

**BEFORE THE
UNITED STATES DEPARTMENT OF TRANSPORTATION
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION
WASHINGTON, D.C.**

Pipeline Safety: Gas and Hazardous Liquid
Pipeline Risk Models

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COMMENTS ON PIPELINE SAFETY: GAS AND HAZARDOUS LIQUID PIPELINE RISK MODELS

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I. Introduction and Executive Summary

The American Gas Association (AGA)¹, American Petroleum Institute (API)², American Public Gas Association (APGA)³, Association of Oil Pipelines (AOPL)⁴ and Interstate Natural Gas Association of America (INGAA)⁵ (jointly “the Associations”) submit these comments on the Pipeline and Hazardous Materials Safety Administration (PHMSA) report “Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation” (the Report).

Pipeline safety is a core value of the Associations and our members, and utilizing tools, methods, and technologies to increase visibility into an operator’s system and characterize risks is critical to promoting pipeline safety. In 2015, PHMSA formed a Risk Modeling Working Group (RMWG), which consisted of federal pipeline regulators, pipeline operators, industry organizations, national laboratory personnel and other stakeholders. The Associations and their representatives collectively represent over 50% of the RMWG. The RMWG’s mission statement was to (1) characterize state of the art pipeline risk modeling for gas transmission and hazardous liquid pipelines, (2) identify a range of state-of-the-art methods and tools capable of addressing the spectrum of pipeline risk management applications, and (3) provide recommendations to PHMSA regarding the use of risk modeling methods, tools and data requirements. The intent was for PHMSA to gather the input of various stakeholders and for PHMSA to author a report to make recommendations to operators on risk modeling. The RMWG discussions and PHMSA’s resulting

¹ The American Gas Association, founded in 1918, represents more than 200 local energy companies that deliver clean natural gas throughout the United States. There are more than 73 million residential, commercial and industrial natural gas customers in the U.S., of which 95 percent — over 69 million customers — receive their gas from AGA members. Today, natural gas meets more than one-fourth of the United States’ energy needs.

² API is the national trade Association representing all facets of the oil and natural gas industry, which supports 9.8 million U.S. jobs and 8 percent of the U.S. economy. API’s more than 625 members include large integrated companies, as well as exploration and production, refining, marketing, pipeline, and marine businesses, and service and supply firms. They provide most of the nation’s energy and are backed by a growing grassroots movement of more than 25 million Americans.

³ APGA is the national, non-profit Association of publicly-owned natural gas distribution systems. APGA was formed in 1961 as a non-profit, non-partisan organization, and currently has over 700 members in 37 states. Overall, there are nearly 1,000 municipally-owned systems in the U.S. serving more than five million customers. Publicly-owned gas systems are not-for-profit retail distribution entities that are owned by, and accountable to, the citizens they serve. They include municipal gas distribution systems, public utility districts, county districts, and other public agencies that have natural gas distribution facilities.

⁴ AOPL is a national trade association that represents owners and operators of oil pipelines across North America and educates the public about the vital role oil pipelines serve in the daily lives of Americans. AOPL members bring crude oil to the nation’s refineries and important petroleum products to our communities, including all grades of gasoline, diesel, jet fuel, home heating oil, kerosene, propane, and biofuels.

⁵ INGAA is a trade Association that advocates regulatory and legislative positions of importance to the interstate natural gas pipeline industry. INGAA is comprised of 28 members, representing the vast majority of the U.S. interstate natural gas transmission pipeline companies. INGAA’s members operate nearly 200,000 miles of pipelines and serve as an indispensable link between natural gas producers and consumers.

overview Report address three NTSB recommendations from the NTSB Safety Study: *Integrity Management of Gas Transmission Pipelines in High Consequence Areas*⁶.

Overall, the Report provides a good summary of the many aspects of risk modeling and outlines descriptions of different risk models. The Associations appreciate the effort to gather many perspectives prior to authoring the Report. The Associations support language within the Report that articulates the need for flexibility and scalability in pipeline risk modeling. Additionally, the Report leveraged findings and observations that were identified through PHMSA's Research and Development (R&D) program. The Associations appreciate the efforts to link the recommendations made within the Report to R&D, such as innovation in technology, which supports pipeline safety.

