# Rebuttal Testimony of John H. Robinson

**Please state your name, employment position and employment address.**

**A.** My name is John H. Robinson. I am Vice-President of Dames & Moore Group. My employment address is 2025 First Avenue, Suite 500, Seattle, Washington.

**Q. Please state your educational and employment background.**

**A.** I received a Bachelor of Architecture degree (minor in economics) in 1971 from California State Polytechnic University, San Luis Obispo. I completed the graduate program coursework in Urban Design (minor in Decision Analysis) at University of California, Los Angeles, 1973. Since 1976 I have been employed at Dames & Moore and Dames & Moore Group in various positions including Senior Planner, Principal Planner, Group Manager, Regional Manager and Director of Energy Services. My principal area of practice has been site selection (routing), licensing, and environmental impact analysis of various types of energy facilities including pipelines (crude, product, natural gas and LNG), power generation facilities (thermal, gas turbine and nuclear) and high voltage electric transmission lines. I have served as Project Director, Project Manager and Senior Technical Reviewer on these projects. I have managed and/or authored a number of environmental risk analyses for pipeline projects and siting of nuclear reactors. Among these are development of a revised population exposure criteria for the Nuclear Regulatory Commission (subcontractor to Sandia Laboratories), a review and evaluation of the Santa Barbara County Oil Transportation Plan for a consortium of oil companies and Feasibility Report for Natural Gas Supply Pipeline for Los Angeles Department of Water and Power among others.

**Q. What has been your previous contribution to the evaluation of the Cross Cascade Pipeline project?**

**A.** I previously prepared a study entitled **Cross Cascade Pipeline Project/Product Spill Analysis** which was incorporated as part of Olympic Pipe Line Company's Application for Certification from the Energy Facility Site Evaluation Council.

**Q. What was the purpose of that study?**

**A.** The Product Spill Analysis provides an evaluation of the Cross Cascade Pipeline (CCP) as part of the overall transportation system to move refined petroleum product to the Eastern Washington market. This evaluation included comparison to the existing transportation system and had two purposes that were both achieved.

This first purpose was to determine if one system of transportation would perform better than the other with respect to spills of product to the environment. The purpose was achieved with the findings, reported in the study, that the proposed Cross Cascade Pipeline would in fact reduce the number of spills. A finding that the testimony of others corroborates.

The second purpose was to describe the consequences of product spills, assuming that they occurred taking into account issues such as emergency response, environmental cleanup, remediation techniques and residual environmental impacts. This purpose was also achieved by evaluation of 17 different product spill scenarios. These scenarios were not theoretical scenarios; they were scenarios at specific locations along each of the different transportation routes that would be used and at locations where sensitive environmental resources were exposed. The study included findings that provide the decision maker with an assessment of project specific impacts and an assessment of the probability that such impacts were likely to occur.

**Q. After having read the various testimony offered by others in this case have you revised the conclusions of your initial study?**

**A.** No. The conclusions of Spill Analysis Report with respect to the number of spills generated by each transportation alternative are corroborated by Dr. Miller in his rebuttal testimony. Dr. Miller and I both found that the proposed CCP will reduce the number of spills in the future. I do not agree with the conclusions of Dr. Miller and others regarding the expected amount of product that would be spilled and other aspects of their analysis. I have therefor prepared a “Rebuttal Analysis” that includes revisions to a number of the statistics used by Dr. Miller, Mr. Mastandrea and others.

**Q. What are the result of your Rebuttal Analysis?**

**A.** The results are shown in Exhibit 1 as two tables. The first shows the number of spills that would result; the second, the expected volume of product released. These tables show that constructing the CCP will eliminate approximately 400 spills of product during transportation to Eastern Washington. The volume of product spilled will be reduced by approximately 335,000 gallons.

However, as I shall discuss further, these results do not stand alone; the environment into which these spills flow must also be considered. The resulting reduction in spills and spill volume will be primarily spills into the marine/aquatic environment.

Tables showing the demand forecast, allocation of product movement to modes of transportation and calculation of spills are included as Exhibit 6.

**Q. What will your rebuttal testimony address?**

**A.** My testimony is organized into three segments: 1) a discussion of the differences between the rebuttal analysis I have prepared and the analyses of Dr. Miller, Mr. Mastandrea, and Mr. Dickens, 2) a discussion of the maximum spill volume and spill sizes adjacent to sensitive resources prepared by Mr. Mastandrea, and 3) a summary of the environmental risk of refined product transportation put into context of the proposed Cross Cascade Pipeline.

**Q. Have your read the testimony of Dr. Miller, Mr. Mastandrea and Mr. Dickens and do you agree with the conclusions that they reach about the risk presented by the proposed Cross Cascade Pipeline?**

**A.** I do not agree with the results presented by Dr. Miller, Mr. Mastandrea and Mr. Dickens. They have presented testimony that incorrectly portrays the proposed Cross Cascade Pipeline project as having greater risk as a means of transporting refined petroleum product to eastern Washington markets than the existing barge/truck system. To reach their conclusions, they:

- Rely on statistical databases to provide estimates of risk without considering the real world experience of the Olympic Pipe Line Company, who will construct, build and operate the pipeline, or the actual CCP proposal itself.

- Have acknowledged differences between national trends for spills from pipelines and barge transportation and actual experience in the PNW that favor the pipeline, yet have not incorporated these data in their conclusions or explained why such differences exist.

- Suggest that the CCP can have spill releases of a size and nature that are not possible.

- Recommend design features and inspection and operating practices that Olympic has used in the past and has incorporated into the CCP; yet ignore the beneficial effect of these current practices and features when making their estimates yet at the same time they include the effect of technological innovation for the marine transportation system.

- Criticize the Applicant's spill analysis as incorrect for not providing an evaluation of the "consequences" of product spills, yet provide no analysis of their own. Instead, they rely on statistical estimates of total volume spilled without systematic consideration of where such spills would occur or the probability that such events would happen in the first place.

