



U.S. Department  
of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

1200 New Jersey Ave., SE  
Washington, DC 20590

JUN 03 2011

**VIA CERTIFIED MAIL [7005 1160 0001 0075 9442] AND FAX TO: 832-320-5708**

Mr. Robert Jones  
Vice President  
TC Oil Pipeline Operations, Inc.  
4450 1st Street, S.W.  
Calgary, Alberta T2P 5H1, Canada

Mr. Vern Meier  
Vice President, U.S. Pipeline Operations  
TransCanada Corporation  
717 Texas Avenue  
Houston, TX 77002-2761

**Re: CPF No. 3-2011-5006H**

Dear Messrs. Jones and Meier:

Enclosed is a Corrective Action Order issued by the Associate Administrator for Pipeline Safety in the above-referenced case. It requires you to take certain corrective actions with respect to your Keystone hazardous liquid pipeline in connection with the May 7, 2011 leak incident at the Ludden Pump Station and the May 29, 2011 leak incident at the Severance Pump Station. Service is being made by certified mail and facsimile. Your receipt of this Corrective Action Order constitutes service of that document under 49 C.F.R. § 190.5. The terms and conditions of this Order are effective upon receipt.

Sincerely,

Jeffrey D. Wiese  
Associate Administrator  
for Pipeline Safety

Enclosure

cc: Mr. Alan Mayberry, Deputy Associate Administrator  
Mr. David Barrett, Director, Central Region, PHMSA

**U.S. DEPARTMENT OF TRANSPORTATION  
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION  
OFFICE OF PIPELINE SAFETY  
WASHINGTON, D.C. 20590**

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**In the Matter of** )

TC Oil Pipeline Operations, Inc., )

**CPF No. 3-2011-5006H**

Respondent )  
\_\_\_\_\_ )

**CORRECTIVE ACTION ORDER**

**Purpose and Background**

This Corrective Action Order is being issued, under authority of 49 U.S.C. § 60112, to require TC Oil Pipeline Operations, Inc. (“TCOPO” or “Respondent”), to take the necessary corrective action to protect the public, property, and the environment from potential hazards associated with two recent leak incidents on TCOPO’s Keystone hazardous liquid pipeline.

On May 7, 2011, a reportable failure incident occurred on pump station piping on the Keystone crude oil pipeline resulting in the release of approximately 400 barrels of crude oil. On May 29, 2011, a second reportable failure incident occurred on piping at another pump station. The Keystone pipeline is approximately 1,316 miles in length and transports crude oil from the U.S.–Canadian Border in North Dakota to Patoka, Illinois and includes an extension running from Jefferson County, Nebraska to Cushing, Oklahoma. Pursuant to 49 U.S.C. § 60117, the Pipeline and Hazardous Materials Safety Administration (PHMSA), Office of Pipeline Safety (OPS), initiated an investigation of the incidents.

**Preliminary Findings**

- At approximately 6:00 a.m. CDT, on May 7, 2011, a failure occurred on Respondent’s pipeline at the Ludden Pump Station in Sargent County, North Dakota, resulting in the release of approximately 400 barrels of crude oil. The failure occurred at Mile Post 216.7 in the vicinity of Brampton, North Dakota. The incident was reported to the National Response Center (NRC Report No. 975573).
- At approximately 2:00 a.m. CDT, on May 29, 2011, a failure occurred on the pipeline at the Severance Pump Station in Doniphan County, Kansas resulting in the release of approximately 10 barrels of crude oil. The failure occurred at Mile Post 742.2 in the vicinity of Bendena, Kansas. The incident was reported to the National Response Center (NRC Report No. 977695).