Unfortunately, the Report does not reflect many of the discussions and recommendations of the RMWG. As outlined by the RMWG presentations and discussions, one of main goals of a risk model is to provide results that enable operators to be more proactive in managing risk. The RMWG noted that it would be helpful to summarize various implementation approaches from different operators and provide recommendations that not only describe the models but show how these models can be applied. This would include addressing considerations such as data inputs, resources, and other factors that may be required to implement a given risk model⁷. As described in greater detail below, data quality and the availability of system-specific data are critical drivers for selecting an appropriate risk model, and this should be reflected in the final Report.

Furthermore, in several places the report indicates that the paper is authored by the RMWG. PHMSA should modify the language to clearly state that PHMSA is the author and that the RMWG provided data and input only. Many of the RMWG operator representatives submitted comments to PHMSA on the draft Report in February 2018. Most of these comments were not addressed in the current draft Report.

Within these comments, the Associations have proposed changes to the Report, which are shown in **red**. The Associations address the following topics within the Report:

1. **Applicability of the Report:** The Report should clarify that the recommendations made by the RMWG and provided within the final Report only apply to gas and hazardous liquid transmission pipelines. While there may be learnings applicable beyond gas and hazardous liquid transmission pipelines, the work of the RMWG was to specifically addresses these pipelines.
2. **Intent of the Report and Implementation of Recommendations:** The Report should clarify its intent to highlight leading practices and provide recommendations to operators, not to create prescriptive requirements. The final Report should clarify that since the Report has not gone through a formal rulemaking process, the recommendations made within the final Report are not regulatory requirements.
3. **Ensuring a Balanced Approach to Presenting Risk Modeling Methods:** The Report currently overgeneralizes the strengths of probabilistic models and exaggerates the ease with which an

⁶ <https://www.nts.gov/safety/safety-recs/recletters/P-15-001-022.pdf>

⁷ <https://primis.phmsa.dot.gov/rmwg/meetings.htm>, Minutes for Pipeline Risk Modeling Work Group, February 8, Page 2

operator can implement a probabilistic model. Additionally, the Report makes unsubstantiated claims about probabilistic models being a best practice. The final Report should remove all statements which are not supported by data and those which do not align with the balanced, flexible and diverse approaches discussed within the RMWG meetings. The report should recognize that the value of risk modeling is not in its perceived precision or technical elegance, but in its effectiveness in managing and reducing risk.

4. **Selecting an Appropriate Risk Model:** Currently, the report highlights preventative and mitigative measures (PMM) as the primary consideration for selecting a risk model. The Associations recommend that the final report look at other uses of risk models outside of PMM. Additional considerations such as threat identification, assessment planning, budgeting and capital allocation and risk analysis, so these functions are also critical in selecting an appropriate risk model.
5. **Limitations of Quantitative and Probabilistic Models:** To be effective, a risk model must accurately reflect relevant risks of the entire system and use this data in a meaningful way to drive decisions that reduce the risk to an operators' system. The Associations recommend that the final Report clarify the importance of data quality and other factors that may limit the meaningfulness or usefulness of quantitative and probabilistic models.
6. **Understanding the Challenges of Moving to a Different Risk Model:** The report oversimplifies the ease with which an operator can change their existing risk model. The Report incorrectly states that probabilistic models are not inherently more complex than other risk models. Below, the Associations outline additional considerations such as data availability, timing and resources that need to be considered within the final Report.
7. **Continuing to Support Innovation:** The Associations support incorporating state of the art technologies and processes that further improve pipeline safety. The Associations recommend that the final Report remove references to specific vendors and instead guide operators to implement technologies and systems that improve risk reduction decision-making.

II. Applicability of the Report

The NTSB risk modeling recommendations aimed to strengthen integrity management and risk assessment for transmission pipelines in high consequence areas. While there may be learnings applicable beyond transmission pipelines, the work of the RMWG was to specifically address transmission. The final Report should clarify that the recommendations within the report are specific to gas and hazardous liquid transmission pipelines. The input provided by the RMWG focused solely on risk modeling for gas and hazardous liquid transmission pipelines. Additionally, the Associations recommend that the Report clarify any recommendations that are specific to a certain commodity (e.g. natural gas or hazardous liquid). The Associations propose the following changes:

- Page 5: "*Federal pipeline safety integrity management (IM) regulations require **transmission and hazardous liquid** pipeline operators to use risk assessments.*"

