BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

IN RE APPLICATION NO. 96-1	)
	)
OLYMPIC PIPE LINE COMPANY:	)
CROSS CASCADE PIPELINE PROJECT	)
	)
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EXHIBIT _____ (HRS-T)

REBUTTAL TESTIMONY OF H. RANDY SWEET, RG, CEG

ISSUE: POTENTIAL GROUNDWATER IMPACTS

SPONSOR: OLYMPIC PIPE LINE COMPANY

Q. Please introduce yourself to the Council.

A. My name is Randy Sweet. I am a hydrogeologist, and have been practicing in the environmental area for more than 30 years.

Q. Please summarize your qualifications and experience.

A. I have Bachelors and Masters degrees in geology with an emphasis in Hydrogeology and Chemistry. Most of my experience in environmental and hydrogeologic projects, ranging from site specific analyses to basin and statewide studies, is in the Northwest. Throughout my career, I have served on many regulatory review boards, such as the EPA's National Task Force involved in the development of a uniform nationwide Ground-Water Monitoring Strategy, and the Oregon DEQ task force responsible for developing the state regulations covering underground storage tanks. I have attended and participated in numerous technical conferences over the past several decades, and have over 50 publications and presentations in my resume. I have testified as an expert in US Senate Hearings, State and Federal District Court and in binding arbitration.

My early years were with the Oregon State Engineer's office as a liaison to the Oregon Department of Environmental Quality. I founded a consulting business in 1974 to provide environmental consulting services throughout the Northwest. I merged that company with EMCON, a California company, in 1986. I was President and Chief Operations Officer of EMCON, responsible for the management of 25 consulting offices throughout the United States, until 1994. In 1994, I left EMCON and have been semi-retired, providing consulting services in the management of environmental liabilities, regulatory requirements and permitting; PRP strategy development, oversight and negotiations; and expert services and litigation support. I managed the federal/state funded Oregon Surface Impoundment Assessment (including development of the Oregon Sensitive Aquifers Map); several Section 208 areawide Wastewater Management Studies (with groundwater modeling to project future impacts); detailed hydrogeologic and geotechnical evaluations at more than 50 private and public hazardous and solid waste sites in the Northwest; sited and designed numerous groundwater supply wells for industry, public and hatchery supplies; and directed permitting and groundwater monitoring/contamination studies for industries ranging from refineries, terminals and gasoline retailers to metals reduction, chemical plants and wood products facilities.

In my spare time, I serve as the Chairman of the non-profit St. John Medical Foundation and on the St. John Hospital Governing Board. I am Chairman of the Cowlitz County Planning Commission and am involved with the Lower Columbia Steelhead Conservation Initiative as the citizen representative for Cowlitz County on the Evolutionary Significant Unit #4 Management Board. A copy of my curriculum vitae is attached as Exhibit HWR-1.

Q. On what issues are you providing rebuttal testimony?

A. The potential impacts to groundwater from the proposed Cross Cascade Pipeline.

Q. Please provide the council with an overview of your rebuttal testimony.

A. My testimony will focus on potential impacts to the groundwater as a result of surface and subsurface hydrocarbon releases to the environment. I will refer to general geologic and hydrogeologic principles, past experience and current understanding of the nature of this contaminant and its fate in the environment. I will also discuss specific areas of concern raised by other witnesses with respect to groundwater resources.

Q. **Could you give a brief summary statement of your opinion regarding the ASC, DEIS and testimony you reviewed, with respect to the potential impacts of the project on groundwater resources?**

A. The intent of my testimony is not to understate the value of groundwater resources, but to point out that there is a large experience base with respect to petroleum hydrocarbon releases into the environment and many options to address them. For every human activity there are potential negative impacts. The key is to put the potential impacts into perspective, determine what is required to manage the impacts, and implement that management system.

In reviewing the comments and testimony regarding groundwater, it is troubling that none of the respondents noted that the ASC is a pre-design document. Some new or expanded information was submitted by the respondents and portions of this information can be constructively used in the final design. Many of the respondents attacked the ASC and DEIS analyses. They then analyzed these same problems from a different angle, and reached the same or a similar conclusion, e.g., aquifer sensitivity ratings. Several respondents criticize the ASC spill scenarios, then postulate spill scenarios with other overly simplistic assumptions. Statistics derived from 'historic' design, construction and operation scenarios are used to project spill routes and frequencies, as opposed to incorporating the numerous modern design, construction and operational elements that will be part of the Cross Cascade project. This is akin to equating a modern gas station, with all its regulated containment and monitoring systems, to one of the older, now closed, facilities that fostered a spate of new environmental regulations and cleanup programs in the 1980's and 90's.

Finally, most of the comments fail to recognize the ability to contain and remediate accidental releases of petroleum hydrocarbons. Natural attenuation of hydrocarbon releases is well documented. Technology is available for treatment of petroleum-contaminated water and proven water resources management techniques are available to facilitate mitigation if a water supply well is contaminated.

