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"Clear Knowledge in the Over Information Age"

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Date: June 20, 2017

To: Rob Wyman
City Manager
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Re: Accufacts Review of Puget Sound Energy's Energize Eastside Transmission project along Olympic Pipe Line's two petroleum pipelines crossing the City of Newcastle

I. Introduction and Scope

Accufacts Inc. ("Accufacts") was asked to perform a technical review of several specific documents identified below ("Documents") related to the Energize Eastside ("EE") project's possible impact on the 16-inch and 20-inch Olympic Pipe Line product pipelines crossing the City of Newcastle ("City"). Within the City, the existing 16 and 20-inch Olympic Pipe Line products pipelines ("Olympic") are collocated on or near Puget Sound Energy's ("PSE's") electric transmission pipeline right-of-way ("ROW") proposed for electrical expansion from 115 KV to 230 KV.

With regard to PSE's EE project, the City asked Accufacts to specifically review and briefly comment on the following Documents:

1. DNV-GL Final Report, AC Interference Analysis – 230 KV Transmission Line Collocated with Olympic Pipelines OPL 16 and OPL 20, dated December 13, 2016,

2. Phase 2 Draft EIS dated May 2017: Chapter 3, Long-Term (Operation) Impacts and Potential Mitigation; and Chapter 4, Short-Term (Construction) Impacts and Mitigation, and

3. Phase 2 Draft EIS Preliminary Draft V-2, "Appendix I. Pipeline Safety, Appendix I-1 through I-5," dated April 2017.

The EE project can present a threat to the pipelines during two separate phases: 1) the construction phase from possible abnormal loading or impact threats that could damage the pipelines, and 2) an operational phase when the electrical power lines are operated at the higher KV that can introduce stray currents, also known as interference currents, that can remove steel from buried pipelines if not properly addressed.

In reviewing the Documents, Accufacts has the following major findings:

1. Olympic Pipe Line bears the ultimate responsibility for possible PSE's EE project interactions that could result in an Olympic pipeline failure.
2. The Documents do not provide sufficient details to assure Accufacts that appropriate precautions will be implemented or effective in protecting the pipelines during the construction phase.
3. The DNV-GL Final Report explains how pipelines address stray current risks near high power electrical transmission lines, but correctly indicates that Olympic must provide additional field verifications to support key assumptions once EE goes operational.
4. Appendix I-5 of the Phase 2 Draft EIS EE Pipeline Safety Technical Report ("Technical Report") risk assessment approach is not relevant nor does it represent the Olympic pipelines, especially within the City.

It is Accufacts' opinion that the PSE's EE can be safely collocated with the pipelines if sufficient details, identified in the Accufacts Detailed Recommendations for EE within the City, Section III below, are implemented by PSE and Olympic, and adequately conveyed to the City. Some of these details may be sensitive and may not be publicly disseminated for obvious reasons, even in a right-to-know state, such as Washington State. My attached CV will demonstrate some of my pipeline investigative background and experience, which included evaluating the Olympic Pipe Line operation for the City of Bellingham after the June 10, 1999 pipeline rupture and tragedy.

II. Additional Accufacts observations related to EE and the Olympic pipelines within the City:

1. Olympic Pipe Line bears the ultimate responsibility for possible PSE's EE project's interactions that could result in an Olympic pipeline failure.

It is not unusual to have liquid transmission pipelines collocated in the same or nearby rights-of-way of high power electrical transmission pipelines. Federal minimum pipeline safety regulations clearly place the ultimate responsibility to assure protection of the hazardous liquid pipeline(s) in such locations squarely on the pipeline operator. Long

standing minimum federal pipeline safety regulations are very clear: "An operator may make arrangements with another person for the performance of any action required by this part. However, the operator is not thereby relieved from the responsibility for compliance with any requirement of this part."[1] "Part" in this context means the federal pipeline safety regulation incorporated as 49CFR§195 setting minimum pipeline safety standards governing the transportation of hazardous liquids by pipeline. The operator of Olympic Pipe Line is ultimately responsible for the operation of their pipelines regardless of studies or actions performed by others.

As further discussed below, while the PSE commissioned DNV-GL Final Report presents a prudent analysis of the possible interactions related to stray current threats from the EE project, and includes rational electrical design/operational suggestions to reduce possible infrastructure impacts by the PSE electrical system, the ultimate threats to the pipeline are the responsibility of Olympic Pipe Line. PSE must provide details as to how Olympic will verify all key assumptions in the DNV-GL Final Report and, more importantly, confirm that actual pipeline field operations are relevant to assure pipeline safety.

