FAQ relating to construction of pipelines.

1. How does the pipeline design consider risks related to ice jams, floods, and other events, that could impact the pipeline when they cross water bodies and drainages?

Federal regulations, in 49 CFR 195 – Transportation of Hazardous Liquids by Pipeline, address reporting, design, construction, etc. for oil pipelines. During the design process, each specific instance of a water body or drainage crossing is addressed based on local terrain and conditions. The design at each location may be different depending on size of the water body, depth of water, and length of crossing.

Open cut (OC, trenching) methods are generally the preferred installation methods for any pipeline when feasible. OC methods are generally less costly and allow the installers to visibly see what they are doing. OC methods can be accomplished for most drainage channels (dry and wet) and small water bodies with minimal planning and water management. Restoration and protection of the bed and banks after construction is described in the CMRP. Protection of the disturbed areas is important to prevent erosion and potential washouts and exposure of the pipeline post construction.

Directional boring methods are generally used in areas where there are other known utilities or infrastructure preventing OC and/or under rivers, streams and other larger water bodies that cannot effectively be de-watered for trenching construction. Boring methods have little permanent impact on the channel morphology of the stream or river crossed.

Once a pipeline is constructed, ice jams, floods, and other hydrologic events would generally not impact the pipelines crossing under the rivers since they are not exposed to flowing water or ice; however, in sever runoff events, there could be the potential for a pipeline to be uncovered due to channel scour. This usually happens in locations where obstructions or constrictions (e.g., bridges, ice jams, debris jams) during flooding change the course or direction of the flowing water causing erosion. A five feet minimum cover for most crossings is reasonable and in line with typical, state-of-the-practice, sub-grade trench type construction activities (e.g. pipelines and other utilities). Many times, in critical areas or under larger streams and rivers, a scour analysis can be conducted to determine a reasonable maximum scour depth. Any conduits crossing these water bodies could then be placed below this elevation.

Specifically, does the present Keystone XL Pipeline design meet the demands above related to water body crossings?

In addition to/in conjunction with those regulations discussed above, the US Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) which is the primary federal regulating body for oil pipelines, developed a set of 57 project-specific special conditions applicable to the Keystone XL Pipeline and recommended that the Department of State impose those "Special Conditions" on the applicant. The special conditions are listed in Appendix Z – Compiled Mitigation Measures, of the Final Supplemental EIS (January 2014). The applicant has agreed to incorporate those special conditions into their project.

The final pipeline design has not been completed at this time. The final design is not due to regulators (PHMSA) until 90 days prior to the anticipated construction start date (Special Condition No. 17). However, the application and some of the other supporting documents address in general terms the construction and restoration methods to be used for the Keystone XL Project. These are not site-specific and could apply to any pipeline constructed.

- Section 8 of the Application includes measures that will be implemented to "restore equivalent capability to lands disturbed by construction along the preferred route and to comply with the PSC regulations and the Nebraska Oil Pipeline Reclamation Act." Appendix D is the Project's Construction, Mitigation, and Reclamation Plan (CMRP) that includes specifications on how to restore impacted areas.
- Section 9 of the Application includes a general description of construction and the methods to minimize or mitigate potential construction-related impacts.

- The CMRP (Appendix D, page 5) states that a minimum cover (surface to top of pipe) of 60” will be maintained for all waterbodies, dry creeks, ditches, drains, washes, gullies, etc., drainage ditches at public roads and railroads.
- Several methods of construction are proposed for traversing drainage channels, waterbodies, and wetlands. Section 7.4 of the CMRP describes the various methods that will be used to cross waterbodies. The CMRP states that each crossing will be constructed “in accordance with a site-specific plan as shown in the construction drawings.” As stated above, those plans are due to PHMSA a minimum of 90 days prior to construction.
- Section 7.4.5 and 7.4.6 address horizontal directional drilling (HDD) and horizontal bore crossings which will be used at “designated major and sensitive waterbodies.”
- The executive summary of NDEQ’s report *Nebraska’s Keystone XL Pipeline Evaluation* dated January 2013 discusses potential impacts on surface water during construction activities. Page ES-16 discusses five rivers that would be crossed and includes a schematic showing a conceptual HDD crossing with a 25 feet separation between the waterbody and the pipe. However, without access to the specific construction drawings for each crossing, it is not apparent what the source is for the 25 feet depth reference in NDEQ’s report.

