**Risk Modeling Work Group Agenda and Notes**

**Location of Meeting**: CenterPoint Energy, 1111 Louisiana, Houston, TX

**Meeting Purpose**: Data and Risk Tolerance

**Date:** Tuesday, March 7 - Thursday, March 9, 2017

**Attendees:** Participants listed at the end of this document.

**Meeting Action Items (identified by “\*\*” in the notes)** *None Identified.*

Tuesday, March 7

1. Introductions / Safety Moment (Mark Clayton, Steve Nanney)
	1. Introduction of Attendees, Safety Moment, Meeting Logistics and Timing

*Ladder safety – Be very careful (when carrying) on stairs!*

1. Past Business (Chris McLaren)
	1. Meeting minutes from last meeting distributed via e-mail and posted to the RMWG portion of the PHMSA Pipeline Technical Resources (PTR) site (<http://primis.phmsa.dot.gov/rmwg/meetings.htm>). Any edits/changes? *None identified.*
	2. Review of open past meeting action items:
* Investigate potential involvement in comment process for PHMSA R&D project DTPH56-14-00004 “Improving Models to Consider Complex Loadings, Operational Considerations and Interactive Threats” (McLaren). *Eduardo Munoz (Kiefner) provided a review to the PHMSA portion of the RMWG team in January. This presentation and research was similar to what NYSEARCH presented to the entire team in a previous team meeting. Final version has been posted (*[*https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=557*](https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=557)*). \*\*Action item closed.*
* Contact NTSB with respect to industry-assigned risk modeling recommendations to see if the RMWG technical document may be helpful in closing the recommendations. Include listing of applicable NTSB Recommendations in appendix of guidance document for time being for completeness (Saulters/Kurilla/INGAA/Kuhtenia). *CJ Osman (INGAA) indicated all four industry recommendations have been closed as of week previous to this meeting. The materials presented to NTSB that resulted in the 4 recommendations being closed are posted at* [*https://www.aga.org/safety/pipeline-safety/federal-legislation-and-regulations/ntsb-recommendations/response-ntsb*](https://www.aga.org/safety/pipeline-safety/federal-legislation-and-regulations/ntsb-recommendations/response-ntsb)*. \*\*Action item closed.*
* Prepare draft industry survey related to data completeness in preparation for the next RMWG (Data) meeting. (Westrick/Trades) (*Facility meeting*) *Pat Westrick reported performing pre-work with the identification of about 75 types of data in the regs, with 175+ pieces of data. This would have resulted in a very large survey, so was not pursued further. This topic was discussed in Westrick’s presentation at this meeting (see item 12 – presentation #7). \*\*Action item closed.*

*Group: Any PHMSA discussion with NTSB regarding RMWG applicability to PHMSA-assigned NTSB recommendations? PHMSA sends quarterly updates to NTSB (Nancy White), so are aware of the RMWG efforts.*

*Chris McLaren – Pushing for “Probabilistic” in the Technical Guidance Document to mean the use of distributions, and “quantitative” to be applied to data sets with “unitized” values. Keith Leewis – Suggested use of term “deterministic” instead of using quantitative for non-distribution data. Jacob Steere – Found risk-informed decision making document to be useful; draft BSEEE report calls out NASA report that emphasizes importance of low consequence high probability events.*

1. Timing of next meeting in TBD and subsequent meetings (Steve Nanney/Dane Spillers)
	1. *Dane Spillers discussed the number of gas transmission operators that have low numbers of HCA mileage. Data presented showed that larger systems have had higher numbers of incidents in HCAs than the smaller systems/operators. [Noted 500+ gas transmission operators have no HCA mileage.]*

*Relative risk models are probably the dominant type of models used by the small system operators. For the Risk Modeling Technical Guidance Document, PHMSA is evaluating if an additional meeting is needed to discuss applications of relative risk models in detail, particularly for these small systems. Steve Allen – These entities need tools to optimize the quality of the type of models they will actually be using – i.e., index models.*

*Meeting would likely be a 1-2 day meeting to cover this topic. More discussion on Thursday.*

