

The Science of Risk Modeling and Modeling Approaches

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The following summary notes are not intended to be a transcript but rather a review of the question and answer session that took place at the conclusion of the webinar. Attendee questions and comments are shown in bold text followed by Ecology responses. Questions are listed in the order they were asked. To see a recorded version of the presentation portion of the webinar, visit our [risk model website](#).

My understanding is that most oil spills in Washington waters occur at the dock or at anchor. These don't seem to be included in your study. Why not? (Rachael Mueller)

JD Leahy: With regard to spills from stationary vessels, there is space within the model framework for discussion of spills that don't require vessel interactions. We characterized them as "transfer spills" in the presentation, but this is essentially a short hand for other types of spills like internal transfers or transfer from facility to vessel. That's where we are incorporating that type of spill.

When we reviewed AIS for information on ATB tank barges, there was some traffic that we needed to account for manually. We are happy to share our experience if it would be helpful. (Rachael Mueller)

JD Leahy: It is a challenge to identify ATBs [Articulated Tug Barges] from AIS data, and we will need to use manual identification to capture all the ATB movements. We would love to touch base on that, and appreciate your offer of support.

What model are you using for your drift model? Is it based on a hydrodynamic model? If so, which one? (Rachael Mueller)

JD Leahy: At this point we've built a framework, which clarifies that we need a drift model, and where it fits in the framework. We have not selected or specified a drift model yet.

Can you please elaborate on the "noisy" AIS data? What is the noise and how will it be fixed with a new system? Have these issues been raised with AIS directly? (Amber Carter)

Alex Suchar: By noise we mean errors showing up in the AIS messages.

Adam Byrd: When we talk about this, we are mostly talking about the noise in the GPS data. GPS data is inherently noisy. It's not a flaw in the AIS system. To reduce the impact of these errors on our modeling and analysis, we're looking at techniques like averaging positioning data and trying to filter out incorrect positions.

What are the estimated costs for each phase [of model development] and for each body of water? (Amber Carter)

JD Leahy: The cost of the model is the cost of the team, so there's not a separate cost for each phase or model run, which is a benefit of having a public agency develop and maintain the model.

Has this model been used elsewhere before? Is this model something off the shelf, or a custom model developed by Department of Ecology? (Nathan Menefee)

JD Leahy: This is a custom modeling approach. That's not to say we aren't relying on scholars and efforts of researchers across the world. What we've presented today relies on previous work, but will be a custom usage of those tools and strategies developed by others.

Alex Suchar: The model framework that we have presented is not new. We have selected it because we believe it is the best framework to answer these questions and because it is flexible enough to cover a wide variety of questions. The modules within the framework will be developed in house.

Is this a reboot of the VTRA risk assessment or is it distinct? (Nathan Menefee)

JD Leahy: Those who are familiar with the 2010 and 2015 Vessel Traffic Risk Assessments (VTRAs) conducted by George Washington University/Virginia Commonwealth University will see similarities between our framework and the structure of the VTRA. That's because this type of framework is what is required to look at these types of questions. However, we will be creating the working components within our framework, and these components will be unique to our model. We are currently reviewing previous work done around the world, including the VTRA and will not ignore the value of these contributions, as we build own model.

How will you address inaccuracy in AIS positioning data? (Paul Devries)

JD Leahy: AIS positioning data is based on vessel's GPS position. There will be slight inaccuracies there since GPS isn't perfectly accurate. This variability should be within the margin of error for our model.

Will you use out of region incident rates as part of model? (Paul Devries)

JD Leahy: Right now we are building a framework that's broad enough to not limit us. We are aware of the challenges and concerns with using out of area incidents and accidents. But we are not dismissing this possibility right now. We are keeping our options open before we start eliminating potentially helpful data from our already sparse data sets. We want to make sure we have a chance to discuss it, not only internally, but with folks on this and future calls.

