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Ms. Tari Enos
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P.O. Box 44620
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Via email to: psmcomments@lni.wa.gov

Re: Cost-Benefit Analysis that is required to support the Process Safety Management Amended Rulemaking (Chapter 296-67 WAC, Safety Standards for Process Safety Management of Highly Hazardous Chemicals)

Dear Ms. Enos:

The Western States Petroleum Association (WSPA) appreciates the continuing opportunity to provide comments relating to the Washington State Department of Labor & Industries' (L&I's) rulemaking that would revise the Process Safety Management (PSM) requirements for petroleum refineries. WSPA is a non-profit trade association representing companies that explore for, produce, refine, transport and market petroleum, petroleum products, natural gas and other energy supplies in Washington and four other western states.

This letter provides our comments and suggestions on how L&I can best meet its requirements under the Revised Code of Washington (RCW) Section 34.05.328 to provide an analysis of the costs and benefits of the potential revisions to the PSM regulations for petroleum refineries. This letter is anticipatory. As far as we know, L&I has not yet made any materials publicly available regarding the cost-benefit analysis for this regulation, and the agency may not yet have begun the analysis. We are taking this opportunity now to lay out what we believe are some of the requirements for a good cost-benefit analysis for this regulation and also to suggest ways that we would like to cooperate with L&I so the agency can meet these requirements effectively.

For a significant rule such as the potential refinery PSM revisions to be adopted by L&I, RCW 34.05.328 requires that:

1. The agency must prepare a preliminary cost-benefit analysis to accompany the proposed regulation, and a final analysis when the rule is adopted.
2. The analysis must support a determination by the agency "that the probable benefits of the rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs".
3. The analysis must also determine that the chosen alternative is the least burdensome way to achieve the program's goals and objectives.

WSPA looks forward to assisting L&I in designing and carrying out this required analysis. We expect that much of the necessary data and expertise for both the cost and the benefits portions of the analysis will reside with the affected refineries and some of this may be proprietary, so we anticipate a close and cooperative working relationship on this cost-benefit analysis.

The remainder of this letter addresses four topics with regard to the cost-benefit analysis:

1. Cost analysis
2. Benefits analysis
3. Choice of baseline
4. Least burdensome alternatives analysis.

Cost Analysis

The draft regulation includes many provisions that impose requirements beyond whatever baseline is chosen for the cost-benefit analysis, and in the cost portion of the analysis L&I must estimate the incremental costs for the five Washington refineries to meet each of these requirements. L&I must estimate these costs comprehensively -- identifying each regulatory provision that imposes costs, and estimating for each provision all of the sorts of costs that will arise. We believe that different sorts of costs might best be analyzed using differing methodologies, and in this cost analysis section of our letter we therefore first discuss the sorts of costs that we expect to arise and we then suggest some methodologies that L&I and we cooperatively might use to estimate each sort of cost.

Major categories of costs from the potential regulation

We believe there are three major categories of costs:

1. Costs for new or expanded PSM elements – costs will be incurred to perform analyses and to implement other PSM program elements that were not previously required, such as hierarchy of hazard controls analysis (HCA), damage mechanism reviews (DMR), safeguard protection analyses (SPA), and process safety culture assessments (PSCA), and the cost of implementing all PSM elements for processes, chemicals, materials and equipment that were not previously designated as covered;
2. Costs due to scope expansions with revised definitions – the revised definitions of 2nd Discussion Draft will require the application of the PSM elements to many more processes, chemicals and materials, equipment, facility modifications, maintenance activities, and investigations than were previously required; and
3. Costs due to facility modifications – the recommendations and corrective actions that the additional analyses and scope expansion will specify will often require facility modifications such as new equipment, instrumentation, controls, and process control systems as well as procedural safeguards. This cost category can dwarf the others due to engineering, equipment, and ongoing operation and maintenance costs.

We will provide some more specific examples of each of these three sorts of costs.

1. Costs for new or expanded PSM elements: The potential revisions to the refinery PSM regulations include many provisions that would require inclusion of a new element in a refinery's PSM program and/or require performance of a new analysis or activity. For example, several provisions in the 2nd Discussion Draft would require performance of a hierarchy of hazard controls analysis (HCA) under specified circumstances:

- HCA required as a stand-alone analysis within five years for all existing processes, with subsequent update/revalidation at least every five years;

- HCA required for all recommendations made by a PHA team for each scenario that identifies the potential for a process safety incident;
- HCA required for all recommendations that result from the investigation of a process safety incident;
- HCA required as part of managing changes, whenever a major change is proposed; and
- HCA required during the design and review of new processes, new units and new facilities.

HCAs have not previously been required as an element of a refinery's PSM program. Performing an HCA requires a team of employees familiar with the process technology, operations, controls, and hazards, plus specialists or consultants experienced in the HCA methodology, and thus the unit cost of performing a single HCA can be substantial. For the single specific provision in the draft regulation that would require HCA "as a stand-alone analysis for all existing processes" (the first bullet in the above list), the regulatory cost analysis should estimate costs for performing this additional element as the unit cost for an HCA¹ multiplied by the total number of Washington refinery processes for which PHAs are required, increased as necessary to reflect the number of five-year updates/revalidations projected as being needed within the time horizon for the cost-benefit analysis. The number of HCAs incrementally required by each of the other provisions giving rise to the four subsequent bullets above should also be estimated and their costs also attributed to the new HCA PSM element included in the draft regulations.

