**Date:** August 9-11, 2016

**Attendees:**

Participants listed at the conclusion of this document.

**Meeting Action Items (identified by “\*\*” in the notes)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Description** | **Responsible** | **Complete** |
| 1 | Identify potential dates for Facilities meeting and Data meeting | PHMSA |  |
| 2 | Provide summary of potential 2016 B31.8S changes | Keith Leewis |  |
| 3 | Provide references version of C-FER presentation | Mark Stephens |  |
| 4 | Provide any comments on draft RMWG summary PowerPoint presentation to Chris McLaren  | All |  |
| 5 | Provide any comments regarding the draft Technical Guidance Document Table of Contents and report structure | All |  |
| 6 | Provide draft RMWG Technical Guidance Document Table of Contents to the October meeting presenters | Steve Nanney |  |
| 7 | Provide reference for C-FER-developed fault trees for PRCI that can potentially be referred to in the technical guidance document. | Keith Leewis |  |
| 8 | Request Kent Muhlbauer to bring along an operator applying newer methodology to next meeting to gain application insights | PHMSA |  |
| 9 | Make referenced 2011 Bullock and GTI interactive threat report documents available to RMWG. | Mark Hereth |  |
| 10 | Make recent draft API report regarding data integration available to RMWG | Stuart Saulters |  |
| 11 | Nominate speakers for the October (consequences) meeting | Erin Kurilla / Stuart Saulters |  |
| 12 | Invite speakers to the consequences RMWG meeting | Vincent Holohan / Dane Spillers |  |

**Agenda and Meeting Notes**

1. Introductions/Safety Moment (Erin Kurilla, Steve Nanney)
2. Introduction of Attendees, Safety Moment, Meeting Logistics and Timing
3. Past Business (Steve Nanney)
	1. Meeting minutes from last conference call previously distributed via e-mail and posted to the RMWG web site.
	2. RMWG web page <http://app-test.cycla.com/rmwg/meetings.htm> has been added to the PHMSA Pipeline Technical Resources (PTR) site.
4. Timing of next meeting in Houston, TX and subsequent meetings (Charlie Childs, Steve Nanney)
	1. Next meeting:
		1. *Date: October 4-6, 2016*
		2. *Location: Kinder Morgan, 1001 Louisiana St, Houston, TX 7700201*
	2. The Doodle survey approach will be used to assist in determining the schedule for the subsequent two meeting so that travel arrangements can be made and assignments re-scheduled, as appropriate. Potential date ranges for the next two meetings \*\*:
		1. *November/December 2016 – Facilities (late November or early December)*
		2. *February, 2017 – Data*
5. Update on B31.8S Status and Plans (Keith Leewis)

*Part 192 still references the 2004 version of B31.8S. Both ASME B31.8 and B31.8S have been updated in 2010, 2012, and 2014, and a 2016 update is in process. What are the anticipated changes for 2016? Keith Leewis needs to look up to confirm specifics, and will send summary for B31.8S to Steve Nanney. \*\**

*Presentation noted that IMP language has been continually added to improve the document since 2004. Discussion noted that “safety management” is a higher level perspective than the IM plan, which is a more detailed/working level program (i.e., IMP is a block within the overall safety management program). Actual risk is often due to organizational or human error and Safety Management Systems can improve the safety culture across the whole organization.*

*Threats – B31.8S has 21 threats: Includes 9 prescriptive threats (Appendix A), 3 time factors (time dependent, resident (old “static”), and time independent (random)). The language for interactive threats, and fatigue are found in the next paragraphs after the list of typical threats. The individual 9 prescriptive threat requirements are found in Appendix A. Performance based IMP requirements are discussed in detailed language.*

*Consequences – Potential Impact Area (PIA), Perimeter of screening circle is 5,000 btu/ft2-hr. The number and proximity of receptors inside the circle are used in B31.8S to assign a consequence value along the whole pipeline. PHMSA originally determined that 20 or more structures for inhabitation or an identified site defined a high consequence area. [Noted PHMSA approaches for HCAs and new proposal for MCAs; INGAA looking to phase in one-structure within PIR criteria for members by 2020.]*

*Noted the PIA basis is to prioritize people safety first, then property damage (screening tool to prioritize IM work); incidents have been seen with property damage that extended beyond the PIR.*