Dr. Miller, Mr. Mastandrea and Mr. Dickens have entered testimony based on statistical analysis of spill frequency and expected spill size. These statistics in most cases are derived from databases for various modes of transportation that represent nationwide data. What they fail to do is place the issue in the context of the Pacific Northwest. When comparing the various modes of transportation, truck, marine (barge and tankship) and pipeline, the inescapable fact is that **all spills from barges and tankship, no matter what their size will occur in the water; in contrast pipeline spills will almost always occur on land.** Why is this a factor critical? If removing spilled hydrocarbon from the environment is important, then land based spills which result in much greater recovery of the spilled product and related environmental and human exposure should be preferred over spills to the marine environment. The testimony of Mr. Roy Elliott, Captain John Felton, Mr. Paul Gallagher and Mr. Harold Zarling all describe the important differences in the effectiveness of recovery and cleanup of land based versus marine spills. Dr. Meyer, in his testimony describes the real consequences of coastal and river spills.

Similarly, spills from tanker trucks while limited to a maximum of approximately 11,000 gallons will almost always occur on busy highways exposing the truck operator and the public to extreme and immediate hazard; indeed, it is the truck spill resulting from a truck accident that is most apt to result in both environmental damage and loss of human life.

**Q. Is Dr. Miller's analysis consistent with the project that has been proposed?**

**A.** No. As part of his testimony, Dr. Miller analyzes an alternative to the CCP, an expansion of Olympic's current pipeline system between Renton and Portland that has not been proposed. This alternative, which is called "Scenario C" in Dr. Miller's testimony and accompanying report, would provide for increased volumes of product to be transported to Portland and moved by barge to Pasco. A barrel of product that would travel 234 miles directly to Pasco would instead make a trip of 394 miles including two transfers.[1] This alternative was included by Dr. Miller without any evidence that it is even feasible. Dr. Miller's testimony concludes that this pipeline presents less total risk without identifying a route for such a pipeline, or determining if such a route were even feasible to construct

[1] Dr. Miller's proposed alternative would parallel the existing Olympic pipeline route but not necessarily follow the same alignment. It would need to cross or travel on 11 major rivers including the Cedar, Green, White, Nisqually, Deschutes (Washington version), Skookumchuck, Newaukum, Cowlitz, Toutle, Coweeman, Kalama and Lewis and Columbia rivers. The CCP only crosses four rivers of comparable size, the Snoqualmie, Tolt, Yakima, and Columbia. To the extent pipeline crossings at major rivers is of environmental concern, Miller's proposal should be the source of significantly greater concern.

and economic to operate. For example, such a pipeline would cost approximately the same to build and operate as the proposed pipeline to Pasco yet it would require that barrels of product using it would still have to pay to get up the river by barge.

**Q. What are the significant differences between your rebuttal analysis and the analysis presented by Dr. Miller?**

**A.** There are three principal differences: 1) the structure of the analysis, 2) the time period of the analysis, and 3) the specific spill frequency factors or rates used for each mode of transportation.

**Q. What do the structural differences include?**

**A.** Dr. Miller and I differ significantly in two primary areas: calculation of tanker truck transportation and distribution of product to Wilma and Umatilla with the CCP in operation. We also have a different perspective on coastal barging of product to meet Eastern Washington demand but this difference is of less significance than the first two issues. I will discuss each of these differences in turn.

1. <u>Tanker Truck Transportation</u> – Transportation of product by tanker truck in Eastern Washington has two distinct elements that must be recognized separately to evaluate the impact of the CCP on tanker truck traffic. As discussed in the Applicant's Product Spill Analysis, (pg 6) product is delivered into the Eastern Washington regional demand area via four transportation paths, barge up the Columbia river to Umatilla, Pasco and Wilma, the Chevron pipeline from Boise, Idaho to Pasco, the Yellowstone pipeline from Billings to Spokane (and on to Moses Lake), and by tanker truck principally over Interstate 90 to Ellensburg and Eastern Washington. In

each case but the last one, the destination of the product is a regional distribution terminal. These terminals, which can be thought of as wholesale outlets are principally located in Pasco, Wilma, Spokane, Moses Lake and Umatilla. From these regional distribution points, local tanker trucks transport the product to retail locations (filling stations and local direct customers). This distinction is important because the local distribution trips to the retail outlets will be the same, with or without the CCP. Dr. Miller has combined deliveries to the regional bulk terminals and the local retail distribution trips. He has done this by using a weighted population/centroid method that attempts to simulate the regional distribution pattern. Not only was this not necessary, but it masks the direct effect of the CCP on regional truck transportation. In my analysis I have focused on those truck trips that would change as a result of the CCP, namely transportation over I-90 to Eastern Washington from Harbor Island and Renton terminals and distribution to the Yakima area from Ellensburg and Pasco.

2. Deliveries to Wilma and Umatilla – With construction and operation of the CCP it is assumed that barrels of product formerly traveling up the Columbia by barge to Pasco are instead delivered at Pasco by the CCP. Currently barges also make deliveries to regional bulk terminals at Wilma on the Snake River near Lewiston, Idaho and to Umatilla for transfer to Hinkle, the site of Union Pacific's rail yard and fueling station.

> In the case of Wilma, it is expected that the barge trade would continue as barging will still be cheaper from Pasco to Wilma than truck transportation. As such, these trips have been included in my analysis of the CCP.

> In the case of Umatilla, current costs do not show a significant advantage to either truck or barge so it could be assumed that the river barge operators would seek this business. An alternative would be for Union Pacific to pick up the product at Pasco and use its own rail system to transport directly to Hinkle. This option, which would be cheaper than rail or barge, is available to Union Pacific with the construction of a very short rail spur at Pasco. Both of these transportation options are discussed in more detail in the testimony of Mr. Rolniak and Dr. Leffler.