*Jacob Steere – Would it be better for the technical document to concentrate on the risk assessment process vs. discussing types of risk models?*

*Steve Allen – Willing to put a set of questions together to query NAPSR community to further the discussion of small system/operator risk models.*

* 1. *Team – Kinder Morgan and AGA would like an additional meeting after having the chance to review the next draft of the Technical Guidance Document.*
1. RMWG Work Product Review (Chris McLaren)
	1. *The PHMSA portion of the RMWG team met in late January; are in the process of incorporating team comments; should have a next draft in 4-5 weeks for industry review.*
2. Technical Presentation #1: PODS Data Management – Capabilities, Use of Available Data Sets in Risk Models (and criteria for Exclusion of Data Attributes in Algorithms), Lessons Learned, and Insights for Improvements (Ron Brush; New Century)

*Currently there are approximately 160 PODS members.*

|  |  |
| --- | --- |
| **Member Type** | **Count** |
|  Large Operator | 48 |
|  Small Operator (< 1000 mi) | 20 |
|  Vendor | 83 |
|  Other | 7 |
| **TOTAL** | **158** |

*Data->Risk Assessment->Action. May lead to questions about data that need resolved to understand and/or make better risk results.*

*Background – Evolved from CAD replacing drafting to current GIS, mobile computing, web 2.0, etc.*

*Standard data format developed from early alignment sheet work. PODS Association is a non-profit consensus-driven association to help standardize data sets. Many uses including data management, consequence analysis, mobile, MAOP/MOP calculations, data analytics, and reporting.*

*Facets of pipeline data management include feature abstraction, linear-referenced centerlines, data granularity (normalize (allows things like dynamic segmentation)), data integrity, and modeling of facilities (not done well by PODS). Data integrity noted as being the most critical facet.*

*Potential indicators of data integrity issues and opportunities to address were outlined.*

* *Expand PODS model tables/attributes to better meet risk needs*
* *Clearly define attributes and appropriate data types*
* *Improve centerline location – spatially and linearly*
* *Correlate/match ILI features with GIS features*
* *Compare coinciding attributes for consistency*

*Current state of data – lesser-used PODS tables include the risk table. Often due to non-PODS data sets being utilized for risk analysis software. Issues can arise when combining PODS and non-PODS data sets.*

*Estimated degree of unknown pipe data discussed – includes basic pipe information such as diameter, wall thickness, grade, long seam, date installed, and manufacturer. How was information derived? Is approximate; looked at a sample of data sets to estimate.*

*Opportunities for improvement –*

*Criteria for including attributes in algorithms discussed – e.g., is data usable, can it be aggregated, does enough data exist, can it be integrated, compatible with algorithm, etc.*

*Additional opportunities for improvement – Allocate time/budget to fix data during migration. Prevent data loss during asset sale – GIS as part of due diligence. Prevent data loss during construction – GIS-ready deliverables and real-time quality metrics. Data completeness assessment with example key performance indicators (KPIs). Enhancing current practices (include ILI (often not integrated)), equipment inspection records, procedures/audit information), and emerging opportunities discussed. Sharing foreign line crossings data noted as being very useful but not yet realized; practical challenge is not technical, but more organizational cooperation (team noted that Common Ground Alliance may be one venue to explore). Noted that current pipeline data sets are usually not connected or in 3D, but could be.*

*Big Data – term for data that is so large or complex that new tools are needed. Predictive analytics is one end-goal of applying Big Data. Can concentrate on improving known data sets for now and make ready for eventual next generation systems integration data platform.*