- After being notified of the Ludden Pump Station leak on May 7 by a local citizen, Respondent initiated shut-down of the pipeline and isolation of the area. The pipeline was restarted on May 13, 2011. Upon identifying the Severance Pump Station leak on May 27, 2011 from pressure readings in the control room, another shut-down and isolation procedure was initiated. The pipeline remains shut-down as a result of the Severance Pump Station leak.
- The source of the leak at the Ludden Pump Station was a threaded connection on small diameter station piping at a 1-inch x 3/4-inch swaged nipple. Respondent performed metallurgical analysis of the nipple and identified the presence of cracks at the root of the thread likely as a result of over-torque during installation. Respondent determined that the cyclic bending stress fatigue due to normal operational vibration propagated the cracks to failure.
- The source of the leak at the Severance Pump Station was a 1/2-inch diameter nipple at the pressure transmitter manifold. Preliminary metallurgical testing provided by the Respondent of this nipple also indicates cyclical fatigue.
- The Phase 1, North Dakota to Patoka, Illinois segment of the Keystone pipeline system was constructed in 2008–2009 and is 1,084 miles in length, has 23 pump stations, and consists mainly of 30-inch diameter pipe. The Cushing Extension was constructed in 2010 and consists of 298 miles of 36-inch diameter pipe and has three pump stations. The system has fusion bond epoxy (FBE) coating and an impressed current cathodic protection system. Phase 1 began commercial deliveries in June of 2010.
- The Keystone pipeline system traverses the states of North Dakota, South Dakota, Nebraska, Kansas, Missouri, Illinois, and Oklahoma. The pipeline includes approximately 389.6 miles of pipe that traverses or could affect high consequence areas (HCAs) including populated areas, river crossings, and environmentally sensitive areas.
- Respondent reported that at the time of the Ludden incident, the actual operating pressure at the failure site was 1110 psig with a station MOP of 1272. Respondent reported that at the time of the Severance incident, the actual operating pressure at the failure site was 1051 psig with a MOP of 1296 psig.
- On May 25, 2011, a transmitter fitting leak occurred on Respondent's pipeline at the Roswell Pump Station that did not meet the reportable criteria. Preliminary metallurgical analysis provided by the Respondent determined that this fitting failed due to cyclical fatigue. Respondent has also experienced minor leakage on several pump seals and from other threaded connections on small diameter piping such as mainline valve drains.

### **Determination of Necessity for Corrective Action Order and Right to Hearing**

Section 60112 of Title 49, United States Code, provides for the issuance of a Corrective Action Order, after reasonable notice and the opportunity for a hearing, requiring corrective action, which may include the suspended or restricted use of a pipeline facility, physical inspection, testing, repair, replacement, or other action as appropriate. The basis for making the

determination that a pipeline facility is hazardous, requiring corrective action, is set forth both in the above referenced statute and 49 C.F.R. §190.233, a copy of which is enclosed.

Section 60112, and the regulations promulgated thereunder, provide for the issuance of a Corrective Action Order without prior opportunity for notice and hearing upon a finding that failure to issue the Order expeditiously will result in likely serious harm to life, property or the environment. In such cases, an opportunity for a hearing will be provided as soon as practicable after the issuance of the Order.

After evaluating the foregoing preliminary findings of fact, I find that the continued operation of the pipeline without corrective measures would be hazardous to life, property and the environment. Additionally, after considering the circumstances surrounding the May 7 and May 29, 2011 failures, the proximity of the pipeline to populated areas, water bodies, public roadways and high consequence areas, the hazardous nature of the product the pipeline transports, the ongoing investigation to determine the cause of the failures, and the potential for the conditions causing the failures to be present elsewhere on the pipeline, I find that a failure to issue this Order expeditiously to require immediate corrective action would result in likely serious harm to life, property, and the environment. Accordingly, this Corrective Action Order mandating immediate corrective action is issued without prior notice and opportunity for a hearing. The terms and conditions of this Order are effective upon receipt.

Within 10 days of receipt of this Order, Respondent may request a hearing, to be held as soon as practicable, by notifying the Associate Administrator for Pipeline Safety in writing, delivered personally, by mail or by telecopy at (202) 366-4566. The hearing will be held in Kansas City, Missouri or Washington, D.C. on a date that is mutually convenient to PHMSA and Respondent.

After receiving and analyzing additional data in the course of this investigation, PHMSA may identify other corrective measures that need to be taken. Respondent will be notified of any additional measures required and amendment of this Order will be considered. To the extent consistent with safety, Respondent will be afforded notice and an opportunity for a hearing prior to the imposition of any additional corrective measures.