Olympic's existing pipeline from Renton to Portland currently operates at capacity. Demand for product to serve the Portland/Willamette valley markets and for transport to Eastern Washington exceeds the supply available from the existing Olympic pipeline. As Dr. Rolniak has described in his testimony the balance to meet demand is met by barges and tankships transporting product from Washington refineries through the Straight of Juan de Fuca, down the Washington coast and 90 miles up the Columbia to Portland. Mr. Rolniak has also testified that some of this excess demand is also met by tankship/barge transportation of product from San Francisco and Los Angeles refineries. It is estimated that in 1999, more than 79 trips will be made each year by barge/tankship (Dr. Paul Rolniak - Testimony) to satisfy the Oregon and Eastern Washington markets from PNW refineries. Construction of the CCP would eliminate these trips for some period of time. Moreover, without the Cross Cascade Pipeline to relieve congestion on the existing

Olympic system, all growth in gasoline and distillate demand from Eastern Washington must be supplied by imports from coastal barges/tankships.

**Q. Dr. Miller argues that the twenty-year analysis performed by the Applicant is inadequate and that a "project lifetime analysis" of 50 years is necessary. Do you believe one period of analysis is preferable to another?**

**A.** The analysis included in the Product Spill Analysis and the Rebuttal analysis both rely on a forecast of refined product demand growth. This forecast is, in turn, the basis for the analysis of the three modes of transportation: pipeline, marine (barge and tankship) and tanker truck. EAI's forecast of regional product demand trends extends to 2005. The analysis to 2019 (20 years) in the Product Spill Analysis extends this forecast 15 years beyond the initial forecast period. To forecast to 2049 (a fifty-year analysis) represents an extended "stretch" in such a growth forecast. In any event, the real effect of carrying the analysis out to 50 years is to further demonstrate that the CCP is the preferred alternative.

The primary reason Dr. Miller argues that a 50-year period is more representative appears to center on the age correction factor for pipeline spill frequency given in Mr. Mastandrea's 1982 study (Mastandrea, John, Petroleum Pipeline Leak Detection Study; Science Applications, Inc., 1982) and used by Dr. Miller and Mr. Mastandrea in the analysis they prepared for this matter. This correction factor significantly increases the spill frequency of pipelines as they increase in age above 25 years; this is not borne out by the existing Olympic system's actual experience which seems not to experience an increase in spill frequency as the pipeline ages[2]. While taking into account age in their analysis of pipelines, Dr. Miller, Mr. Mastandrea and Mr. Dickens do not account for age or time dependant factors for other modes of transportation such as the forecasted increase in traffic on the I-90 corridor along which significant volumes of refined product would be transported by truck if the pipeline is not built or the increases in marine traffic on the Columbia River. This increase in future marine and highway traffic density must surely merit a similar modification to the risk of accidents and resulting potential spill incidents. Indeed, barge trips on the Columbia would increase from their present level of approximately 350 today to 511 trips/per year in 20 years and 730 trips per year in 50 years.

There is neither a “correct” time period nor a regulatory requirement for a specific time period. The 50-year time period that Dr. Miller recommends is no less arbitrary than the 20-year time period offered by the Applicant with the exception that the uncertainty of the statistical analysis must be considered to be less reliable the longer the forecast. In the Rebuttal Analysis that has been prepared, a 50-year period is used so the results can be compared to the analyses of Dr. Miller and Mr. Mastandrea.

**Q. Do you agree with Dr. Miller’s thesis that a risk analysis must evaluate both the likelihood and the consequences?**

**A.** Dr. Miller’s testimony says that “Risk” analysis must include both predictions that events (spills) will occur and the consequence of their occurrence; I would agree. Dr. Miller claims that the Applicant’s analysis did not consider consequences (Dr. Miller, pg. 3) yet

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[2] Olympic’s total spills by decade are: first ten years – 3 line spills/18 total spills, second ten years – 4 line spills/13 total spills, third ten years – 3 line spills/13 total spills, current decade (3 years) – 0 line spills/2 total spills.

the entire second half of the Applicant's Spill Analysis Report (pgs 12-32 and 56 page Appendix) describes spills from each transportation system, means of responding to such spills, and the consequences. Instead Dr. Miller employs an oversimplified analogy in his testimony and attempts to imply that a barge or tanker truck spill is a minor type of consequence while a pipeline spill is a holocaust event.

The type of analysis provided by the Applicant gives the decision maker a real world picture or perspective on consequences. Dr. Miller discounts this approach as improper and suggests that decision makers should be concerned about worst case disasters that are simply not credible for the proposed pipeline. For example, Dr. Miller suggests that a pipeline spill of over 22 million gallons of product is possible. For such a spill to occur from the CCP, the <u>entire pipeline must be emptied more than two times over which would take 4.5 to 5 days, pumping at maximum capacity, with no one doing anything to stop it</u>. It would take on the order of 10 days at the pipeline's initial volume flow rate.

Dr. Miller argues that the appropriate measure for comparing proposed transportation modes and the project proposal is to multiply the possibility that spills will occur (as derived from a statistical database) times an average spill size (also derived from a statistical data base). While statistics are a useful measure, and indeed many times the only means for evaluating future consequences of decisions, they should always be viewed with some skepticism (as Dr. Miller does when including statistical confidence intervals). Statistics must always be placed in context. Both Dr. Miller's and Mr. Mastandrea's statistical results yield a number but do not, as the Applicant's analysis does, address the ultimate consequence including the extent to which product spilled to the environment can be successfully recovered and the degree to which there is a resulting impact to the environment. What are the real world implications of the statistical analysis?  Referring again to Dr. Miller's slip and fall versus holocaust comparison, surely a fiery tanker truck accident on I-90 involving other vehicles, injuries and the spill of 11,000 gallons of gasoline onto a busy freeway is not a slip and fall incident (see Exhibit 7).  At the same time, a spill of 100,000 gallons or more from a pipeline, which can largely be recovered, should not be characterized as a holocaust.

A smaller, but perhaps more relevant data base, is the operating history of the company that will build and operate the proposed pipeline, a State of Washington based company that has been operating for more than 30 years.  This company, operating a pipeline of the same size and for the same use, has had in its 33-year operating history only two spills as large as the average spill used in Dr. Miller's analysis.