*Team discussion:*

* *Data quality metrics? Not stored in PODS currently, some operators integrate into their own data sets. Likely included in PODS NextGen.*
* *When transferring asset data, does PODS have a default definitions/nomenclature that can be a commonality? Yes, PODS has a recommended set, but is not required.*
* *When transferring asset data, does PODS have standard domain/codelist values that can be a commonality. No, PODS has a recommended set of domain values, but is not required.*
* *Any guidance on combining disparate data sets? Common location referencing (spatial and Linear). Next generation PODS will likely have interoperability aspects. Any metrics for data quality? Not explicitly; is a challenge (includes both qualitative and quantitative aspects); may be a part of the next generation PODS.*
* *PODS members larger or smaller operators? Mid to larger companies. Steve Allen – with respect to smaller operators – is there sort of a “PODS-light” version that is more scalable for small systems? PODS NextGen will start as a PODS-light type of approach. Discussion also noted that beyond the basic pipeline characteristics to set up the model, use of the various “modules” is optional at the user’s discretion, so entire PODS structure need not be used.*
* *Team noted that PODS is only about the storage and structure of data, not the use/application of that data.*
* *Any use for design type work? Separate issue – PODS only stores the data. Any sort of application can extract that data for a specified application. However, the PODS community has an understanding of many applications, so data structure keeps those in mind when being developed.*
* *How handle data uncertainties when extracting information – e.g., where “unknown” values are encountered for specific areas such as SCC? Default values for unknowns are normally assigned within the risk application or during the ETL process into the risk application.*
1. Technical Presentation #2: Scope and Purpose of API’s Technical Report on Data Integration (TR 1178) (Bruce Dupuis (TransCanada))

*API TR 1178: Integrity Data Management and Integration.*

*APR RP 1173: Safety Management System (previously released)*

*API RP 1160: Integrity Management (new version scheduled for ballot in 2017 to integrate update cycle better with the new sub-tier doc’s). [Note: Delineates threat management vs. risk assessment (previous version combined)]*

* *Three sub-tier documents that focus on specific aspects of pipe integrity*
	+ *RP 1176 Assessment and Management of Pipeline Cracking (previously released)*
	+ *RP 1133 Managing Hydro-technical Hazards (to be released shortly)*
	+ *TR 1178 Data Management and Integration Outline (to be released shortly)*

*Selected TR 1178 selected details:*

* *Data Quality – breaks general notion of “quality” into constituents*
* *GPS Coordinates – defines consistent terms and nomenclature (more than one standard)*
* *Alignment for Purpose of Pipeline Integrity – common frames of reference and alignment (including estimating spatial error at joint-to-joint level)*
* *ILI Lifecycle – Designed for non-Integrity personnel to help frame data needs*
* *As-Built Asset Integration – Introductory level of detail.*
* *Annex A: Data Integration and Interpretation Report – Based on experience of operators, including best practices.*

*Other pending API data integration initiatives – API 1163 revision (ILI tool quality through performance and validation), and onboarding construction data into operations.*

*Team discussion:*

* *For 1178, is emphasis mainly on ILI data? Not necessarily, but ILI data often used as an example of an exemplary practice.*
* *MOC (Chapter 11) background (e.g., new data being introduced into existing model) – More of highlighting MOC challenges vs. a lot of details. Data expectation aspects of 1178 make data alignment easier to manage.*
1. Technical Presentation #3: Accounting for Data Uncertainty in Risk Models (Ernest Lever; GTI)

*Why even need risk models? Overall goal is improved prevention and mitigation decisions through balanced lifecycle management: risk/cost optimization; mission success.*

*Uncertainty due to data quality – Concept of data pedigree levels; have defined five levels. Record Integrity, Authenticity, Compliance, Transparency, Reliability.*

*How to score data quality – Can combine pedigree level, and other data quality attributes and come up with a score. However, should also look at quality and uncertainty.*

*For example, look at multiplicative impact of uncertainty – should be thought of as non-linear when independent factors are multiplied. This puts in doubt simple data quality attribute relative scale type of scoring. Levels of uncertainty can actually be orders of magnitude different vs. a linear understanding.*

*Example of probabilistic risk model that includes uncertainty modeling: Aldyl A gas distribution systems. 32 main factors. Especially challenging when consider interacting factors. Must inject causality into associations/dependencies or are open to false dependencies that are really just random associations. Performed via a Semantics/Ontological approach.*

*How to attach numbers to an associative network? Depends on type of variable. Apply a Rate Process Method (RPM) for example, and look at sensitivities of model. Also compare to actual experimental and real life data. Assign relative ranking values of 1-5 based on probabilistic uncertainty bands. Look at underlying physical examples to identify which parameters fit into which relative ranking failure bands. Derived an “equivalent stress intensification factor (SIF)” model that does a reasonable job of capturing degradation over time, and focuses on parameters that an operator can control/understand.*