### **Required Corrective Action**

Pursuant to 49 U.S.C. § 60112, I hereby order TC Oil Pipeline Operations, Inc. to immediately take the following corrective actions with respect to the Keystone pipeline:

1. Prior to resuming operation of the pipeline, develop and submit a written re-start plan for prior approval of the Director, Central Region, OPS (Director), Pipeline and Hazardous Materials Safety Administration, 901 Locust Street, Suite 462, Kansas City, MO 64106-2641.
2. The re-start plan must include steps to perform repairs at the failure locations and provide for adequate staffing, monitoring, and patrolling of pump stations during the restart process to ensure that no leaks or failures occur at any station. Provide details summarizing all modifications and evaluations made to any facility, including but not limited to vibration or pulsation testing, control valve application review, and instrumentation controls. The re-start plan must also specify a daylight restart and detail

advance communications with local emergency response officials. Obtain written approval of the re-start plan from the Director prior to resuming operation of the pipeline.

3. Prior to re-start, complete mechanical and metallurgical testing and failure analysis of the failed pipe components. Complete the testing and analysis as follows:
  - A. Document the chain-of-custody when handling and transporting the failed pipe section and other evidence from the failure site; and
  - B. Ensure that the testing laboratory distributes all resulting reports in their entirety (including all media), whether draft or final, to the Director at the same time as they are made available to Respondent.
4. Within 60 days of receipt of this Order, conduct a review of all Keystone facilities and submit a report to the Director as follows:
  - A. Compile all available data on previous failures of similar small diameter piping and components;
  - B. Prepare a list by location that includes all sizes of pipe, size of pipe components or fittings, material strength, manufacturers, length of pipe segments, purpose of piping, and whether or not it was modified by a contractor at initial construction; and
  - C. Submit a report to the Director documenting Items A and B.
5. Within 45 days of receipt of this Order, conduct a review of all Issues and Incidents occurring since the beginning of Keystone pipeline operation and submit a report to the Director as follows:
  - A. Summarize by location all Issues and Incident Tracker (IIT) reports. Include information regarding who issued each report and their contact information, when the report was filed, date of the report event, who the report would have been reviewed by, what the report addressed, and copies of each report;
  - B. Compile copies of any other media, i.e., photographs, video, etc., obtained or used to provide back-up support evidence or documentation for issues on the pipeline reported through the IIT reports or reported to the employees superiors or managers;
  - C. Compile documentation, i.e., reports, memos or other correspondence, produced as a result of each IIT report or incidents;
  - D. Provide the status of the IIT reported element, the date and description of all final actions implemented or a date and description of all planned actions to address the IIT reports;

- E. Include a review of all ITT reports for all locations and determine and report how many are similar by each type of reported issue or incident;
  - F. Interview all field personnel associated with facilities identified through the IIT reports and obtain their input as SMEs on the development of a risk model and method to analyze the risk associated with the issue reported on the ITT reports. Adjust the risk model as needed based on their input and ensure the model accounts for the same issue submitted more than once. Summarize this process and how the model and risk analysis methods were derived; and
  - G. Implement the risk model and analysis in a manner that prioritizes all issues for action based on this risk analysis.
6. Within 60 days of receipt of this Order, conduct a review of all facilities since the first day pipeline operations were commenced and determine by location and date how long (in hours) each facility has been manned and provide a summary report to the Director. Include a list by location of the specific dates and times each facility has been manned while the pipeline was running and the total manned hours versus total unmanned hours. In addition, report the total hours of actual runtime for each facility in hours (if station is bypassed or pump units are not running, then report this in the total time unmanned or manned but do not include this in total hours for actual runtime). Report the pressure, flow, pipeline and/or unit configuration associated with each manned event and the number of personnel on site. Summarize all other pipeline configurations that have been run unmanned (pressures, flow, pipeline and/or unit configuration) by date.
7. Within 60 days of receipt of this Order, complete a root cause failure analysis (RCFA) for the failure incidents that is supplemented and facilitated by an independent third-party expert acceptable to the Director. Elements of the root cause analysis must include, but not be limited to: a scoping document of the root cause analysis; procedures associated with root cause analysis; multiple methods used for the analysis and updates on each method as it progresses; contributory factors; documentation of the decision-making process including management decisions associated with previously identified issues or incidents; and a final report of the root cause process results, including any lessons learned and whether the findings are applicable to other locations, processes, or procedures within the Keystone System. The RCFA must consider but not limited to the initial design and design review approval processes, construction and construction oversight processes, operations and final facility review and approval processes upon initial service of the pipeline.
8. Within 90 days following receipt of this Order, submit a remedial work plan ("Work Plan") to the Director for approval that includes corrective measures. The Work Plan must provide for the verification of the integrity of the pipeline and must address all factors known or suspected that caused or contributed to the May 7 and May 29, 2011 failures and other known releases, including, but not limited to:
- A. The integration of the results of the RCFA and other failure analyses and actions required by this Order with all relevant operating data including all historical repair information, construction, operating, maintenance, testing, leak history,

metallurgical analysis or other third party consultation information, and assessment data;