2. Costs due to scope expansions with revised definitions: Costs will be incurred when PSM activities or analyses required by the existing regulation must be performed for a larger set or number of refinery processes, chemicals and materials, equipment, and incidents. These costs must be estimated also. For example, the much broader set of circumstances under which "incident investigation - root cause analysis" would be required under Discussion Draft Round 2 (must be performed when there is "a near miss ... or other event that could cause a ... release of a hazardous chemical or material" see pages 32 and 5) than under current rules (must be performed when there is an "incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace" WAC 296-67-049) will require many more root cause analyses for events with little or no potential for catastrophic harm. One refining company, which already performs many more root cause analyses than are required by the current regulation, estimates that the revised definition will triple the number of root cause analyses that the company will perform if the revised definition is interpreted only as extending root cause investigations from Tier 1 and 2 to Tier 3 incidents. If the draft new definition were interpreted instead as extending literally for example to all fugitive emissions, it could require several orders of magnitude more root cause analyses.

Several more of the expanded definitions in the 2nd Discussion Draft also represent instances where costs will be incurred. The draft new definition of "hazardous chemical or material", which drops the qualifier "highly" and any reference to threshold quantities, greatly expands the number of regulated substances covered by the 2nd Discussion Draft. Each of these changes will increase the number of PSM analyses or activities that will need to be completed or the number of instances in which PSM elements will need to be implemented.

3. Costs due to facility modifications: We will return to HCAs for an example here. In addition to the costs to conduct HCAs, refineries will incur costs to implement the recommendations that

¹ Or perhaps instead of there being a single unit cost for an HCA, there might be several unit costs for HCAs as a function of the size and complexity of the process for which the HCA is being performed.

HCAAs will generate. HCA requires the employer to “Eliminate hazards to the greatest extent feasible using first order inherent safety measures”, then second order, then passive, and so forth down the hierarchy of controls. HCAAs thus may yield recommendations for facility modifications that require additional and potentially very costly changes to hardware and instrumentation even though a refinery’s existing safety measures have already mitigated process hazards to a level that protects workers, especially if economic factors alone cannot be the basis for recommendations to be found infeasible. Costs for the facility modifications recommended as a result of the additional HCAAs may include not only the initial capital improvements but also subsequent continuing costs for inspection, testing and operations and maintenance of the new equipment. We will suggest later in this section how costs might be estimated in a different manner for potential facility modifications growing out of recommendations from PSM analyses than how costs would be estimated for conducting the HCA analyses themselves.

The following table indicates the magnitude of costs we would expect due to the draft regulation for an average refinery in Washington (approx. 125,000 BPCD). The magnitudes of costs shown in the table are:

- Low – hundreds of thousands of dollars
- Medium – millions of dollars
- High – tens of millions of dollars
- Very high – hundreds of millions of dollars

Costs are dependent on each refinery’s specific situation and can vary, so the cost magnitudes shown in the table should be interpreted to represent a broad range.

**Table 1: WA PSM - Discussion Draft 2 Costs
 Magnitude of Additional Costs for an Average Washington Refinery by Source of Cost**

PSM Element/Cost source	PSM Elements (adding new PSM analyses for existing processes, PSM application to additional processes)	Scope Expansion due to Revised Definitions (additional PSM analyses for additional processes, equipment, incidents, changes)	Facility Modifications (new equipment, instrumentation, controls, and safeguards to address recommendations from additional PSM analyses)
DMR	High	High	High
PHA/SPA	High	High	High
HCA	High	High	Very High
PSCA	Medium	Low	Low
MI	Medium	High	High
RCA	Medium	High	Medium
Human Factors (embedded in other elements)	High		Low
MOOC	Low	Low	Medium
PSI	Medium	High	Low
Procedures (human factors)	High	Low	Low
MOC/PSSR	Low	High	Medium
PSM Program	Medium	High	Low
Employee Collaboration (embedded in other elements)			

Training	Low	Low	Low
Contractors	Low	Low	Low
Hot Work	Low	Medium	Low
Emergency Response	Low	Low	Low
Compliance Audits	Low	Low	Low
Corrective Actions	Low	High	High

The costs for the three categories are independent and, therefore, additive. A PSM element with a High cost in every category could have a total cost that is Very High when all of the costs are added together. Because the cost categories are multiples of ten, the total cost for a PSM element is likely to be determined by its highest category, e.g. the total cost for PSCA will be Medium even though it has a Low cost in two categories.

Methods for estimating these costs from the potential regulation

L&I must carefully estimate the full life-cycle costs that the five Washington refineries will incur, including those for: i) Performing the additional **PSM elements** directly required by the regulation; ii) Implementing the further PSM elements necessitated by the expanded scope of the requirements due to the **revised definitions**; and iii) Implementing and maintaining the additional **facility modifications** that may be recommended by the PSM elements.