*B31.8S references four types of risk assessment approaches – SME, relative assessment models, scenario based models, probabilistic models. SME’s are used in all. Any plans to update? Upates after more than ten years of experience will come under evaluation and the outcome of this committee will provide guidance.*

*Current B31.8S is generally used as prescriptive methodology; however the requirements for a performance based IMP are also outlined. Also a draft of a developing life cycle-based design (80% life cycle model) is in committee and reliability based integrity management (similar to CSA Z662 Annex O, Reliability Based Design) (draft ballot in 2010; still outstanding) requiring another calibration of target values to set/define a tolerable level of risk (available on the ASME website).*

*ASME recommends using societal risk; however, other less litigious countries have explored individual risk approaches. Canadian Chemical Engineering Society (Risk assessment – Recommended practices for municipalities and industry) is based on site specific plants and individual risk targets and also has interesting approach for railways that may apply.*

*Also noted the existence of CSA Z662 Annex O – reliability based method (probabilistic in nature). Different risk assessment methodologies are used to quantify different threats. [Will be partially covered by C-FER presentation.]*

*Data trends were also presented for industry integrity related performance (per year for on-shore GT) since 1970 (data was derived from PHMSA-published information, but failure classifications were based on the 9 annual report classifications and validated for the different reporting periods via a separate review process).*

1. RMWG Overview Template and Draft RMWG Report Table of Contents (Chris McLaren)

*Presented for comment; members requested to provide any comments to Chris McLaren. \*\* Leewis: Be careful to define “facility” properly – i.e, facilities are valves etc. not necessarily all that is found inside the fence at a meter, pump, or compressor station. Phone: How prioritize differing model results should be included.*

*Group asked to comment on the draft Technical Guidance Document Table of Contents and report structure. \*\**

*AGA – Discussed potential interaction between the new GT safety rule (and liquid rule) and this document. PHMSA not prepared to explicitly discuss rule making, but considers them to be separate efforts. AGA requested that PHMSA keep in mind that the eventual guidance of the RMWG document and the anticipated 192.917 changes should not be contradictory. API emphasized that they seconded the motion.*

*Team requested that the draft RMWG Technical Guidance Document TOC be forwarded to the risk R&D presenters scheduled for the October group meeting. \*\**

1. Criteria for Selecting Pipeline Risk Analysis Methods (Andrew Kendrick (Kendrick Consulting))

*Emphasis on defining what actually is trying to be calculated – random failures, systematic failures, common-mode failures, black swans?*

*“Is answer actionable?” is a very important aspect of what is actually estimated/calculated and is actually useful to operators.*

*Range of potential errors in risk modeling results is an important aspect that is generally overlooked. For example, human health studies often emphasize uncertainty in results; i.e., if error is too high, then must go get additional data to have better confidence in a result. Not really a conversation for pipeline risk models to-date.*

*Term “positive” or “negative” error – If populate a parameter with a “conservative” value, can push results in either direction, and can skew results.*

*C-FER – Error, also called “uncertainty” in probabilistic models. Treatment of uncertainty is very important for all risk estimates.*

*Steve Nanney – It is difficult to know what degree of remediation efforts are needed to be successful in a risk analysis environment. How do we communicate that actual risks have been reduced? [For example, response to critics that immediate conditions for IM did not address the correct anomalies.]*

*Various modeling approaches are tailored to answer different questions – Noted the “tails” of risk categories are quite important, especially for low probability high consequence events.*

*Bayesian analysis – fairly new to industry; okay if a very specific failure is being studied; not as useful for more generalized overall pipeline risk estimates. Any known applications by pipeline operators? GTI doing some research. Leewis indicated has been used for anomaly dig analysis. C-FER: Bayesian is an elegant process that may be useful, but is a challenge to characterize and apply new information sets. Have applied to some pipeline analysis.*

*Process Safety Management (examples include ASME PCC3, API570, API580, &581) – Useful for operational systems (good for acute risks); very labor/time intensive, is good to capture worst-case analysis and tribal knowledge. Hard to apply to an overall pipeline system. AGA: Why not used more for pipeline facilities? Seems to be used more, for example for specific topics such as CRM. Really hard for high mileage, given the many threats applications for a pipeline system as a whole. Other operator uses? Say yes, but limited to a “box” (compressor station, etc.).*

