**

VFD Station pressure transmitters PT-201 and PT-203, located upstream and downstream from the station Pressure Control Valve, were off-mounted and their nozzles and manifolds were braced as a part of the 2011 bracing program defined within the Work Plan submitted to PHMSA on September 1, 2011 and approved on October 21, 2011. Typical bracing of the PT nozzle and manifold is shown below.



Figure 1. Typical PT-201 & PT-203 nozzle and manifold bracing. The red arrow points to the stress concentration area in the manifold "neck".

Validation testing carried out during Q1 2012 Vibration Remediation Work revealed that vibration of the PT-201 and PT-203 manifolds at some VFD stations exceeded limits specified in the Keystone Vibration Evaluation Criteria.

Attempts to modify the PT manifold bracing in order to reduce their vibration to acceptable levels were not successful. The concern is the stress concentration area (“neck”) at the bottom of the manifold, indicated by the red arrow in Figure 1. In order to eliminate this area of concern, a modification of the manifold was developed, which involves reinforcing of the manifold “neck”, as shown in Figure 2. All PT-201 and PT-203 at VFD stations will be modified no later than September 30, 2012.

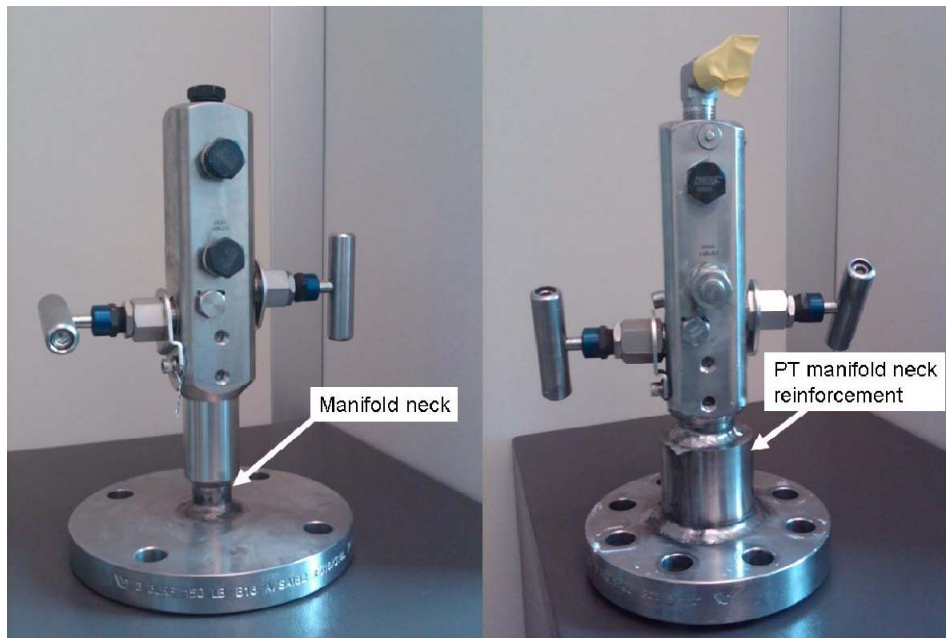


Figure 2. PT manifold “as is” and with reinforced “neck”.

## **Final Vibration Report**

Keystone will continue to report on the progress of additional component modifications, testing and evaluation within the Monthly Report format until such time as all modifications and evaluations have been completed. A final Vibration Report encompassing all final vibration related modifications and the results of testing and evaluation will be submitted after the conclusion of this iterative process that will be finished no later than September 30, 2012.

CPF No. 3-2011-5006H – Keystone Pipeline Corrective Action Order  
May 2012 Monthly Report

**Executive Summary**

In accordance with the Corrective Action Order (CAO) issued by PHMSA on June 3, 2011 and amended on June 28, 2011, TC Oil Pipeline Operations, Inc. (Keystone) submits the following information in a report format.

Additional remediation work identified through the validation process is ongoing at Fixed Speed stations, VFD stations and Delivery Terminals. This work, including submission of the final validation testing report, will be completed no later than September 30, 2011.

**Introduction**

Keystone oil pipeline system operates from Hardisty, Alberta to delivery terminals in Wood River and Patoka, Illinois and Cushing, Oklahoma. On May 7, 2011, the system experienced a reportable oil release of approximately 400 barrels at the Ludden, ND pump station. On May 29, 2011, a second reportable oil release of approximately 10 barrels occurred at the Severance, KS pump station.

A Corrective Action Order (June 3, 2011) and subsequent Amended Corrective Action Order (June 28, 2011) were issued to TC Oil Pipeline Operations, Inc. A series of Monthly Reports have been submitted beginning in July of 2011 to document TC Oil Pipeline Operations, Inc.'s progress regarding the work undertaken to ensure the reliable operation of the Keystone Pipeline.

The following Monthly Report is submitted per Item 11 of the CAO.

## **Vibration Remediation Work**

As reported in the April 2012 Monthly Report, Q1 2012 Vibration Remediation work scope was completed at all facilities with the exception of St Paul, Hartford, Pierron, Patoka, Hope, Rock and Burns. In addition, replacement of the suction and discharge pressure transmitter manifolds on the last pump (pump #4) at the Fixed Speed stations was not completed due to long delivery lead times for the new manifolds. The work not completed in Q1 2012 as well as additional remediation work identified through validation testing completed earlier in 2012 is currently ongoing and will be completed no later than September 30, 2012 as a part of the Remediation Work. The work includes replacement of insulation which had to be removed at various times to allow for installation of bracing.