**Q. Now turning to the specific statistical factors used in the different analyses, do you agree with the spill frequency and average spill sizes used by Dr. Miller and Mr. Mastandrea?**

**A**. In most cases, I do not.  I find that there are significant differences in the values that were used in the Spill Analysis Report (Applicant) and those represented in the testimony of Dr. Miller and Mr. Mastandrea.  Dr. Miller's report documents the difficulty of finding data bases that support derivation of valid and reliable spill frequency and size statistics. Dr. Miller has also documented the difference between National, Regional and Local statistics.  His analysis shows the Regional and Local spill frequency is somewhat lower than the National values for pipeline and he recommends that the Regional value be used in his preferred case.  Interestingly, the opposite is true for barges, the Local and Regional values are higher for barges than the National value yet he uses the national value as the basis for his analysis.

**Q. After reviewing Dr. Miller's and Mr. Mastandrea's calculation of spill frequency what pipeline spill rate have you used in the Rebuttal analysis?**

**A.** I have used the rate for line spills derived from Olympic's actual 33-year history instead of Mr. Mastandrea's approach. Dr. Miller uses the same value as I have as the basis for his "Olympic Best" case.

Mr. Mastandrea's method for calculation of expected spill frequency and average spill size[3] includes several "correction factors" that modify the general case to the specific configuration of a specific pipeline. Of the several correction factors developed by Mr. Mastandrea, his correction factor for pipeline age and his correction factor for size of spill are the two that have the greatest influence on the calculated expected frequency of spill[4]. However, applying Mastandrea's method to Olympic's existing operating history shows that his method can vary significantly from individual pipeline experience.

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[3] Dr. Miller's analysis adopts the same method.

[4] Dr. Mastandrea claims that more recent data concerning spill frequency compiled by the California State Fire Marshall for years 1986 to 1989 confirms the accuracy of his 1982 study estimates (page 22 of Exhibit JRM-2). His exhibit does not report the age of the pipelines considered, however. Data compiled by the U.S. Department of Transportation, Office of Pipeline Safety, for the years 1984 through 1997 show a result comparable to that indicated by the California State Fire Marshall's report; that the frequency of occurrence of spills from pipelines is relatively constant. Rather than supporting Mastandrea's earlier results, this information seems to refute it. If the likelihood of a pipeline spill increases as pipelines age (up to a factor of 3.64 when the pipeline is over 45 years old), then the aging U.S. pipeline network should demonstrate an increase in the frequency of spills when compared to Mastandrea's 1982 study (which was based on pipeline ages and spill records from 1971 through 1975). Mastandrea himself recognized that his suggested age factor should result in an increase in the number of pipeline spills reported each year as the U.S. pipeline system ages (Mastandrea, 1982, page 223). It is not clear why he currently believes that the failure to identify such a result somehow confirms his "reference pipeline" spill frequency statistic. It seems to refute his age-related spill frequency correction factors.

**Pipeline Age Correction Factor -** Mr. Mastandrea's original work (1982) was based on spill statistics from 1971 to 1975, and suggested that the "average" pipeline age was 25 years. It is not clear how the "average" age was determined, and Mastandrea (1982) concedes that the actual ages of pipelines were not known (page 237). Although we do not know the current average age of the U.S. pipeline system, it is reasonable to assume that it is older today than it was in 1975. To assume otherwise would require that all new pipelines installed would be offset by retiring at least an equivalent amount of the oldest pipe in service. Mastandrea predicts this aging of the U.S. pipeline system on page 223 of his 1982 report. If his age correction concept was correct, the current frequency of spills should be higher than that observed in 1971 to 1975. As Mastandrea indicates in his own testimony, this is not the case. The fact that current spill frequencies are comparable to those computed by Mastandrea using 1971 to 1975 data actually refute his age correct hypothesis, they do not confirm it.

**Mastandrea's Spill Size Correction Factor –** Mr. Mastandrea claims that the Olympic analysis of spill frequency understates the likely occurrence of spills by omission of spills smaller than 2100 gallons (page 5, lines 6 and 7). On page 4 (lines 33 and 34) Mastandrea claims that "there are far more small spills than large ones." The report attached to his testimony uses a total spill frequency estimate of $7.15 \times 10^{-3}$ spill/mile-year for an identified "reference" pipeline, of which $1.3 \times 10^{-3}$ spill/mile-year are expected to exceed 2100 gallons, and 5.85 x

$10^{-3}$ spill/mile-year are claimed to be associated with spills less than 2100 gallons. The principal data source cited by Mastandrea is a 1982 report he prepared while employed by Science Applications Inc. which is based on spill data from 1971 through 1975.

Review of Mr. Mastandrea's 1982 report indicates that his current analysis overstates the incidence of small spills associated with petroleum product pipelines. The "reference" pipeline statistics used as a starting point for Mastandrea's calculations are all based on average spill statistics which include crude oil pipelines as well as petroleum products pipelines, even though information specific to petroleum product pipelines is presented in Appendices B, C, and D of his 1982 report. In his 1982 report, Mastandrea devotes specific attention to the separate calculation of spill frequency curves for crude oil and petroleum products.

His 1982 report clearly showed that spills less than 50 barrels (2100 gallons) from product pipelines are very uncommon (about 9 percent of the total number of spills, as indicated in Tables D-6 and D-7 of Mastandrea, 1982). Review of the spill frequencies calculated in Tables D-6 and D-7 (Mastandrea, 1982) with pipeline mileage data from pages 380 to 415 of the same report, leads to the calculation of a total spill frequency estimate (including spills smaller than 2100 gallons) of $1.0187 \times 10^{-3}$ spills/mile-year. This is less than one-seventh the number used by Mastandrea as a starting point for the calculations attached to his testimony. The database used by Mastandrea included crude oil pipelines; his own 1982 study clearly showed that crude oil pipelines had both a higher incidence of large spills and a much higher incidence of small spills when compared to products' pipelines. By ignoring the product-pipeline specific data in his own 1982 report, Mastandrea's current testimony establishes a starting point for his subsequent calculations which overestimates the likelihood of a spill associated with product pipelines.

