BEFORE THE
PUBLIC UTILITIES COMMISSION
STATE OF SOUTH DAKOTA

KEYSTONE XL PROJECT
DOCKET HP09-001

SUPPLEMENTAL PREFILED TESTIMONY OF WILLIAM MAMPRE
ON BEHALF OF THE COMMISSION STAFF
OCTOBER 2009

BEFORE THE PUBLIC UTILITIES COMMISSION STATE OF SOUTH DAKOTA

SUPPLEMENTAL PREFILED TESTIMONY OF WILLIAM MAMPRE

Q. Please state your name and business address.

A. My name is William Mampre. My business address is 7135 Janes Avenue, Woodridge, Illinois, 60517.

Q. Did you review the application and previously provide direct testimony on behalf of Commission Staff?

A. Yes.

Q. Several questions came up as you prepared to file your initial direct testimony. Did the Applicant respond to the questions posed in your original testimony?

A. Yes. The answers were provided in the following data requests:

4-6 – Training of SCADA control room employees.

4-7 – Pipeline shutdown procedure for SCADA information suggesting a leak.

4-8 – Pipeline surge protection model.

The applicant's answers are attached as Exhibit A.

Q. Based on the answers received in the above data requests, are there any conditions that you recommend as part of granting the siting permit for South Dakota? If so, what are they?

A. The questions were answered satisfactorily. I do not recommend any conditions as part of granting the siting permit for South Dakota.

4-6

Data Request:

Please provide information to demonstrate that training of SCADA control room operators and other employees is sufficient to recognize a release has occurred.

Response:

Because the Keystone XL pipeline will operate in both the USA and Canada, the Keystone XL Pipeline Controllers will be trained to meet the requirements of both US DOT (PHMSA) and NEB (National Energy Board) regulatory requirements. The regulatory requirements for Pipeline Controller training for leak detection in the USA and Canada are outlined in API 1130 Section 6.5 and in CSA (Canadian Standards Association) Z662 Annex E. The combination of the requirements of these two regulatory documents outlines a very thorough training program for control room staff.

For Keystone XL, the training of Pipeline Controllers will utilize:
- a Telvent Simsuite OTS (Operator Training Simulator). For leak detection training, the simulator allows various sizes of leaks and at various locations to be impressed upon the simulation. The Pipeline Controllers learn how to recognition and respond to these simulated leaks.
- a formal pipeline hydraulics training course and training in the use of a pipeline hydraulic calculator that a Controller can use for pipeline hydraulic analysis
- in the OTS testing of the Pipeline Controller's ability to recognize and respond to leaks and qualification testing of the Pipeline Controllers
- table top exercises in how to recognize a leak, how to analyze a leak and how to respond
- training so the Controllers thoroughly understand the capabilities of the four types of leak detection applications that will be used on the Keystone XL pipeline
- training in Emergency Response and how to work with support staff and field staff to verify leak size and location

The following text is the applicable Pipeline Controller training section from API 1130. Keystone XL will meet all of the requirements of this section.

Response prepared by: Don Scott, TransCanada

Exhibit A

6.5 PIPELINE CONTROLLER TRAINING & RETRAINING

The users of the CPM system (i.e. the Pipeline Controllers) and any CPM support staff require appropriate CPM training. CPM alarms may be the most complex type of alarm experienced by the Pipeline Controller. Specific training and reference material is necessary to prepare the Pipeline Controller to adequately recognize and respond to these alarms. This requires both a knowledgeable perspective on the alarms themselves as well as the nature of the alarms. The American Petroleum Institute has created a Recommended Practice RP1161 for Controller Training that considers many important related training issues outside the scope of this publication.

The training plans may include;
- Periodic reviews and or knowledge testing of the Pipeline Controller
- Review of training material to be accurate and thorough

Retraining may be aided by review of known cases where the irregular operating condition alarms or abnormal operating conditions have occurred and possible commodity release alarms have been generated.

The following technical areas may be considered: (only as they relate to the CPM system)

• Hydraulics. A Pipeline Controller should be trained in the basic concepts of pipeline steady state hydraulics as they relate to the CPM system. The variances of hydraulic pressure due to elevation profiles, batches of differing density, temperature effects, and DRA. The controller should also be trained in the basic relationship of pressure and temperature during shut-in conditions.