How will you account for risk mitigations already in place such as tug escorts, pilots, navigational aids, etc? (Paul Devries)

JD Leahy: One of the challenges is the maritime system is complex and it's not fully specified. Nobody has a clear quantified picture of the value of all the components and their effect on risk and processes that are part of accidents. For escorts, the process by which an escort might be able to intervene in a casual chain might be more readily quantified than the presence of a pilot. Either way we are open to looking at those things and looking for data that allows us to quantify those things. We are certainly aware that there are a lot of risk interventions and policies in place.

How are you planning to determine if a vessel is laden or in ballast? (Michael Anthony)

JD Leahy: This is an important aspect of this project. Advance Notice of Oil Transfer (ANT) data is something that we hope to leverage, but it's limited to the transfers that are taking place at Washington facilities, so it is not comprehensive to vessels transiting the entirety of the study area. This is one of the challenges we are faced with, and we'll look to the community who may be able to help with vetting the estimates that we produce.

Will you be including incidents in Canadian waters? (Rachael Mueller)

JD Leahy: We'll be looking at Canadian incidents and data. We're taking a broad look at things so not excluding any strategies or data types at this point in the process. We want to see what we can do with what's out there and then have discussions about lack of data later on.

For the oil outflow model you said you may be using data from historical spills. How will you incorporate advances in vessel safety and vessel construction that have taken place over the years? (John Fu)

JD Leahy: There are simpler ways for modeling oil outflow, like just looking at historical spill rates, and there are more complex ways. The reason that these more complex strategies exist is that they allow us to get at some of the things that you have brought up. The challenge with these more complex strategies is that they require more data. We hope to be able to support a more robust model for oil outflow that allows us to incorporate things like changes in hull construction that have happened over time.

Alex Suchar: There are strengths to both approaches. If we look at historical incident rates we may face the challenge of changes in vessel construction. If we use a mechanistic model, there are no guarantees that each vessel that visits our area will be able to be modeled in this way.

My biggest concern with relying on AIS is that barges don't carry it. Further, you don't know if the tugboat is laden or unladen. (Sol Kohlhaas)

JD Leahy: We are looking to do some manual identification of tugs to allow us to look at which are towing oil and which are towing container or deck barges. This doesn't help us determine if they are running light, or not towing a barge, on that day. When considering laden or unladen status, if we are talking about amount of oil on board, this is a challenge that we are aware of. We hope to use some of Ecology's ANT data for getting at this question, and we'll also look for suggestions from the community to look how to solve these challenges.

Brian Kirk: One of the key advantages of using this module-based approach is the transparency and the opportunities for participation. So if we look at figuring out how to simulate laden traffic, Ecology has ANT data and AIS data, which can give us insight into how oil moves in the system. We also have the ability to talk to you, experts in your field, and you can give us more insight into vessels that would be expected to be unladen or laden for a particular leg. Because we are simulating vessel movements, we have control over which vessels are designated as laden or unladen in the simulation. We can share this info with you and ask for your feedback to help us refine the simulation.

September 1st will be first stage of implementation of this legislation [tug escorts for certain tank vessels in Rosario Strait and connected waters to the east]. How will this be used in the study? Can you use this step

by step implementation as something to verify aspects of the model or help with accuracy with having portions of it in real time? Will the added escort traffic be added into the model? (Sol Kohlhaas)

JD Leahy: Right now we are focused on digging into the AIS data and cleaning this up to build the framework, and to do this we are using historical data. But we want to have a model that's flexible enough to incorporate new data. We'll need to be looking at things like the new implementation of tug escorts. As to the second question, our goal is to do our best to simulate vessels within the system. With that in mind, we will need to model the light tugs and their distribution. Escort tugs are an interesting component because their movement is related to other vessels so they aren't independently out there on their own.

Can you talk more about [NOAA's] GNOME [oil trajectory] model and if you have plans to incorporate or include this model? (Donna Schantz)

JD Leahy: In terms of the GNOME model, it's produced and maintained by NOAA. It is one of a variety of trajectory models that are in existence. We are focused on building our foundational model to produce the outputs discussed in the presentation...the foundational model doesn't get to the point of looking at spill trajectory. But the model output could be used by trajectory type models. It is not our intent to incorporate a trajectory model into our model framework.