**Q. Do you agree with Mr. Mastandrea's method for estimated spill volume for the proposed Cross Cascade Pipeline?**

**A.** No. I believe it significantly overstates the estimated spill volume that may result from the pipeline's operation. As in the calculation of spill frequency, Mr. Mastandrea's spill size methodology also includes several correction factors that are applied to an average or "reference" pipeline spill. However, in his 1982 study (Mastandrea, 1982) which first documents this methodology he cautions "Because reportable information on accidental spills and operating company lines in the use is limited (see Section 6.2.1), values for some factors may be qualitative, and should be considered as very rough estimates." He continues to caution users of his "correction" factors: "These factors are intended for use in developing spill prevention and control guidelines and should not be used for other analysis purposes." To interpret, Mr. Mastandrea's method was developed using a broad national database and any conclusions that are derived from using it should only be applied to similarly broad issues. Instead, the method has been applied to a specific pipeline project and the results are expected to be interpreted as a reasonably accurate forecast of the pipeline's performance.

A test of the efficacy of this approach would be to apply his methodology and equations to the existing Olympic pipeline. If his method is reasonably predictive then its results should be similar to Olympic's actual performance.

The results of just such a test, based on the specific configuration of the existing Olympic pipeline (including 12, 14, 16 and 20 inch diameter pipeline sections) over its 33-year operating life, when compared to the results of Mr. Mastandrea's analysis are as follows:

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|---|---|---|
| Olympic Actual Operating History | 44 Total Spills[5] (1.3/year) | 544,110 gal. |
| Mastandrea Method Predicts | 24 Total Spills (0.7/year) | 1,575,691 gal. |

To compare, Mr. Mastandrea under predicts the number of spills (both spill frequency estimates include spills less than 50 Bbl.) and over predicts by a factor of 2.4 the total volume released. It is also interesting to note that the average spill size Mastandrea's method predicts of 65,653 gallons (1,575,691 gal./24 spills) is in the same range as the value used by Dr. Miller in the case that he recommends the Council use as guidance in making its decision; yet the actual operating experience of the company that will build and operate the CCP is much better. This demonstrates that Mr. Mastandrea's analysis is flawed and unreliable when used to evaluate a specific pipeline.

[5] All spills recorded by Olympic including line spills and facility spills; also includes spill <50 Bbl.

**Q. To what do you attribute the apparent better performance of Olympic's existing system when compared to the predicted performance from Mr. Mastandrea's method?**

**A.** Mr. Mastandrea has introduced an age correction factor into his spill volume calculation method. The function for this correction was shown on Figure 2-4 (JRM-T, pg. 15) of his report. This function is not similarly shown in his 1982 report, which forms the basis of his method. While Mr. Mastandrea corrects for pipeline age, his method does not explicitly take into account the technology improvements that have occurred in pipeline construction and operation. A summary of these improvements is given in Exhibit 2 – Comparison of Pipeline Design Features. This table shows that in 1968 with the advent of Department of Transportation - Office of Pipeline regulations a number of changes in pipeline design and operation were stimulated. Pipelines subject to these regulations would have only been 7-10 years old at the time of Mr. Mastandrea's 1982 study; not sufficient time for the effect of these regulations to be related to pipeline age. Exhibit 2 also shows the specific actions that Olympic has taken to improve the operation of its pipeline system beyond what is required by regulation. In particular, Olympic apparently was one of the first pipeline systems to have installed and used a computation pipeline model (real-time model) as part of the pipeline's operation as an advanced leak detection system. Olympic has made other improvements such as installing remotely controlled valves in some locations, placing valves in vaults so they are more easily inspected and monitored for leaks and conducting internal inspection at regular intervals. These "lessons learned" have been applied to the design of the Cross Cascade Pipeline as are shown in Exhibit 2. In fact, a number of the improvements recommended by Dr. Miller and Mr. Mastandrea are included in the design. It appears that Olympic is committed to using the best practices and technology for operation of its existing pipeline and would take similar steps for the proposed pipeline. This approach to pipeline design and operation may be largely responsible for the much smaller actual loss that Olympic has had when compared to what Mr. Mastandrea's method would predict.

**Q. What spill size have you used in your analysis?**

**A.** I have used a spill size value based on Olympic's actual operating experience of 35,000 gallons per release. This is the average for line spills alone. It is similar to the value of 38,000 that Dr. Miller uses in his "Olympic Best" case. As with many pipeline spill histories, one large spill typically dominates the history. When the largest spill in Olympic history is removed, the average spill size is reduced appreciably.

**Q. Dr. Miller's spill frequency statistic for barge and tanker spills is based on three years of data. Do you find this to be adequate?**

**A.** Dr. Miller bases the spill statistic used for calculation of spill frequency from barge and tankship on a database of three specific years: 1992, 1994 and 1995. This database is misleading because it does not recognize any coastal spills and it significantly underestimates barge incidents. In 1985, the tankship Arco Trader went aground at Port Angeles, in 1988 the Barge Nestucca collided with its tug off of Westport, and in 1990 the tankship American Trader was involved in an incident that resulted in hull rupture off of Huntington Beach, California. All three of these Pacific Coast spill incidents go unrecognized by the selection of these three specific years.

**Q. Do you agree with the average spill size for Tanker/Barge spills that Dr. Miller has used in his analysis?**

**A.** No. Dr. Miller's assessment of the average tanker and barge spill size is based on only three years of data, including data from 1992 which represents the lowest volume spillage from barges over the past 20 years (including more recent years). A longer term record from the years 1990 through 1996 results in an average of 2099 gallons per barge spill according to U.S. Coast Guard data. Dr. Miller's analysis uses an average volume per spill of 545 gallons, which is only 17.8 percent of the volume that would be estimated using a longer term record from the same U.S. Coast Guard database. If Dr. Miller applied the longer-term average barge spill size to his spill analysis, the resulting spill predictions for the existing system (his Scenario B) based on his calculated spill frequencies would be:

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|---|---|
| Barge transit, Refineries to Portland: | 152 spills x 2099 gallons per spill = 319,048 gallons |
| Barge transit, Portland to Pasco: | 234 spills x 2099 gallons per spill = 491,166 gallons |
| Total Barge Spillage: | 810,214 gallons/50 years |

This value is significantly more than the 210,114 gallons he reported.