We expect that it would be extremely difficult for L&I alone to develop reasonably accurate cost estimates for the five Washington refineries because so much of the data and expertise required to do so lies with the refineries, including information on:

- Extent to which required activities are already performed;
- Cost of materials, fabrication, and installation;
- Labor costs, overheads and other unit cost information;
- Estimated number of hours required to perform the tasks comprising each procedure including availability of necessary expertise;
- Typical skill mix comprising work groups for different tasks or procedures;
- Equipment, processes and chemicals specific to each refinery;
- Etc.

We believe that a collaborative process between L&I and industry will be necessary to estimate costs for each refinery.

We plan as a first step that we will prepare a comprehensive list of all the provisions in the draft regulation that will impose incremental costs by requiring additional actions from the refineries. Despite our Table 1 showing costs as attributable directly to the rows of PSM elements, we think it best to begin the cost analysis at a deeper level by tracing forward from the individual provisions in the draft regulation (including the individual expanded definitions) to how the provision causes the refineries to have to do something they weren't previously required to do which then entails a cost. We believe it is important to focus initially on the individual provisions because the individual provisions determine whether and how a cost occurs.

For example, referring to our previous discussion on HCAs, there appear to be 5 provisions in the draft regulation that would require performance of HCAs under differing circumstances. In total as shown in Table 1 we estimate that these provisions will result in high costs for the performance of additional HCAs for the average Washington refinery, both directly as a required PSM element and indirectly via scope expansions, but to estimate these costs more accurately

we need to build the cost estimates directly from the estimated activities or workload that each of the provisions will require. How many HCAs will need to be performed to meet the requirement in one provision for a stand-alone HCA for each existing process? How many HCAs will be needed to meet the requirement in another provision for one HCA for all recommendations that result from the investigation of process safety incidents? Each of the several provisions relating to HCAs adds a need for more HCAs; the total need for them can be ascertained by summing across each of the relevant provisions. Another reason for focusing the cost analysis specifically on the individual provisions is that as the regulatory development process proceeds, individual provisions may be added or deleted and strengthened or weakened (perhaps as a part of the least burdensome alternatives process?), and one will want to keep track of the impacts of the potential changes on the projected costs (and benefits) of the regulation. To do so, one needs to be able to track costs by provision.

So, we plan to provide a comprehensive list of the provisions in the draft regulation, including both PSM provisions and changes in scope and definitions that we believe will require additional actions from the Washington refineries that will entail costs. For each provision, the list will trace how the provision will require actions, what these actions are, and when, how or how often these actions might need to occur. We believe the list will thus be a useful starting point toward estimating the costs that each provision will entail in terms of PSM elements and scope and definitions. We will provide the list within the first quarter of 2019.

WSPA suggests that L&I consider a couple of approaches for beginning with this list and then estimating the costs to comply with the potential regulatory changes. We suggest these approaches specifically for estimating the costs involving PSM elements and scope and definitions, but will suggest an alternative approach for estimating the costs associated with potential facility modifications. To estimate the costs involving PSM elements and scope and definitions, L&I might:

- Survey the refineries. L&I might request the refineries to prepare cost estimates for each of the provisions, pursuant to instructions and a survey template to be developed jointly by an L&I/industry/consultant workgroup. The template would encourage consistency in approach and interpretation as the five refineries individually provide their estimates. The survey would be administered and analyzed by a third party. Individual refinery or company results would not be reported; aggregated results only would be reported to L&I and the workgroup.
- Perform detailed, bottom-up workload cost modeling for each provision that will require additional procedures to be conducted. For each refinery, this would involve estimating the number of processes, items of equipment or incidents for which the PSM element or analysis (e.g., HCA) will need to be performed, the number for which it already is performed, and thus the additional number of procedures of each sort needed. Estimate the workload (hours of different labor categories, other direct cost needs, etc.) to perform the procedure one time, perhaps as a function of process complexity or risk tier or incident magnitude, and scale up by the number of procedures needed. Apply loaded labor rates and other unit costs and sum across processes/areas/incidents and procedures. Normalize frequencies so as eventually to express all costs as costs/yr. Work will be performed by some combination of refineries developing their own individual estimates for some quantities and by an L&I/industry/consultant workgroup that develops “typical” or “representative” or “default” estimates for other quantities. Again, as for all cost estimates, individual refinery or company results would not be reported to L&I or to WSPA or to the workgroup; a third party would be contracted by L&I

to hold the individual results confidential and would report the aggregated results to the interested parties.

We suggest a different approach that L&I might use for estimating the potential costs for facility modifications that might be adopted as recommendations or corrective actions pursuant to additional PSM element activities required by the new regulation. Under this approach, we would:

- 1) Define a set of sample facility modifications that individually may be recommended at least occasionally by multiple PSM elements for multiple processes at multiple refineries and that in total may significantly reduce the risk of a major refinery incident for any refinery that implemented them;² and
- 2) Estimate the costs of installing and then operating and maintaining this set of measures.