Q. What is your opinion of the reasonableness of the respondents' claimed risks to groundwater?

A. A great deal of concern has been registered with respect to the Cross Cascade project regarding the potential for groundwater contamination. Responses from the Attorney General of Washington (Devitt, Miller and Kenniston-Longrie), Cross Valley Water District (CVWD), King County Department of Development and Environmental Services (DDES), East King County Regional Water Association (EKCRWA), City of North Bend, City of Snoqualmie, Cascade Columbia Alliance and their various consultants, and others discuss short term catastrophic and long term residual or chronic impacts to groundwater users from pipeline releases. Nearly all of these responses either pre-suppose or construct models which result in the migration of petroleum product and/or their dissolved constituents to water wells, rendering them useless. Floating product and residual saturation are postulated to be contaminant sources for years and decades to come. Although protection of groundwater resources is major concern with respect to any development, experience does not support the doomsday scenario presented by the respondents.

Q. You mentioned "experience" with respect to hydrocarbon releases. What does that experience tell us?

A. Experience has shown that natural attenuation mechanisms, e.g., biodegradation, dilution, and sorption, limit the migration of petroleum derived contaminants in all groundwater systems. A recent editorial in the publication Ground Water noted:

> "the chemical properties of gasoline as one of our luckiest accidents with respect to restoration of our ground water resources…imagine what the quality of our nation's ground water would be if gasoline components degraded slowly in the subsurface. Under this scenario, gasoline contamination would be ubiquitous. Fortunately, until now, gasoline has contained compounds that are readily degradable, and ground water contamination with gasoline components has not been widespread because natural processes have degraded the gasoline components in ground water" (Andrews, 1998).

Q. In assessing the risk of petroleum spills, what components of petroleum do you consider?

A. Some of the respondents describe the movement of petroleum hydrocarbons in the subsurface, from infiltration, light non-aqueous phase liquids (LNAPLs) or floating product, and residual saturation to dissolved fraction. Much of the available research, as well as the respondents emphasis, is on the soluble benzene, toluene, ethylbenzene and xylene (BTEX) compounds common to petroleum. Since benzene is the most water-soluble constituent of gasoline, is a recognized human carcinogen, and is a regulated drinking water constituent, it is commonly used in modeling and projecting impacts from leaks or spills.

Q. Is benzene readily mobile in groundwater?

A. It is mobile, but not as mobile as the groundwater itself. Moreover, if benzene were as mobile as projected in the respondents' models, one would expect to see it today in public water supplies as a result of the thousands of leaking underground storage tanks and historic petroleum releases in developed areas. A 1991 study of more than 7,000 wells serving water supply systems throughout California found that only 10 wells reported detectable levels of benzene, and none of these exceeded the maximum allowable concentration for drinking water (Hadley and Armstrong, 1991). The report concluded that the most likely explanation for the nonoccurrence of benzene is that it is destroyed near its source by natural biodegradation.

Q. Are you aware of any such evidence or research regarding pipeline releases?

A. A recent article by Chapelle (1999) discusses the bioremediation of petroleum hydrocarbon-contaminated groundwater from a pipeline release. An excerpt from that article states:

> "During the 1980s, there was an enormous effort to assess and monitor petroleum hydrocarbon contamination of ground water in the United States and Europe. From this mass of information came several unanticipated and surprising results. It was widely observed, for example, that plumes of petroleum-hydrocarbon contaminated ground water stopped expanding over time and assumed a dynamic steady-state configuration. Perhaps the best-documented example of this behavior was a crude oil spill in northern Minnesota near the town of Bemidji. In 1979, an oil pipeline ruptured and spilled 1670 cubic meters (more than 440 thousand gallons) of crude oil onto

> the land surface. Over the next year, oil migrated downward and formed a lens floating on the water table. The site was instrumented with observation wells and monitored throughout the 1980s and 1990s. A plume of dissolved hydrocarbons, principally BTEX compounds, was observed to develop downgradient of the oil lens. However, by 1985, the BTEX plume had stopped spreading, extending only about 150 meters downgradient of the oil lens. Subsequent studies showed that a dynamic steady state had developed between the rate that soluble hydrocarbons were leaching into the ground water, and the rate that anaerobic and aerobic biodegradation processes were consuming the hydrocarbons. Thus, after about 1985, the position and size of the BTEX plume did not change significantly."

This evidence, like the study of California releases, speaks to the effect of natural attenuation and bioremediation.

Q. You cited natural attenuation. Can you relate how that process relates to a pipeline release and cleanup?

A. The point of much of the Chapelle (1999) article is to emphasize the role of natural processes in the attenuation of petroleum hydrocarbons and to introduce the concept of intrinsic bioremediation, which is defined as the use of natural attenuation processes to treat contaminated groundwater. Intrinsic bioremediation is not solely a reliance on natural attenuation, which occurs ubiquitously, but includes site evaluations, monitoring and management. The Environmental Protection Agency (EPA) has recently released directives which apply to the use on intrinsic bioremediation combined with environmental monitoring as a remedial strategy.

Logic dictates, and experience has shown, that intrinsic bioremediation of petroleum hydrocarbons is most effective when combined with source removal of free-phase hydrocarbons (U.S. EPA, 1997). Source control and timely removal are primary design, construction and operations objectives of OPL. They are required by regulation. OPL's final design must be approved by a vast array of regulatory authorities and OPL has stated it will prepare an Emergency Response Plan in accordance with state and federal statutes.

