Keystone Response to Battelle RA Review

LINE NO.	KEY FINDINGS / RECOMMENDATIONS	COMMENTS
INDEPENDENT ENGINEERING ASSESSMENT		
	FAILURE FREQUENCY	
	KEY FINDINGS	
1	Had the results from Appendix K been inserted into Appendix Q of the SEIS, a much more reasonable estimate of the failure frequency and the mean and median spill volumes for mainline pipe would have been realized. It is believed that if the results from Appendix K were inserted into the Appendix Q analysis, the result would support the recommendation (made below) that a median spill volume of 100 barrels be used for planning purposes.	By not parsing data between data and pipeline facilities, Keystone effectively overstated the risk to the mainline pipeline. Battelle repeatedly concurs with this statement (Battelle recognizes this on line 35). By overestimating risk to the pipeline, we focus attention on those areas where impacts to the public and environment would be the greatest. Spills within facilities would be largely contained on site and impacts borne by the operator. Whether 3 or 100 barrels are selected as the median spill volume, it does not effect ERP or IMP planning, which is based on worst case discharge. The risk assessment disclosed a range of impacts to environmental receptors based on a wide distribution of spill volumes.
2	A basis should be provided for any engineering factors used to adjust the failure frequencies that are expected to be realized by the new required standards and procedures. In a 2013 draft risk analysis report prepared by Battelle for the northern segment of the Keystone XL Pipeline, another approach was used: comparing the US failure rate with that in other countries—specifically, Australia, where most of their pipeline is built to modern standards. Their failure rate is 10 times lower than the US rate. Because of some characteristics of the US system (for example, the use of larger-diameter pipe, with its increased capacity), the full 10-fold reduction in failure rate might not be realized.	Use of modification factors or the Australian database each have advantages and disadvantages. The salient point is that both approaches recognize failure frequencies for new pipeline will be significantly less than those calculated from PHMSA historical incident database. Keystone acknowledges that it is uncertain whether a ten fold reduction in failure rate (or some greater or lesser reduction) might be realized. Keystone's modification factors were based upon best professional engineering judgment, which remains a valid approach.

3	The analyses performed in Appendix P of the FEIS (Appendix Q of the SEIS) did not use all the cause codes in the PHMSA database and attributed all the failures to pipelines, in general. The former results in an underestimation of the number of failures, but the latter results in a large overestimation of failure rates for mainline pipe, because about 60 percent of the failures occur at facilities such as pumping stations. In addition, the spills at the fixed facilities and at valve sites tend to be smaller. Thus, the spill frequency for mainline pipe, prior to the engineering adjustments, are overestimated, and even after engineering adjustments are applied, the median and mean spill volumes are underestimated by perhaps as much as an order of magnitude. Appendix K improves the original analysis in Appendix P of the FEIS by considering the following factors: (1) only crude oil spills, (2) a spill record for almost 11 years (instead of 6.5), and (3) division of the pipeline into system elements. Unfortunately, the results from Appendix K were not factored into Appendix Q of the SEIS.	Keystone did not use the PHSMA Cause Codes due to the presence of the undifferentiated "Other" category. Rather, Keystone utilized ASME Cause Codes to identify all applicable threats to the pipeline system. With regard to over estimation of risk to mainline pipe, under estimation of risk at pump stations, and median spill volumes, see Response Line 1. While all cause codes were not incorporated into the analysis, all spill events were incorporated. Therefore, overall spill frequency was likely overestimated Battelle's own assessment demonstrates that Keystone did not underestimate failure frequency. In Section 2.2.4.4 of Battelle's Independent Engineering Assessment, Battelle documents that the Keystone failure frequency would result in 1.2 occurrences per year. In this same table, Battelle's assessment estimates a failure frequency of 1.1 occurrences per year. Therefore, Keystone's failure frequency is slightly more conservative than Battelle's. The number and spacing of facilities across the US cannot be accurately derived solely from the Keystone XL project design and location. For the reasons discussed below, Appendix K is fundamentally flawed and should not be factored into Appendix Q. Appendix K is the premise for all of Battelle's subsequent analyses and recommendations. See items number 1 and 2 of the attached *Keystone's Review of Battelle Risk Assessment* . -There are no reliable databases that quantify the number of pipeline-related facilities in the United States. -Appendix K created numbers of facilities based on unsupportable assumptions. -Valve spacing of 20 miles: while Keystone XL's valve spacing was required to be no more than 20 miles per Special Condition 32, there is no reason to expect valves for other pipelines to have similar spacing. -Pump stations: pump station spacing is a function of hydralic analysis. Assuming pump station spacing of all liquid lines would be comparable to Keystone XL is improbable give the range of products transported, pipeline diameter, thoughput, terran, interconnections, and length of other pipeline projects. -Tanks: Appendix K tries to estimate the number of breakout tanks in the US without an existing database. Secondly, Appendix K then equates the number of breakout tanks (used for overpressure events) to storage tanks
	RECOMMENDATIONS	