We suggest defining and estimating the costs to implement and maintain a set of facility modifications or measures that will significantly reduce the risk of major refinery incidents toward zero for the Washington refineries subject to the potential new rule. Our suggested requirement that the cost analysis include an extensive and effective, and thus probably expensive, set of facility modifications is intended specifically so that the cost side of the cost-benefit analysis will match up with the benefits side. We will explain.

In the benefits section of this letter, we suggest that L&I adopt an “avoided-damages” approach to estimating the benefits of the draft rule, where benefits are defined as equal to the damages that would have occurred from the future refinery incidents that may be avoided as a result of the actions taken and measures implemented due to the rule. Not knowing now what incidents could occur in the future in the absence of the rule and what damages could occur from those incidents, though, benefits analysts often assume that the baseline rate of incidents and damages in the future could perhaps be similar to the rates of incidents and damages that have occurred in the recent past for the facilities and geography in question. Thus L&I might estimate that a regulation that would prevent all future refinery incidents for the five Washington refineries would generate future benefits in an amount roughly equal to the average annual rate at which damages have occurred from refinery incidents in Washington over the past 5 or 10 years or so.

The important implication that this “avoided damages” approach to the benefits analysis holds for the cost analysis lies in an “all or nothing” element that also tends to get added to the avoided damages approach. As we will discuss further in the benefits section, in recent benefits analyses for rules such as the potential Washington PSM revisions that make relatively marginal changes to an established regulatory program, analysts have found they were not capable of quantifying the reduction in incidents or damages that could be expected to result at a complex facility such as a refinery from the particular variety of procedural, operational and capital changes that they projected employers might implement in responding to the regulatory changes. The analysts found this sort of quantitative modeling of incidents or damages avoided to be too difficult to accomplish for something other than a very large regulatory requirement. Instead, for regulations making marginal changes to a program (such as the draft Washington PSM rule would be) the analysts simply estimated how much in the way of damages might be avoided if all future incidents were prevented, despite the fact that they knew that the regulatory

² We do not intend our eventual provision of this set of sample facility modifications as constituting an endorsement of this list or any item on it as appropriate for any particular refinery or for refineries in general. Every refinery is different; every refinery will have unique solutions to mitigating hazards, and there are many legitimate reasons why the cost and technical and economic feasibility of specific measures may differ from refinery to refinery.

changes being examined were well short of those that might be needed to avoid or prevent all future incidents. In essence, the analysts had no confidence in estimating the relatively limited amount of benefits that might be generated by the relatively limited set of compliance activities prompted by the proposed regulatory requirements, while the analysts had some confidence in projecting the larger amount of benefits that might ensue from a presumably much larger set of compliance activities that could serve perhaps to prevent all future incidents.

If one accepts this idea that the benefits side of the Washington PSM rule cost-benefit analysis will be pegged to the elimination of all major refinery incidents, then it should be supposed in parallel on the cost side of the benefit-cost analysis that the regulation should be interpreted and enforced so as to require the implementation of measures sufficient to eliminate all or nearly all incidents -- and costs should be estimated accordingly. A fair match between the benefits side and the cost side requires that a very substantial set of (probably costly) facility modifications be included and costed out as necessary to achieve the total or near-total reduction in incidents that is presumed in the analysis on the benefits side.

The following are several capital and/or safer alternative facility modifications that may be costed out. All have been and likely will be recommended by multiple PSM procedures for multiple processes at multiple refineries:

- Addition of controls to fired heaters so that interlocks/safeguards can be installed. These include costs for sensors (temperatures, pressures, flows, flue gas analyzers, etc.) and controls (shutoff valves, damper positioners, modifications to process control system, etc.) so that heaters can be shut down (or put in a safe state) automatically. Analyzers (and their upkeep for calibration, etc.) are one of the more expensive items.
- Metallurgy upgrades to construction materials resistant to HTHA in process units operating close to the Nelson curve.
- Upgrade of low-silicon carbon steel components subject to sulfidation corrosion to metallurgies (e.g., higher chromium steel) that resist sulfidation rather than reliance on an intensive inspection program for sulfidation corrosion.

We will provide in the first quarter of 2019 a longer, more complete list of measures that we suggest be costed out as resulting in total probably in a very substantial reduction in the likelihood of a refinery incident. The list will be based on a more careful analysis of incident data. We suggest that each of the five Washington refineries should be asked to estimate their costs to implement these measures, with the survey form to be developed jointly by an L&I/industry/consultant workgroup. An independent third party would collect and analyze the responses and provide the aggregated results, preserving the confidentiality of the individual responses.

WSPA would like to discuss with L&I management and staff these or other possible approaches for developing reasonable cost estimates for PSM elements, scope expansion and facility modifications in a manner that accurately estimates the full life cycle costs of the proposed regulatory changes. If L&I chooses to utilize the industry's information and expertise in this area, then proprietary information will need to be protected, and cost estimates and other data for individual refineries must not be released publicly. Perhaps the estimates for the individual refineries could be provided to a contracted third party who would provide totals to L&I, WSPA and the other interested parties but keep the individual figures confidential. For WSPA's part, we must avoid antitrust concerns potentially associated with inter-company discussions about

regulatory compliance costs. As such, it will be crucial for proprietary information, including cost estimates, to remain confidential and protected.