*SME – Is a start, especially when data is lacking; helps to ID the worst-case, and the most-likely. Helps to bracket the analysis. Says use a lot, and tends to work well in the pipeline industry environment, perhaps because of the importance of tribal knowledge that is unlikely to ever be captured in a formal model. Kendrick approach is to modeling, then gain SME input. Not very repeatable for rarer type of events (i.e., easier to get better, more predictive SME consensus on normally observed things like corrosion rates, etc.). Helps to have a strong facilitated process to even out the human irregularities involved and ensure continuous improvement.*

*Probabilistic models – says tend to underestimate catastrophic risks the likelihood of catastrophic failures (cited Fukishima as an example), if not deliberately exclude it… Not really good at identifying “black swan” events (can’t model; can’t manage).*

*But can manage specific ID risks and reduce each that would end up contributing to a black swan type of event (i.e., the risk analysis would never model a Bellingham, but a risk management process might have introduced better preventive measures that would minimize such an event from occurring).*

*So, what is the best approach? Depends on what problem you are trying to solve. Need an integrated approach that applies the best approach for the particular threat being evaluated.*

*Model validation – Says would be very instructive to go back after an accident and see how model behaved (did it predict it?).*

*AGA: Seemed to think IM up until now is largely about pig and dig. Operators are starting to look at doing specific preventive and mitigative actions. Questions if the RMWG document is going to focus on reducing risk, or how to predict failures? Group discussion indicated that it seems to involve both. Models look to indicate where likelihood is higher so that resources are directed where most effective, but most risk models are not really trying to predict exactly where the next failure will occur. Also noted need to integrate “silos” of information within an operator’s organization.*

*Bottom Line: Define what you are actually trying to do with a risk study – six step process. End with evaluating the performance of the risk models (as part of risk management) post-event. Noted that the technical guidance should not be thought of as a one-time thing, but should be kept evergreen and up to date.*

1. Methods for failure probability estimation (Mark Stephens)

*Aspects of qualitative and quantitative approaches described.*

*Group: Large, small leaks – regulatory definition? Reporting criteria different for differing agencies. PHMSA reporting does not use the large/small categories. No standard definition; B31.8 has some discussion of leak definitions in leak detection Appendix M.*

*Linear system considerations – some threats are in known fixed locations, some are overall distributed threats. Need some way to combine. Suggest using an “evaluation length” that involves consideration of receptor consequences.*

*Probability estimation – Options:*

*Statistical methods: Historical data from various industry and governmental data sets; is subject to the respective limitations of each data set; e.g., can also important to know attributes of similar lines that did not fail (the denominator)). Discussion noted that improvements to the granularity of industry data would be very helpful in improving the usefulness of these methods.*

*Model-based methods: Apply probability distribution functions to both “loads” and “resistances” to identify likelihood that the load exceeds the resistance. Distributions have random variations, measurement uncertainty, model uncertainty.*

*Type of failure indicates type of model to apply – time-dependent (p(failure)/time, similar to pipe structural reliability type of model) vs. time-independent (p(failure)=event frequency \*POF/event (structural reliability type of model)).*

*How define acceptable levels of probability? Generally, must consider consequences to define.*

*Benefits vs. Cost: Benefit is that probabilistic models can provide significant risk insights, but require significant developmental effort; additionally, data requirements can be significant.*

*Feasibility – Structural reliability methods around for 20 years or so. (CSA Z662 Annex O for implementation example.)*

*Validity – Model development have included calibration/validation to historical North American transmission pipelines; described to be in good agreement.*

1. Roundtable Discussion with the Day 1 Technical Presenters
	1. *Steve Allen (URC Indiana (NAPSR)): Should there be a separate threat for terrorism (direct physical damage, cyber, etc.) – could be thought of as part of 3rd party damage threat category in B31.8S. Include in the RMWG document? Group discussion indicated uncertainty as to including this document (maybe just reference how it fits into existing threat categories); PHMSA will investigate/evaluate.*
	2. *Scenario modeling: What is it? Approach looks at specific failures, and seeks to identify events that could lead to that failure. A HAZOP is a type of scenario model. For pipelines, some hazardous liquid operators used them, so were included in B31.8S. Still in use? Hereth: Yes, in specific cases where a particular consequence is of concern. Kendrick: Also being used for CRM; determining setpoints, etc. Also used for training controllers in AOC development process.*