Additional questions for the applicant, specific to this design-level concern may include:

1. What is the minimum cover depth based on?
2. Was a scour analysis completed for the “major” crossings or other locations that would have potential for scouring to more significant depths?

2. Why not use double walled pipe in construction of oil pipelines, especially in environmentally sensitive areas?

Double walled pipe is not typically used in pipeline construction including crude oil pipelines. It is sometimes used as an insulating measure to protect transported materials with significantly different temperatures than the surrounding soil. Cost is often cited as one of the reasons it is not used; however, complexity of construction and safety concerns relative to single wall pipe are also mentioned in many literature sources. Below are two sources of information that address this question.

1. Excerpted from the Canadian Energy Pipeline Association:

   We are often asked why pipeline companies wouldn’t simply use a double-walled system, to prevent pipeline spills. It’s an interesting question, because the technology does exist to build double-walled pipelines, and they are already used in certain circumstances. We asked Dr. Alan Murray (an adjunct professor in the Schulich School of Engineering at the University of Calgary) why double walled pipelines are not routinely used to help prevent pipeline spills. Here’s what we learned:

   When double-walled pipelines are most commonly used.

   Alan explained that double-walled pipelines may be used when there are large differences in temperature between the flowing liquid and its surroundings. For instance, some offshore pipelines carry a waxy crude, which would solidify if it were exposed to the colder temperatures of seawater. The insulation afforded by using aerogel (which has a very low thermal conductivity) in the gap between the layers of pipe keeps the crude at an appropriate temperature.

   “Closer to home,” said Alan, “the issue of large temperature difference can be found with steam-assisted gravity drainage (SAGD) facilities, where the product could be at say 160 degrees Celsius while the ground temperature is often below zero. That temperature difference will cause the metal to expand or contract, but if the pipe is relatively free to expand inside the outer pipe jacket then it is not subjected to very high longitudinal stress. There are several such pipelines in northern Alberta and Alaska.”

Double-walled pipelines as a spill prevention technique.

“The double skin concept is widely used in ocean going oil tankers – essentially to prevent the inner skin being breached in the event of a collision or running aground,” Alan explained. “The equivalent for a pipe would be external damage and, yes, a second pipe is likely to afford protection. However, there are other, more cost-effective, solutions such as burying the pipe deeper or, in areas with a higher risk of interference, by placing slabs over it to prevent a line strike.” Unfortunately, there have been incidents of double-walled pipelines leaking, which is why leak containment is not considered their primary purpose.

The disadvantages:

So let’s take a look at why double walls are not more commonly used in new pipeline construction:

- They are extremely complex, and costly, to design and construct because of the extra pipe and welds required, and the technology needed to centralize the two concentric pipes.
- It is more difficult to monitor a double-walled pipeline. For instance, inline inspection tools are unable to evaluate the condition of the outer pipe, to confirm that it is still in a fit condition to act as a leak containment device.
- The outer pipe interferes with maintenance efforts and integrity digs.
- If the inner layer were to leak, then the airspace between pipes would have to be large enough to contain the escaping fluid, adding further to the cost.

“In situations where double-walled pipelines have failed,” said Alan, “the contributory factors are likely to have been the same as in conventional pipeline failures.” In other words, any additional protection they might provide does not make them a viable option given today’s technology and economic environment.

2. California State Fire Marshal – Pipeline Safety Division. The California State Fire Marshal’s position on double-walled pipe for hazardous liquids describes their position as to why they do not allow double-walled pipe for hazardous material transfer. The document is attached.

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INFORMATION BULLETIN

Date Issued: October 30, 1998

SUBJECT: **STATE FIRE MARSHAL'S POSITION ON DOUBLE-WALLED PIPING FOR HAZARDOUS LIQUID PIPELINE SYSTEMS**

The California State Fire Marshal (CSFM) prohibits the installation of double-walled pipe for jurisdictional hazardous liquid pipeline systems. Our opposition is based on reasons of legal jurisdiction, design and construction difficulties, operation and maintenance problems, risk to the public and to the environment, and economic impact. Let us explain each of these in more detail.

Legal Jurisdiction: We believe that other state or local agencies are preempted by law from issuing requirements concerning the safety of any hazardous liquid pipeline.