We specifically recommend L&I not generate cost estimates for the Washington refineries by somehow adapting or extrapolating the cost estimates developed by the Rand Corporation in 2016 for their cost-benefit study of the California refinery PSM and accidental release rules.³ We have several reasons for this recommendation:⁴

- The Rand approach provided insufficient guidance to the California refineries in estimating costs; the study therefore obtained substantially inconsistent results from the refineries;
- The cost interview guide did not elicit estimates for alternative measures to achieve California's regulatory objective and goals;
- The benefits estimates were generated presuming elimination of all major refinery incidents (MRIs), but the cost estimates presumed implementation of a set of measures that seemed far short of those needed to eliminate all MRIs;
- There are real and substantial differences between the California regulation and the proposed Washington regulation; and
- The baselines for the two analyses may be different.

Benefits Analysis

Perhaps the key question for L&I in the benefits analysis is whether the Agency can show convincingly that the draft regulation would prevent future refinery incidents relative to the number that would occur in the baseline absent the new regulation. And, if L&I can show that the regulation would prevent at least some incidents, can a rate be estimated at which incidents will be prevented, so there is some possibility of quantifying the benefits associated with avoiding the damages that would have occurred from the incidents that will be avoided?

Perhaps surprisingly, recent cost-benefit analyses for other similar rules preventing major incidents have been unable to show that these rules would prevent incidents or to estimate a rate at which the rules would prevent them.⁵ These analyses apparently viewed the regulations in question as involving relatively small changes to an established regulatory program affecting complex facilities at which incidents occur via a wide variety of mechanisms that are very difficult to model in a manner that can yield quantitative benefits estimates. Both studies eventually estimated benefits using what we have termed an "all or nothing" approach to

³ Daniel Gonzales, Timothy R. Gulden, Aaron Strong, William Hoyle. Rand Corporation. Cost-Benefit Analysis of Proposed California Oil and Gas Refinery Regulations. 2016.

⁴ In the benefits section of this letter, we cite several reasons why we recommend also against L&I somehow adapting or extrapolating Rand's California benefits estimates to Washington. Chief among these reasons are: i) significant differences between the two states in terms of characteristics of their refineries and their product markets (particularly for gasoline) that would tend to make the impacts of a refinery outage quite different in the two states; and ii) an overly broad list of benefits included in the Rand study, including several key "benefits" that do not represent real resource impacts but instead transfer payments or impacts that should have been counted as partly or fully offset elsewhere.

⁵ Rand's cost-benefit analysis of the California PSM and Accidental Release Program rules, *op cit*, and U.S. Environmental Protection Agency. Regulatory Impact Analysis. Accidental Release Prevention Requirements: Risk Management Programs Under the Clean Air Act, Section 112(r)(7) December 16, 2016.

benefits analysis for regulations that aim to avoid incidents in very difficult-to-model circumstances -- benefits were estimated for a case in which all future incidents were assumed to be avoided, and then the estimated regulatory costs were compared against what these maximum potential benefits might be. Both analyses concluded in some manner that the benefits from avoiding all incidents would be greater than the regulatory costs, with this conclusion being much stronger in the case of the Rand study than for EPA (though again, we have substantial methodological problems with the Rand study). In both instances these studies made what we view as the mistake of mismatching the compliance scenarios underlying the benefit and the cost analyses. The measures that facilities were assumed to implement in the benefits analysis were sufficient to reduce the number of future incidents to zero (i.e., very extensive), while the measures that facilities were assumed to implement in the cost analysis were far less extensive; sufficient only to comply with the new regulation and far short of what might be needed to reduce the number of future incidents to zero.

These two recent studies that could not draw a quantitative link between the regulation being analyzed and the reduction in future incidents that might result contrast with OSHA's original regulatory impact analysis in 1992 for the PSM program.⁶ In this analysis, OSHA cited a variety of case studies and expert opinion as evidence to support their estimate to the effect that a thorough safety management program such as PSM could result in an average 80% reduction in five years in the baseline rate of process-related workplace injuries and deaths. One of the key factors in OSHA being able to make such an estimate was apparently the fact that the original PSM regulation represented a substantial and not marginal change to existing process safety programs at that time.

We expect that L&I will find itself now in a situation very much like that of California and EPA recently insofar as it will be very difficult to show and quantitatively estimate how the potential Washington PSM regulatory changes will reduce the likelihood of refinery incidents.

We have recently done some initial investigation to compare the rate of process safety events as defined by ANSI/API RP 754 between 2012 and 2015 for the 5 Washington refineries against the rate for the refineries subject to the Contra Costa County standards, which we judge as roughly similar to the draft standards being considered for Washington. This comparison is thus essentially between a group of refineries subject to Washington's existing standards and a group of refineries subject to what may be Washington's new standards, and we find essentially no significant difference between the performance of the two groups of refineries.

We assume that L&I will probably perform a benefits analysis for the new PSM regulation using the approach of assuming a hypothetical full elimination of future refinery incidents. We will be pleased to assist L&I in this analysis. We assume in most of the remainder of the benefits discussion in this letter that L&I will pursue this approach for the benefits analysis.