4	The PHMSA Liquid Hydrocarbon Incident Database should continue to be used, but the analysis should be limited to crude oil spills and should consider the very different spill performance data for major systems (i.e., mainline pipe). The results should be presented without the use of engineering adjustment factors. A decade from now, there will be enough modern pipeline performance data to negate the need for adjustment factors. Until then, data from other sources, such as performance data on the more modern Australian pipeline system, should be used to show that the results presented are conservative. A conservative performance range could be presented if an updated spill frequency estimate is needed for the entire pipeline. Appendix K of the SEIS should be used as the starting point for such an updated analysis. Until that re-evaluation is performed, it is recommended that, for planning purposes, a medium spill volume of 100 barrels be used. A larger volume may have to be used in locations where the terrain produces a hydraulic gradient. See "Outflow Analysis and Valve Placement" below for the assessment of spill volumes in these areas.	Keystone disagrees with the parsing of data in Appendix K of the DSEIS due to extrapolation of data for tanks, valves and other facilities when no actual values are available. The Australian data demonstrates that the use of modification factors to recognize that modern pipelines have lower failure frequencies remains a valid approach. Issues concerning the median spill volume are discussed in response Line 1. More importantly, the Emergency Response and Integrity Management Planning are based upon maximum spill volumes, not median spill volume.
	RISK ASSESSMENT	
	KEY FINDINGS	
5	The Risk Assessment in Appendix P of the FEIS and republished as Appendix Q of the SEIS does not meet one of the key objectives of a risk assessment program: identifying the major sources of risk, and then identifying the components and/or procedures that can mitigate those risks. The historical spill analysis presented in Appendix K of the SEIS and the risk analysis performed by Battelle demonstrates that a meaningful risk assessment can be performed using data on crude oil spills. The two analyses also show the importance of breaking the system down into major system components and calculating the risk for each system. Such a breakdown of the pipeline system into major components provides the proper emphasis on important preventive, protective, and mitigative devices and programs.	Risk is a function of frequency and consequence. The report erroneously equates risk with threats and states that Keystone has failed to identify the major sources of risks/threats and the components and/or procedures that can mitigate those risks/threats. However, Appendix A of Keystone's 2009 Risk Assessment does identify major threats to the pipeline and identifies components and procedures to address each of those threats. Keystone believes that there are insufficient data to break the PHMSA data set into major system components and that Appendix K and Battelle's Risk Assessment inappropriately extrapolate from limited data set using invalid assumptions (e.g. It is invalid to extrapolate the number of valves in the U.S. from Keystone XL's more frequent valve spacing, which results from Special Condition 32).
6	While the PHMSA database is useful for assessing the overall performance of pipelines, the risk assessment capabilities of this database are limited. This database should not be the sole source of failure causes and their consequences. Standards such as American Society of Mechanical Engineers (ASME) B31.8S and American Petroleum Institute (API) 1160 describe risk assessment programs which are an essential part of an integrity management program (IMP). The data requirements for this risk assessment are much more extensive and need to be identified during the development of the IMP. The data requirements for this program are not available for the more general assessments performed for environmental impact statements.	The Keystone Risk Assessment was prepared for NEPA purposes, providing decision makers with a reasonable range of potential impacts. The PHMSA database is fully adequate for this purpose and is consistent with standard industry practice. As required by regulation, the Risk Assessment is expected to be clear, concise, and understandable to the lay reader. As previously stated, Integrity Management Program Standards are not applicable or appropriate for NEPA purposes. Keystone has incorporated American Society of Mechanical Engineers (ASME) B31.8S and American Petroleum Institute (API) 1160 as applicable.

	RECOMMENDATIONS	
7	Future risk assessments should divide the pipeline system into component parts, assess the risk for each component, and then calculate the system risk from its components. The risk analysis performed by Battelle used Total Incident (Damage) Cost as a measure of the consequences. This consequence measure would be an ideal measure if the contributors to the overall cost (e.g., emergency response costs, environmental recovery costs) were better understood. At this time, only the effectiveness of preventive programs can be measured using the total damage cost consequence measure. Because spills can never be totally prevented, the only way to value protective and mitigative systems and procedures is to have these programs focus on the component systems that control risk. The Battelle risk analysis shows that the subsystems that generate most of the risk are the mainline pipe and the fixed facilities such as the pumping stations. Thus, when developing preventive, protective, and mitigative programs, equal focus should be on the mainline pipe and the fixed facilities.	As discussed above, Keystone disagrees with the assumptions used in the analysis to assess risk for pipeline components due to insufficient data. Further, Keystone strongly disagrees with Battelle's use of cost as the measure of consequence. The analysis consists of numerous fundamental flaws and cost is only one of many measures to assess consequence (see Attachment A - Review of Battelle Risk Assessment). For NEPA purposes, cost may be one of the least appropriate measures, as opposed to quantification of impacts to environmental resources and receptors. Notwithstanding how Battelle's conclusions were reached, Keystone agrees that protective and mitigative systems should focus on mainline pipe and pump stations. Keystone is doing so with its design and construction practices as well as the development of its ERP and IMP.
	OUTFLOW ANALYSIS & VALVE PLACEMENT	
	KEY FINDINGS	
8	The model used to estimate outflow volumes is based on sound mathematical principles, the Bernoulli Equation, and the assumptions made about crude oil available for release are conservative. While it was not possible to confirm the results, the process used to place the valves is correct.	As per Special Condition 32, Keystone is required to submit its valve placement design to PHMSA for review and approval.
	RECOMMENDATIONS	
9	The model and the process that were used to ensure that valves are placed to minimize the total outflow from a breach appear to be correct and should continue to be used. It is recommended that portions of the outflow analysis be redone to reflect the new route and thereby ensure that the results are not significantly different from the results presented at the time the FEIS was published.	Keystone will complete a revision to the outflow analysis for ERP planning based on the IFC route.
	FATE & TRANSPORT	
	KEY FINDINGS	
10	Major factors affecting the behavior and fate of crude oil in the environment are: (1) the nature of product spilled; (2) the volume and rate of the spill; (3) the physical, chemical, and biological characteristics of the receiving environment; (4) the weather conditions at the time of the spill; (5) the amount of time elapsed until detection; and (6) the adequacy and timing of response activities. Of particular importance is the receiving environment (e.g., water and soil attributes, slope, gradient, topography, underlying geology, and weather and climate), which in turn impacts the dispersion, fate, plume size, and transport.	Agreed.

11	Environmental transport and fate of petroleum products is dependent on many factors, and modeling transport and fate is a complex exercise. Gaps were identified in the Keystone fate and transport analysis regarding the transported product's chemical and physical characteristics, and its weathering and transport behavior. To close these gaps, Exponent was asked to provide a quantitative fate and transport analysis and numerical screening model, which take into account the characteristics of oil, in order to shed light on potential transport and fate of the transported product.	Keystone acknowledges that Exponent was tasked with providing a quantitative fate and transport analysis. For the purposes of NEPA, the Risk Assessment was not meant to be an exhaustive analysis of physical and chemical characteristics, weathering, and fate and transport of crude oil. As reflected on Line 12, Exponent concluded that the physical characteristics of the transported products are within the bounds of typical medium to heavy crude oils and do not pose an excess risk as compared to typical crude oil.
12	Exponent's analysis of the physical and chemical characteristics of the transported products indicates they are within the bounds of typical medium to heavy crude oils. The analysis also finds that the products are sufficiently similar such that they should not pose an excess risk as compared to typical crude oil in case of a release.	Agreed.
13	Exponent's results indicate that even small subsurface spills of oil into the soil become detectable at the surface within about one month. Aboveground surveys then detect these smaller leaks.	Agreed.
14	Exponent's results indicate that surface or subsurface spills of oil on land will tend to remain localized and will migrate slowly into the soil because of the high viscosity of this crude; therefore, potential threats to groundwater depend on water table levels local to the spill.	Agreed.
15	Exponent applied a numerical screening model to estimate the behavior of a large spill of diluted bitumen (dilbit) in an area with a highly permeable, shallow aquifer as characteristic of the Sand Hills Region of Nebraska. The outcomes showed that (1) a large spill one foot above the water table could begin forming a non-aqueous phase liquid (NAPL) lens at the water table between one and two years after the spill; (2) despite the short distance to the groundwater, the high viscosity of the oil and the presence of natural soil moisture limits the NAPL permeability in the soil, resulting in limited migration; and (3) the time for formation and subsequent transport of the plume is long relative to the response time for spill control and countermeasures.	Keystone agrees that this was the methodology used. Keystone emphasizes the importance of the finding in Item 3 that "the time for formation and subsequent transport of a plume is long [approximately 130 days] relative to response time for spill control and counter measures." This confirms the importance of recognizing containment and cleanup measures in assessing and modeling potential spill impacts.
16	Exponent notes that spills into surface waters can be transported beyond the 5-mile distance used to identify sensitive environments (e.g., high-consequence areas [HCAs]).	Keystone will address downstream transport of 20+ miles in its detailed analysis.
17	Exponent's transport and fate analysis in groundwater concludes that plumes of dissolved hydrocarbons in groundwater, to the extent they develop, will be on the order of hundreds of feet in length and will move relatively slowly. Further, they note that longer plumes can occur under pumping conditions.	See Line 19 of Keystone's comments on the Exponent Assessment.