I think Melba had mentioned definitions of marine incidents [during the presentation], those are defined in 46 CFR part 4. Also, The USCG requires deep draft vessels undergo a series of pre-checks before they come into port, and if they have any issue they are required to request a letter of deviation. These are some of the steps that are already in place to help mitigate some of these things. (Wes Geyer)

JD Leahy: As you mentioned, the Coast Guard has steps for the arrival process, and other rules and inspection procedures in place. And just to clarify, none of this work is meant to take away from the existing efforts or policies in place to keep our risk of spill low.

How are you going to take into account the presence of a vessel traffic system? The VTS has been very successful over the years at intervening with potential incidents. (Laird Hail)

JD Leahy: We don't have the answer to this today, but we can note that the VTS is an important aspect of the system, and we will need to consider this as we further build out the model. Your support in terms of VTS data would be appreciated and welcomed.

Will your code be freely accessible for research use? (Rachael Mueller)

JD Leahy: We hope to provide transparent descriptions of how our model works.

Adam Byrd: We don't know if we will get to the point of having a product available. There's a level of effort associated with creating a package that can be used by people. We would like to do this, but we also have to prioritize our time.

How does this risk approach compare to the Canadian national process? (Robert Lewis-Manning)

Brian Kirk: You may be referring to the vessel risk process that Transport Canada is doing. They worked with a commercial consulting firm to take an existing risk model and tailor it to Transport Canada's needs. We also considered this kind of approach, but the direction from the legislature was to build the capacity to develop and maintain this model within our staff.

You used a propulsion loss example in your presentation. One of the challenges is that all propulsion losses are not the same. If you are off the coast there is a wide waterway and a tug nearby, or if you have just left the dock and your tug is still with you. In the past, these may have been considered the same incident type, but they are completely different from a risk perspective. This is a challenge so just throwing it out there. It starts skewing the results of the model when you lump them together. (Mike Moore)

JD Leahy: Just to talk a little about how we are thinking about this, the idea is that a loss of propulsion is simulated to take place on a certain day, at a certain tide, with specific weather. The weather and tides influence the direction of drift and the possibility of other things, like towing assistance, that might provide a potential intervention prior to a grounding. This strategy doesn't address all the concerns and complexities that you raise, but this speaks to some of how we are thinking about it. You are right, not all of these loss of propulsion incidents result in groundings.

The NOAA GNOME model was mentioned, and I'm the lead developer for GNOME. [The consideration of oil] fate and transport is something you are pushing out to the future, but I would encourage you to start that conversation sooner rather than later. The oil transport problem might need a hydrodynamic model which might influence your drift model. There's room for collaboration with NOAA and Ecology on this part of the model. (Christopher Barker)

JD Leahy: Look forward to getting in touch and talking more about opportunities to work together on this.

What will the output of the model look like? If it's intended to inform the BPC on rulemaking [connected to new escort rules], will it be "if then" statements? (Blair Bouma)

JD Leahy: Right now we are building the foundational model that has discrete outputs that form the building blocks for future analyses. A list of simulated spills isn't very useful as a decision making tool, so when we move to the new phase when we look at the analysis projects, that's when we'll need to look at how we translate these foundational outputs into a format that will be a helpful decision making tool for people.

Additional Comments:

We have observed that some tank traffic data appears to have signals jump such that the ship tracks are segmented into fragments that are < 2 km long. My colleague who was looking at the data suggested that pings would jump to a non-local location, which compromised our linking algorithm. Not sure if this jumping is related to this [article](#) but it's something to consider. (Rachael Mueller)

I believe the VTRA modeling used a 1/8 factor on incident reports to estimate accidents. I feel that factor was too high and frankly too simplistic to model accident probability. In addition, modeling resulted in the probability factor as a percentage, so the reduction was at most two significant figures, while the consequences was up to six significant figures. So, since the modeling was done in absolute terms (vice

relative terms) the 1% of a 6-figure oil outflow still seemed dramatic and over-estimated the spills, in my opinion. Please take into account the “size” of each variable. (John Fu)