We believe in principle that L&I should estimate as benefits attributable to the proposed regulation the damages that will be avoided from future refinery incidents that will no longer occur because of compliance with the regulation. The future incidents and the resulting damages that would occur absent the regulation and those that would be prevented by the regulation obviously cannot be known when the regulation is being considered and the cost-benefit analysis is being prepared. Facing such uncertainty, benefits analysts for PSM refinery rules and other similar "accident-prevention" sorts of rules typically assume that the damages

⁶ U.S. Department of Labor, Occupational Safety and Health Administration. Final Regulatory Impact and Regulatory Flexibility Analysis of the Final Standard for Process Safety Management of Highly Hazardous Chemicals. February, 1992.

that might be avoided when the regulation prevents such incidents in the future might bear some relationship to the damages that have occurred from such incidents in the past.

Most such benefits analyses thus collect and analyze data on the historical frequency of and damages from past incidents or accidents that seem similar to those that the regulation might prevent in the future. The analysis typically estimates the average annual rate at which damages have occurred in the past from the incidents in question.

Rand concluded (incorrectly, we believe, see footnote), for example, that major incidents at California refineries not subject to the more stringent Contra Costa County PSM requirements have resulted in an average of \$800 million/year in losses to the California economy over the period from 1999 through 2015, and thus that preventing all such incidents at non-Contra Costa County refineries in the future might generate annual benefits of about \$800 million/year.⁷ We presume that L&I will similarly try to estimate the historical annual rate of damages from refinery incidents in Washington as an initial step in the benefits analysis for the draft Washington rule. But data on refinery incidents in Washington and the damages they have caused are not readily available. There would seem to be several possible approaches for developing refinery incident frequency and damage estimates that might be helpful in estimating benefits in Washington, including perhaps: research to develop a Washington State-specific database of refinery incidents and damages, mining other State or national databases for incidents at refineries similar to those in Washington, or others. L&I should take care to ensure that the historical data set of incidents that is reviewed to assess frequency and damages matches as well as possible the character of the future incidents that may be prevented by the draft regulation. We would very much like to participate and will be glad to assist in this process.

One key concern is that L&I should draw frequency information for refinery incidents that have occurred in the past only for periods and in jurisdictions where regulatory requirements have existed that are roughly similar to the requirements that will prevail in the future in Washington in the absence of L&I's proposed PSM regulation. Presumably, then, the rate at which incidents occurred at refineries in the location and time period being investigated would roughly match the rate at which they might be expected to occur in the future in the baseline for the cost-benefit analysis. We think this means basically that L&I should focus on refinery incidents that have occurred since the mid-90s or so in locations where there have been no State or local requirements significantly exceeding the combination of OSHA PSM and EPA RMP. On the other hand, the industry's process safety performance has improved over the past 20 years, and it would probably be reasonable to assume that the future baseline rate of incidents will be lower/better than the average over the past 20 years or so.

Other concerns involve matching the setting and characteristics of the historical incidents that are reviewed and the damages they caused against the setting and characteristics and damages of the refinery incidents that may be prevented specifically from the Washington refineries in the future. It's clear, for example, that an incident that caused a six-month refinery outage in California would have had a far different impact on gasoline prices in that State's nearly closed gasoline market (California's unique gasoline standards effectively prevent out-of-State refiners from serving the California market and making up for any in-State shortfall in production) than would a similar refinery outage in Washington have on Washington's gasoline market. And, an outage at a larger refinery would cause a greater impact on a State's economy

⁷ Note that much of these potential benefits of the CA PSM rule that Rand estimates consist either of estimated paper rather than real "losses to the California economy" that we do not believe are appropriate to be counted as benefits of the standard or of losses for some groups that should have been offset in large part by gains for other groups. We have several other objections to the Rand study.

than a similar duration outage at a smaller refinery. Using previous benefit or damage estimates for large refineries in California such as those Rand developed cannot be transferred directly to Washington refineries, since the average size of the three California refineries at which major incidents occurred is much larger than the average size of the five Washington refineries to which the figure might be applied. Perhaps some experience with refinery damage incidents in states other than California may be relevant to Washington, but California's experience, at least insofar as Rand has investigated it, does not appear transferrable.

In general, we anticipate that L&I will face a variety of issues involving data availability, data quality and data relevance that will need to be resolved in choosing the scope (time period, geographic purview, size and type of facilities, etc.) across which historical incidents will be identified and reviewed in order to project the future frequency and average damages per incident that will be assumed as the "without the draft regulation" baseline for the Washington refineries.

After investigating the rate at which incidents have occurred in the past, the most common assumption for most benefits analyses is that they might continue to occur at this same rate in the "without regulation" future baseline. Instead, though, one might assume that incidents will decrease at some rate in the future; for example, the API RP 754 data shows a decreasing rate of incidents in recent years.