A Pipeline Controller should be trained to recognize the effects of pump start-ups/shutdowns, valve operation switch, pressure setpoints and other everyday activities, which cause transient conditions. Any of these will cause a system flow or pressure transient to appear potentially affecting CPM thresholds leading to non leak alarming.

• Alarming/Performance. The Pipeline Controller should be able to recognize and react to all CPM alarming, cognizant to indicators of CPM system performance.

• Data Presentation. A Pipeline Controller should be trained in the recognition of the CPM notification or alarm and may be trained to research the cause of the alarm (data failure, irregular operating condition or possible commodity release), or in methods of correlation of the alarm to independent data so Controller will pursue the appropriate response. The presentation of CPM alarm data is a crucial component, such as the trend of the probability of a leak, or the description of the location for which the leak declaration has occurred. Other specifics to Data Presentation can be referred to in API 1165

• Instrument Failure. The Pipeline Controller should be able to qualitatively identify the impact of an instrument failure on the CPM system. The Pipeline Controller should be trained to link the alarm event with the concept that the CPM system could be impaired.

• Validating CPM Alarms. An evaluation of the CPM system and operating conditions is necessary for validating or explaining the cause of a CPM alarm. The Pipeline Controller should be trained to recognize and react to abnormal operating conditions and to take appropriate action. The training may be directed towards following procedures or calling upon and working with external resources for alarm evaluation.

• Line Pack Change (Online). A Pipeline Controller should be trained to recognize CPM hydraulic pressure changes due to varying line pack. A fundamental element in the spectrum of inventory control is the calculation of mass, or the comparison of barrels in versus barrels out. This training would include the ability to recognize the compressibility behaviour of the liquid hydrocarbons that are transported.

A Pipeline Controller should be knowledgeable about sections of the pipeline that are susceptible to intermittent "slack line conditions". The Controller should be knowledgeable about how this condition affects the CPM performance.

• Trending. A Pipeline Controller should be able to recognize benefits provided by trending analysis of pipeline variables from SCADA and CPM. Trending data can be presented graphically or may be presented as a tabular display of historical data. A graphical output may provide the best visual history of CPM parameters. The Controller should be able to cross correlate CPM output with SCADA output wherever possible confirming CPM alarm evaluation.

• CPM System Operation. The Pipeline Controller should be trained to understand the CPM system, and the concept/theory of its operation. A portion of Pipeline Controller training may include periodic review of the use of the CPM system in a training environment. Training may cover all the various CPM systems in use within the Control Center and unique aspects of each application as they apply to individual pipeline segments.

Response prepared by: Don Scott, TransCanada

The Pipeline Controller should be trained to interpret alarms correctly and in a timely manner or work with internal or external resources to evaluate the alarm. The CPM system should be implemented so the alarms are readily recognizable.

• Abnormal Functions. The Pipeline Controller should be trained to recognize and react to the abnormal function of a CPM system as well as the abnormal function of the SCADA system. The loss of either should elicit certain predefined actions intended to preserve pipeline integrity. Targeted response actions should be thoroughly analyzed and scripted for prompt, efficient action.

For example, if the CPM system becomes non-functional or severely degraded due to field equipment or SCADA failure, the Pipeline Controller should be trained to employ other leak detection methods to compensate for the inadequacies of CPM. Alternatively, the Control Center may need to define what interval of time the CPM can be non-functional and what action needs to be taken. Short term solutions may consider manual line balance and over-short and pressure /flow monitoring. Actions might include tightening of pressure and flow alarm parameters.

• Other Leak Detection Techniques. The Pipeline Controller should be trained in how to employ the results of other leak detection technique such as 3rd party reports, SCADA deviation alarms etc so that a CPM system is not considered to be the only means of detecting leaks. The Controller should know what procedures to follow and reactions to make for other methods.

Response prepared by: Don Scott, TransCanada

4-7

Data Request:

Please provide procedure information sufficient to demonstrate procedures are in place to shut down the pipeline immediately in the event there is a question or concern any data is received that may suggest there is a release of product to the environment.