*Leewis: Can the current CRM modeling be used as a template to account for field rather than control room incorrect operations in risk modeling?*

*Spillers: May also be useful as a component of a larger risk modeling approach.*

*McLaren: Have also seen used for facility risk; to do for entire pipeline can be resource intensive.*

1. Bayesian Analysis Approaches to Risk Modeling (Bob Youngblood (Idaho National Lab))

*Many issues can be thought of as a decision process as to whether or not a problem exists – analyst has partial information, and the consequences of the potential problem are significant*

*Are always going to gather imperfect information – aleatory (variability from one trial to the next) and epistemic (state of knowledge uncertainty) uncertainties*

*Bayesian analysis is a technique to relate additional knowledge into a set of previously known knowledge, and use that combined set of information to provide an updated estimate of occurrence.*

*One challenge is to know whether or not performance is declining over a short period of time (vs. the understanding of the experience base). Adjusting the prior set of information can have a great effect on the Bayesian answer for the current (updated) expectation of performance.*

*General principles – Use all possible information available; don’t underestimate uncertainty; understand the impact of potential adjustments to the prior distribution.*

*Discussion: How hard to work at getting the prior distribution as best as possible (if have a lot of data)? At least can exclude non-physically valid areas. [Note: If model simply does not include observed things or trends, then model is likely not correct.] Must be careful/thoughtful in how to set up prior’s and how to weight new information; practical guidance for application to the pipeline environment is needed.*

*How applied in practice in the nuclear industry? NRC uses as part of performance oversight of power plants (plant-specific component level failure reporting). If updated information infers significant degradation of important plant safety systems, a regulatory response is initiated.*

*How incorporate risk tolerance? Generally not well defined.*

*Application to topics such as quality of inspections (NDE, etc.)? Some work ongoing; presentation reference 1 reviews such topics. Other known references with respect to pipeline practices? None noted.*

*Can apply to things like corrosion anomaly growth? Yes, in theory, but prior distributions would have to be carefully considered/applied.*

*Marathon Pipeline has risk personnel with nuclear background and some familiarity with Bayesian techniques – how see application of these types of techniques? Looking at improving use of predictions vs. performance; Bayesian may be on approach to apply. Establishing a valid prior distribution appears to be a common challenge.*

*INGAA: How do such an approach in the pipeline industry that have many companies and varying models? Other industries such as NASA, NRC-regulated industry do much more consistent and collaboratively. Would be a challenge to implement in the pipeline industry with many more variables; establishing prior distributions across the industry would be a challenge.*

1. Risk Assessment Methodologies for US Army Corps of Engineers Civil Work Infrastructure (Robert Patev)

*Four major areas of risk assessment: major rehab program, dam safety, levee safety, asset management program.*

*Major rehab program: Engineering Pamphlet EP 1130-2-500 is major document; EC 1110-2-6062 document has implementation details. Use FMEA and reliability analysis – probabilistic (four methods; mainly simulation) and non-probabilistic methods (three types).*

*Dam safety: Guidance ER 1110-2-1156 (Safety of Dams) (2014) Focus on loss of life and property damage.*

*USCAE initially performed a screening portfolio risk assessment via a relative risk method (base rate adjusted by dam-specific descriptors).*

*Updated technique to include a risk assessment methodology: Potential Failure Mode Analysis, event trees, expert elicitation to determine relative likelihood for event tree branches, examine tolerable risk curves (FN (farmers) curves); includes societal risk value/curves. [1 life; 1E-3/year]) (by mandate, USCAE societal risk curves are “risk neutral”).*

*Now also use a semi-quantitative risk assessment (SQRA) (called this as the loading frequency is quantitative) that is similar to the screening level approach but with more rigor.*

*Levee safety: Guidance ER 1120-2-xxxx (Safety of Levees) (under development). Response to Katrina failures in New Orleans. Interagency Performance Evaluation Task Force (IPET) risk assessment process applied to evaluate the overall New Orleans levee system. Approach is similar that taken for dam safety risk evaluation efforts.*