Q. Did the respondents' testimony give appropriate weight to natural attenuation and bioremediation?

A. Most, if not all, of the respondents to the ASC and the DEIS fail to recognize the degree of natural attenuation and the ultimate dynamic balance between the rate of spread and natural degradation of hydrocarbon plumes. An understanding and recognition of this reality is key to focusing on the identification of significant potential impacts to groundwater resources and developing appropriate responses.

Q. Were there some general themes or common areas of concern in the responses you reviewed?

A. Themes which are prevalent throughout the respondents' testimony and comments include a desire for a better definition of sensitive and vulnerable aquifers; reduction of the potential for spills and/or undetected leaks; containment of leaks and spills; improved response time for cleanup; and the mitigation of impacts to groundwater.

Q. Would you give us your opinion with respect to the respondents' concerns regarding sensitive and vulnerable aquifer definition?

A. The ASC is a pre-design document and as such does not include all the details of site-specific geologic conditions and related engineered controls. Consequently, the DEIS does not contain the specificity that many of the reviewers seemed to expect. This concern led to the submission of a number of documents which provide an expanded data base for the geologic and groundwater conditions along the proposed alignment. Unfortunately, it also led to the development of a number of hypothetical release scenarios that were coupled to cleanup projections, aquifer impacts, and qualitative or quantitative statements of the risks posed by the proposed project. Review of several of the respondents' scenarios shows that they do not consider experience in dealing with petroleum hydrocarbon releases. Also, they do not take into account current regulatory requirements; modern design changes in pipeline construction; and specific measures proposed by OPL for sensitive/vulnerable areas along the pipeline corridor.

Q. Did the "new information" provided by the respondents differ materially from OPL's aquifer sensitivity evaluation presented in the ASC?

A. Together with the expanded data base for geologic conditions, the respondents made general reference to the inadequacy of the DEIS and Table 3.3-10 GROUNDWATER CONDITIONS ALONG PIPELINE ROUTE from the revised ASC (May 1, 1998), see p. 3.3-69 to 71. Although, much of the respondents' new data provided more detailed information and more current references with respect to the proposed pipeline corridor, the general "sensitivity/impact ratings" in the table were not changed. The revised ASC states that "ratings of 10 or greater can be considered significantly more sensitive than the mean or typical conditions...", see p. 3.3-66. Review of Table 3.3-10 shows that these include the Cross Valley Sole Source Aquifer, Snoqualmie Aquifer and the Ellensburg City Wells. All of these areas provide existing groundwater based supplies and are planned for expansion. In short, these groundwater resources were already rated as sensitive in the ASC and were to be treated as such.

Q. Does the Cross Cascade Project pose a risk to groundwater?

A. Yes. The Revised ASC clearly states that "potential impacts to water quality from a large spill are possible…" and furthermore that "water supply sources for towns and other purveyors that are located less than 5 miles downgradient of the pipeline are considered at potential risk for planning purposes…", see Section 3.3.6.1. A listing in the Revised ASC identified larger municipal and other public water purveyors to include: Cross Valley Aquifer Association, City of Carnation, City of Snoqualmie, City of North Bend, City of Cle Elum (surface water), City of Ellensburg, City of Kittitas, Kittitas PUD (wells and surface water), Port of Royal Slope, City of Pasco, and East Columbia Basin Irrigation District (canal crossings), see p. 3.3-77 to 81.

Q. What steps can be taken to minimize the risk to groundwater resources, especially those that supply drinking water?

A. The prefiled testimony of J. Wesley Miller suggested that "each area requiring protection shall be carefully studied…(for) the specific vulnerabilities of the groundwater resources and sole source aquifers…Combinations of protective measures can then be evaluated as to their likely effectiveness and reliability over the pipeline lifetime", see p. 39. The Revised ASC notes that "actual risk is dependent on the geologic and watershed …conditions in each area…", see p. 3.3-77. Furthermore, "potential impacts will be prevented and/or minimized by pipeline monitoring, maintenance and integrity testing, and implementation of appropriate design features…for sensitive groundwater…sections…", and in the spirit of cooperation "OPL will discuss and incorporate its construction, operation and monitoring plans with each municipal/public supply purveyors management and protection plans", see Revised ASC Section 3.3.6.2. Finally, OPL states that with respect to public water supplies that "in the event that a spill occurred, and occurred in an area that caused impact to a public water supply, OPL would provide alternative water supplies and compensation to the water users until the water supply is restored", see Revised ASC Section 3.3.6.3.

Q. What, in your opinion, should be done to ensure that the proper sensitivity/vulnerability levels are considered in the pipeline design and construction?

A. In order to clarify the issues of sensitivity/vulnerability, or risk to a public groundwater supply, a compilation of existing and currently proposed public groundwater supplies along the proposed pipeline corridor should be completed as part of the final design of the pipeline. This compilation should include all registered class A and B systems. Wellhead protection zones for the identified systems should be plotted on the alignment geologic map(s) and the susceptibility/vulnerability of each system, based on the wellhead protection zone and the local hydrogeologic conditions, used to determine if any site specific modifications, *e.g.*, special design, detection, and/or monitoring, are warranted. The information developed in this exercise will allow OPL and the local purveyor(s) to focus their efforts on "potential" as opposed to "perceived" problems and incorporate one or more of the measures discussed above in the final design, construction and operation plans.