18	Exponent notes that a set of criteria were proposed to identify potentially sensitive groundwater areas that include distance from the pipeline (vulnerable areas lie within 1,000 feet), water table elevation (within a few feet of pipeline), and the presence of clusters of domestic and irrigation wells.	See Line 19 of Keystone's comments on the Exponent Assessment.
	RECOMMENDATIONS	
19	Exponent developed and applied criteria to identify potentially sensitive environments downstream of small stream crossings, with a number of such environments identified along the pipeline route. From an engineering perspective, concern for small streams could and should be managed proactively during construction via micro-bore or such techniques. During construction, and continuing into the operational phase, further analysis should be done to assess overland flow (spreading) and transport for specific pipeline sections that intersect identified sensitive habitats, including the four streams identified by Exponent. This modeling exercise could then be used to inform ERPs. Well depth and depth of release should also be assessed relative to the water table to screen / identify sensitive groundwater resources that may be more vulnerable to exposure to a hydrocarbon plume in the event of an oil spill. Finally, it is recommended that the presence of polycyclic aromatic hydrocarbons (PAHs) and naphthenic acids be better quantified for the oils that are actually transported in the pipeline for more informed environmental remediation and response planning.	See Lines 10, 11, 19, 20 and 37 of Keystone's comments on the Exponent's Assessment. Keystone notes that the 4 streams identified by Exponent are located in Texas and are not located on the Keystone XL route.
	LEAK DETECTION	
	KEY FINDINGS	
20	The leak detection approach proposed for the Project, computational pipeline monitoring (CPM), is the industry standard for crude oil pipelines and should have better than average performance because of Keystone's more frequent use of sensors. While CPM is the standard practice, the detection limit is normally expressed as time to detect a specified percentage of throughput. Thus, the detection time can be large when the throughput is large, as is the case with the Keystone Pipeline. This means that leak detection cannot rely solely on CPM.	Detection time is independent of throughput. Nonetheless, Keystone does not rely soley on CPM for leak detection. See Line 20 below.

21	Keystone will also rely on the non-standard use of an over/short analysis, which calculates a long-term system volume balance. In some studies, it has been shown that the ability to quickly detect small leaks exists, at levels as small as 1.5 to 2 percent of throughput. Since there is a desire to detect leaks that are smaller than the capability of the CPM, reliance should be placed on other methods such as ground-based or aerial surveillance. These surveillance activities could be more frequent in sensitive environmental areas or in areas where third-party damage is more likely.	Keystone does utilize ground based and aerial surveillance to supplement its leak detection capabilities. Keystone does not believe it is appropriate to require more frequent surveillance activities for the following reasons: -The incremental value of increased surveillance activities is negligible. -Both PHMSA regulations and Special Condition 41 recognize that a biweekly surveillance interval is adequate to detect small leaks on a timely basis. -Keystone is employing a suite of additional measures, such as high strength puncture-resistant steel (per Special Conditions 1-9), four feet of cover (Special Condition 19), line-of-sight pipeline markers (Special Condition 40), a comprehensive public awareness program (Special Condition 48), and participation in State One Call programs, to reduce the possibility of third party damage and to protect environmentally sensitive areas. To the extent that more frequent leak detection surveillance or ground patrols are required, this requirement should be limited to areas where third party damage is more likely.
	RECOMMENDATIONS	
22	In the risk analysis performed by Battelle, it was shown that facility risks were significant. Therefore, it is recommended that not all the leak detection efforts be placed on the mainline pipeline sections. Note that between the start of 2002 and the end of 2012, the largest spill was a 49,000-barrel spill from a tank at a fixed facility. The largest spill from a mainline pipe rupture, while still large, was smaller - about 31,000 barrels. Indeed, if the leaks at fixed facilities are significant and frequent, leaks detected by the CPM may be attributed to the facility leaks and an actual leak along the pipeline may go undetected for a longer period of time.	Keystone implements leak detection capabilities, including CPM methods, at facilities as well as along the mainline pipe.
23	As new leak detection technologies emerge and start to be deployed in the field, Keystone should continue to evaluate these technologies and consider them for implementation if they represent a significant increase in leak detection sensitivity. In-line leak detectors should also be deployed as part of the pig trains run under the IMP. Leaks are not expected to be frequent; however, because many of the failures are the result of human activities, it is recommended that aerial surveys and/or ground patrol frequency be increased to once a week.	Keystone has committed to continue to evaluate evolving leak detection technologies and to consider them for implementation if they represent a reliable and significant increase in leak detection sensitivity (see South Dakota Public Utility Commission Permit and Nebraska Department of Environmental Quality Final Evaluation Report). In-line detectors are unproven and evolving technology. Should they be proven as an effective technology, Keystone will consider them for implementation. To the extent that more frequent leak detection surveillance or ground patrols are required, this requirement should be limited to areas where third party damage is more likely.
	LEAK PREVENTION	
	KEY FINDINGS	
24	The minimum 0.465-inch-thick wall adopted for the mainline system affords significantly better resistance to both corrosion and mechanical damage as compared to the historic database. Viable quality controls in place for both the steel and the longitudinal seam ensure that the pipe as delivered meets minimal regulatory and code requirements and the requirements of the PHMSA's Special Conditions associated with the line pipe.	Agreed.