L&I's benefits analysis might then take a variety of approaches in speculating about the fraction of all potential future incidents that the regulation might be able to prevent. Some cost-benefit studies, including Rand's, use a sort of "break-even" analysis, in which the analyst explores the fraction of all potential future incidents that the regulation would need to prevent or mitigate if benefits from the regulation are to exceed its costs. We presume that L&I will want to perform some sort of "break-even" analysis and we support your doing so.

The following table lists categories of damages or costs that may be incurred when there is a refinery incident or accident, and indicates which of these sorts of costs should be counted as a benefit when a regulation such as the draft Washington PSM standard prevents or reduces the impacts of future refinery incidents, and which of these sorts of avoided damages or costs should not be counted as a benefit in such circumstances or may need to be discounted or reduced. Several of the sorts of avoided costs that are listed below as not to be counted as benefits or needing to be discounted or reduced are listed as such because they do not constitute real resource losses but are instead transfer payments or losses that are compensated for in whole or part elsewhere.

Table 2: Avoided Losses from Refinery Incidents: Which Sorts of Losses Should be Counted as Benefits and Which Sorts Should Not?

Losses from a refinery incident that should be counted as benefits when avoided:		
	Monetized value of injuries, illnesses and deaths among workers and the general population	Should be valued by market prices or (less preferable) revealed preference, not by legal awards
	Damages or costs of repairs to refinery plant and equipment and to surrounding communities	
	Emergency response costs	
	Medical costs	
	Productivity losses, indirect losses	If well documented

Losses from a refinery incident that should <u>not</u> be counted as benefits when avoided or that may need to be discounted or reduced:		
	Increased consumer costs for gasoline during a refinery outage	Likely offset by gains by other market participants. Significant price impacts are unlikely in competitive product markets
	Value of lost refinery production during outage	The real loss should include only value added, not total value. Must consider also other refiners who may make up for the outage shortfall and possible increased imports or reduced exports from the State where outage occurred
	Loss in property values	Property value effects are very likely to reflect other locational disamenities
	Transfer payments (e.g., fines and penalties)	Loss by one party is a gain for another
	Lost refiner profits during outage	Likely compensated for by increased profits for unaffected refiners

Rand's benefits analysis for the California refinery PSM standard adopts a more inclusive definition of what constitutes a "benefit" than is usually applied in regulatory cost-benefit analyses. Several of what Rand has treated as categories of "benefits" represent losses that would accrue to one group when there is a refinery incident and outage but which would be partly or fully offset by gains that accrue to another group during the outage. These offsetting gains and losses to different groups would be addressed in comprehensive regulatory impact analyses by Federal agencies such as EPA or OSHA in the economic impact analysis portion of their studies, not in the cost-benefit portion. Again, we strongly advise L&I not to use the Rand California study as a guide to performing a good cost-benefit analysis for the draft Washington PSM standard.

Choice of baseline for the cost-benefit analysis

L&I must choose the baseline they will assume for the cost-benefit analysis. The baseline is the state that the world is assumed to be in in the future absent the regulation that is being analyzed. It provides the starting point for a cost-benefit analysis -- the baseline is the scenario against which the benefits and costs attributable to the regulation are measured.

So as to focus the analysis on the benefits and costs of the potential regulatory changes themselves rather than on the benefits and costs of complying with the existing regulatory requirements, the baseline in virtually every regulatory cost-benefit analysis is defined to assume full compliance with existing regulatory requirements. There is no reason to differ from this general practice here: for the Washington refinery PSM cost-benefit analysis baseline, L&I should assume full compliance by the refineries with existing PSM requirements.

There is a meaningful choice to be made in another respect in defining the baseline for the WA PSM cost-benefit analysis because nearly all refineries now perform in some ways better than the current applicable PSM requirements. The baseline could be defined in either of two ways:

- Baseline A: The baseline could be defined as all refineries simply meeting current regulatory requirements (despite the fact that many in fact appear to exceed requirements). In a cost-benefit analysis assuming this baseline, costs and benefits would be estimated assuming that refineries must implement compliance measures sufficient to progress from compliance with the existing regulations to compliance with the new regulation, ignoring the fact that refineries have already taken steps to get part of the way beyond the requirements of existing regulations and toward the requirements of the new regulations. The costs measured under this definition of the baseline, however, would truly reflect the costs attributable to the increased stringency of the regulations from current or existing to new.
- Baseline B: Alternatively, the baseline could be defined as a hybrid -- the higher/more stringent of current practice or current regulatory requirements. Wherever and to the extent that current practice exceeds current regulatory requirements, the baseline would “move up” to reflect this voluntary better practice. Under this definition of the baseline, the set of incremental compliance actions that refineries are seen as needing to implement to do what the new regulations would require is smaller than the set that is needed for compliance under a Baseline A, defined as current regulatory requirements. Under this definition of the baseline, the voluntary overcompliance with existing regulatory requirements gives refineries a “head start” toward compliance with the new regulatory requirements, and the incremental costs and benefits of compliance with the new regulatory requirements relative to the baseline both appear lower than they would had the baseline been defined simply as current regulatory requirements, ignoring the “head start”.