- Page 14: *“This document provides an overview of methods and tools used for risk modeling in support of pipeline integrity and risk management for gas and hazardous liquid transmission pipelines”*
- Page 53 *“For hazardous liquid pipelines, operators have often used spill response plan assumptions in risk models to estimate spill volume and dispersion and distance as the basis for consequence estimates.”*

III. Intent of the Report and Implementation of Recommendations

The Report is intended to provide operators with recommendations for modeling risks on their gas transmission and hazardous liquid pipelines. The Associations recommend this intent be clarified in the final Report within the Executive Summary, and propose the following language:

- Page 5: *“As outlined within ASME B31.8S, operators establish risk models that appropriately address the risks within their given system, and improve the safety of their system. The Pipeline and Hazardous Materials Safety Administration (PHMSA) is issuing this report to highlight the strengths and limitations for pipeline risk models, and support improvements in pipeline risk models.”*

The Associations support the Report’s recommendation that operators should select the best model approach possible⁸, and agree that operators should have the flexibility to identify the most appropriate risk models for their system⁹. The final Report’s discussion of risk model selection should account for opportunities and limitations presented by an operator’s system, data, resources and staffing. The Associations recommend the language be revised as follows:

- Page 6: *“Instead, operators should select the best model approach that can be integrated within an operator’s system, considering factors such as resources and staffing, and then populate the model...”*

The Associations also recommend that PHMSA remove any recommendations from the final Report which require operators to apply risk models consistent with the report’s conclusions:

- Page 7: *“~~PHMSA recommends that pipeline operators develop and apply risk models consistent with these summary conclusions and the associated technical recommendations contained in this document.~~”*

The Report does not substantiate several of its recommendations, and not all of the recommendations align with the discussions and recommendations from the RMWG. Currently, readers are guided towards specific methodologies, vendors, tools, and data models for risk modeling, sometimes without

⁸ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 6

⁹ *“Pipeline operators should select risk models capable of supporting risk management decisions required as part of pipeline IM programs...”* Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 23

“Operators planning to continue the use of Qualitative and Relative Assessments / Index models should seek to supplement personnel judgement with as much pipeline physical attribute data as can reasonably be acquired over time.” Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 6 and Page 25

acknowledgment that other solutions may be available and appropriate. References to specific vendors or products should be removed as their presence implies an endorsement, which should not be the intent of the report.

The Associations are supportive of shared learnings and developing leading industry practices. Should PHMSA plan to update any regulatory language relating to risk modeling or use the Report to change enforcement practices, PHMSA should vet proposed changes through the Gas Pipeline Advisory Committee (GPAC) and the Liquid Pipeline Advisory Committee (LPAC) to ensure the changes proposed are technically feasible, reasonable, cost effective, and practicable. As well, any regulatory change would need to go through the appropriate process per the Administrative Procedure Act (APA).

IV. Ensuring a Balanced Approach to Presenting Risk Modeling Methods

The Report states, “The overriding principle in employing any type of model to support risk assessment is that it be capable of supporting risk management decisions.”¹⁰ If this is the goal, then operators should choose the model type that fits their decision-making processes. The report should recognize that the value of risk modeling is not in its perceived precision or technical elegance, but in its effectiveness in managing and reducing risk. The Associations recommend refocusing Section III: *Overview Information for Use of Risk Model Types*, on a discussion of the strengths and weaknesses of each of the model types and removing Table III-1: *Risk Model Types and Applicability to Decisions*.

The final Report should acknowledge that different risk modeling approaches make sense for different reasons. The Report currently favors probabilistic models. Instead, the Report should be encouraging operators to use risk models that allow them to utilize the best available information to support risk management decisions and reduce system risk. All pipeline operators, their pipeline systems and their data are distinct.

The Report implicitly discounts the value of relative risk/index-based models. The report fails to capture discussions during multiple RWMG meetings where these models were described and demonstrated as being “condition based.” After all, managing the condition of the system is an essential part of managing risk. These models use available data regarding the condition of a segment of the pipeline system in its purest form to determine its relative risk. There is no translation, interpolation and extrapolation to create a probability, but the available data is directly used to guide and support decision making. Where data depth and quality enable use of probabilistic models, the RWMG discussions supported their use. It is also important to recognize that the intent of risk modeling is not to predict “when” an event might occur, but to prioritize work to reduce risk.