25	Considering normal operation at its maximum allowable operating pressure (MAOP) and at the minimum wall thickness for the mainline system, the first IMP repair time response threshold (repair in 180 days) occurs at a defect depth of 40 percent through-wall and corresponds to an anomaly length in excess of 15 inches. The second repair threshold (repair in 60 days) occurs at a defect depth of 60 percent through-wall and has an associated length on the order of 6 inches. Such features are reliably found using usual in-line inspection (ILI) tools that target corrosion.	Agreed.
26	It was determined that under worst-case circumstances, at least three ILI cycles occur prior to reaching the first IMP (scheduled) threshold (repair in 180 days), which, using worst case corrosion rates, would not occur until after about 12 years of operation.	Agreed.
27	The planned inspections that Keystone has committed to perform prior to the start of operations should detect any defective welds or major defects in the pipe wall and defects caused by placement of the pipe in the ground. These defects should be repaired before operations and therefore prevent leaks.	Agreed.
28	The practices adopted for corrosion protection since the 1990s directed at the use of fusion bonded epoxy mill-applied coatings with comparable developments for field-applied coatings have brought about a step reduction in incidents due to external corrosion.	Agreed.
29	While the incidence of internal corrosion is increasing as the diameter and number of pipelines transporting crude increase, Keystone plans to operate the pipeline in the turbulent flow regime, which should control the internal corrosion.	Keystone agrees that operating the pipeline in a turbulent flow regime will control internal corrosion.
30	The practices that involve one-call and related activities mutually supported by the industry and the regulators have significantly reduced the frequency of third-party damage.	Agreed.
31	While the throughput of modern pipelines has increased significantly relative to the sizes of pipelines that populate the PHMSA database, the spill volumes have shown a step decrease since the 1990s, with a five-fold reduction in volumes.	Agreed.
32	There has been a five-fold reduction in spill volume since the 1990s, whereas the throughput has more than doubled over the same interval, leading to a 10-fold net reduction in spill volume relative to throughput.	Agreed.
33	There is clear evidence that transport of crude oil occurs at the lowest incident frequency and smallest spill volume when transported through recently constructed pipelines. If crude oil is to be moved by pipeline, then new or recently constructed systems are clearly the best option.	Agreed.
	RECOMMENDATIONS	

34	It is recommended that ILI be performed proactively prior to the start of operations. These inspections are capable of detecting major defects in welds and in the pipe wall, as well as defects caused by placement of the pipe in the ground. Any detected defects can be repaired before the start of operations and thereby reduce the probability that a leak will occur soon after the start of operations. It is understood that Keystone has committed to these ILIs prior to the start of operations.	Keystone has committed to conduct the ILI as stipulated in Special Condition 43.
	PROTECTIVE & MITIGATIVE MEASURES	
	KEY FINDINGS	
35	An analysis of the PHMSA data finds that only 40 percent of all spills are due to mainline pipe spills; however, the lineal (mainline pipe) component of the Project will most likely be the primary source of environmental exposure because of its potential to impact HCAs and other resources along the proposed RoW and because of the remote location for some sections of the pipeline. Consequently, the pipeline's design, construction, operation, and maintenance in compliance with the 57 Conditions are the foundation for pipeline integrity.	Agreed.
36	Keystone is taking preventive actions over and above the U.S. Code of Federal Regulations minimum, including the following: (1) the entire pipeline is being designed as if it transits an HCA; (2) greater than the required depth of cover will be provided for usual trenched construction (4 feet in general, locally deeper for select sites); and (3) horizontal directional drills (HDDs) will be used for select crossings.	Agreed.
37	Keystone developed a very workable method of analyzing the effectiveness of isolation and check valves to limit the spill size. The graphs they provided demonstrated the utility of their calculation scheme to prevent larger volumes of crude oil from being spilled using check valves; however, sufficient detail was not available to demonstrate that the valves were spaced to minimize the total spill volume as required in the regulations.	Valve placement will be reviewed by PHMSA prior to placing the pipeline into operation.
38	Though there is increased throughput of oil in modern pipelines, overall spill volume in these pipelines has decreased, with about a 10-fold net reduction in relative spill volume as compared to 1950s construction. This reduction in spill volume coupled with a corresponding reduction in the frequency of releases suggests that when possible and motivated by market drivers the transport of crude by new construction brings clear environmental benefits.	No comment.
	RECOMMENDATIONS	

39	The information provided to Battelle was quite limited and did not address any spills in sensitive areas. Additional spreading analyses should be performed in areas where sensitive environmental receptors are found to demonstrate that these areas are being adequately protected and that additional valves would not have a net benefit. Since it is very expensive to move the placement of valves after all the construction details have been developed, the greatest utility of these calculations would be to have preliminary results available early in the process with the formal validation of their placement, demonstrating that the placement does minimize spill volumes.	Keystone provided confidential appendices that identified pipeline segments that could potentially affect HCA's. The appendices also addressed valve locations relative to the HCA's. Additional detailed analysis will be conducted as required per Special Condition 14. Valve placement will be reviewed by PHMSA prior to placing the pipeline into operation.
40	During the construction phase, response team and equipment needs should be identified based on the scope of transported products and their potential interaction with the ecosystems that the pipeline traverses. Keystone has recently stated concurrence with this action and has indicated that they will (1) target response plans to the ecosystems and resources traversed, with concern also taken to address unique/site-specific aspects, and (2) reduce the response time to two hours in such cases as compared to the minimum 12 hours of 49 CFR 194. Response teams and packages should be selectively located at ecosystems and resources deemed high-value, at a level more refined than the current narrow PHMSA definitions of an HCA or unusually sensitive area (USA).	Keystone acknowledges that it will undertake the steps identified in Item (1). With respect to Item (2), Keystone will comply with the minimum 12 hour requirement mandated by 49 CFR 194. The two hour response time was only committed to for the Sand Hills region of Nebraska, which has since been rerouted. Keystone does not agree with Exponent's development of Areas of Special Ecological Consideration or sensitive ground water resources (See Line 25 and 37 of Keystone's Comments to the Exponent Assessment).
41	Since areas along the pipeline where seals and seats are present (e.g., on equipment and pumps) have a higher potential for spills, Keystone should be diligent about the material selection for seals and seats, from both the design and maintenance perspectives, over the life-cycle of the equipment. They should also consider more frequent scheduled maintenance for valves and other equipment, at least initially, and utilize pre-service offsite leak checks and equipment shakedown where plausible.	Keystone is diligent about material selection for seals and seats. Keystone will comply with the maintenance requirements specified by federal regulations (49 CFR 195). Keystone will complete initial pre-service leak checks and equipment shakedowns.
42	Depending on need dictated by the nature of the terrain, aspects of the water table, and other factors, Keystone should consider the selective use of concrete coated line pipe (or an equivalent or better approach). For location-specific elements, like facilities, which are currently sited in sensitive ecosystems or resources, Keystone should also consider unique approaches to protect those sites, such as containment of facility leaks through the use of concrete pads and berms.	Keystone has a number of buoyancy control measures which could be utilized during construction, including set-on weights and concrete-coated pipe and will utilize its suite of tools as appropriate. Keystone utilizes berms to protect sensitive ecosystems and resources at all pumpstations. Berms provide sufficient protection such that concrete pads are not necessary.