*Once a Bayesian/associative network is defined, can run the model backwards (so to speak) and define which parameters are the most important to the overall result. This can then be useful in simplifying a more workable model.*

*Team discussion:*

* *In general, how many data points, are important to have in-hand? Only really used the 180 or so data points developed by Dupont originally, as they were defensible/accepted by all.*
* *How compare with transmission line pipe application? Could likely come up with equivalent models for threats of interest (e.g., cast iron pipe).*
* *What if do not have something as good as the original reference Dupont data? Chose it as it was available and defensible. Could also do with other available data sets to come up with the equivalent SIF.*
* *With respect to grooves, why choose this as the basis for the equivalent SIF? Noticed that real world plastic pipe had long linear grooves/scratching.*
* *Why use Bayesian/probabilistic approach? Thought to be the best way to characterize uncertainty and change of uncertainty as better information is developed, and to capture the actual causality/dependencies. Also allows for different detailed sub-level modeling and provides a method to collect these together.*
1. Technical Presentation #4: Performance Data Analysis for Nuclear Power Plants (Industry Data Approaches) (Shawn St. Germain; Idaho National Laboratory)

*Ongoing since 2001 in various forms. Objective is to collect, code assure quality of, and maintain all reactor operating experience for the Nuclear Regulatory Commission.*

*Primary data sources are Licensee Event Reports, Monthly operating/daily status reports, ICES (equipment reliability) database (often get root cause information). Input into an Integrated Data Collection and Coding System, from which various data sets are generated. Use of data include the Mitigating Systems Performance Index (MSPI), risk-informed testing/Tech Specs, Reactor Oversight Process (ROP), significance determination process, risk-informed engineering programs, plant PRAs, plant risk monitors for configuration control, etc.*

*Data Collection is turned into PRA data via an Integrated Data Collection and Coding System.*

*Have various data quality controls in place to help confidence in coding/classification of data.*

*Equipment reliability data is generated from industry-collected data. INL process to classify data helps keep data consistent.*

*INL produces NRC Reactor Operating Experience Data, which includes a variety of industry-average failure rate and frequency data. Include use of Bayesian techniques to estimate updated failure rates. Produce both system-level and component-level data.*

*Team discussion:*

* *How resolve data conflicts (e.g., two-person review team disagrees)? Two reviewers try to resolve; can take to a tie-breaker if needed.*
* *Risk significance thresholds defined by NRC? Yes. Process of risk significance threshold determination has been in place for ~ 15 years.*
* *Failure rates are determined by looking at valid period of performance that has flat performance and sufficient amount of data. Re-look at annually to see if needs to be adjusted. Most represent approximately five-years of information.*
* *System does not address things that have never occurred (e.g., large piping breaks); in those cases use an engineering-derived value that is informed by the zero occurrences to-date.*
* *How handle a new “widget” manufacturer? Not all that relevant to industry, but generally use initial vendor data informed by judgment of similar equipment performance.*
* *How similar is database for things like line pipe, etc.? Would have to look at case by case, and pick a starting point for which to gather data.*
* *How account for variability in local conditions? Do not explicitly account for at the component level; most nuclear plant important safety components are in similar operating environments.*

Wednesday, March 8

1. Safety Moment (Mark Clayton/Steve Nanney) Cal Centers, CenterPoint Vice President of Safety and System Integrity

*Safety is not just about following the rules/compliance. Must also use our brains and judgment to be effective.*

1. Technical Presentation #5: Data Integration – Industry Practices and Opportunities for Improvement (Tony Rizk; Boardwalk Partners)

*Desired to have variety of information/data for line pipe available in real time to all employees. Used a PODS ESRI Spatial Model. Includes risk tool (Geonamic) (relative risk model).*

*Completely cloud based GIS (Amazon (EC2) Elastic Compute Cloud environment. Uses elasticity/virtualized hardware for the computing platform.*

*Now use own hi-res imagery from fly overs (vs. USDA imagery) and an automated HCA calculator (raw images set up for algorithm by BWP personnel). Have a similar Class calculator.*

