Probability Technical Discussion
July 28th, 2021

Ecology Staff:

Brian Kirk, *Prevention Section Manager*
Jase Brooks, *Legislative Policy Analyst and Tribal Liaison*
Adam Byrd, *Research and Information Technology Unit Supervisor*
Alex Suchar, *Expert Model and Analysis Scientist*
JD Ross Leahy, *Maritime Risk Modeling Specialist*
James Murphy, *Model and Analysis Scientist*
Alex Hess, *Maritime Risk Lead*

Attendees:

Ahren Stroming, *Puget Sound Partnership*
Christopher Barker, *NOAA ORR ERD*
Clare Fogelsong, *City of Bellingham*
David Bain, *Orca Conservancy*
Eleanor Kirtley, *Green Marine*
Fred Felleman, *WAVE Consulting*
John Veentjer, *Marine Exchange of Puget Sound*
Liz Wainwright, *Maritime Fire and Safety Assc*
Lovel Pratt, *Friends of the San Juans*
Marta Green, *San Juan County*
Martin Teachout, *Trident Seafood*
Paul McCollum, *Port Gamble S'Klallam Tribe*
Robert Poole, *Western States Petroleum Assc*
Ross McDonald, *Sause Bros.*
Shayne Cothern, *WDNR*
Sol Kohlhaas, *Marathon Petroleum*
Tom Ehrlichman, *Swinomish Indian Tribal Community*
Tom Glade

The following summary notes are not intended to be a transcript but rather a review of the discussion session. Participant questions and comments are shown in bold text followed by Ecology responses. Ecology responses that have been added after the conclusion of the event are preceded by the text "Supplementary answer."

Please define the term "hazard" as you are using it. Please define "geographical area" as it relates to identifying "factors." It's not clear why you would look at areas other than the study area. (Tom Ehrlichman)

JD Leahy – Our list of hazards covers all the model events that could precipitate a potential spill. We have a link to the list of hazards in the focus sheet included in today's materials (link).

To the second question, the geographic area in this context is the geographic scope of the accident dataset that we would examine for historical hazard occurrences. The question as to why not just use the same geographic scope as the study area is an important one. Our concern is that there in such a small geographic area, there may not be sufficient hazard occurrences to allow us to calculate probabilities. It may also be that if we use a small geographic scope we are pushed towards using a

longer temporal scope. That may create the risk of incorporating incidents that occurred under a previous safety culture and regulatory regime. In order to work with data available to us, there is a lot of value in getting comfortable with the idea of expanding our review of historical occurrences outside of the study area.

Alex Suchar – We cannot use standard approaches to calculating probability if an event doesn't occur in the historical data. Our idea is to try to balance relevance to our study area with the need to incorporate useful information from other places.

Under that definition, you may want the geographic scope to include areas that have similar volumes of oil and hazardous materials moving through narrow channels, strong tidal changes, and anchorages. (Tom Ehrlichman)

Would port facilities in rivers where spilled oil would reach marine waters be included? (David Bain)

JD Leahy – Depending on how we define our geographic scope it may or may not look at portions of rivers. Our study area does include rivers such as the Duwamish.

I think using the whole Salish Sea area, including Coastal BC makes sense. The Aegean Sea may also be another good option. (Paul McCollum)

Have you reviewed the Clear Seas Mapping tool to visualize marine safety around Canadian waters? (Fred Felleman)

JD Leahy – Yes we've taken a look at that, they did a lot of work to integrate the US and Canadian incidents.

Does probability analysis include movement of oil or dispersal after the spill itself? If so, see Kinder Morgan study on spill at Arachne Reef. It's a projection of how oil would disperse during different seasons from a major spill at that location. (Tom Ehrlichman)

JD Leahy – Today's discussion is focused on accident probability, as opposed to spill probability. We have a separate module that addresses oil outflow if an incident occurs. However, the model will not look at dispersal or behavior of oil, it will provide as outputs simulated accidents and estimates of oil spilled.

Supplemental Answer: We will present our approach to oil outflow modeling in September, please register here (link).

The way in which you use old data is critical to avoiding some of the challenges that became a real point of contention with regards to the last VTRA. Looking at accident probabilities rather than spill volumes allows you to have a larger temporal scope. There will be more pushback if you use older data for likelihood of oil spilled than perhaps if you used it for likelihoods of accidents. (Fred Felleman)

JD Leahy – We've decided to split the probabilities of incidents apart from spill likelihood and size in the model. This would allow us to use different time periods and areas.

If you're just using US/Canada data, you really should look at the Clear Seas report. One of the key things they look at is vessel type. They have far more bulkers than we do in Canada and those are by far the most frequent source of incidents in Canadian waters. The fleet that calls on our waters may have improved over the years but they have less sophisticated management than tankers. It will be very important to include Canadian data. I do also need to ask about the variability of volumes of traffic across a week. If that signal is there and you're looking at rates of likelihood, the times where there is very little traffic will dilute the actual risk. The times when traffic is heavier should have a weighting. (Fred Felleman)

JD Leahy – We understand the importance of determining the intervals at which traffic enters the system, and will describe our approach to that when we have one.