 *Levee Screening Tool to screen/rank levees based on a relative scale.*

*Levee Safety Program – current risk assessment methodology, similar to dam safety program approach.*

*How adjust fn curves for continuous length of levee? Divide into segments and characterize each based on perceive vulnerability and calculate the (lower case) fn curves.*

*Basis for seismic fragility? Look at range of event severity and use expert elicitation for failure probability. [Looking at using probabilistic methods for probability of failure.]*

*Now have a SQRA process similar to dam program*

*Where did acceptable societal tolerable risk values come from? Based on international standards (said to be very similar across respective international efforts). Note: USCAE has a legal requirement to be risk neutral as consequence increases.*

*Asset management: Goes across all USACE activities. Use a Lifecycle Portfolio Management Process:*

 *Originally applied 5x5 relative risk matrix.*

*Moving to Operational Risk Analysis (ORA) workbook tool, more probabilistic in nature – assign condition ratings, estimate baseline probability of operational failure x consequence of failure.*

*Operational Condition Analysis (OCA) and ORA done on a component level. Roll up into a Total Risk Exposure value.*

*Tools – use a lot of Palisades @Risk software for probabilistic work, also have in-house software.*

*Performance metrics – OMB has metrics for USCAE. Any related to risk per-se? Have risk reduction target levels for their infrastructure.*

*Seismic risk: Apply probabilistic seismic hazard analysis for design.*

1. Modeling for optimized safety decisions (Shahani Kariyawasam)

*[GT specific presentation] Need to match choice of risk assessment model to what is needing to be done. Major factors include Objective and Scope of Risk Analysis, Magnitude of Decision, and Organizational Maturity:*

*Objective and Scope of Risk Analysis – Need to define a tolerable level of risk. Overall goal is to prevent failures and reduce risk. [CAN/CSA-ISO-31000 referenced for effective risk management principles.]*

 *Threats are highly system and segment-specific*

*Threats and failure modes are sub-system and time specific. Say cannot use global industry stats and needs quantification (qualitative/index models cannot capture).*

*Actual risk is often due to organizational or human error.*

*Learnings from failures are important. Have identified some new threats (e.g., thermal expansion (stress failure)). [Now have 10 threat categories vs. original 9.]*

*Evidence of threats comes from many disparate data streams; important to use all available data.*

*TransCanada has chosen to only use quantitative models (mix and match available models, depending primarily on data limitations and best model for each location). Qualitative methods stated as not being able to compare between threats and has no meaningful risk measures or criteria. Note: Quantitative approach also has limitations, and does not necessarily always have all of the answers.*

*Apply different sub-divisions of lines depending on specific threats. Calculate likelihood of failure for each threat on each subsystem annually. Predicted failure rate is a combination of assessment-derived and historical failure rates information (bias toward using ILI data when available).*

*Interactive threats – Include three aspects: coincident defects, activating threats, common mode conditions.*

*Validation – 11 categories of validation. Also do sensitivity analysis.*

*Calculate individual risk, societal risk (use UK standard), and likelihood of failure with a criterion for each.*

*How big group doing this work – 15 staff (do other things besides risk analysis work; 69,000 km of pipe and facilities).*

*Group discussion:*

*Human performance aspects (incorrect operation, human error)? Consider, but treatment not as mature as for major threats (consider to be a smaller, more contributory threat for the TCP GT system). Colonial noted there are human-oriented data points that have contributory human performance aspects, but is hard to understand the relative importance of these aspects.*

*How handling overall data requirements? Have a separate data group; risk analysis group passes data needs to this group to identify areas of improvement. Still have separate data bases within TPC; working toward a central data structure. [Group noted data fidelity is a particular issue during industry acquisitions.]*

1. Roundtable Discussion with the Day 2 Technical Presenters (Chris McLaren)

*Presenter feedback:*

*TPC – Guidance is fine, but prescriptive requirements would be counterproductive.*

*C-FER – Preparation of a Technical Guidance Document is a challenging task for the RMWG, but anything that can improve transparency and consistency will be a positive contribution.*

*Kendrick – Guidance should emphasize that data is king; smaller operators may not understand importance of data accuracy. Also, concept of uncertainty and how it impacts evaluation of preventive measures and mitigative measures is important.*