**Q. Now lets turn to the calculation of spill frequency and size for tanker trucks as developed in Dr. Miller's testimony. Do you agree with the method that Dr. Miller has used?**

**A.** I do not agree. Dr. Miller has used a very different method for calculating the number of truck trips and corresponding truck spills, which I believe give misleading results. The significant differences between the approach he used and the one I find appropriate include:

- Focus on local distribution trip which will be the same with and without the pipeline
- Spill frequency that is significantly lower than realistically appropriate.

**Q. Please describe what you mean by the incorrect focus on local distribution trips.**

**A.** As I discussed earlier in my testimony, the primary difference in the use of truck transportation between the existing situation and the proposed pipeline is the transport of product from Seattle terminals (Harbor Island and Renton) to Eastern Washington via I-90 and transportation from Pasco to the Yakima area. All other truck distribution of product in the Eastern Washington demand area will follow the same patterns that they do now. This is because the trips are local from the bulk distribution centers to retail and direct sale customers and are governed by brand/distributor relationships. Transportation over the Cascades via I-90 (and to a minimal extent State Route 2) and the distribution to the Yakima area are special cases as follows: (Personal Communication: Paul Rolniak).

- The primary source of products distributed to the Ellensburg and Okanogan areas is Seattle, which is the closest source with available supply (Energy Analysis International, Inc., Pacific Northwest Regional Analysis, 1997 Edition). Currently approximately 14,320 Bpd of product are shipped to Eastern Washington from Harbor Island and Renton terminals (Texaco, Arco, Tosco and GATX). This amount exceeds the forecasted demand so the remainder is delivered to the Yakima area. The balance of the Yakima area demand is supplied from its closest regional bulk terminal, that is Pasco.

  - Construction of the Cross Cascade Pipeline will include a regional bulk terminal at Kittitas. This terminal will serve the Ellensburg, Okanogan and Yakima areas, eliminating trucking from Seattle and trucking from Pasco to Yakima, increasing truck trips from Ellensburg (Kittitas) to Yakima. These are the truck trips that will principally be eliminated by the pipeline and are the only ones that are relevant to the comparison of the existing status quo scenario and the pipeline.

Because of the organization of his analysis Dr. Miller includes truck trips which are not economically served by truck transportation. Just two examples include: trips from Pasco to Moses Lake which is supplied by the Yellowstone Pipeline and trips to Spokane which is supplied by the Chevron Pipeline (Pasco-Spokane). (Pers. Commun. – Rolniak and Leffler)

**Q. Why do you find the spill frequency statistic developed by Dr. Miller to be unrealistic?**

**A.** As I discussed earlier, one must always test statistics against reality whenever possible. To test Dr. Miller's spill rate of 5.17 x10-9 spills per ton-mile transported. One test is to apply the statistics to context of our region, for example, the I-90 route from Seattle to Ellensburg. Applying the statistic Miller users in the following context:

- Average of 52 Large Truck accidents on I-90 per year between North Bend and Cle Elum (Average from 1994-1996; WashDOT)

- Total petroleum truck trucks on I-90 in 1999 – approximately 18,000 trips annually.

- Spills Predicted by Dr. Miller's statistic for North Bend to Cle Elum portion of Seattle-Ellensburg trip – 13 spills in 50 years or 0.25 spills per year (equivalent to 1 spill every 4 years).

- Equivalent to one spill every 72,000 trips.

To summarize, on a 52 mile portion of I-90, over which 18,000 petroleum tank trucks annually travel, and where there are 52 large truck accidents annually, there would be only one accidental release every four years according to Dr. Miller’s spill statistic. The DOT based statistic used in the Spill Analysis Report and the Rebuttal Analysis (US Department of Transportation: Present Practices of Highway Transportation of Hazardous Materials, 1990) predicts approximately one spill per year which is much more consistent with the actual accident history based on the proportion of total truck traffic represented by the tanker truck trade. While petroleum transporters and indeed all transporters of hazardous materials are subject to tighter safety standards than the trucking industry in general, the result of less than one in 200 accidents involving a petroleum truck on a route heavily traveled with a large number of petroleum trucks does not seem reasonable. Indeed, there have been two rollover petroleum tanker truck accidents in the Pacific Northwest in the last two months (See Exhibit 7).

The development of a truck spill statistic is difficult given the incompatibility of data sources and reliability of the data itself. Dr. Miller has used two separate data sources to calculate his spill statistic. He relied on the US DOT for number of spills and the Association of Oil Pipelines for the exposure (ton-miles transported) data. Reconciling data from two separate sources is always difficult since they are often collected for different purposes and in different and incompatible formats. Indeed, these databases are from two completely different organizations. Neither Dr. Miller nor Mr. Mastandrea has shown how the data from two sources were reconciled.

The following table summarizes three spill statistics and the results of applying them to the Seattle-Ellensburg transportation segment over the fifty-year time frame.

| | | Spills/ Truck Mile | Truck Spills /50years | Incidents/ Year | Spills/ Ton Mile |
|---|---|---|---|---|---|
| **USDOT –1** | **All Trucks** | **6.6x10-7** | **130** | **2.6** | **(1.927x10-8)** |
| **USDOT – 2** | **Haz-Mat Trucks*** | **1.987 x10-8** | **136** | **2.7** | |
| **Miller** | | **5.17x 10-9** | **35** | **0.7** | |

***Carrying hazardous cargoes including petroleum product.**

USDOT-1 and USDOT-2 are derived from the same source document, which is itself an integrated compendium of different data sources. USDOT-1 is a statistic derived from statistics on large truck accidents and applied to the petroleum transport trade. USDOT-2 is a statistic derived from hazardous materials transport segmented by type. From different perspectives and using different data sources they reach a similar result.