43	Although analysis of anomaly response and trending of the incident causes as a function of the diameter clearly show that the lineal portion of the Keystone XL Project is robust from a preventive perspective in regard to axially oriented anomalies, care should be taken to ensure that similar analyses are considered in the context of the girth welds, and that related defect tolerance is assessed and achieved, subject to the PHMSA process.	Special Condition 18 addresses this issue.
44	All aspects of prevention, protection, and mitigation should be monitored to ensure that plans and commitments remain viable and are implemented as outlined.	PHMSA is responsible for auditing and ensuring compliance.

Additional Comments

A second adjustment factor equal to 0.2 is introduced(4), but here the focus is IC. It is clear that the indicated mitigation is cause-specific and that there is no statistical support to justify pooling such causes; therefore, lumping their mitigative effects into a single adjustment factor lacks technical justification.	The safeguards utilized in determining the adjustment factor for internal corrosion include frequent cleaning runs of the pipeline, a 0.5% solid and water by volume tariff specification, and a turbulent flow operating regime.
In regard to the PHMSA's 57 Conditions, the outcome can depend on how each condition is implemented. For example, consider the conditions that apply to the line pipe and its construction into the mainline system. Depending on the steel and pipe manufacturer(s) selected for the project, and the field construction contractors and their methods used to build it, one could anticipate quite different incident rates. This is because different steel and pipe suppliers and different construction contractors can take different routes to satisfy the Project's specifications, with outcomes that are not always equal or satisfactory. This is demonstrated in the experience that underlies some of the Special Conditions imposed, which reflect evidence of critical quality shortfalls even though all deliveries to the spreads satisfied the applicable CFR requirements and the company's specifications. On the basis of such concerns, one can take issue with the factors used. On the other hand, the net result of the many adjustment factors involved is quite small, which casts uncertainty on the merits of focusing on this detail when seeking a high-level metric of long-term pipeline integrity. If such details are considered significant, Battelle recommends that the risk analysis uncouple the currently coupled aspects as the process moves forward toward the IMP developed later in the process.	All steel and pipe manufacturers as well as field construction contractors are required to meet all of Keystone's manufacturing and construction specifications and are required to provide and adhere to a quality management plan. In addition, these manufacturers and contractors undergo rigorous qualification processes prior to becoming eligible to undertake any work for TransCanada. There is no evidence to support the claim that outcomes for various contractors have not been satisfactory. There is no support for the statement that the Special Conditions reflect evidence of "critical quality shortfalls."

The following conclusions derive from this review: -Equipment-related concerns represent a viable threat, which should either be addressed or demonstrated, through analysis or trending, that they can be ignored. -The currently coupled threats involving IC and EC should be uncoupled, as should those involving material versus construction threats, unless statistically valid reasons are established to pool these data. -Incorrect operations should be included as a threat unless it can be demonstrated it is not relevant. Concern exists in this context regarding human error, failure to follow SOPs, and/or the existence of outdated SOPs. -A rationale should be provided on the record for the exclusion of other threats included n ASME B31.8S.	Equipment-related concerns were considered, but were eliminated because Keystone is a new pipeline. The analysis will reassess these threats as this project matures per Special Condition 53.
To improve data interpretation, run pre-service ILI for all technologies anticipated for use in the IMP to establish a background against which subsequent interpretation can better distinguish changes in potential threats.	This suggestion is inconsistent with the PHMSA Special Conditions. Keystone will inspect the pipeline in the timeframe as required by Special Conditions 42, 43, 44, 45, and 46.

Keystone Response to Exponent RA Review

LINE NO.	FINDINGS & CONCLUSIONS / RECOMMENDATIONS	COMMENTS
1	**Chapter 3 - Review of Crude Oil Composition**	
2	**FINDINGS & CONCLUSIONS**	
3	The physical and chemical characteristics of dilbit are consistent with a heavy crude oil	Agreed.
4	The physical and chemical characteristic of SCO are consistent with a medium gravity crude oil	Agreed.
5	The benzene concentrations of both oils are within the range of typical crude oils	Agreed.
6	The concentrations of PAHs are within the range of typical crude oils	Agreed.
7	While the total acid number of dilbit is within the range of acidic crude oils, the fraction of the acids consisting of naphthenic acids is unknown	Agreed.
8	For the factors considered by Keystone in the Risk Assessment, we agree with their conclusion that dilbit and SCO are sufficiently similar to crude oil so that they should not result in an excess risk in case of a release	Agreed.
9	**RECOMMENDATIONS**	
10	Although PAH concentrations in petroleum are low compared to some environmental sources, this class of compounds can be a long-term driver for remediation and risk management following an oil spill. While not required at this stage in the process, Keystone should consider obtaining addition information on the PAH chemistry of the oils to be transported	While Exponent acknowledges that obtaining additional information on PAH chemistry is not required at this point in the process, nonetheless, Keystone will consider obtaining additional PAH data, if and where available. In the event of a spill, Keystone would provide MSDS sheets to emergency responders and undertake chemical analysis to determine cleanup levels in coordination with federal and state agencies, as appropriate.
11	Given the perceived link between tar sands processing and aquatic toxicity due to naphthenic acids, Keystone should consider obtaining addition information on the naphthenic acid content of the oils to be transported	While Exponent acknowledges that obtaining additional information on naphthenic acid chemistry is not required at this point in the process, nonetheless, Keystone will consider obtaining additional naphthenic acid data, if and where available. In the event of a spill, Keystone would provide MSDS sheets to emergency responders and undertake chemical analysis to determine cleanup levels in coordination with federal and state agencies, as appropriate.
12	Knowledge on the chemistry of dilbit continues to increase. This new information should be incorporated into planning and operations as appropriate (e.g., to improve the spill response planning)	Keystone will continue to monitor developments and lessons learned within the industry, including evolving understanding of diluted bitumen (dilbit), and incorporate this knowledge into the emergency response planning and operations as appropriate. For example, Keystone has reviewed the recent report from the National Academy of Sciences, which found that dilbit was not significantly different from other crude oils (National Academy of Sciences. *TRB Special Report 311: Effects of Diluted Bitumen on Crude Oil Transmission Piplines* 2013).
13	**Chapter 4 - Transport and Fate of Crude Oil**	
14	**FINDINGS & CONCLUSIONS**	