Table III-1 oversimplifies the advantages and disadvantages of different types of pipeline risk models. Applying Table III-1 to all operators does not account for the factors that are unique for each pipeline operator and appropriate to the level of analysis needed. It is inappropriate to assume that all operators have the necessary data, systems, and resources needed to transition to a probabilistic risk model, or that such a transition would substantively enhance pipeline safety.

¹⁰ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 6

It is unclear what data and factors were considered in developing Table III-1. If operators are to use Table III-1 in a meaningful way, PHMSA should clarify the basis for the table. The table is inconsistent with the RMWG discussions. For example, it shows that all four risk modeling methods can be used to prioritize risks for baseline assessments, but does not clarify why probabilistic models are a best practice for performing baseline assessments.

Table III-1 also shows that additional inputs are needed for operators using qualitative models or relative assessment/index models to compare PMM, review the cost-benefit analysis with implementing PMM, determine a reassessment interval, and for general decision making. Each of these activities can be successfully completed using a relative/index model. Without clarification, Table III-1 incorrectly implies that operators may be inadequately managing their integrity management programs. The Associations do not believe this is the intent of the table and recommend that the final report provide additional clarity around what additional inputs are required. The Associations also recommend the following language be removed from the final report which makes the same assertion:

- Page 18: ~~“Upgrades to risk assessment processes using quantitative or probabilistic risk models is an important step for operators to take to improve IM programs, allowing better understanding of the risks on pipeline systems and better support for risk management practices.”~~

Furthermore, the final Report should clarify that cost-benefit analysis can be determined using relative models. The Associations recommend the following language be incorporated into the final Report:

- Page 25: Quantified risk reduction benefits **for all four modeling methods** can be combined with data on implementation costs to perform benefit-cost analysis to further enhance decision making.

The Report also focuses on the benefits of quantitative and probabilistic models, while over-emphasizing the weaknesses of the qualitative and relative assessment/index models¹¹. Examples of this are within Section III.A: *Selecting an Appropriate Risk Model*¹². The Associations believe an expansion of Section III.A with more in-depth considerations, advantages, disadvantages, and utilizations for each model type be beneficial for enhancing operator’s risk models.

The Report also makes the assertion that “(u)pgrades to risk assessment processes using quantitative or probabilistic risk models is an important step for operators to take to improve IM programs...and better support for risk management practices...” Such an assertion is not supported with data and contradicts the direction provided during the GPAC meeting for the Safety of Gas Transmission and Gathering rulemaking¹³. The Associations recommend removing generalized statements from the final report which

¹¹ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 25-26. The report states that probabilistic models are considered a best practice for supporting all decision types and that “(r)isk models that produce consistent qualitative output in standard risk units (probability of failure, expected loss, etc.) provide an easier format for evaluation and comparing risk alternatives, particularly for larger multi-regional pipeline systems. For applications such as the cost analysis, some form of quantitative type of risk model output in standard risk units is generally needed.”

¹² Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 23

¹³ GPAC Technical Pipeline Safety Standards Committee Meeting Transcript, January 12, 2017

state that probabilistic or quantitative models are a best practice. The Associations recommend the following language be incorporated into the final Report:

- Page 6: “Quantitative System model or Probabilistic models ~~are more versatile~~ may provide greater capabilities to provide risk insights and support decision making. Such models are ~~not necessarily~~ more complex ~~and or~~ need more data than other types of risk models.”
- Page 7: “8. Risk models that rely on generic estimates or SME information for a significant portion of input data can be useful to gain insight on risk issues and support decisions. This is especially so if the model algorithm reflects the physical and logical relationships of the input variables and the model output risk measures are expressed in standard units.”

(This conclusion is already on page 74, but should also be included in the key conclusions at the beginning of the document.)