*Also have an baseline assessment tool. Not only about HCAs, MCAs, USAs – it is about safety – protecting people, environment, and greatly reducing risk to company.*

*Have an MAOP application that shows individual joint MAOP and basis. When have an unknown data parameter, can develop a plan to get that data.*

*Have an automatic alignment sheet generation tool.*

*Demonstrated IntegraLink GIS viewer overlay of data. Is available to field personnel via smart phones, tablets, etc. Includes risk values for each portion of pipe. Can essentially access all pipe/environment information at a click.*

*GIS system is commercially available. Had a PODS model prior to implementation; all company data is now on a common data scheme.*

*Fourth year of work with this system. Initial target was to get a system in place in seven months. About 1.5 years to get bug free. Continuing to improve.*

*How much training for field personnel – Piloted with select personnel, then when debugged release for training field personnel (use WebEx, etc.).*

*Risk model – Use a Geonamic D.R.I.P. model (Drivers, Resistors, Indicators, Preventers) with risk ranking scores. Is a relative risk model. Worked with (now) TRC and customized for Boardwalk.*

*GIS type of interface allows for viewing of risk data. Can view at HCA-level, dynamic segment level, etc.*

*Can do real time what-if analysis for things like P&M measures – have a pick list to choose from and estimate the risk reduction value (can enter cost, etc.). Risk reduction metric looks at cost/mile\*risk change to give the RRM parameter. Generally use during project planning/budgeting process (versus in-field).*

*Team discussion:*

* *MOC process for data? Have an MOC review process for all data updates; limited personnel access to PODS. Have all data available to field personnel allows for easier ID of errors and eventual correction – electronic forms available and their use helps report issues (including things like bell hole inspection form, etc.)*
* *Has GIS/risk tool changed annual work planning process, or just validating existing process? Say both. Tool makes it easier to risk rank projects, so has improved resource allocation on a risk basis.*
* *Consequence modeling include just HCAs? No, look at other structures in addition to HCAs.*
* *Include in business decisions also? Yes; provides a risk perspective. Tool allows for easy ID or risk drivers, which helps personnel understand data/results.*
* *How integrate MOC process with a live system? Any identified change goes through a process for validation; once approved goes into the live system.*
1. Technical Presentation #6: Data Integration – Industry Practices and Opportunities for Improvement (Pete Veenstra; TRC)

*Current Trends – Industry has difficulty in sharing information and knowledge: competitive reasons, investment reasons, balance between under/over proscribing regulatory requirements.*

*Risk models and modeling GIS data uncertainty – relational databases and pipeline data models have been used to-date. Works well; good at managing assets, but not as good at recording conditions. Weakness is that cannot support unstructured data, un-validated data, or massive amounts of data.*

*Geography is important – allows to integrate things in a common coordinate system but forces us to deal with different things. Allows data to be overlaid to form new data in a different manner than the standard SQL table join.*

*Making accessible to small operators – is a challenge. Other industries have set up smaller data models and collectively built open source technologies for data management.*

*One general challenge is that pipeline data/information systems are often built in separate silos (e.g., CP, SCADA, etc.). Projects tend to be done/finished without much thought for data hand off.*

*Lack of operational excellence for the desire of a “system of record” in a data form. Digital workflow is often incomplete especially in new construction transition to operations.*

*Cloud provides a scalable up to date method to provide any reasonable amount of computing power; should not be a resource issue for most organizations. Notification platform can provide needed monitoring. Provides a platform for data import/sharing between data sets.*

*Unstructured data: JSON and GeoJSON provide mechanism for organizing unstructured data. Structure makes it searchable (dump into a big pile, not data tables). Can then be searched, organized, and aggregated on demand if tagged appropriately.*

*Bottom line is to pull data from various sources into an aggregated data set that can be consumed by the end risk product.*

*Machine learning and Business Intelligence – are tools out there, but need to use in an informed manner.*

*Risk models and Data Uncertainty – Risk models are both machine-driven and SME-driven. Data certainty – few models look at things like how many default values were used; noted that causality is an important part of likelihood.*