Considering a 20 year versus 10-year span for probabilities, I think 10 years is a better metric. That's because of the STCW work hours, bridge watch rules, better navigation tools and electronic charting with radar overlay. Customers are ensuring compliance and enforcing the rules. Things were very different 20 years ago so 10 years is a better span of time. (Sol Kohlhaas)

The smaller the time period used, the more likely you are to introduce bias into the model. One potential solution to this would be to compare probabilities calculated in a few different ways and compare them to local data to test for similarity. If you get similar results you can pool them to get more detailed predictions. (David Bain)

When you're talking about temporal scope, it seems like understanding what you're modeling would inform the scope. With the VTRA 2015, in order to analyze spills of certain volumes, they had to go back farther in time. Given the safety of this area, there were many years when there were no incidents. So it raises the question whether the model will evaluate the risk of spills of different sizes or only the probability of accidents. What the model will tell us must be defined in order to determine what the geographic and temporal scope should be. I'm not clear on what exactly is being modeled. (Lovel Pratt)

JD Leahy – In this conversation we're looking at probability of hazards, not spills. Separately, in September when we talk about the oil outflow module, we'll be looking at the probability of a spill and spill volume. We imagine that a portion of that work will be statistical. We will likely look at different geographic and temporal scopes when looking at historical accidents vs. historical oil spill volumes.

I don't really understand how those two simultaneous approaches intersect in the model. When you get there it would be good to clarify that for the public. (Lovel Pratt)

Will scope be binary or weighted? Will recent or more geographically proximate incidents be weighted more heavily? (Ahren Stroming)

Alex Suchar – To do any kind of weighting, we would have to have some understanding of what values to use for the weighting. That is very challenging without data.

How much have shipping patterns changed in 10 vs 20 years? If patterns have changed the older data may not be relevant. Since the older the data is, the less relevant it is, you might look at a large spatial scale for changes and patterns and from that adjust the weight for older data. (Christopher Barker)

As important as it is to define how far back to go, it is also important to ensure you catalogue incidents up to the current date July 2021, in order to capture the nature of incidents that reflect current trends. This makes the study prediction of risk more relevant to current conditions. Also, the study of probability is looking into the future and the further into the future you look, the more likely the occurrence of a major spill. In order to capture the risk of larger volumes, wouldn't you need to go back far enough to capture an accident with larger volume? (Tom Ehrlichman)

JD Leahy – We want to include as much present day data as possible. We absolutely are thinking about the challenge of large spill volumes. That's why we're separating oil outflow from the accident probability. First we want to know how often an accident might happen. Then, how many of those result in oil spill to water. We are considering both statistical and mechanical approaches to oil spill outflow.

Alex Suchar – We want to get the best accident data as possible so we need to define the spatial and temporal scale. If the same search window allows us to make an accurate estimate of oil spilled per accident, that would be great, but we aren't counting on that.

What is the data source for incidents that did not result in an accident or oil spill? How will you catalogue those within the Salish Sea? Coast Guard VTS reports? Ecology records? (Tom Ehrlichman)

JD Leahy – We will only be counting occurrences for the hazards we listed. We will be excluding some incidents such as personnel injuries that are present in the USCG and Canadian data.

On the hazard definition list, does navigational allision include a vessel underway striking a ship at anchor? The collision between vessels definition has both vessels underway. Where would anchored vessels be addressed here for a vessel that's not necessarily dragging anchor? (Lovel Pratt)

JD Leahy – A ship colliding with a ship at anchor will be counted as a "vessel to vessel collision." We will clarify this in our list of hazards.

Looking at list of hazards you have listed things that do result in an accident as well as things that may or may not like loss of steering. So the hazard list isn't limited to those incidents that result in an accident. If that's the case, why wouldn't it include things like loss of communication which could be considered parallel to loss of steering? (Tom Ehrlichman)

JD Leahy – You're right, there are some incidents in the list that aren't necessarily accidents. When we presented the structure of the vessel accident module, we talked through how we came up with the list of hazards.

We selected few indirect hazards, like loss of steering and loss of propulsion because these are transparent in a way that other types of precipitating events such as human error, language or communication challenges, or fatigue are not. We can model these based on physics and there is data that allows us quantify these.

The other piece is that we are specifically tasked in the future with evaluating tug escorts and an ERTV as potential interventions. A loss of propulsion event is one of the main ways that an ERTV could intervene in an accident chain. We wanted to make sure we had a complex way to evaluate a tug intervening after a loss of propulsion. That's why we define the group as hazards and it includes both accidents and preceding events.

I recognize that you do have a need to model tug interventions. I do think though that you have data on communications whether that's language barriers or radio problems. I know this issue has been raised by the USCG at the Harbor Safety Committee when no pilot is aboard. I do think you should include that data if you can find it. (Tom Ehrlichman)

Supplementary Answer: It's not just information on the existence of a communication issue that we need – we would also need a quantified understanding of how that communication issue may have affected accident probability. That is the data that is unavailable.

I'm wondering if you are able to use different times and areas for addressing causes such as mechanical failures. I imagine that would be equally likely everywhere. If you're able to separately address causes would you be able to stratify the data? One example would be to use different mixes of times and spaces and causes for situations that differ such as high density or low density traffic areas. (David Bain)

JD Leahy – We're certainly looking at the idea of using different populations of interest depending on the hazard type. Some hazards are more universal and some are more location specific. Some hazards may seem universal – that is, not place specific – but could be influenced by the composition of the ships that call on an area.