- Page 19: PHMSA inspections of operator IM programs include operator risk assessment processes and the risk models employed in those processes; inspection experience indicates that operators’ risk assessment approaches, primarily qualitative and relative risk models, can be improved. have been inadequate in many cases to meet all IM requirements and provide meaningful insight into the risks in an operator’s unique operating environment.
- Page 20: The Relative Assessment or Index models may use algorithms that model the physical and logical relationships of the pipeline system risk factors, the threats to system integrity, and the potential consequences of a product release from the system. These models use quantitative or qualitative inputs to derive numerical outputs using a scoring algorithm.
- Page 25: ~~Risk models that produce consistent quantitative output in standard risk units (probability of failure, expected loss, etc.) provide an easier format for evaluating and comparing risk alternatives, particularly for larger multi-regional pipeline systems.~~
- Page 25: ~~In practice, continued use of qualitative and relative assessment/index models is better suited for small, less complex pipeline systems, where the effects of preventive and mitigative measures on risk can be reasonably be understood via changes to the model inputs. These systems can be characterized by limited geographic extent and lower mileage; simple system configuration; uniform risk factors throughout the system; affected HCAs limited in extent and similar in nature; and single, small operating organization.~~
- Page 64: ~~Any quantitative system~~ model ~~that, if it~~ represents the logical and physical combination of risk factors to produce likelihood and consequence estimates, can produce useful results and can account for uncertainties in the input data. even if uncertainties exist in the input data.
- Page 71: ~~If a probabilistic model is being used,~~ Priorities for additional data collection may be developed systematically using a value-of-information analysis. This analysis estimates how additional data collection is expected to affect risk assessment results and thereby potentially change decisions on risk reducing measures. If the analysis finds that collecting specific additional information could change decisions significantly, then risk reduction could be significantly enhanced by collecting the additional information. To ensure complete and accurate data for risk model, operators should ensure that records are preserved and retrievable.

V. Selecting an Appropriate Risk Model

Selection of PMM is only one criterion an operator should consider when selecting a risk model. Risk models are also utilized for threat identification, risk analysis, assessment selection, budgeting and capital allocation and assessment timing and prioritization. Focusing solely on PMM does not ensure that operators are making fully informed decisions about the risks on their system. Robust and well-thought-out relative risk models can be very effective for the various purposes of a risk model. Accordingly, the Associations recommend modifying the following language so that certain sections of the report are focused on more than just PMM:

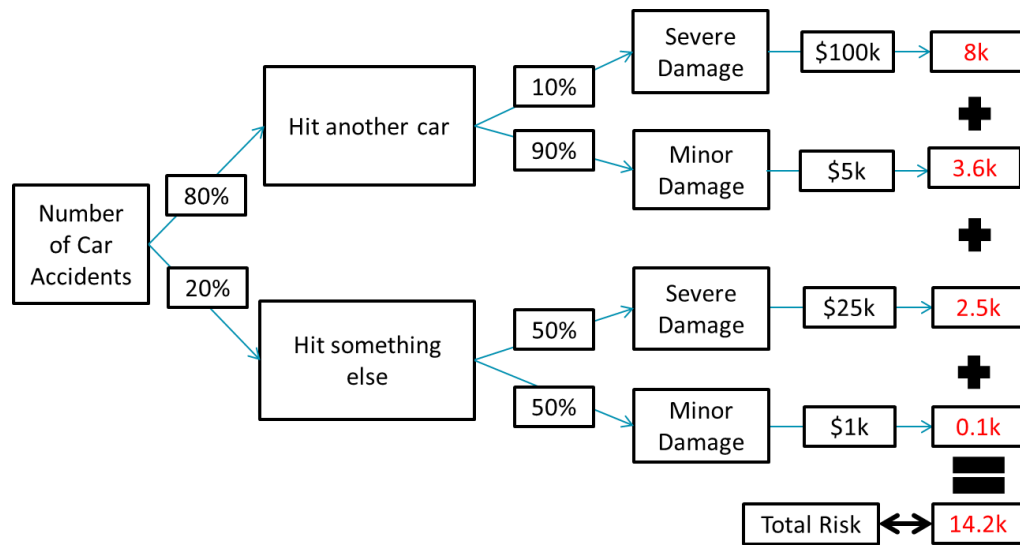
- Page 25: *“Operators planning to continue the use of Qualitative and Relative Assessment/Index models should ~~seek to supplement personnel judgment with the highest degree of pipeline physical attribute data as can reasonably be acquired over time.~~ ensure that their risk model is capable of supporting risk management decisions required as part of pipeline IM programs, such as the selection of preventive and mitigative measures, and can be utilized for threat identification, risk analysis, and general risk management decisions.”*
- Page 30: *~~Identification and evaluation of preventive measures is an important application of risk assessment and required by IM regulations. This application can be supported by a risk model that has the following characteristics:~~* (The three bullets below apply to the risk model as a whole and not just PMM.)
 - *The model can indicate the change in risk from implementation of the risk reduction measure.*
 - *The model includes all threats to the pipeline segment that can be addressed by preventive measures.*
 - *Model inputs represent the pipeline characteristics, consequence receptors, and other risk factors affected by the ~~risk reduction preventive~~ measures, so that the effect of each measure can be evaluated through changes in inputs or changes to the structure of the model.*
- Page 32: *~~Pipeline integrity management regulations (see Appendix E) require identification and evaluation of preventive measures to reduce the likelihood of failure. Most preventive measures implemented by pipeline operators attempt to reduce the likelihood of failure due to a single threat or a subset of threats. Evaluation of these measures will require the evaluation of the effect on the likelihood of failure due to each threat (also accounting for interacting or dependent threats) and summing up overall affected threats to obtain the total effect on failure likelihood.~~*

