

Email from Kathy Davies, PGE Trans.
Re: KB Pipeline - Flow Slide.

From: Kathy Davies [Kathy.Davies@pgn.com]
Sent: Tuesday, April 07, 2009 10:50 AM
To: Chu, Kuang (UTC); Jones, Al (UTC); Lykken, David (UTC)
Cc: Sam Hicks; David Hendrix; GeorgeHutcherson
Subject: FW: Kelso-Beaver (KB) Pipeline - Flow Slide
Attachments: KB-C014.pdf; KB-C015 Flow Slide Parameters.pdf; CIMG1530.JPG; CIMG1532.JPG; CIMG1525.JPG

Kuang,

It was a pleasure meeting you at the audit of the KB pipeline the week of March 23, 2009. This e-mail is a follow-up to the discussion you and I had on Tuesday March 24, and subsequent conversations with Sam Hicks from Cascade Natural Gas regarding the Flow Slide.

Below are our responses to your inquiry:

Has PGE/KB Owners considered exposing the pipeline to relieve the pressure?

PGE has been monitoring the Hazel Dell Road Slide since 2000 which incorporates the Allen Brothers Slide and Flow Slide areas. Since 2006, PGE has been monitoring the Flow Slide every two (2) weeks during the rainy season (Nov. 1 to April 1), with additional monitoring following a 2 inch rain event in a 24 hour period. During the dry season, monitoring takes place every 6 weeks. Throughout the surveillance period, the pipe and the adjacent ground has not moved in this area. We have not considered exposing the pipeline due to the lack of movement and because the large scale excavations required to expose the pipeline could very easily initiate land sliding in areas that are currently not active.

What are the stresses on the pipeline and has it moved?

There have been no detected pipe movements in the Flow Slide area which would have resulted in additional pipe bending stresses. This section of pipe was and still is operating at normal hoop stresses of approximately 22,000 psig within +/- 2,000 psig range.

What are the stress analysis numbers from Mustang?

Mustang Engineering, out of Denver, Colorado, was hired to perform stress calculations using Caesar II Version 4.5 analysis on the Allen Brothers (AB) above ground pipe. Based on this analysis, the bending stress limits that would occur with pipe movement were determined based on CFR 192, ASME 31.8S. Per code, the maximum bending stress shall not exceed 0.72S, where S is the specified minimum yield stress and the maximum operating stress shall not exceed the specified yield stress S. The pipe position accuracies taken were greater than +/- 0.01' in the x,y and z coordinates.

The AB calculations used pipe displacements multiplied by 1.5 (1.5 multiple not required) at a MAOP of 809 psig (normal operating pressures between 550 and 650 psig). The pipe ends, where the pipe goes underground, were assumed constrained in the calculations. The maximum displacement was found to be about 12" in about 120' pipe length without exceeding code limit.

We would like to point out that the recent flow slide activity was brought on by 6+ inches of rainfall over a 24 hour period which is a very unusual event. The recently completed fix buttresses the slide area and improves area drainage. The fix significantly improves the stability of the slope as well as the drainage.

I have attached a drawing showing the flow slide along with the survey monitoring points that PGE monitors every 2 weeks, or anytime we have 2" or more of rain in a 24 hour period.

I have also attached pictures of the flow slide area now that the work is complete. Kuang, pictures # 1530 & 1532 were taken at the place where you and I were standing. Picture #1525 was taken on the other side of the slide. I hope this provides you with an idea of the finished work.

Please call me if you have questions. I can schedule a conference call with you and our engineers if you wish further technical discussion.

Sincerely,

Kathy Davies
PGE Transmission Contracts Analyst
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