Response:

Procedures for immediate shutdown of the Keystone XL pipeline will be developed and will be in place to cover two situations:

a) the occurrence of a large leak that is greater than approximately 25% of the line flow rate. This size of leak causes a severe and obvious degradation of the hydraulic profile of the pipeline. The Pipeline Controller will notice this change in operations through SCADA monitoring and will initiate an immediate controlled shutdown of the pipeline.

b) the situation where a leak alarm occurs in conjunction with another "leak trigger". The procedure would contain these words or details: In the event an operator receives an alarm, regardless of severity, in conjunction with an additional leak trigger, the actions will be the same: Shutdown and isolate the pipeline as per Isolation and Segmentation Standards – Emergency Shutdown.

Leak triggers would normally include:

- Sudden unexplained drop in upstream discharge or downstream suction pressure.
- Sudden unexplained change in throttle or VFD percent synchronous.
- Pump falling off on low suction in combination with an increase in upstream flow rate.
- Pump Station locking out in combination with an increase upstream flow rate.
- A Leak Detection System (LDS) Alarm from one of the four additional leak detection systems.
- An anomaly in pipeline balance (Volume In vs. Volume Out) over 2 hour window greater than 5 %.
- Third Party Call-in

Response prepared by: Don Scott, TransCanada

4-8a

Data Request:

Please provide the pipeline surge protection model or other information that demonstrates that the calculations from the transient model showing the maximum surges along the pipeline from the failure of one of the devices mentioned below , unexpected shutdown of a pump station or the unexpected closure of a pipeline valve will not overpressure the pipe. Also, please provide information on any other overprotection methods in place to protect the pipe from overpressure in surge conditions.

SCADA system software at the OCC

a. Suction based discharge pressure algorithm

Response:

Overpressure protection of the Keystone XL pipeline considers two aspects: steady state pressure profile; and surge pressures.

The suction based discharge pressure reduction (SBDPR) algorithm is calculated based upon the steady state pressure profile of the pipeline. The SBDPR calculation is continuous and the values therefore change as the pipeline conditions (e.g. suction pressure) change. The algorithm defines a relationship between the suction pressure at a downstream station and the discharge pressure of the pump station that is immediately upstream. For example, a combination of a high discharge pressure with a high suction pressure could create a midline pressure that would exceed the maximum allowable pressure (MOP) at that location. The SBDPR forces the reduction of the allowable discharge pressure so an overpressure cannot occur anywhere in that section of the pipeline. The SBDPR algorithm resides in the SCADA system in the OCC (Operations Control Centre).

A transient hydraulic model is used to calculate possible surge pressures (for example caused by events such as pump station shutdown or unexpected valve closure) and the calculated surge pressure is overlaid on the steady state pipeline pressures. Specific control algorithms or additional hardware is then added to the pipeline to ensure that the combined pipeline pressure does not exceed 110% of MOP at any pipeline location.

Response prepared by: Don Scott, TransCanada

Addressing surge pressures only, the magnitude of the surge pressures that could occur on the Keystone XL pipeline are calculated by use of Advantica SPS (Stoner Pipeline Simulator) transient hydraulic simulation software. This modeling software is licensed from Stoner. The configuration of the software and the interpretation of the outputs is specific to the pipeline being studied and the set of conditions that are being reviewed. Because of its proprietary nature, Keystone is not able to provide the pipeline surge calculation model.

The surge pressure design for Keystone XL Pipeline is underway but has not been completed. Using the example of an unexpected valve closure, there are two ways to handle the possible surge: prevention; and/or mitigation. To prevent an overpressure, the SCADA system, when it determines that a valve is in-travel from an open state, will shut down the pipeline upstream of the valve closure. To mitigate possible valve closure overpressure, the motorized valve operator will be programmed to close slowly for the last part of its travel. This slower closure reduces the moving fluid speed over a longer period of time and minimizes the surge to a value which when added to steady state pressure will not exceed the 110% MOP pressure that is allowable by the pipeline code.

Response prepared by: Don Scott, TransCanada

4-8b

Data Request:

Please provide the pipeline surge protection model or other information that demonstrates that the calculations from the transient model showing the maximum surges along the pipeline from the failure of one of the devices mentioned below , unexpected shutdown of a pump station or the unexpected closure of a pipeline valve will not overpressure the pipe. Also, please provide information on any other overprotection methods in place to protect the pipe from overpressure in surge conditions.