2. **The Documents do not provide sufficient details to assure Accufacts that appropriate precautions will be implemented or effective in protecting the pipelines during the construction phase.**

During the construction phase, threats to the pipelines can be introduced from abnormal loads either from surface activity such as heavy equipment or excessive forces such as excavation/auguring. While construction activity can also introduce threats that can contact the pipelines and directly damage them, one does not have to hit a pipeline to cause damage that can fail at a later time as a delayed failure, such as abnormal loading that can deform a steel pipeline. Fortunately, the science and engineering associated with evaluating such construction activity threats to buried pipelines is well established. Depending on the specific location, such potential threats diminish rapidly with lateral distance from a pipeline, and adequate depth can quickly provide a safety factor, depending on the abnormal loading threat expected near/above a pipeline.

The Phase 2 Draft EIS report indicates that, across the City, the pipelines are in the "center of the {PSE} right-of-way."[2] It is important to note that some of the Documents

[1] 49CFR§195.10 - Responsibility of operator for compliance with this part.
[2] EE EIS, "Chapter 3 Long-Term (Operation) Impacts and Potential Mitigation," May 2017, p. 3.9-9.

could mislead the reader regarding the requirement for pipeline depth.[3] Much of the Olympic system, including the segments crossing the City, is classified as interstate and not subject to the additional conditions imposed by the Washington Administrative Code that instill additional requirements beyond federal regulations on the limited intrastate portions of the Olympic system. I believe the pipeline segments spanning the City are classified as interstate and thus have no requirement to maintain pipeline depths at the initial installation depths that occurred many decades ago. It is thus Olympic Pipe Line's responsibility to confirm pipeline lateral and, more importantly, depth to avoid construction threats that could result in pipeline failure, as actual depth could have changed over the years.

PSE must work with Olympic to readily demonstrate to the City that adequate protections are to be utilized to avoid these short-term threat activities during construction. Depending on the right-of-way, there is no "one size fits all" distance, either lateral or depth, that should be used, as such safe distance determinations regarding abnormal loading on pipelines are ROW site specific and depend on various factors such as load which can change by project/location.

Given the challenging elevation profile of the pipelines across the City, PSE also needs to confirm that EE activities (either on or off the electrical transmission ROW) will not introduce landslide potential on the Olympic pipelines. No pipeline can withstand massive breakaway landslide abnormal loading that can occur from soil liquification in areas of steep elevation profile experiencing high rainfall or flooding, such as that which can occur in Western Washington. Breakaway landslide usually results in a pipeline rupture (high rate releases). This potential threat should be an easy threat to identify, evaluate, and assess, but has not been mentioned in the Technical Report.

3) **The DNV-GL Final Report explains how pipelines address stray current risks near high power electrical transmission lines, but correctly indicates that Olympic must provide additional field verifications to support key assumptions once EE goes operational.**

During the operational phase of the EE effort, a phenomenon commonly known in the pipeline industry as "stray current" or interference current can impact pipeline integrity if not properly addressed. Stray current is a term that captures an electrical current path generated from, among other things, high voltage power lines, poor CP system

[3] EDM Technical Services, Inc., Appendix I-5, "Technical Report, Pipeline Safety and Risk of Upset," p. 28.

design/operation, inadequate foreign crossing design/installation, or electrical "fault" short circuits from lightning or downed power lines where high energy current reaches a pipeline and causes pipe metal loss.

Federal pipeline safety regulations have been codified and prescribed for many years concerning stray current interference/interactions.[4] Even before placement into federal regulations, experienced pipeline operators were well aware of the possible interactions of high energy electrical power transmission systems on pipelines that can cause the rapid loss of buried pipeline steel. Olympic should be well aware of and experienced in stray current interaction as much of their product pipelines are collocated in high energy electrical transmission ROWs in other areas of the state that has successfully operated for over 50 years.[5] Current federal pipeline safety regulation, 49CFR195.3, places explicit prescribed regulatory obligations in the area of interference or stray current interactions on hazardous liquid pipeline operators.[6]

The DNV-GL Final Report does suggest several design modifications that PSE can utilize to reduce and control the risk of stray current to the pipelines from the EE project.[7] The DNV-GL Final Report also correctly recommends further field follow-up by Olympic Pipe Line and PSE concerning additional field monitoring and verification of both the electrical line and liquid pipeline operation to assure effectiveness of the design/operational approaches concerning possible stray current impacts from PSE's project.