The federal Hazardous Liquid Pipeline Safety Act of 1979 establishes the basic safety standards for the transportation of hazardous liquids and pipeline facilities. Authority for enforcement of this law rests with the US Department of Transportation's Office of Pipeline Safety (OPS). Specific federal regulations concerning the safety of hazardous liquid pipelines are found in parts 190, 195, 199 and 40 of the Code of Federal Regulations. CSFM's Pipeline Safety Program has been authorized by OPS to enforce these federal standards.

Hand-in-hand with the federal regulations, the Elder California Pipeline Safety Act (Chapter 5.5, California Government Code) directs that CSFM has "exclusive safety, regulatory and enforcement authority over intrastate hazardous liquid pipelines" within this State. This authority extends to the design, construction, operation and maintenance of these pip0elines. As such, this code preempts other requirements which are inconsistent with standards enforced by CSFM.

Design and Construction: Difficulties in designing and constructing a double-walled system will be numerous and complicated. However, three of the more significant issues are:

- **Cathodic Protection:** If the outer pipe is to serve as secondary containment, bother inner and outer pipes must be cathodically protected. In addition to the considerable engineering and installation difficulties involved (such as the installation of test leads on the inner pipe), this duplicate system may be a serious economic burden to the pipeline operator due to increased installation and maintenance costs.

- **Valves:** Installation of block valves or other appurtenances will be extremely difficult in a double-wall system.

- **Bends:** Installation of pipelines requires fabrication of directional bends and turns in the field. This task will be significantly complicated with the introduction of two concentric pipes of different diameters.

Operation and Maintenance: Double-wall pipe used in hazardous liquid pipeline service will make it extremely difficult if not impossible for the pipeline operator to comply with normal operation and maintenance requirements and may profoundly affect the operator's ability to respond quickly during an emergency. For example:

- **Corrosion:** The operator will have difficulty identifying general corrosion that has reduced wall thickness of the inner pipe to less than that required for maximum operating pressure. It will also be difficult to identify areas of localized corrosion pitting to the degree where leakage might result.

- **Unintended Movement/Abnormal Loading:** The operator will have difficulty assessing the effects on the serviceability of the inner pipe from unintended movement or abnormal loading of the pipeline caused by events such as earthquake, landslide or flood.

- **Leak Detection and Hazard Mitigation:** The operator will have more difficulty detecting and locating the site of a leak or rupture. Should a release occur, hydrocarbons will tend to fill the voids of the annular spaces between the inner and outer pipes. Presence of these flammable or combustible vapors make repair operation more dangerous, more arduous, more time-consuming and more costly for the emergency responders (fire, health, police agencies, etc.) and the operator.

- **Thermal Stress:** Double-walled pipe introduces serious stress on the pipeline system due to thermal expansion and contraction. While significant, the impact of this effect varies with the differing diameter and thermal environment of each pipe.

- **Electrical Short Circuiting:** Electrical isolation of the inner and outer pipe is necessary to avoid electrical shorts. Any metal-to-metal contact of inner and outer pipes caused by the previously identified thermal expansion-contraction may result in an electrical short form currents generated by the cathodic protection of the pipeline. In addition, the complications arising from field fabrication of pipe bends will most probably allow areas where the distances between the inner and outer pipes may be compromised. This underscores two serious problems:

  (a) There is an added risk of pipeline failure caused by corrosion pitting due to electrical shorts rendering the cathodic protection system useless; and ,
  (b) The short may act as a source of ignition if flammable or combustible vapors have been released through pinhole leaks. This situation could result in a catastrophic incident.

Risk to the Public and to the Environment: Regulations have been established at the federal and state level to assure minimal risk to the public and the environment. The design, construction, operation and maintenance difficulties listed above serve as some examples of how the proposed installation of double-wall pipeline is contrary to established law, regulation and established engineering principles and could compromise public and environmental safety.

Each case where the design and installation of the system is made more difficult results in increasing the chance that a mistake will be made. Each instance where there is more difficulty in identifying corrosion, pipe stress, or cathodic protection failures increases the risk that the operator will not be able to successfully identify a problem before it becomes a crisis. All of these result in increasing the risk to the safety of the public and the environment.

Economic Impact: As is done across this country, compliance with established federal and state standards assures that crude oil and petroleum products may be transported with minimal risk to the public and the environment. The economic impact of operating and maintaining a pipeline meeting the requirements of federal and State standards is not a consideration. However, in this case, the proposal for double-wall construction adds significant operator costs for design, construction, operation and maintenance while increasing the risk to the public and the environment.

Questions regarding this Bulletin or any issue concerning pipeline safety may be directed to:

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