SCADA system software at the OCC

b. Suction based discharge pressure reduction algorithm

Response:

See response to 4-8a above.

Response prepared by: Don Scott, TransCanada

4-8c

Data Request:

Please provide the pipeline surge protection model or other information that demonstrates that the calculations from the transient model showing the maximum surges along the pipeline from the failure of one of the devices mentioned below , unexpected shutdown of a pump station or the unexpected closure of a pipeline valve will not overpressure the pipe. Also, please provide information on any other overprotection methods in place to protect the pipe from overpressure in surge conditions.

SCADA system software at the OCC

Logic in the stations PLCs

c. Flow based discharge pressure deduction algorithm

Response:

Please refer to the answer provided in 4-8a for information on the model and surge pressures.

The flow based discharge pressure reduction (FBDPR) algorithm is calculated based upon the steady state pressure profile of the pipeline. The FBDPR calculation is continuous and the values therefore change as the pipeline conditions (e.g. flow rate) change. The algorithm calculates the hydraulic profile of the line based upon the flow in the pipeline (measured by a flow meter at each station) and the characteristics of the fluid in the pipeline and uses that profile to infer the suction pressure at downstream stations. If the algorithm calculates that an overpressure could occur in the section of line considered by the FBDPR, it forces a reduction in the station discharge pressure to a value which would prevent overpressure anywhere in the section being protected. The FBDPR algorithm resides at the station where the flow is measured. It is, therefore, independent of SCADA and the communications infrastructure.

Response prepared by: Don Scott, TransCanada

4-8d

Data Request:

Please provide the pipeline surge protection model or other information that demonstrates that the calculations from the transient model showing the maximum surges along the pipeline from the failure of one of the devices mentioned below , unexpected shutdown of a pump station or the unexpected closure of a pipeline valve will not overpressure the pipe. Also, please provide information on any other overprotection methods in place to protect the pipe from overpressure in surge conditions.

SCADA system software at the OCC

Logic in the stations PLCs

d. Station control valve control to prevent pipeline over pressure

Response:

The station PCV (pressure control valve) reduces station discharge pressure by throttling pressure that is in excess of the set point discharge pressure at the station. It is a device that controls the steady state pipeline discharge pressure. The response time of a PCV is normally slower than the traveling velocity of a surge pressures so PCV's are not used to block or reduce a pipeline pressure surge.

In the case where a PCV fails, it will usually fail in last position. But if the last position is not adequate to maintain the pressure below the in-force allowable pressure, the overpressure protection system will reduce the speed of the last in series pump (if there is a VFD installed) or shutdown the last in series pump (or cascade additional pumps or shutdown the entire station if necessary) to ensure that the safe pressure maximum is not exceeded. The overpressure protection set points is dictated (either through SCADA or encoded in the station the PLC).

Response prepared by: Don Scott, TransCanada

4-8e

Data Request:

Please provide the pipeline surge protection model or other information that demonstrates that the calculations from the transient model showing the maximum surges along the pipeline from the failure of one of the devices mentioned below , unexpected shutdown of a pump station or the unexpected closure of a pipeline valve will not overpressure the pipe. Also, please provide information on any other overprotection methods in place to protect the pipe from overpressure in surge conditions.

SCADA system software at the OCC

Logic in the stations PLCs

e. Speed control of motors with VFD to prevent pipeline over pressure

Response:

The station VFD (variable frequency drive) pump speed control equipment reduces station discharge pressure by reducing the speed of the pump until station discharge pressure matches the set point for the discharge pressure at the station. It is a system that controls the steady state pipeline discharge pressure. The response time of a VFD is normally slower than the traveling velocity of a surge pressures so a VFD is not used to block or reduce a pipeline pressure surge.

In the case where the station VFD fails, the pump that is being controlled by the VFD will shut down. But if the discharge pressure being produced at the station is above the in-force maximum pressure (either provided through SCADA or encoded in the station the PLC), the overpressure protection software at the station will shutdown the last in series pump (or the entire station of necessary) to ensure that the safe pressure maximum is not exceeded.

Response prepared by: Don Scott, TransCanada