- B. The performance of additional field testing, inspections, and evaluations to determine whether and to what extent the conditions associated with the failures, or any other integrity-threatening conditions are present elsewhere on the pipeline. A third party contractor specializing in vibration and pulsation analysis, upon acceptance by the Director, shall be retained to design evaluation methods, facilitate and review any required training, perform analysis of field test results and provide recommendations. Include a detailed description of the criteria to be used for the evaluation and prioritization of any integrity threats and anomalies that are identified;
  - C. The performance of repairs or other corrective measures that fully remediate the condition(s) associated with the pipeline failures and any other integrity-threatening condition, including those identified per Items 4 and 5, everywhere along the pipeline where they are identified. Include a detailed description of the criteria and method(s) to be used in undertaking any repairs, replacements, or other remedial actions;
  - D. The implementation of continuing long-term periodic testing and integrity verification measures to ensure the ongoing safe operation of the pipeline considering the results of the analyses, inspections, and corrective measures undertaken pursuant to this Order; and
  - E. A schedule for completion of the Items A–D.
9. The Work Plan becomes incorporated into this Order. Respondent must revise the work plan as necessary to incorporate the results of actions undertaken pursuant to this Order and whenever necessary to incorporate new information obtained during the failure investigation and remedial activities. Submit any such plan revisions to the Director for prior approval. The Director may approve plan elements incrementally.
10. Implement the Work Plan as it is approved by the Director, including any revisions to the plan.
11. Submit monthly reports to the Director that: (1) include all available data and results of the testing and evaluations required by this Order; and (2) describe the progress of the repairs or other remedial actions being undertaken. The first monthly report is due on July 31, 2011. The Director may change the interval for the submission of these reports.
12. It is requested but not required that Respondent maintain documentation of the costs associated with implementation of this Corrective Action Order. Include in each monthly report submitted, the to-date total costs associated with: (1) preparation and revision of procedures, studies and analyses; (2) physical changes to pipeline infrastructure, including repairs, replacements and other modifications; and (3) environmental remediation, if applicable.

13. With respect to each submission that under this Order requires the approval of the Regional Director, the Director may: (a) approve, in whole or part, the submission; (b) approve the submission on specified conditions; (c) modify the submission to cure any deficiencies; (d) disapprove in whole or in part, the submission, directing that Respondent modify the submission, or (e) any combination of the above. In the event of approval, approval upon conditions, or modification by the Director, Respondent shall proceed to take all action required by the submission as approved or modified by the Director. If the Director disapproves all or any portion of the submission, Respondent must correct all deficiencies within the time specified by the Director, and resubmit it for approval.

14. Respondent may seek the termination of this Order upon a written request from TCOPO providing reliable technical justifications demonstrating that the hazard has been abated including documentation establishing that all measures necessary to correct the condition(s) leading to the failures have been fully implemented as determined by the Director.

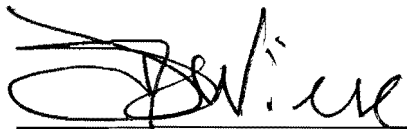
The Director may grant an extension of time for compliance with any of the terms of this Order upon a written request timely submitted demonstrating good cause for an extension.

The actions required by this Corrective Action Order are in addition to and do not waive any requirements that apply to Respondent's pipeline system under 49 C.F.R. Part 195, under any other order issued to Respondent under authority of 49 U.S.C. § 60101 et seq., or under any other provision of Federal or State law.

Respondent may appeal any decision of the Director to the Associate Administrator for Pipeline Safety. Decisions of the Associate Administrator shall be final.

Failure to comply with this Order may result in the assessment of civil penalties and in referral to the Attorney General for appropriate relief in United States District Court pursuant to 49 U.S.C. § 60120.

The terms and conditions of this Corrective Action Order are effective upon receipt.



Jeffrey D. Wiese  
Associate Administrator  
for Pipeline Safety

JUN 03 2011

Date Issued