Q. Can you address the respondents' concerns regarding slow, undetected leaks?

A. Some of the respondents observed, and I agree, that perhaps the greatest risk to groundwater involves the undetected, long-term slow leak. As an example, the prefiled testimony of Jon R. Stack and its attachments suggests "for 'undetectable' releases, the closest thing to prevention would involve trench or vault designs that could accommodate an 'undetectable' release without overflow or seepage into the ground." Kenneth H. Johnson recommended that OPL "line the block valve vaults to capture leaked or spilled product…"

It is important to note that slow leaks of long duration have historically occurred at OPL's pump stations and block valves. OPL's historic releases from block valves occurred from facilities that were buried in soil with no secondary containment. As such, slow leaks were more difficult to detect. OPL's plans for the Cross Cascade Pipeline call for the use of aboveground block valves with secondary containment. This will facilitate visual inspection and early detection of slow leaks. Likewise, the design and construction for pump stations has changed over the years. It is noted in the Revised ASC Section 3.3.5.3 that "to prevent accidental spills at pump stations from reaching surface or groundwater, OPL provides leak containment at each pump station. Valves and pump stations will be kept to a minimum in the most sensitive pipeline segments."

Q. Can you address the respondents concerns regarding spill detection and response for the proposed pipeline?

A. Response to releases, either from ruptures or slow leaks, is addressed in the ASC and DEIS. Miller's prefiled testimony noted that "emergency response plans must conform to requirements of the Oil Pollution Act of 1990, which includes the requirement to respond to the threat of a spill, such as may be present during flooding, fires, and storms", see p.

44. An Emergency Response Plan is required by regulation to be submitted to the regulatory agencies 180 days before the start of operation. The prefiled testimony of Christian Pitre notes that “response time will be a critical factor”; and Jon R. Stack’s attachment from Robert H. Anderson notes that “mitigation and contingency plans (should) reflect the site specific and operational aspects of the CVWD service area.” Miller went so far as to recommend that “ground survey monitoring periodically, say every two weeks, in critical areas, using trained personnel with hydrocarbon probes” be implemented, see p. 39. This intensity of monitoring is simply not supported by the rate of subsurface movement of hydrocarbons. That said, the ASC specifically recommends in Table 3.3-10 that spill response be coordinated with Cross Valley, Carnation, Snoqualmie, North Bend and Ellensburg. These coordinated emergency response plans will include details that pertain specifically to the location of the purveyor’s wellheads and methods designed to protect the wells. It is also OPL’s intention to provide a cache of supplies and cleanup materials at a mutually agreeable location for the local Fire District and to maintain a state of readiness for the materials.

Q. Can you expand on the issue of hydrocarbon migration in aquifers?

A. There is a sense among the many respondents that groundwater contamination impacts an entire aquifer and cannot be mitigated or remediated. Experience shows that releases of hydrocarbon contaminants are typically limited in areal extent and depth. Contaminant arrival at a well or spring is gradual, rather than as a “slug” of material. With LNAPLs, the product is bound to soil as residual in the unsaturated zone, ‘floats’ on the surface of shallow saturated zones, and more soluble constituents slowly dissolve in the groundwater and move with it. Movement of the floating product is typically limited to the immediate source area. Groundwater seepage velocities are commonly measured in a fraction of feet/day to tens of feet/day. The rate of movement of dissolved constituents in groundwater is commonly a fraction of the rate of movement of the groundwater. These conditions allow for control and effective remediation through a number of proven methods, several of which were listed in the CVWD response, including: excavation and ex-situ bioremediation; soil vapor extraction for the unsaturated soils; air sparging and pump-and-treat for groundwater; or combinations of these activities. The CVWD response also discussed enhanced in-situ bioremediation, an older, less effective technology.

Q. A number of respondents expressed concern regarding the feasibility of mitigation for contamination of a groundwater supply. What is your understanding of the means available to OPL to mitigate the impacts to a water supply aquifer?

A. Mitigation options include the reclamation or replacement of impacted water supplies. These might include treatment at the wellhead; installation of new or deeper replacement well(s) in unaffected areas of the aquifer; interties to alternative sources; and/or other appropriate actions. In any case, OPL has clearly stated in the Revised ASC that "in the event that a spill occurred…in an area that caused impact to a public water supply, OPL would provide alternative water supplies and compensation to water users until the water supply is restored", see p. 3-3-81. Several respondents, including Johnson, suggest in their prefiled testimony that OPL "should be required to negotiate compensation packages with all senior water right holders and water purveyors…" The Revised ASC states on page 3.3-76 that "to protect existing and senior water right holders, OPL will develop, as part of the project implementation, a compensation plan worked out with the communities, state and local agencies on a WRIA basis to be implemented in the event of an accidental release."

Q. Are you familiar with the prefiled testimony regarding the potential impacts on the Cross Valley Aquifer?

A. Yes. A number of respondents made similar comments with respect to the Cross Valley Aquifer. The respondents noted highly permeable "windows" in the surficial till; well locations and wellhead protection zones near and within the corridor; improved leak detection; the vulnerability of HDPE and styrene-butadiene components in water distribution lines to gasoline releases; need for a spill response plan; and the need for additional emergency response equipment. Historic leaks from block valves were one area of particular concern. One respondent, Kenniston-Longrie went so far as to postulate that DNR managed lands outside, but near, the Cross Valley Aquifer were at risk, see p. 47. Finally, support for the many concerns and requests by the Cross Valley Water District was based substantially on a "preliminary quantitative risk assessment, "prepared d by Golder Associates.