15	The flow of oil overland is affected by many variables including spill rate, topography, soil type, and vegetation. To provide a sense of scale, a highly simplified case of a sudden spill of 25,000 bbl to a flat surface is presented. If the spill flows in a radial pattern, is 1 ft. deep, and there is no spill response, it would spread with a radius of about 200 ft. A pool with a depth of 0.1 ft. would spread to a radius of about 700 ft. If a surface spill was influenced by topography and flowed in a channelized manner, the distance traveled could be on the order of thousands of feet, depending on the steepness of the terrain, presence of vegetation, etc. Keystone conservatively assumed in the Risk Assessment that a large spill would be capable of moving overland up to 1 mile. Therefore, considering our analyses, the 1 mile distance criterion used in the Risk Assessment is considered adequate. Where HCAs are located within 1 mile of the pipeline, Keystone is required to perform a site-specific evaluation of overland flow (spreading analysis)	This is not quite correct. Special Condition 14a requires Keystone to conduct a detailed analysis of overland flow and to identify pipeline segments that have the potential to affect HCAs and 100 foot waterbodies. While a 1-mile distance was used in the preliminary analysis and may be used for the detailed analysis, this distance was not specified in Special Condition 14a. The distance used in Keystone's detailed analysis will be a function of site-specific conditions. The Condition also requires that the methodology be reviewed by PHMSA to ensure that the analysis is appropriate.
16	Exponent applied a numerical screening model, the hydrocarbon spill screening model or HSSM, to estimate the behavior of a large spill of dilbit from the pipeline in an area with a high permeability shallow aquifer. The HSSM modeling simulation showed that groundwater impacts from a large spill would likely occur first from infiltration from the trench near the rupture and not from oil spread across the ground surface. Oil in the potentially filled trench near the rupture could begin forming a non-aqueous phase liquid (NAPL) lens at the water table in less than 1 day if the water table is 1 ft. below the trench (8 ft. below ground surface), in 7 days if the water table is 3 ft. below the trench (10 ft. below ground surface), and in 50 days if the water table is 10 ft. below the trench (17 ft. below ground surface). In contrast, oil infiltrating from the ground surface would reach a water table 8 ft. below ground surface after approximately 240 days	No comment.
17	Results from HSSM simulations of a large spill (25,000 bbl) illustrate that plume lengths for dissolved hydrocarbons (i.e., benzene at or above the MCL) under typical groundwater gradients could be between 100 and 900 ft. in length. This range is consistent with those reported in the literature; most reported plumes are less than 200-300 ft. and a very small number of plumes exceed 1,000 ft. HSSM simulations were also performed to explore an elevated groundwater gradient, representing the potential influence of groundwater extraction (irrigation wells) near the pipeline. When coupled with a simulated low degradation rate (representing an upper bound condition), the higher groundwater gradient could extend the plume length to as much as 2,600 ft.	Keystone submits that the likelihood of incurring a 1000 foot plume (or a 2600 foot plume) is extremely low and should not form the basis for any recommendation or condition. It assumes a 25,000 barrel spill, which is a low probability event. It also assumes that no cleanup occurs, which is an invalid assumption.

18	Modeling results agree with the conclusions in the Risk Assessment that a small leak going undetected indefinitely is unlikely. More likely, oil from a small “pin hole” leak (28 bbl/day) would reach the ground surface on a time scale of a few months. Based on the screening level modeling, a benzene plume that may form because of a small leak was estimated to travel down gradient by as much as 600 ft.	Keystone submits that a small leak remaining undetected for several months is a very low likelihood event. Leak detection measures, including long-term system volume balance and direct observation (aerial surveillance, foot patrol/landowner reporting), are expected to discover such leaks in a shorter timeframe.
19	Many private wells located near the pipeline do not meet the criteria to be classified as HCAs in the Risk Assessment. Exponent considered potential factors that could be used to identify non-HCA groundwater areas for shallow groundwater (< 50 ft.) where more extensive spill prevention measures and monitoring may be warranted. Based on our analysis of possible plume dimensions, we selected a down gradient distance of 1,000 ft. from the proposed centerline of the pipeline as a reasonable boundary of a plume for identifying shallow groundwater and associated wells that could be within the influence of an oil spill. This distance recognizes that large spills would be readily detected and remediated and that small leaks that could take longer to be detected would have smaller plumes. Based on an independent review of the NEDNR well database in Nebraska, Exponent identified approximately 260 wells (not screened by depth) within 1,000 ft. of the proposed centerline of the pipeline. Most of these wells are used for irrigation purposes but domestic wells are also present, several of which draw from shallow groundwater. This list will need to be revised once the final pipeline is determined	Mitigation for private wells within 1,000 feet is inappropriate because: 1) Exponent's analysis based on 25,000 barrel spill assumes no cleanup. Since plume length is correlated to residual source oil, using 1,000 feet as the evaluation distance over-estimates reasonable plume length. Figure 2 demonstrates that initial ground water flume formation would not occur for 130 days. This reinforces the fact that it is unrealistic to assume that a 25,000 barrel spill would not be cleaned up before a plume formed. 2) 1,000 feet is described as occurring in "very few" instances, while less than 200 feet for most plumes suggests that selection of 1,000 feet is unreasonable 3) HCAs focus on those areas where there may be significant impacts to public health, regional economies, or ecological resources. Exponent states that most of these wells are irrigation wells and, therefore, do not pose a public health risk comparable to municipal wells. 4) In the event of a spill, Keystone would be required to contain, cleanup, and remediate the release. These efforts would be directed by the Incident Command Structure, which would include appropriate agency personnel. Consequently, prescribing new and unique mitigation based on a hypothetical modeling exercise is inappropriate. 5) Keystone's analysis assumed that impacts could occur if the margin of a groundwater HCA was intercepted. Since groundwater HCAs (included SWPAs and WHPAs) are based on a 20-year time-of-transit, Keystone's analysis is highly conservative. 6) Keystone has committed to provide an alternative water source if groundwater quality is significantly impacted. 7) Exponent agrees that impacts would be highly localized. 8) High gradient groundwater areas that Exponent identifies as being related to the 1,000 foot plumes are related to agricultural uses, not private wells. Therefore, use of 1,000 foot plume distance is not appropriate to use for identifying wells for potential additional protection measures 9) Additional mitigation measures are not appropriate because: a) They disregard existing pipeline safety regulations that are developed through the public rule-making process b) Application of additional mitigation of these measures only to KXL is arbitrary since they would not be applied to other pipelines currently transporting heavy crude oils, including diluted bitumens c) If DOS or EPA believe that pipeline regulations are not sufficiently protective, they should work together with PHMSA to develop regulations that are applicable to all pipelines