Additionally, the final Report should acknowledge that data integration is a consideration when operators select a risk model. The report indicates in many places that certain types of models are better at integrating data and understanding interactive threats. Many operators integrate data and make decisions outside of a risk model. The final Report should address that data integration may take place outside of the risk model. The final Report should clearly discuss the distinction between data integration and risk assessment, while acknowledging that a risk model may offer an efficient way to integrate data.

VI. Limitations of Quantitative and Probabilistic Risk Models

To be effective, a risk model must accurately reflect relevant risks of the operator’s entire system and use this data in a meaningful way to drive decisions that reduce risk. The Associations recommend that the final Report clarify the importance of data quality and other factors that may limit the meaningfulness or usefulness of quantitative and probabilistic models.

Algorithm Complexity – Probabilistic risk models typically utilize a decision tree approach including a term to estimate the probability of failure for a system. It is critical that this term accurately reflects system performance. These terms are commonly mathematically complicated and very complex to “tune” to a specific operator’s system. An example of the decision tree approach is provided below utilizing the example of the risk of a car accident. The above referenced term is on the far left (number of car accidents).



By contrast, relative models are typically much less complicated mathematically. In addition, the accuracy of each individual variable is less important so long as they are accurate relative to each other. These models are much more compatible with systems where less data is available (for example, systems that cannot accommodate inline inspection to generate condition data).

Data – Relative risk models require input data to be accurate relative to other input data. If there is a question about the accuracy of data in the absolute, users of a probabilistic models may still choose to utilize the outputs as relative scores.

Probabilistic risk models often utilize cost data to calculate consequence. Although catastrophic cost values (fatality, property destruction, etc.) are publicly available, less severe failure costs are not (cost of leak repair for an external corrosion leak vs. cost of repair of third party damage vs. cost of repair for external forces-related leak).

The importance of data quality was emphasized by the RMWG, which noted that operators should prioritize data quality over complex risk models¹⁴. A quantitative or probabilistic model requires an operator to have sufficient data inputs for its entire system. Conditions along a given pipeline can vary significantly. An operator must have detailed data that reflects these conditions for a quantitative or probabilistic model to function effectively. If an operator attempts to apply a quantitative or probabilistic model with a lack of detailed data, this can result in overgeneralized risk outputs. Operators may have to rely heavily on general, industry-wide data to implement these more complex risk models, and in the process abandon the company-specific data on which their risk models were originally built.

Measuring Risk Reduction – Similarly, the Report claims that quantitative and probabilistic models are superior for identifying “the effects of preventative and mitigative measure on risk... via changes in the model inputs...”¹⁵ The report does not substantiate this statement. If the inputs are based on assumed values, rather than operator-specific data, this statement is generally incorrect.

Conversely, relative risk models can differentiate risk results using weighting factors. Adjustment of weighting factors can be very useful for differentiating risk results by increasing or decreasing weighting factors for model inputs that are known to be more or less prevalent on a given operator’s pipelines. Weighted risk results can help to eliminate dilution of risk results, which may be introduced by unnecessary approximations and/or assumptions that may otherwise be required by the risk model. The Report misstates that weighting factors “can introduce distortions in the likelihood of failure estimates for specific pipeline segments. These distortions should be avoided/corrected...” The Report does not provide any details on how numerical weighting introduces distortion, or guidance on how an operator may prevent such distortion. The Associations recommend that the Report clarify that weighting factors developed through the review of data and SME input can be used to evaluate the likelihood of failure for specific pipeline segments. The Associations recommend the following language be incorporated into the final Report:

- Page 34: “*The use of fixed numerical weights, **which have been developed through the review of pertinent data and SME input, can be used to evaluate applied to risk factors and/or categories can introduce distortions in** the likelihood of failure estimates for specific pipeline segments. **These distortions should be avoided/corrected as part of the necessary adjustments to apply the output from these models to the evaluation of risk reducing measures affecting specific segments.**”*

The Report also notes that “...the probability of failure and an overall risk can be estimated using different integrity assessment intervals”¹⁶ by using probabilistic models. For high frequency events, distribution curves can be used to model risk reductions; however probabilistic models may not be effective for estimating the likelihood of very low frequency events. The Associations recommend PHMSA more fully address the limitations of probabilistic models within the Report. The Associations recommend the following language be incorporated into the final Report:

¹⁴ <https://primis.phmsa.dot.gov/rmwg/meetings.htm>, Minutes for Pipeline Risk Modeling Work Group, February 8, Page 7

¹⁵ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 25

¹⁶ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 26

- Page 64: “PHMSA does not believe that any specific model type is preferable simply based on the level of data quality available to support the model inputs. **However, it should be acknowledged that the accuracy of a specific model is relative to data quality.**”

VII. Understanding the Challenges of Moving to a Different Risk Model

The Risk modeling Report significantly understates the complexity of quantitative and probabilistic risk models as well as the challenges of converting from a relative risk approach to a quantitative or probabilistic approach. The Report notes “(t)he structure of Quantitative System models is not inherently more complex nor do they necessarily require more data than Index models, and may be developed and implemented with common tools such as spreadsheets”¹⁷.

Section A.1: *Moving from Qualitative or Relative Assessment/Index Models to Quantitative Systems or Probabilistic Models*, directly advises operators to transition from qualitative to quantitative risk models, which is not appropriate given that there are advantages and disadvantages for all model types. In addition, the section fails to describe the additional level of SME data or assumptions that may be required to move to quantitative models. The Associations recommend that Section III.A.1 elaborate on the strengths and limitations of transitioning risk models, rather than advise operators to transition risk models.

Appendix D: *Migration from Older Risk Analysis Methods to Quantitative Models*, should be removed from the final Report. This section significantly oversimplifies the process to move to a quantitative model and directly incorporates a process being promoted by a single vendor.

In general, quantitative and probabilistic models are more complex, require more data and require more resources. Statements to the contrary are completely misleading. For example, B31.8S states probabilistic models are “the most complex and demanding with respect to data requirements.”

A quantitative model may require more sophisticated tools than spreadsheets. The Associations recommend removing the following language from the final Report:

- Page 26: “**The structure of Quantitative System models is not inherently more complex nor do they necessarily require more data than Index models, and may be developed and implemented with common tools such as spreadsheets.**”

The Report should also highlight the potential value of managing risk models using in-house resources. This allows operators to implement a risk model that leads to more meaningful and effective decisions. The Report should highlight this as a potential benefit to using a less complex model. Quantitative model types are more complex to develop. Working with third party vendors or contractors to migrate to quantitative models may be a lengthy and complex process.

The Report notes “(o)rganizational experience in developing and implementing quantitative models for a limited number of threats can then be applied in a way that maximizes the benefits and optimizes the level of resources needed as the quantitative model and probabilistic approaches are

¹⁷ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 26

applied to an increasing number of threats.”¹⁸ This assertion that moving to a quantitative or probabilistic model in a step-wise fashion would not require an increase in resources *to maintain multiple risk models* is incorrect. It also underestimates the difficulty of attempting to combine results from a relative/index model with that of quantitative or probabilistic model into a meaningful output.

The Associations recommend that data be provided to support statements within the Report that probabilistic models do not require additional time and resources to develop and implement. If this data is not available, these statements should be removed.

The Report also oversimplifies the process to perform a sensitivity analysis¹⁹. Performing a sensitivity analysis can be a major undertaking for operators, especially with many identified threats, and would require additional resources to complete. The language in the final report should clarify the challenges associated with conducting a sensitivity analysis.