Q. In your opinion, where is the Cross Valley aquifer the most susceptible to an accidental release?

A. The ASC and the DEIS point out that there are areas of greater susceptibility along the pipeline corridor. Across the Cross Valley Aquifer the documents state that "approximately 4% of the alignment (approximately 0.3 miles or 1,700 feet) crosses well drained permeable soils that are directly underlain by portions of the aquifer", see Revised ASC p. 3.3-63. The CVWD response made reference to a 1996 USGS aquifer sensitivity rating method for the Snohomish County Groundwater Management Area, which is purported to be more detailed than the DEIS, but concluded that "for a project such as the Cross Cascade Pipeline, the use of the USGS sensitivity ratings is insufficient for assessing the vulnerability to contamination."

Q. How has OPL addressed these areas of higher susceptibility?

A. OPL has in fact agreed that prior to construction, "OPL will further identify through field inspection the physical limits of these areas and will adjust the final pipeline alignment to either avoid these areas entirely or to the maximum extent practical", see Revised ASC p. 3.3-75. Final decisions regarding susceptibility will be made after detailed mapping for final design and in all reality will be refined in the field as the trench is excavated. Furthermore, OPL's response to the DEIS noted that "there is potentially 1700 feet of corridor identified with highly permeable soils. If this area cannot be avoided during construction, OPL proposes to replace these highly permeable soils (*i.e.*, with a select bentonite backfill material) to add additional protection", see OPL response p. 5.

Q. Some respondents noted a concern regarding susceptibility of Cross Valley's water transmission lines. Can OPL mitigate such a risk?

A. Some respondents (Jon R. Stack and Robert A. Clark) commented on the susceptibility of HDPE pipe and styrene-butadiene gaskets to deterioration as a result of contact with gasoline. OPL plans to work with the Cross Valley Water District in the location and evaluation of susceptibility of water transmission lines which are within the pipeline corridor. OPL has agreed to replace susceptible waterlines to the District's satisfaction.

Q. Can you provide commentary regarding pipeline leak detection and trench lining in the CVWD area?

A. Johnson's prefiled testimony recommended among other things that the pipeline incorporate remote leak detection. Modern pump station and block valve designs are discussed above. However, with respect to Cross Valley, the Revised ASC adds that the Thrasher "pump station will be electronically equipped to detect leaks …", see Revised ASC p. 3.3-76. The Johnson prefiled testimony also suggested lined trenches. OPL has agreed to the use of low permeability backfill in sensitive areas. However, as noted in the OPL response to the DEIS, "a lined trench is not consistent with Best Management Practices and the proven technology of providing cathodic protection to a buried underground pipeline", see p. 5.

Q. Did you review a risk assessment submitted by the respondents in their prefiled testimony?

A. Yes.

Q. What is your understanding and opinion of the general hydrogeologic framework of that risk assessment?

A. The "preliminary quantitative risk assessment" prepared by Golder Associates, and attached to the prefiled testimony of Mr. Roberds as Appendix A of Exhibit WJR-1, concludes that there is a "4% chance (1 in 25) over a 50 year period" that "a pipeline release would exceed action levels at a CVWD well…" The document includes a lengthy discussion of hydrogeologic conditions, constituents of concern, and the fate and transport of those constituents if released from the pipeline. Without getting into details of the postulated release, fate and transport, and the calculation of risk, several general points should be considered in assessing the accuracy of Golder's "risk assessment."

Section 4.7 of Golder's risk assessment describes the aquifer "over most of the project area" as unconfined. Section 4.8 refers to a "detailed west-east geologic cross-section drawn along the proposed pipeline alignment" which is shown on Figure 4-2. Notably, the cross-section shows the aquifer to be confined or semi-confined, with static water levels generally well above the screened zones. In Section 4.9 the document agrees with this interpretation stating that the "aquifer zone contributing to the wells is classified as semi-confined." Later, in Section 4.10, the document further states that "complex flow patterns are likely on the Cross Valley recharge area." The important point is that confined aquifers are not highly susceptible to LNAPL contamination. This is especially true when there are numerous perched saturated zones above the aquifer, which is common in the area. Stratigraphic sequences such as those underlying the Cross Valley Water District provide a significant degree of natural protection, in part due to the tortuosity of flow and the resultant increase in flow distance, and consequently the time of travel, for constituents released at the surface to reach the aquifer production zone.

Q. What is your opinion regarding the conclusions reached in the Golder risk assessment?

A. The greatest concern in Golder's "semi-quantitative risk assessment" is its conclusion with respect to exceeding "action levels for certain contaminants." In Section 5.2.1 it is stated that "in terms of groundwater contamination, the gasoline components of most concern include the major aromatics …BTEX and MTBE." However, the tabulated results show the "calculated probability" of benzene exceeding the "action level", i.e., one-half the drinking water standard, "in at least one CVWD well" is 0.00 (zero). The "calculated probability" of MTBE levels exceeding action levels, i.e., one-half the EPA advisory level, which is based on taste and odor, "in at least one CVWD well" with pipeline releases of more than 5000 barrels is 0.00077919. From this table it is apparent that the primary constituent of concern is MTBE. In some areas, such as California, MTBE is a major contaminant of concern (Andrews, 1998). Unfortunately, the author failed to recognize that MTBE is an additive not commonly used in Washington. Fuel transported from the refineries to terminals via the pipeline does not contain MTBE. To the extent MTBE is used, it is added after the fuel is transported through the pipeline.