20	The relative vulnerability/sensitivity of groundwater resources to a dissolved hydrocarbon plume from an oil spill can be assessed by considering combinations of several factors: 1) proximity to the pipeline (<1,000 ft.); 2) depth from point of the oil release to the water table (e.g., release of oil at or below the water table will affect groundwater quality more quickly than releases many feet above the water table); 3) depths of receptor wells (wells that are 10s of feet deep are more vulnerable than wells that are 100s of feet deep); and 4) the pumping of receptor wells (wells with higher pumping rates are more likely to draw plumes further downgradient than wells with lower pumping rates). The following combination of factors could be used to identify groundwater resources that do not meet the listing criteria for HCAs but may be more vulnerable to a dissolved benzene plume emanating from an oil spill. An example of this would be a cluster of irrigation wells and domestic wells located within 1,000 ft. of a pipeline segment where a release of oil occurred in or within a few feet of the water table	In the unlikely event of a spill near private wells, there are state and federal regulations that require Keystone to contain, clean up, remediate, and monitor to ensure there are no impacts to the water quality of those private wells. In the event water quality was adversely affected, Keystone has committed to provide an alternative water source to that landowner. In addition, the use of Exponent's criteria to identify locations where additional mitigation would be required is inappropriate. (See Line Item 19)
21	The assessment in the FEIS conservatively assumes that in the event of a worst-case spill in which all of the benzene partitions from the oil into water in streams with a range of flow rates. The assessment is useful for comparison of worst-case benzene concentrations to human health and ecological concentration benchmarks and is discussed further in Section 5 of our review. However, the FEIS does not provide an evaluation of possible transport distances of oil via surface water. This appears to be a gap that needs to be addressed	As Exponent recognizes, Keystone will address this issue in its detailed analysis.
22	The primarily qualitative assessment of the transport and fate of oil in the event of a spill presented in the Risk Assessment is consistent with our analysis and review of the literature. Ultimately, quantitative analysis of transport and fate in surface waters is required by Special Condition 14 and PHMSA regulations as part of the Integrity Management Program during the final design of the project after the final route is selected. These evaluations should take into account the lessons learned from the pipeline rupture in Enbridge, Michigan in 2010	Change "Enbridge, Michigan" to "the Enbridge spill at Kalamazoo, Michigan"
23	**RECOMMENDATIONS**	
24	Keystone, as part of the final Project design, should perform further evaluation of overland flow (spreading analysis) of spilled oil, and further evaluation of the transport of spilled oil in small streams (e.g., the downstream distance crude oil could travel from the proposed centerline of the pipeline) for purposes of ERP. These analyses should take into account potential density and viscosity increases associated with the loss of volatiles from heavy crudes and diluted bitumen	Keystone will address these issues as part of its detailed analysis as required by Special Condition 14 and incorporate this analysis into Keystone's Integrity Management Program and Emergency Response Planning.

25	Keystone should use the screening criteria (e.g., well depth, depth of release compared to water table, lithology between pipeline and aquifer) suggested in our report for identifying vulnerable/sensitive groundwater resources adjacent to the pipeline that do not classify as HCAs but that may be more vulnerable to exposure to a benzene plume in the event of a an oil spill. For example, these could be defined as clusters of both domestic and irrigation wells within 1,000 ft. of a pipeline segment where an oil spill could occur in or within a few feet of the water table. Exponent recommends that additional modeling be performed as part of the final design of the Project to further refine the appropriate downgradient distance criteria to be used for identifying sensitive clusters of wells. Exponent recommends that these non-HCA groundwater resources should be afforded a degree of protection from the occurrence of an oil spill and from the consequences of a spill similar to what is currently afforded to groundwater resources that are defined HCAs	Keystone submits that this recommendation should not become a condition. See Line 19. Keystone will comply with Special Condition 14 and request PHMSA approval of methodology. As Battelle has acknowledged (Key Finding 2 in Protective and Mitigative Measures, page ES-12 of Independent Engineering Assessment), Keystone is already affording the pipeline a degree of protection from the occurrence of an oil spill and from the consequences of a spill similar to what is currently afforded to resources that are defined as HCAs.
26	Considering the above-mentioned screening analysis, Exponent recommends that Keystone consider how to improve upon external leak detection through more frequent inspections and education of property owners for wells within these areas of sensitive groundwater resources	Keystone submits that this recommendation should not become a condition. These issues are already addressed by the Special Conditions. No additional mitigation is warranted. External leak detection will be improved by virtue of increased Operator presence along the RoW that will result from additional inspections as required by Special Conditions 15, 19, 34, 36, 37, 38, 41, 42, 44 and 54. Education of property owners is addressed in Special Condition 48, which requires Keystone to incorporate Common Ground Alliance best practices for damage prevention into its integrated public awareness program.
27	**Chapter 5 - Analysis of Risks Related to Small Stream Crossings**	
28	**FINDINGS & CONCLUSIONS**	
29	The Risk Assessment appropriately followed standard PHMSA guidelines for identifying contributory pipeline segments (CPSs) associated with small stream crossings and the high consequence areas (HCAs) potentially affected	Agreed.