**Q. Your analysis and Dr. Miller's analysis use different spill statistics (spills per distance traveled) and different estimates for the total number of truck trips. Can you reconcile the differences in these two variables and make a direct comparison of the differences in your analysis?**

**A.** Yes. The spill statistics that have been used are as follows:

Rebuttal Analysis – 6.6 x 10 –6 spills per truck mile

(1.987 x 10 –8 spills per ton mile)

Dr. Miller – 5.7 x 10-9 spills per ton mile

Spills per ton-mile mean the number of spills that would occur from each ton of product (approximately 307 gallons) transported each mile. To compare these statistics an assumption about the average size load per truck must be made.[6]

The most direct way to compare the results of Dr. Miller's analysis to the revised Applicant's analysis is to apply his spill statistic to the change in the number of truck miles (or tons miles) resulting from the project. In the rebuttal analysis, the result of building the pipeline is to eliminate the truck trips from Seattle to Ellensburg and to reduce the length of trips to supply Yakima. The truck trips (or ton-miles) associated with these trips and the resulting predicted spills are as follows:

| | **No Project** | **Project** | **Change** |
|---|---|---|---|
| | 6.717 billion ton/miles | 1.140 billion ton /miles | -5.577 billion |
| Rebuttal Analysis | 130 spills | 22 Spills | - 108 Spills |
| Dr. Miller | 35 Spills | 6 Spills | - 29 Spills |

The result of this comparison show that the three times more highway spills will be reduced based on the DOT spill statistic (derived with either method). The much lower spill statistic used by Dr. Miller significantly minimizes the real reduction in highway spills resulting from tanker truck transportation that will result from the pipeline.

**Q. Do you have a perspective on the average size truck spill that would occur?**

**A.** Dr. Miller's analysis describes the average truck spill as 2,539 gallons. A tanker truck's maximum spill would be on the order of 10,500 gallons. Tanker trucks like most bulk

[6] In the Applicant's Spill Analysis Report that was submitted 2 years ago a value of approximately 8,000 gallons per load was used. Since that time a number of larger capacity tanker trucks have come into service. These trucks have a cargo capacity of approximately 11,000 gallons. Because of the difference in weight of distillate and gasoline they cannot always be loaded to capacity. In the Rebuttal Analysis a value of 10,500 gallons per load has been assumed.

carriers have segmented cargo containment so it is reasonable to assume that except in the most severe accident only a portion of the load would be lost. In the two most recent accidents in the PNW (Feb. 21, 1999 and a second on March 4, 1999, see Exhibit 7) approximately 2,000 gallons of gasoline were spilled in each case. Both were single vehicle rollover accidents so they were less severe than if they had been multiple-vehicle accidents. Given these considerations the average spill size Dr. Miller has used is in an appropriate range.

**Q. Now turning to the maximum volume of a spill that could occur on the proposed Cross Cascade Pipeline, have you reviewed the calculations performed by Mr. Mastandrea?**

**A.** Mr. Mastandrea has reasonably characterized the sequence of phases that would occur in a release event for a major spill. However he has simplified his analysis in several ways that may significantly overestimate the amount of product that would be released. His estimate of the maximum release from the CCP is approximately 600,000 – 1,000,000 gallons. His testimony and attached report do not provide sufficient detail to reconstruct his calculations and Mr. Mastandrea has not been available for a deposition to explain in detail his calculations. Despite a lack of detail regarding his calculation procedure, I estimate that he has significantly overstated the maximum release. I believe a more appropriate estimate may be in the range of 150,000 – 250,000 gallons for the circumstances that he describes, a significantly smaller volume. However, this value can only be confirmed after Olympic has had the opportunity to review Mr. Mastandrea's work with him in deposition. Moreover, his estimate is only theoretical; it is not based on the actual pipeline, which is described in the Application. Several key assumptions that led to the incorrect calculation included:

- He has assumed that hydraulic pressure in the pipeline is constant throughout the length of the pipeline. For this to be true there could be no friction loss as the product moves through the pipeline and there would only need to be one pump station. In reality as the product moves outbound from the pump station the operating pressure in the pipeline drops. The pipeline has been designed such that the pumps will produce an internal pressure of approximately 1440 psig at the pump discharge. By the time the product arrives at the next pump station the pressure has been reduced to a few hundred pounds. Indeed the location of pump stations is primarily governed by the need to re-pressurize the fluid flowing in the pipeline and moving towards its destination. This error leads to a significantly higher value for the volume of product that would be discharged from a breach in the pipeline during the detection and shutdown phase of the spill event.

- As Mr. Mastandrea has noted the rate of discharge (volume leaving the pipe) from the hole or breach in the pipe is on the order of 4.5 times pipeline flow rate during leak detection, 3.6 times pipeline flow rate during pump shutdown and 2.1 times pipeline flow rate during valve closure. This means that 4.5 times as much volume of product flows out through a 4-inch diameter hole than flows through the entire 14-in. diameter pipeline[7]. For a volume of product to escape faster than it flows in the pipe (except for a very brief period) requires that the entire mass of product must accelerate or speed up at the very time when the pumps, the driving mechanism for moving product through the pipeline, have been shut down. The amount and time period involved in speeding up product flow to satisfy the calculation is inconceivable. Moreover, Mr. Mastandrea assumes that this phenomenon would last for a long period of time.

- Mr. Mastandrea's calculation method has assumed that the pipeline is an open system which means that air would be allowed to enter the pipeline to replace the product leaving the line through the breach. Obviously if air can enter the system during a spill, then product must be able to leave the system by the same mechanism during operation. Both Dr. Miller and Mr. Mastandrea surmise that air would enter the system around flanges, valve stems and other fitting. For this to occur in sufficient volumes to replace the product they calculate will be released would mean the system must continually leak since the purported air leaks are not at the same location as the pipeline breach and thus are unrelated to its occurrence.