Q. What is your basis for that statement?

A. According to Brian Sullivan of ARCO (1999) effectively all gasoline cleaning additives are blended with the product at the terminal. As an example, ARCO sometimes adds ethanol to the gasoline, but since it is hygroscopic it must be added at the terminal. In any case, he emphasized that "ARCO doesn't use and does not intend to use MTBE in gasoline in the Northwest in the near future."

Q. Given the absence of the MTBE, what conclusion would you expect with respect to the risk assessment?

A. I would have to conclude from the respondent's prefiled testimony's "semi quantitative risk assessment" that the "calculated probability" of the most soluble and mobile constituent of concern evaluated, i.e., benzene, "exceeding action levels in at least one of CVWD's wells" is 0.00 (zero). In short, based on the data contained in the Golder risk assessment, the CVWD's existing water supply wells are not at risk from OPL's proposed pipeline for the spill scenarios analyzed.

Q. Are there other CVWD respondents who postulate a risk based on the presence of MTBE in the pipeline?

A. The same mistake with respect to MTBE is included in other prefiled testimony. For example, Pitre's reference to MTBE's "recalcitrant and persistent" nature, and Anderson's attachment to Stack's testimony suggesting a "treatability and engineering design study" to include MTBE.

Q. Can you comment on the need for a standby water supply for the CVWD?

A. Yes. Mitigation of a spill or release which impacts a groundwater supply is discussed throughout many of the CVWD comments. Several respondents (Stack, Hajek and Pitre) discuss the need for a redundant or standby water supply alternatives to ensure "the uninterrupted supply of public drinking water", prior to the initiation of flow in the pipeline. Hajek, General Manager of CVWD, stated that they have 11 wells which when pumped 16 hours per day, produce 3.7 MGD; and that "presently, no excess supply is available from the District's wells." However, the prefiled testimony of CVWD's consultant, William J. Roberds, does not appear to support these conclusions. Roberd's tabulated data shows that the CVWD has water rights for the instantaneous withdrawal of 4,800 gal/min and a maximum of 5338 acre-ft/yr (note this is 14.6 acre-ft/day or approximately 4.8 MGD). Furthermore, he notes that CVWD currently pumps 4090 gal/min, which equates to 3.9 MGD, over a 16 hour pumping period. If the existing wells were pumped for 24 hours at 4090 gal/min, the daily production would be 5.9 MGD. This exceeds the current demand by nearly 40 % and their existing water right by almost 25%. With respect to future growth, Roberds states "the projected requirements to the year 2008 (5.83 MGD) exceeds the current capacity of the CVWD wells. The loss of one or more wells is a potentially serious consequence." If the wells were pumped for 24 hours per day at the instantaneous rate allowed in the water rights, they would be capable of exceeding the 2008 projection by more than 15 %. These data suggest that CVWD currently, or in the near future will, require additional water, with or without the pipeline.

Q. Do you believe that an accidental release over the CVWD could be mitigated?

A. Yes, cleanup and mitigation of groundwater contamination are required under state and federal law and OPL has stated its acceptance of responsibility for any damage to water supplies resulting from their activities. As noted above, instantaneous and catastrophic contamination of a deep confined aquifer by LNAPLs is not supported by experience, nor is it a realistic scenario. Groundwater supplies by their very nature lend themselves to management of localized contamination. For example, the contamination of one well or a portion of the Cross Valley aquifer does not preclude the continued, or accelerated, pumping of other unaffected wells. The respondents' own data indicate that this would be a possibility, at least up to the limits of their water rights.

Q. Would you give us your opinions with respect to the prefiled testimony you reviewed regarding the potential impacts to the Snoqualmie Aquifer?

A. Major sources of comment regarding the Snoqualmie Aquifer were the King County DDES, EKCRWA, the City of North Bend and Henry Landau (consultant to Cascade Columbia Alliance City of North Bend and City of Snoqualmie). Respondents' commentary related to aquifer sensitivity; current and proposed future use of the aquifer; and the related risk of contamination.

Section 3.3.6 of the Revised ASC noted that the existing water supplies at Snoqualmie and North Bend are springs located upgradient of the proposed pipeline alignment and wells located downgradient. In both areas there are backup wells within 1 mile downgradient. Many comments focused on the plans for development of the Snoqualmie Aquifer as a long term source of up to 40 million gal/day to supply the future needs of East King County. Although the ASC did not expound on proposed future uses of the underlying aquifers, it did note that alluvial and glacio-fluvial deposits in the area have the highest sensitivity/impact rating along the proposed pipeline alignment, see Table 3.3-10.