VIII. Continuing to Support Innovation

The Associations support innovation and technology that helps improve an operator’s knowledge about its system. This includes the efforts undertaken by PHMSA’s R&D program. However, the Associations recommend that the final Report avoid directing operators to a specific commercial vendor. For example, while the Report references the PODS database for organizing pipeline data, this is not the only available software/model. Also, the Report states, “Another method for assessing the likelihood of failure for different threats is the “triad” approach recommended by Muhlbauer²⁰.” Directing operators to implement the use of specific vendors or technology could be expensive, cumbersome, and most importantly, not appropriate for their system.

Similarly, the Associations recommend that the final Report remove references to GIS, and instead state the importance of tying risk assessment data to asset management and work management systems, as deemed appropriate by the operator. This would allow operators flexibility to identify the appropriate tools to increase their system visibility.

IX. Other Items to Consider

The Report notes that “(m)odel results should be consistent with historical failure data. If operating history of the analyzed pipeline or similar pipelines include failures or consequences that are not captured by the model, then changes to the model should be considered to include factors related to such historical events.”²¹ This recommendation does not consider that system

¹⁸ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 27

¹⁹ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 27

²⁰ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 34

²¹ Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 29

characteristics may have changed, perhaps significantly, following a prior failure. The Associations request additional clarification of this statement.

The Report also suggests in several places that a full range of consequence scenarios should be modeled²². While modeling every scenario may be a tedious but practical exercise for facilities, the same is not true for pipelines. The resource and computational requirements make it impractical to calculate every potential scenario for larger pipeline segments. The Associations recommend that operators identify a range of scenarios to consider.

- Page 7: “Varying levels of sophistication are possible in the analysis of the consequences of a failure. However, it is important **to consider a range of scenarios, as determined by the operator to consider a full range of scenarios (this may include those scenarios that even if they do not have a high probability of occurrence),** to capture the **full** spectrum of possible consequences, including the high consequence outlier. “

Similarly, the Report recommends additional processing and interpretation of results from certain model types in order to facilitate decision-making. This recommendation assumes that all pipeline risk models incorporate significant mileage and variations of assets. In some situations, there may only be a short segment of pipeline being modeled and therefore “additional processing” is unnecessary and should not be “required.” The Associations recommend the language be revised as follows:

- Page 30: “Therefore, additional processing and interpretation of the results **may be is** required to apply model risk evaluations to decision making, **as deemed appropriate by the operator.**”

The Report also notes that the continuing occurrence of significant pipeline incidents points to a need for operators to upgrade their tools for risk modeling. The Associations were unable to identify data to support a relationship between risk model types/characteristics and incident frequency. The Associations recommend that this language be removed from the Report.

The Report should also refrain from using the word “continuously” as it is vague and can be interpreted differently by various readers. For example, the Associations recommend the language be revised as follows:

- Page 29 “To accomplish this, input data should be **continuously** reviewed and updated, as appropriate...”

Similarly, the use of “threat” is inconsistent throughout the report. In certain sections, “threat” is formalized, referencing a specific pipeline threat category, such as external corrosion. In other instances, it is just used generally. An example of the inconsistency of the definition of “threat” is that Section IV.A (pages 32-33) presents 13 threats, but Section IV.E (page 41) contains 25 threats. Also, there is a lack of consistency throughout the report where the word “relevant” accompanies “threat.” The Associations recommend the final Report clarify the definition of “threat,” and apply it consistently through the report.

²² Pipeline Risk Modeling: Overview of Methods and Tools for Improved Implementation, May 2, 2018, Page 7

In addition to the topics highlighted above, the RMWG also discussed unique characteristics of pipeline facilities that create facility-specific risk modeling challenges. These discussions should be referenced or incorporated into this Report.

There are a large number of “should” statements in the Report. These should be reviewed, and PHMSA should consider where “may,” “might,” or “consider” would be more appropriate.

X. Conclusion

The Associations support the work of the RMWG to improve risk modeling and promote pipeline safety. The use of innovative technologies and flexible risk modeling approaches allows operators to identify the technologies and methods which provide greater insight into their systems. The Associations commend PHMSA for gathering the feedback and input from the RMWG. As noted above, the final Report should place a greater emphasis on highlighting the strengths and limitations of each model, which would greatly increase the value of the Report as a tool for improving integrity management programs. This approach is consistent with the RMWG discussions over the last several years.

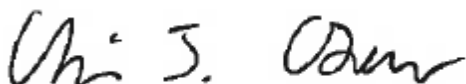
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