30	Based on transport and fate analyses described in Section 4 of our report, we used a downstream distance of 10 miles as a basis for identifying locations of sensitive areas around small stream crossings. Using a set of ecologically relevant criteria, Exponent identified at least ten small stream crossings areas that should be considered for additional protection. An additional four small stream crossings were identified as having special water bodies within 10 miles downstream of the proposed centerline of the pipeline that likely have high wildlife habitat value which should also be given further consideration	HCA definitions were developed through the rule making process, which included public and agency involvement. It would be inappropriate here to develop a new definition for Areas Of Special Ecological Consideration outside of the rule making process. This would result in holding Keystone to a different set of requirements than the rest of the industry. Of the ten small stream crossings identified by Exponent: -Two will be crossed using the HDD method (Keya Paha and Niobrara); -Three are no longer on the pipeline route (South Fork Elkhorn River [two crossings] and Holt Creek); -Two rivers are no longer crossed at the sites evaluated by Exponent (Big Blue River and Lincoln Creek) -Stream scour analyses have been conducted for Big Blue River and Lincoln Creek as well as two stream crossings that remain at the original location (West Fork Big Blue River and unnamed tributary to Turkey Creek). The pipeline would be installed at a depth sufficient to prevent damage from scour and to protect downstream ecological resources at each of these locations; and -The final stream (Cotton Creek) is located in Texas and is not part of Keystone XL. See tab "NE Select WB Species Analysis." Keystone requests that the last sentence of this key finding be removed as well as Section 5.4.2 "Major Waterbodies", since all these waterbodies are in Texas and not part of Keystone XL Project.
31	Exponent agrees with the assessment of the potential magnitude of risk of an oil spill on aquatic life in the water column associated with the toxicity of dissolved hydrocarbons (represented by benzene). While the toxicity assessment based on benzene is not rigorous, it appears to be sufficiently conservative for assessing short-term effects to aquatic biota residing in the water column. However, depending upon the characteristics of the water body into which a spill occurs, some portion of the spilled oil could come into contact with shorelines or with the bottom of the water body and be entrained into sediments. The oil and associated chemicals that may be present within sediments could exert longer-term chronic effects on aquatic biota that are not captured by considering benzene alone	Keystone agrees with this finding and will incorporate shore line impacts into the Emergency Response Plan.

32	Exponent determined that the list of special status species identified in the FEIS was a comprehensive and a complete list in the Project area. Exponent also found that the preliminary findings of “May Affect, Not Likely to Adversely Affect (NLAA), No Effect (NE) or Not Applicable (NA)” for 29 of the 30 species and “May Affect, Likely to Adversely Affect (MALAA)” for 1 species (American burying beetle) were arrived at through a sufficiently rigorous review of the distribution, abundance, and biological use of the Project area by special status species	Agreed.
33	Exponent believes that there could be habitat utilized now or in the future by special status species that is not specifically identified as PHMSA-designated ESAs based on our review of information in the FEIS	Agreed.
34	Exponent believes ongoing natural shifts in resources underpinning the distribution and abundance of special status species and the species they rely upon will likely result in a shifting of locations where special status species occur during the lifetime of the Project. Keystone is planning annual updates along the entire pipeline route. This will include new consultations with USFWS to identify critical T&E species that may not be captured within the existing PHMSA database, and may result in the environmental protection of additional areas along the pipeline corridor	As indicated, Keystone will conduct annual updates of HCA's along the entire pipeline route; however, shifts in species occurrence and habitat use are expected to occur over a longer period of time. Therefore, it is Keystone's intention to consult with the U.S. Fish and Wildlife Service at least every three to four years or within one year of TransCanada becoming aware of new ecological HCAs.
35	**RECOMMENDATIONS**	
36	A distance of at least 10 miles downstream from the proposed centerline of the pipeline should be used for the identification of sensitive areas and for identifying CPSs during the final design phase of the Project	A downstream distance of over 20 miles will be used during detailed analysis that is required by Special Condition 14.
37	Based on location-specific analyses of fate and effects of spills that Keystone will undertake prior to construction, consider the use of additional valves and/or noninvasive boring technologies at the small stream crossings that Exponent identified as associated with additional potentially sensitive ecological areas, and where Keystone’s release analysis shows the potential exists for medium to very large spills to occur	Keystone submits that this recommendation should not become a condition. First, as discussed above Keystone does not agree with Exponent's development of alternative Areas Of Special Ecological Consideration. Second, stream crossings methodologies, including boring technologies, are reviewed and approved by the U.S. Army Corps of Engineers under the Clear Water Act. Third, Keystone has complied with Special Condition 32, which required placement of additional valves to reduce spill volumes. PHMSA will review Keystone's valve placement. [See line 30 with respect to the ten streams identified by Exponent.]
38	Keystone should rely upon stream-specific specific scour analyses for small stream crossings to identify where the pipeline should be buried deeper than 5 ft. or where HDD may be warranted. The particular small stream crossings identified by Exponent should be given attention in this regard	Keystone submits that this recommendation should not become a condition. Keystone has conducted stream scour assessments that identified appropriate burial depth. In addition, stream crossing methodologies will be reviewed and approved by USACE. The status of the stream crossings identified by Exponent are set forth in tab "NE Select WB Species Analysis."
39	While Exponent is not charged with reviewing the ERP, we recommend that the ERP consider the possibility that spilled oil may be entrained into sediments and that these types of conditions be anticipated as part of response and clean-up	The ERP will address the potential for oil to become entrained in sediments and identify spill response and potential cleanup methods. However, actual selection of cleanup methods will be determined in coordination with federal and state authorities as appropriate and will be based on methodologies in use at that time.

40	The ERP should also take into account the sensitive areas identified in our review (e.g., Rainwater Basin, small stream crossings associated with ESAs, and special downstream water bodies). For example, wildlife habitat for special status species, within close proximity of the pipeline could be designated as “special and/or unique areas” for purposes of the ERP	Keystone submits that this recommendation should not become a condition. As discussed above Keystone does not agree with Exponent's development of alternative Areas Of Special Ecological Consideration.
41	Exponent recommends that Keystone develop explicit plans for updating the status and presence of special status species and the habitat they rely upon every 2 years, and that identified changes be incorporated into the ERP	As indicated, Keystone will conduct annual updates of HCA's along the entire pipeline route; however, shifts in species occurrence and habitat use are expected to occur over a longer period of time. Therefore, it is Keystone's intention to consult with the U.S. Fish and Wildlife Service at least every three to four years or within one year of TransCanada becoming aware of new ecological HCAs.
	Additional Comments	1) The report incorrectly includes the Gulf Coast Project. Many of the numbers of resources referenced in the report are overstated, as they include the Gulf Coast Project. 2) The report should not place HCA maps in the public domain. 3) relative to figure 4, there is no basis for using a 5.5 year leak detection time frame when Exponent's own analysis predicts a surfacing time of 1-2 months.