The EKCRWA submitted comments specific to the hydrogeologic conditions in the Snoqualmie Aquifer. They described the shallow unconfined and the deep confined to semi-confined aquifers. Section 8.0 of Landau's pre-filed testimony describes a "leak scenario" involving block valve or pump station releases. It does not, however, take into account the design changes for secondary containment described above. The leak of a small valve "similar to Renton's" is assumed to continue for 12 months prior to detection (note again that the scenario fails to recognize the aboveground block valves with containment). A floating plume is described on the shallow water table aquifer, and "a dissolved phase plume occurs in Zone 1 and starts to migrate advectively in the direction of groundwater flow…the actual leading edge of the …plume defined by the MTBE travels at a faster rate (by a factor of 1.2) due to longitudinal dispersion. BTEX constituents travel at a slower rate due to retardation (by a factor of 2)." The plume is pulled from Zone 1 into the confined aquifer, Zone 2 and "MTBE arrives in the City production well after about 250 days."

Q. Do you agree with the respondent's characterization of the risk to the Snoqualmie Aquifer?

A. Like the Cross Valley "risk assessment," this scenario oversimplifies the release, fate and transport of contaminants in the environment. For the Snoqualmie Aquifer, respondents fail to consider the protections provided by aboveground valves, containment for pump stations or, as stated in the Revised ASC, the fact that "in sensitive areas with confirmed well-drained soils, impermeable soils will be employed that will prevent petroleum products from escaping the trench, and will direct the petroleum products toward a lower sensitivity area for capture and clean-up", see Revised ASC p. 3.3-76. Landau's comments describe the LNAPL migrating along the trench as floating product, partially dissolving (including BTEX and MTBE) and being induced from the unconfined shallow aquifer into the deeper confined aquifer. Note again the reliance on MTBE in "modeling" the movement, when in fact no MTBE will be carried in the pipeline.

Q. Can OPL's pipeline design features address any of the respondents' concerns regarding the Snoqualmie Aquifer?

A. Yes. The EKCRWA response notes that pump stations and block valves are sources of historic releases from pipelines. They therefore term the location of the North Bend Pump Station as "unacceptable" and state that "there is no indication of design refinements or protective measures at the North Bend Pump station." However, they fail to recognize the pump station containment and remote monitoring previously described. The Revised ASC describes a number of planning, design, construction and operation elements that have been proposed for sensitive areas. Many of these are described above, and parallel the requests of the EKCRWA including: Emergency Planning (coordinated with local districts), special design, use of hydrocarbon sensors at pump stations and electronic leak detection, among others.

Q. **Would you give us your opinions with respect to the prefiled testimony you reviewed regarding the potential impacts to the Ellensburg water supply?**

A. The Revised ASC clearly states that "the city of Ellensburg obtains its supply from six groundwater wells located within City limits, all located greater than three miles downgradient of the pipeline alignment…the wells tap into the alluvial aquifer associated with the Yakima River." Table 3.3-10 gave this segment of the alignment a sensitivity/impact rating of 10. Landau's testimony in Section 4.9.1 suggests that the City wells tap the alluvial aquifer as well as the underlying Upper Ellensburg Formation. Landau suggests that additional characterization of the alluvial aquifer and the Ellensburg Formation to evaluate aquifer sensitivity. OPL has agreed to additional evaluation of areas where existing and proposed municipal water supplies are potentially at risk. Wells that are 3 miles downgradient of the pipeline simply are not at risk, for the reasons discussed earlier.

Q. **Would you give us your opinions with respect to prefiled testimony you reviewed regarding potential impacts to aquifers between Kittitas and Pasco?**

A. Some of the comments do not reflect an understanding of the nature of the aquifers and the properties of hydrocarbons, or the current regulatory status in the region. Kenniston-Longrie of the DNR notes that "the Eastern Columbia Plateau Aquifer System is a proposed sole source aquifer…", but later quotes that "EPA Region 10 has decided to indefinitely hold in abeyance the proposed designation pending the development and evaluation of a voluntary, comprehensive, and community-based approach to ground water protection…", see p. 48.H. Additional testimony, the attached table, and the maps in Kenniston-Longrie's prefiled testimony continue to emphasize 'sole source' and 'candidate for sole source'. What Kennston-Longrie fails to note is that the Columbia

Basin Ground Water Management Area (CBGWMA) was formed through an agreement between counties, EPA, and WDOE as an alternative to a sole source designation.

Q. You mentioned the 'nature of the aquifer' and the 'properties of hydrocarbons'. how does that relate to the risk posed by the pipeline?

A. Kenniston-Longrie makes several mistaken assumptions, as noted above, including: that an entire aquifer is impacted; a failure to recognize the characteristics of LNAPLs; misses the point that most of the deeper 'interflow zones' are confined and not prone to contamination by LNAPL; that the proposed pipeline corridor skirts the western edge of the aquifer system; and that the very nature of the aquifer system lends itself to alternative mitigation scenarios, in the event of an accidental release.

Q. What is your understanding of OPL's efforts to protect large public water supply wells between Kittitas and Pasco?

A. The Revised ASC, see p. 3.3-80 and 81, notes a number of water supply wells along this portion of the pipeline alignment including: City of Kittitas wells located upgradient of the alignment; Kittitas PUD wells near Wanapum Dam, which are more than five miles downgradient of the pipeline alignment; a capped industrial well located adjacent to the pipeline alignment at the Port of Royal Slope; and the City of Pasco wells, which are located within 3 miles downgradient of the pipeline. Respondents also noted that there are shallow single domestic and irrigation wells near the proposed pipeline alignment in this reach. Landau noted in Section 4.9.1 that "a number of specific groundwater basins …" have been identified in this area. Because surface water provides some potable and irrigation supplies in this area, there is also concern with respect to ground-surface water interaction. This concern extends to potential aquatic impacts, as expressed by the

Yakama Indian Nation. Segments of the pipeline will be below the water table along this portion of the alignment. Where shallow water tables result in submersion of the pipeline, concern was expressed with respect to additional corrosion potential.