1. Interactive Threat Modeling Roundtable Discussion (Dane Spillers, Chris McLaren)

*PHMSA experience – Have noticed that operators do not always consider the potential for this interactive type of threat dynamic (e.g., operators only looked at incident, leak, and repair data to identify existing threats, and have not adequately considered potential and interacting threats when quantifying threats and when identifying threats that must be accounted for in integrity assessment method determinations). PHMSA data reporting also does not lend itself to identifying interactive threats.*

*Gas transmission IMP inspection in 2004 identified a method to systematically review threat interactions and document threat interactions applicable (and not applicable) to specific systems for use in risk assessment and integrity assessment method determinations. Graphic example below of a two-dimension threat interaction table and process for determining applicability:*

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*A version of NYSEARCH Final Report 15-060 has been distributed for internal RMWG use only; interactive threats for application to a relative (index) risk model. Team discussion:*

* *Team noted challenge of reported incident descriptions providing sufficient information to determine if event truly involved interactive threats*
* *Adoption by industry? KM is in process of incorporating. AGA says some operators have test-driven the NYSEARCH approach, but not sure if using yet for decision making. Other members noted that some use the matrix as an “addition” to the risk score.*
	+ *Team noted that B31.8S does not have an explicit definition of “threat”*
* *Discussion of internal / external corrosion occurring at the same linear location being “coincidental” or “interactive.” Differing opinions as to how risk models would handle this situation. [Discussion also noted that TCP defined an “interacting defects” sub-category for this type of phenomena.]*
* *Team noted that regardless of specific approach adopted, it is quite important for the analysis developers to go through the thought process to decide how to include interactive threats in their risk analysis approach.*
* *How integrate into a quantitative reliability type of model? Discussion not clear, but some noted that the point is to identify actionable information/data, so generally rely on ILI runs, etc. to provide current condition of the line. If degradation noted, may need to assess earlier, correct CP, etc.*
* *Phillips66 noted that IC can mask EC readings when using ILI metal loss tools. This can be thought of as a type of “interactivity” with respect to understanding the condition of the line.*
* *AGA noted that eventual technical guidance document should accommodate small operators who generally apply SME-oriented risk analysis approaches (noted as being aware of interactive threat concepts, but struggle with how to formalize in a cost effective manner) versus what is perceived to be overly-expensive probabilistic risk approaches. Other operators indicated that they, in fact, do perform detailed analyses to identify interacting threats and how to address.*
1. Review of Technical Presentations (Part I) (Mark Hereth, Dane Spillers)

*Main take-aways:*

* 1. *Criteria for Selecting Pipeline Risk Analysis Methods (Kendrick): Tails are important for risk thresholds. Fault trees are often applied to root cause, but not always used for threats; can help the SME process be more rigorous. Error/uncertainty is important in understanding results.*
	2. *Methods for failure probability estimation (Stevens): Model-based methods, based on identifying the overlap of load and resistance. Failure measures and aggregation of risk is important to define. Time dependence of risk should be included (considering maintenance impact), in addition to data uncertainties.*

*Group: C-FER has developed a set of fault trees for PRCI that can potentially be referenced (Mark Hereth to provide to group) \*\**

* 1. *Bayesian analysis approaches to risk modeling (Youngblood): Overall background of Bayesian analysis and pros/cons of application of the concept to risk analysis. Expert opinion processes referenced for improved results when incorporating SME input.*

*Quantification of uncertainty is important (should not underestimate). Combining data sets can be useful, but need to be careful with characterizing the “prior” distributions. Concept is then to update the combined prior distribution via a Bayesian method.*

* 1. *Risk Assessment Methodologies for US Army Corps of Engineers Civil Work Infrastructure (Patev): Expert opinion elicitation (EOE) process potential area of improvement to SME process. Also have a lot of experience regarding consequences, especially related to weather events.*

*Noted have developed more sophisticated tools over time; started with more simple approaches, and have continually improved/enhanced over time. Pareto curve shown as example of diminishing returns for extra effort.*

* 1. *Modeling for optimized safety decisions (*Kariyawasam*): Distillation of risk management steps into key concepts – consistent commitment to risk based goals, grounded in reality, responsive and innovative. Understanding subsystem-specific threats is important in addition to an overall pipeline system risk. Group: Where apply PSM type of approaches? Examples included third party damage, facility risk, also for evaluating design alternatives.*