Given the wide variation in field measurement conditions, PSE must have the pipeline operator confirm that key assumptions in the DNV-GL Final Report are indeed conservative and appropriate for their pipelines once the power lines go into operation at their higher voltage. AC interference, ground fault, and high energy arc potential that might reach a buried pipeline, need additional verification from Olympic as to their assumption/field measured accuracy. For example, arcing potential to pipelines from faults is highly dependent on the quality of the pipeline's external coating at a specific

[4] 49CFR§195.577 - What must I do to mitigate interference currents? Added to federal pipeline safety regulations Dec. 27, 2001.
[5] U.S. Department of Energy, "State of Washington Energy Sector Risk Profile," 2014, pp. 2 & 4.
[6] NACE SP0169-2007, Standard Practice, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems," reaffirmed March 15, 2007 (NACE 0169), IBR approved for §§ 195.571 and 195.573(a).
[7] DNV-GL Final Report, "AC Interference Analysis – 230 KV Transmission Line Collocated with Olympic Pipelines OPL 16 and OPL 20," dated December 13, 2016, p. vi.

possible threat location. Only Olympic may know such coating conditions using various field measurements. Coating quality at a specific location can have a critical influence on arc safety distances in the rare occurrence of a ground fault from high power electrical sources. While electrical arcing into a pipeline can leave clear evidence of such an event, the real danger occurs where such energy leaves the buried pipeline, a location which can be highly unpredictable along a pipeline system.

Application of prudent integrity management principles, such as sound in-line inspection ("ILI"), or smart pigging, corrosion assessment can assist in demonstrating past approach effectiveness in dealing with possible stray current interactions from such sources that can cause pipe steel removal. I must caution, however, that some stray current interactions can occur quite quickly causing rapid pipe wall metal loss and possible pipeline failure. Since ILI inspections may also occur infrequently, ILI inspection should not be the only approach to guard against stray current interaction possible threats.[8] A prudent pipeline operator will employ and integrate other measures beyond ILI, such as incorporating effective cathodic protection monitoring and analysis, to assure more timely gauging of pipeline safety approaches to confirm pipeline integrity in such collocated high power electrical transmission rights-of-way. ILI should not be the only method to verify pipeline integrity in stray current high-risk threat potential areas.

III. Accufacts Detail Recommendations for EE within the City:

In light of the above discussion, Accufacts specifically advises, in addition to the general recommendations outlined in the DNV-GL Final Report and Draft EIS, the following more detailed requirements be imposed by the City:[9, 10, 11]

1) Given the criticality of the location of the pipelines, especially their depth, to avoid construction threats that could harm the pipelines, PSE and, especially, Olympic Pipe Line should:
    a) confirm and identify specific pipeline lateral locations, including the important depth values which will vary along the pipelines,

[8] 49CFR§195.452(j)(3) & (4) *Assessment Intervals* requiring reassessment intervals of up to five years not to exceed 68 months unless a variance for longer reassessment is justified.
[9] DNV-GL Final Report, "AC Interference Analysis – 230 KV Transmission Line Collocated with Olympic Pipelines OPL 16 and OPL 20," dated December 13, 2016, p. vi.
[10] EE EIS, "Chapter 4 Short-Term (Construction) Impacts and Mitigation," May 2017, p. 4.9-7 thru 4.9-9.
[11] EE EIS, "Chapter 3 Long-Term (Operation) Impacts and Potential Mitigation," May 2017, pp. 3.9-54 & 55.

b) pinpoint what specific construction activities, including their locations and possible maximum loads, that may occur during the EE installation effort that could be a threat to the pipelines,
c) for these identified possible construction threats, commit to detailed precautions that will be required, implemented, and monitored/checked to avoid construction damage to the pipelines, and
d) verify EE activity does not introduce breakaway landslide threats to the pipelines.

2) During the operational phase of EE, Olympic, in conjunction with PSE, should:
   a. verify that the actual current densities do not pose a threat near the pipelines, especially during the early phase of EE when the power lines may be operated imbalanced (230/115 KV),
   b. establish notification protocols that would alert Olympic of possible major PSE power transmission imbalances,
   c. not only rely on periodic corrosion tool ILI to assure pipeline wall loss from possible interference currents is not occurring, and
   d. verify pipeline coating reasonable integrity to substantiate fault arcing distance determinations.

PSE, with Olympics' cooperation, should be able to sufficiently demonstrate to the City such details, including documented engineering analysis as needed, proving that sufficient safety factors exist to avoid threats to the pipelines during the construction and operational phases of EE.

IV. Accufacts General Observations on Appendix I-5 of the Phase 2 Draft EIS EE Pipeline Safety Technical Report ("Technical Report"):

It is not unusual to see a risk management approach similar to that presented in the Technical Report. From my perspective, however, the Technical Report approach is not relevant to the EE project's possible impact threat to the pipelines. Some key reasons for this are:

1) The risk assessment approaches utilized in the Technical Report are not incorporated into U.S. pipeline safety regulations.