OPL has committed to site-specific review of all existing and currently proposed public water supplies along the pipeline alignment. For public water supplies, OPL has stated it "will discuss and incorporate its construction, operation and monitoring plans with each municipal/public supply purveyors management and protection plans", see Revised ASC Section 3.3.6.2. As additional protection in this portion of the pipeline, "OPL agrees it will run a 'smart pig' through the Kittitas to Pasco reach one additional time every five years" effectively doubling the monitoring frequency for corrosion assessment, see Stipulations Between the Olympic Pipeline Company and the Yakama Indian Nation, D. Monitoring Activities, No. 6.

Q. Would you give us your opinion regarding surface-groundwater interaction and the potential impacts to aquatic habitat?

A. Some respondents referred to the potential impacts to aquatic environments as a result of an accidental release. The pre-filed testimony of Henry G. Landau suggests that "the proposal is inconsistent with Washington State's efforts to protect and restore salmon resources.", see p. 4. In his attached report, he discusses surface-ground water interconnection(s) and aquatic toxicity. Others are responsible for the response to aquatic toxicity.

As noted above, a release to groundwater commonly results in the slow migration of the hydrocarbons, floating on the uppermost saturated zone. A subsurface release near a stream or on a floodplain could result in a visible sheen on the surface water, but as noted in the spill scenarios, these typically are contained by booms or evaporate. A dissolved fraction would also evolve, as noted above for the groundwater descriptions. Given the relatively slow movement of groundwater, and the attenuating mechanisms described above, this fraction would "slowly bleed" into the surface water body. In most streams it is quickly mixed and diluted to nondetectable levels. Landau states in Section 4.4.1.3 that "a groundwater impact could result in a surface water impact (such as Olympic's Renton spill) and, consequently, kill or damage endangered fish populations." The Renton experience, that is cited by many of the respondents, was from a buried block valve. This is not the design proposed by OPL. The DOE Spill Response Manager at the time of the release has stated "a light sheen was noted on the Green River and that it was traced back to the source." He further stated that one of his responsibilities was "resource damage assessment, and to his knowledge there was no reported damage to aquatic life or fish." He emphasized that "none was ever documented or reported to him" (Baker, 1999). Again, the respondents fail to recognize the characteristic movement of LNAPLs and experience in remediation/mitigation.

I declare under penalty of perjury under the laws of the State of Washington that the foregoing testimony is true and correct to the best of my knowledge and belief.

DATED this _____ day of March, 1999.

____
H. Randy Sweet, RG, CEG

References

Andrews, Charles, 1998, MTBE-A Long-Term Threat to Ground Water Quality. Ground Water, Vol. 36, No. 5, Editorial.

Baker, Craig, 1999, Personal Communication. Former Spill Response Manager, Washington Department of Ecology, Northwest Region.

Chapelle, F.H., 1999, Bioremediation of Petroleum Hydrocarbon-Contaminated Ground Water: The Perspectives of History and Hydrology. Ground Water, Vol. 37, No. 1, p 122-132.

Hadley, P.W. and R. Armstrong, 1991, Where's the Benzene?-Examining California Ground-Water Quality Surveys. Ground Water, Vol. 29, No. 1, p 35-40.

Sullivan, Brian, 1999, ARCO Director of External Affairs, Northwest, personal communication

United States Environmental Protection Agency, 1997, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Office of Solid Waste and Emergency Response, Directive Number 9200.

Testimony Reviewed

Anderson, Robert H., Exhibit RHA-1

Clark, Robert A., Exhibit RAC-T, pp. 1-3, and including a letter and attachments to CVWD dated November 6, 1998

Devitt, Ronald C., Issue: Water Quality Compliance and Enforcement. Sponsor: Department of Ecology, pp. 1-9.

Hajek, Gary, Exhibit GH-T, pp. 1-3 and Exhibits GH-1, GH-2 and GH-3.

Johnson, Kenneth H., Testimony dated February 11, 1999, pp. 1-7 and Exhibit 1 attachment.

Kenniston-Longrie, Joy, Exhibit JKL-T and attached Exhibits JKL-2 through 7.

Landau, Henry G., Exhibit HGL-T, pp. 1-14 and attached Exhibit HGL-1.

Miller, J. Wesley, Issues: Comparative Risk, Spill Analysis, Pipeline technology, Mitigation, Decommissioning. Sponsor: Counsel for the Environment, p. 1 and 39 through 44.

Pitre, Christian, Exhibit CVP-T.

Roberds, William J., Exhibit WJR-T and attachment Exhibit WJR-1.

Stack, Jon R., Exhibit JRS-T, pp. 1-5 and attached Exhibits JRS-1, JRS-2, JRS-3, and JRS-4 (a letter to CVWD dated February 11, 1999 from Robert H. Anderson).