### **PT-201 and PT-203 Manifolds at VFD Stations**

As reported in the April 2012 Monthly Report, validation testing carried out during Q1 2012 Vibration Remediation Work revealed that vibration of the PT-201 and PT-203 manifolds located upstream and downstream from the station Pressure Control Valve exceeded limits specified in the Keystone Vibration Evaluation Criteria at some VFD stations. The manifold bracing, shown below, proved to be ineffective in reducing the vibration to acceptable levels. The concern is the stress concentration area (“neck”) at the bottom of the manifold, indicated by the red arrow in Figure 1.



Figure 1. Typical PT-201 & PT-203 nozzle and manifold bracing.  
The red arrow points to the stress concentration area in the manifold “neck”.

In order to eliminate this area of concern, PT-201 and PT-203 manifolds at all VFD stations will be reinforced during remediation work by welding stainless steel collars around the manifold “neck”. The same modification will be implemented at Hartford and Patoka Delivery Terminals for PT-2201, PT-2204, PT-2207 and PT-2208 manifolds located upstream and downstream

from the Terminal PCV (four manifolds at each Terminal). Figures 2 and 3 show the modification completed on PT-2204 and PT-2207 at Patoka Delivery Terminal.



Figure 2. Modified PT-2204 manifold at Patoka Delivery Terminal.



Figure 3. Modified PT-2207 manifold at Patoka Delivery Terminal.

## **Final Vibration Report**

Keystone will continue to report on the progress of additional component modifications, testing and evaluation within the Monthly Report format until such time as all modifications and evaluations have been completed. A final Vibration Report encompassing all final vibration related modifications and the results of testing and evaluation will be submitted after the conclusion of this iterative process that will be finished no later than September 30, 2012.

CPF No. 3-2011-5006H – Keystone Pipeline Corrective Action Order  
June 2012 Monthly Report

**Executive Summary**

In accordance with the Corrective Action Order (CAO) issued by PHMSA on June 3, 2011 and amended on June 28, 2011, TC Oil Pipeline Operations, Inc. (Keystone) submits the following information in a report format.

Additional remediation work identified through the validation process is ongoing at Fixed Speed stations, VFD stations and Delivery Terminals. This work, including submission of the final validation testing report, will be completed no later than September 30, 2011.

**Introduction**

Keystone oil pipeline system operates from Hardisty, Alberta to delivery terminals in Wood River and Patoka, Illinois and Cushing, Oklahoma. On May 7, 2011, the system experienced a reportable oil release of approximately 400 barrels at the Ludden, ND pump station. On May 29, 2011, a second reportable oil release of approximately 10 barrels occurred at the Severance, KS pump station.

A Corrective Action Order (June 3, 2011) and subsequent Amended Corrective Action Order (June 28, 2011) were issued to TC Oil Pipeline Operations, Inc. A series of Monthly Reports have been submitted beginning in July of 2011 to document TC Oil Pipeline Operations, Inc.'s progress regarding the work undertaken to ensure the reliable operation of the Keystone Pipeline.

The following Monthly Report is submitted per Item 11 of the CAO.

## **Vibration Remediation Work**

As reported in the May 2012 Monthly Report, Remediation Work not completed in Q1 2012 as well as additional work identified through validation testing completed earlier in 2012 is currently ongoing at delivery terminals, fixed speed and VFD stations. This work, including replacement of insulation which had to be removed at various times to allow for installation of bracing, will be completed no later than September 30, 2012.

The Remediation Work has been completed to date at the following facilities:

Delivery Terminals	Patoka
	Hartford
VFD Stations	Pierron
	Hartford
	St Paul
	Middletown
	Centralia
	Salisbury
	Tina
	Steele City
	Wilber
Fixed Speed Stations	Turney
	Severance
	Seneca

## **PT-10x1 and PT-10x3 Manifolds**

As reported in the May 2012 monthly report and previous monthly reports, replacement of pressure transmitter manifolds located on the suction and discharge piping of the last pump at the pump stations could not be completed during Q1 2012 Vibration Remediation Work because of long delivery of the new manifolds. The new manifolds have now been received and are being installed on the last pump at all fixed speed and VFD stations. An example of the original manifold is shown in Figure 1 with the red arrow pointing to the stress concentration area in the manifold “neck”. Figure 2 shows the new, wide base manifold installed at Seneca fixed speed station.



Figure 1. Original PT-10x1 & PT-10x3 manifold design.  
The red arrow points to the stress concentration area in the manifold "neck".



Figure 2. Wide base PT-1041 manifold installed at Seneca Fixed Speed station.

## **Final Vibration Report**

Keystone will continue to report on the progress of additional component modifications, testing and evaluation within the Monthly Report format until such time as all modifications and evaluations have been completed. A final Vibration Report encompassing all final vibration related modifications and the results of testing and evaluation will be submitted after the conclusion of this iterative process that will be finished no later than September 30, 2012.