The risk approach utilized in the Technical Report is not defined in federal pipeline safety regulations. There are many assumptions and approaches in the Technical Report that are not specifically representative of the Olympic pipelines, especially in

the event of a significant release such as a pipeline rupture. Based on my extensive experience in hydrocarbon releases, including incident response, attempts to characterize the impact area in the Technical Report are unrealistic small. For example, the pipelines' elevation profile, an important consideration in liquid pipeline operation, is neither discussed nor provided. In fairness to EDM, certain critical sensitive information known to Olympic that would assist EDM in a risk assessment approach if it were permitted, in all probability has not been disclosed to EDM given the information's sensitivity. It is, however, important to recognize such risk assessments are not codified in U.S. pipeline safety regulations for many good reasons.

In all probability, important additional safeties incorporated into Olympics' operation after the 1999 Olympic rupture tragedy in Bellingham have also not been made public. In addition, it is my experience that the Bellingham rupture cannot be well modeled by a "pool fire" as presented in the Technical Report. The challenging terrain, the pipeline elevation profile and location, as well as other considerations play a critical part in determining an impact area in the event of a release.

2) **Acceptable pipeline risk thresholds (individual or societal) are neither defined nor codified in U.S. pipeline safety regulations.**

The U.S. has more gas and liquid transmission pipeline mileage than any other country in the world by a considerable margin. While some countries have defined and incorporated certain "consequence" risk thresholds, such as acceptable mortality thresholds, into their country's pipeline safety approaches, such as the use of Quantitative Risk Assessment ("QRA"), U.S. pipeline safety regulations do not incorporate the use of this type of risk assessment approach.

The EE EIS correctly mentions that "there are no adopted federal or Washington State criteria for acceptable levels of individual risks" and "there are no adopted federal or Washington State criteria for acceptable levels of societal risk."[12] This same document cites risk thresholds for another state and other countries, but the matter quite simply is not defined, codified, nor accepted in the U.S. or Washington State pipeline safety regulations.

[12] EE EIS, "Chapter 3 Long-Term (Operation) Impacts and Potential Mitigation," May 2017, pp. 3.9-36 & 37.

3) **Assigning risk factors utilizing PHMSA/OPS historical reporting databases can be misrepresentative, as the databases are often woefully incomplete, inadequate, and can be easily misused for a specific pipeline.**

For many reasons, historical PHMSA/OPS database files can be inadequate and incomplete so as to make their use in assigning risk probability inappropriate or inadequate, for a specific pipeline operation, even with "normalization" attempts such as releases per pipeline mile. While PHMSA has made considerable attempts to make pipeline incident/accident information reported to the agency public, reports are often filed before sufficient information can be supplied to accurately complete a pipeline failure report. It is well known that numerous initial reports are not accurately updated. This can be especially problematic as to actual cause, or released volumes, which historically have been found to be inaccurate or misleading. In my experience, I have seen probability analysis abuses based on PHMSA/OPS databases on both sides of the fence, usually to drive false agendas or preordained conclusions about pipelines. These databases should be applied with great caution.

4) **Historical database files do not predict nor represent future risk probabilities on a specific pipeline system in a specific location.**

Risk probabilities derived from industry-wide databases do not represent the risks that may exist on a specific pipeline operation as management safety cultures can vary widely. Such safety culture variations can significantly increase the risk of pipeline failure. While I can appreciate that attempts to characterize pipeline releases into "simple models" that might make engineering analysis easier, the fact remains that the June 10, 1999 Olympic pipeline rupture release in Bellingham is not well represented by modeling as a pool fire. Any efforts trying to define a release impact zone from a pool fire in such a challenging terrain are overly simplistic, and unrealistic, likely underrepresenting the actual impact area. Following the Bellingham rupture release, the pipeline elevation profile played a key role in the technical safety team's role in assisting the pipeline operator in adding/applying at the time unregulated integrity management approaches to assure pipeline integrity, as well as installing additional "safeties" to the Olympic Pipe Line operation.

V. Conclusions

As discussed above, cooperation and proper management between PSE and Olympic concerning the EE project should allow the EE project to not increase risks to the Olympic pipelines. Both PSE and Olympic, however, need to demonstrate to the City those important

details as outlined in Section III above to assure the pipelines are protected during the design, construction, and future operation of the EE effort. Lastly, Accufacts understands that, for the Olympic Pipe Line Company, the majority ownership has changed from BP to Enbridge. Such changes can introduce risks in operational approaches caused by a loss in pipeline operational experience and/or a shift in management safety culture, (such as not incorporating proper levels of safety to avoid a pipeline release). It is imperative that the new majority ownership understands the risks that can be introduced to the pipelines from the EE effort, and that prudent prevention efforts are in place and implemented to avoid a release.

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Accufacts Inc.