Many refineries exceed current applicable regulatory requirements in some ways, and L&I will need to make this choice about how to treat overcompliance in defining the baseline for the cost-benefit analysis. We believe there are some pros and cons in either direction for the two possible baseline definitions:

Baseline A -- Define the baseline as current regulatory requirements:

- Less commonly chosen for cost-benefit analyses than Baseline B.
- Will focus the cost-benefit analysis specifically on the impact of the regulatory changes.
- Recognizes and gives the refineries “credit” for currently doing and spending more than existing regulations require.
- But defining the baseline this way would make it more difficult for refineries to estimate the costs of the regulatory changes because some of what they are already spending/doing would have to be identified as not required by current regulations and added to the incremental new spending they will estimate as needed to meet the incremental new requirements.

Baseline B -- Define the baseline as the higher of current practice or current regulatory requirements

- More closely represents the “real” state of the world absent the proposed regulation than Baseline A.
- More commonly chosen for regulatory cost-benefit analyses than Baseline A.
- Doesn’t highlight or give credit to refineries for current practice that exceeds regulatory requirements.
- Easier for refineries to estimate costs of regulatory changes.

In theory, the choice of baseline should affect both the cost and the benefit sides of a cost-benefit analysis. The higher the baseline that is assumed -- the better the performance that employers are assumed to exhibit in the future world absent the regulation -- the lower will be both the costs and the benefits of achieving whatever it is that's required by a proposed new regulation. In actual practice, though, this will not prove true of a cost-benefit analysis for a rule addressing low probability, potentially high consequence events like refinery incidents.

- The cost analysis for such a rule will be able to calculate the higher costs for a rule assuming Baseline A rather than Baseline B; but
- The data and techniques for estimating benefits for such a rule are sufficiently limited and imprecise that, in practice, the benefits analysis for such a rule will not be able to portray benefits as being distinguishably higher when assuming the lower Baseline A vs. Baseline B.

In effect, then, choosing to use Baseline A would make it a bit more difficult for L&I's cost-benefit analysis to conclude that the "probable benefits of the rule exceed the probable costs". Choosing Baseline A would portray the proposed regulation as imposing higher costs than choosing Baseline B, while choosing A or B would not materially affect the benefits that the analysis projects as attributable to the rule.

We have no strong recommendation on which of the two baseline alternatives L&I should adopt for the cost-benefit analysis. We will be pleased to discuss the implications of the baseline issue with L&I.

Least burdensome alternatives analysis

L&I must meet the RCW 34.05.328 requirement to consider alternatives and choose the least burdensome way to achieve the program's goals and objectives, we believe both with respect to the regulation as a whole and with respect to its individual provisions. We appreciate the Washington code's emphasis here on cost-effectiveness -- if an alternative exists either for the regulation as a whole or for an individual provision that reduces risks to worker safety and health and at less cost than what has been proposed, then that alternative should be chosen.

We take this requirement for least burdensome alternatives analysis seriously, and put on the table for L&I's evaluation and consideration a number of what we believe to be promising, more effective, less burdensome alternatives, some that are quite broad involving many provisions of the draft regulation, and some that are so narrow as to involve only a single draft provision. The following is our initial list of only a couple of sample items for L&I to consider in the least burdensome alternatives analysis. We will add to this list in the first quarter of 2019, hopefully relatively early.

Table 3: Some Suggested Candidate Less Burdensome Alternatives to 2nd Discussion Draft Provisions

Alternatives to all draft provisions: enhanced enforcement of the existing regulation	
	L&I could conduct a State Emphasis Program for refineries if it believes that Washington State refiners as a group perform worse than other higher hazard industries
	L&I could establish a Severe Violator Enforcement Program (SVEP), if it believes that an employer has demonstrated indifference to their WAC obligations by committing willful, repeated, or failure-to-abate violations.

Alternatives involving at least several draft provisions	
	Do not adopt new definitions for highly hazardous material, major change, process safety incident, process, process equipment, process safety hazard
	Incorporate human factors only into those PSM elements for which they are relevant

Alternatives involving essentially one draft provision	
	Do not require root cause analysis for all process safety incidents; only for major incidents
	Do not require HCA for existing process units

Conclusions and Next Steps

A good cost-benefit analysis will be critically important toward informing a protective, effective and less burdensome regulation. WSPA and our Washington refining member companies look forward to assisting L&I in designing and carrying out such a cost-benefit analysis that will meet the RCW requirements. We will provide you soon, during the first quarter of 2019, with several items toward this analysis that we forecast in this letter, including lists of:

- The provisions in the 2nd Discussion Draft that we believe will require incremental actions of the Washington refineries and will entail compliance costs;
- Sample facility modifications that could result from PSM element recommendations and that could in total perhaps result in a significant reduction in refinery incidents; (Note that many of these facility modifications might appear to be economically infeasible and thus would not be implemented if they were recommended under current regulations) and
- Less burdensome alternatives that we suggest L&I analyze.

In beginning our cooperation on this cost-benefit analysis, we hope that we can schedule a conference call in the first half of January to discuss your reactions to this letter and to begin planning our next steps together. Please contact me if you have any immediate questions.

Sincerely,



cc: Tom Umenhofer, WSPA
Liz Smith, L&I
Alan Lundeen, L&I