- Mr. Mastandrea assumed there would be no response to the spill. While recognizing that the pipeline's pumps would be shut down and the block valves closed, he then assumed that no response in the field would occur. In fact, immediately upon recognition that a spill is likely occurring, Olympic is required to mobilize a response team. One of this team's first actions would be to locate the source of the leak, excavate a depression around the pipe and install recovery equipment. While product

[7] 4-inch diameter hole in pipeline has a cross-sectional area of 12.6 square inches; 14-inch diameter pipe has a cross-sectional area of 153.9 square inches. While it doesn't seem intuitive that more fluid could come out of a 4 inch hole that a 14 inch hole, it will, but only until the pumping pressure is relieved and then not at the high rate that has been calculated.

may continue to flow from the leak, it is immediately recovered into trucks and the "uncontrolled release to the environment" would stop. Olympic spill response procedures (Olympic Pipeline Company: Spill Response Plan, 1995) include the use of clamps and saddles as temporary measures to cover and stop leaks. In Mr. Mastandrea's theoretical example no response is assumed and the pipeline is permitted to leak until it is completely emptied.

**Q. Mr. Mastandrea has calculated the potential drain down for sections of the pipeline that could impact sensitive areas. Given your approach to calculating drain down would you revise the results Mr. Mastandrea has calculated for these pipeline sections?**

**A.** Yes, they are significantly overstated. In section 2.1.4.4 (JRM-pg.22) of his testimony, Mr. Mastandrea refers the reader to Appendices A, B and C which are two figures and a table describing the "Potential Spill Sizes" at locations of sensitive sites along the pipeline route. To calculate the potential drain down volume Mr. Mastandrea has made two simplifying assumptions, which significantly overstate the volumes that could be potentially released. The assumptions are:

- That no product would remain in the low spots. He assumes that the entire line drains between two points of high elevation and ignores the fact that the pipeline is almost never on a continuous slope but has intermediate high and low spots between the peaks. Product will remain in these intermediate low spots after all drainage has stopped.

- That the column of fluid will be free to drain out; in reality since no air is free to enter the pipeline a vacuum will be created at the high points in the line which will impede the flow of the product out.
- That no emergency response would take place and no recovery action would be taken; that the pipeline would be simply left to drain out. Olympic has responded to every spill it has had in its operating history.

Exhibit 3 of my testimony is a table showing the revised calculations for those locations Mr. Mastandrea has analyzed. In this table I have only corrected for the intermediate low spots where product would pool in the line. It does not correct for any response action to reduce and stop a release or the other factors that govern the hydraulics of a drain out. The corrected values show that Mr. Mastandrea's estimate is 2.8 times more than it should be for pipeline length alone. If a correction had been made for response to the accidental release, the estimated values would be even lower.

**Q. Did Dr. Miller perform a similar analysis and do you agree with the results?**

**A.** Dr. Miller has made a similar analysis but qualified the results by saying that they indicate the order of magnitude of the release that could occur at these locations. Dr. Miller's results which are included in Table 2-7 of his report (JWM-T, pg 2–28) make the same two simplifying assumptions as Mr. Mastandrea. Correcting only for pooling in the intermediate low spots for the pipeline segments analyzed reduces the volume calculated by Dr. Miller by almost 50%. Exhibit 4 of my testimony includes a table showing these corrections.

**Q. How would you summarize the risk of the proposed pipeline as compared to continuing the existing trucking and coastal and river barge system?**

**A.** Both the applicant and intervenors in this case have provided a wealth of quantitative information designed to portray with a single number or fact that one alternative is superior to the other. This is certainly true of Dr. Miller and Mr. Mastandrea and to some extent the testimony of Mr. Dickens where they equate total volume of product spilled to the risk and hence determination of the most appropriate transportation system. An underlying concept of Dr. Miller's approach is that barrels spilled on land are equivalent to barrels spilled by trucks on busy highways which are in turn equivalent to barrels spilled in the marine and aquatic environment. In other words the effects of spills from different transportation systems on different environments can simply be measured as a "barrel" or "gallon" of diesel or gasoline spilled. I believe that the comparison is more complex and that simply adding spill volumes together is not the correct approach.

To evaluate the "consequences" of the project and compare it to the existing system involves balancing out potential for spills, the impacts of those spills on different environments and the degree to which the spills are eliminated or reduced. This balancing is summarized on Exhibit 5 – Summary of Current Transportation System vs. Proposed Cross Cascade Pipeline. The table shows by transportation system the risk factors that could be considered in the broader context. It shows that individually the proposed pipeline will decrease risk for tanker truck, coastal barge and river barge transportation. In two cases, truck and river barge transportation, a significant to almost complete elimination of transport by these methods over certain routes can be expected to occur. The exhibit also shows that the size of spills for these spills are small to moderate. However, they occur on busy highways and in the region's waterways, both areas of public concern. The one individual factor where risk is increased is the introduction of the pipeline because it doesn't exist now. However, while accidental spills from pipelines can be of moderate to larger size, they are far less frequent than truck or barge spills and in most cases will be in an environment where recovery and cleanup can be more effective.

The quantitative analysis that have been offered by the Council for Environment show an increase in annual spill release if the pipeline is built on the order of 1,500 gallons per year (see WJM-T Table 1-5, pg 1-9); the rebuttal analysis that has been prepared calculates a reduction of 6,700 gallons/per year over 50 years. All analyses predict approximately 400 fewer spills if the pipeline is constructed. Recognizing that the statistics used by all experts in this proceeding are still just estimates of the future, it would seem appropriate to step back and look at the broader view as summarized in Exhibit 5. If a significant number of spills can be reduced and risk can be removed from highways and waterways, this benefit balances the effects of potential pipeline spills that may result from the CCP, but which would also likely occur in environment that favor the containment recovery and cleanup.

Dated this ____ day of March, 1999

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John H. Robinon