*Formal process to learn from failure events can be helpful to assure threat identification is adequate. Variety of quantitative (and qualitative) tools available for mixing/matching to address threats (TCP only uses quantitative). Group: May be useful for technical guidance document to define consistent terminology (even something like “expert elicitation” vs. “SME” process, especially if described).*

*Group: Maximizing the use of all available data is a worthy goal of any approach, particularly those that are quantitatively oriented. \*\* Request Kent Muhlbauer to bring along an operator applying newer methodology to next meeting to gain application insights (described as much a philosophy/thought framework as an off the shelf application).*

*Interactive threats – \*\* Mark Hereth to make the referenced 2011 Bullock document available; also GTI interactive threat document. API also offered a recent data integration draft document (Stuart Saulters). \*\* Group noted the available Integrity Dictionary (Clarion Technical Publishers) may be useful when defining terminology.*

*Validation of model results is important for any approach.*

*The presented characteristics of a sound/mature risk analysis, while general in nature, are good to consider when an operator is evaluating risk analysis approaches.*

1. Review of Technical Presentations (Part 2) (All)

Specific discussion topics:

* Interactive threat treatment (e.g., incorrect operations)
* Human performance inclusion
* Criteria for eliminating threats from consideration for integrity assessments
* Handling unknown values in threat identification
* Methods for, and appropriate usage of, weighting factors in likelihood calculations (all modeling approaches)
* Methods for aggregating risk along a pipeline (dynamic segmentation based on attribute changes affecting likelihood for this discussion)
* Others?

*See previous notes for specifics of above topics.*

1. Consequence Modeling (lead-in for next meeting)

*Group reviewed the draft agenda for the October 2016 RMWG meeting. No additional sessions were identified for the meeting. Per the draft agenda, three R&D sessions and four technical sessions (GT, HL, HLV, human performance) in the meeting.*

1. Identify potential presenters for topics at the upcoming meeting in Houston

*Group discussions centered on potential speakers for the respective four technical sessions tentatively slated for the October 2016 RMWG meeting. Erin Kurilla and Stuart Salters agree to take the lead on nominating industry representatives for these sessions.*

1. RMWG Work Products (Steve Nanney)

*Group discussion centered on the need for the eventual technical guidance document to be applicable for the broad spectrum of operator and pipeline systems sizes.*

*PHMSA noted the intent to distribute initial draft technical guidance material regarding likelihood to team members prior to the October RMWG meeting in Houston.*

**Attachment 1 – Meeting Participants**

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| **Pipeline Risk Modeling Work Group Meeting; February 8-9, 2016** |
| Name (First) | Name (Last) | Organization |
| Steve | Allen | URC of Indiana (NAPSR) |
| Brandon | Cavendish | Colonial Pipeline |
| Peter | Chace | PUC of Ohio (NAPSR) |
| Charlie | Childs | Kinder Morgan |
| Mark | Clayton | CenterPoint |
| Chris | Foley | Phillips66 |
| Robert | Fristoe | Phillips66 |
| Mark | Hereth | INGAA |
| Vincent | Holohan | PHMSA |
| Shahani | Kariyawasam | TransCanada |
| Andrew | Kendrick | Kendrick Consulting |
| David | Kuhtenia | PHMSA (Cycla) |
| Erin | Kurilla | AGA |
| Ken | Lee | PHMSA |
| Keith | Leewis | Leewis & Associates (B31.8S) |
| Mason | Matthews | Athens Gas Utilities (APGA) |
| Andy | McClymont | PHMSA (Cycla) |
| Chris | McLaren | PHMSA |
| Steve | Nanney | PHMSA |
| Christopher | Osman | INGAA |
| Robert | Patev | US Army Corps of Engineers |
| Mark | Piazza | Colonial Pipeline |
| Stuart | Saulters | API |
| Dane | Spillers | PHMSA |
| Mark | Stephens | C-FER |
| Jill | Watson | Marathon Pipeline |
| Pat | Westrick | Marathon Pipeline |
| Bob | Youngblood | Idaho National Lab |
| **On-line:** |
| Matthew | Nicholson | Columbia Gas |
| Jacob | Steere | Consumers Energy |
| Jared | Tooley | Kinder Morgan |