*Small Operators – PODS LITE (part of PODS Next-Gen) is one way to address this (would include NPMS reporting capabilities). In development. Should lower entry threshold into this data environment.*

*Team discussion:*

* *Small operators have different data flow than larger organizations. How make sure that results get to the overall organization to get risk information/results in the proper decision making context for all size organizations? Is not so much a data issue as a business organization issue.*
	+ *Some companies use the concept of a “risk register” to look at various types of risk on a common basis.*
1. Technical Presentation #7: Operator’s Process for Using Data in Relative models with Respect to Decision Criteria (Pat Westrick; Marathon Pipeline (MPLX))

*Noted that “Data Integration is Pointless without Analysis that Drives Decisions…”*

*Data Integration – Various regulatory requirements of data integration listed. MPLX has four main points where data integration is highlighted in their process – IMP applicability, assessment intervals, other repair conditions, additional P&MMs, periodic evaluations.*

*Can group data by purpose (objective/model) – discharge volume/rate, overland transport, air dispersion, receptors, other specific likelihood factors, etc. When do this exercise, it reveals other factors not listed in the regulations but that are necessary (e.g., elevation profile, absorption factor, etc.).*

*Have various data sources from disparate types of company databases.*

*Data quality – Dimensions of data quality need to be better defined. Example shown from 1991 MIT study: assigned 4 key dimensions – useful, accessible, believable, interpretable. MPLX assigned into 3 practical buckets – useable data, desired data, useless data.*

*Need to choose a modeling technique (MPLX uses a variety of techniques). Guidance for developing models: choose between differentiation or normalizing as a strategy, choose aggregation strategy, research algorithms, design for incomplete data, make assumptions (make sure are documented), review frequency distribution of results, calibrate range of results (e.g., an “8” is the same across different modeling techniques).*

*Validation of results – compare high and low risk segments, look at predictive vs. ILI results, model historical events and compare to real life events (e.g., release events, line hits (puncture and non-puncture).*

*Decision Criteria – Send risk scores to organization, but more important practically, assign recommended action levels (A-D) (based on consequence/probability matrix) to top 5% of risk results (by threat areas, overall risk score, etc.). Action level defines necessary level of response actions.*

*Have a technique to convert relative score to absolute risk (allocated from indices scores) [Note: risk scores increase linearly with risk (i.e., difference between 2 and 4 is more or less the same as between 6 and 8.] Team: Can this sufficiently discriminate between segments (scores look very similar in the graphs)? MPLX: Understand that many scores are normalized so end up with similar numerical results; are working to improve this.*

*MPLX also noted they have a separate process risk evaluation approach that looks at non-asset risk (outside the scope of this presentation).*

*Decision Examples –*

* *Systems that can affect HCA: decision criteria is simple*
* *Assessment intervals: do remaining life estimate (incorporate consequence consideration as an added safety factor)*
* *Risk informed dig locations (195.452(h)(4)(iv)): (MPLX considers this to be a lagging form of risk analysis)*
* *Periodic evaluations: risk analysis, risk evaluation, risk treatment (P&MMs, process/program improvements)*
* *Leak Detection evaluation and new EFRD locations treated as unique exercises. EFRD uses cost/benefit ratio, which needs conversion of relative risk scores to absolute risk.*

*Conclusions – Data integration occurs throughout integrity process; make the most of data available, work on data desired to improve model in future. All integrity functions can benefit from risk prioritization; without criteria, won’t know whether enough has been done; criteria should be set to coincide with company risk tolerance.*

*Team discussion:*

* *How treat humans in the system without HRA? Look at response times of operators for certain operational systems. For incorrect op’s, look at complexity of operations to score index model (guidance is available in the appendix of API 580 & 581).*
* *Corporate risk tolerance – How define underlying corporate risk value (to derive the A-D score)? Have six different 7x6 likelihood/consequence risk matrices (safety, financial, etc.) to define the A-D risk level definitions. Are doing some F/N type of analysis for HVL lines; still working on risk tolerance for that context. Say believe that for multiple fatality events, need to move away from the risk matrix approach.*
* *How handle interactive threats? Build into the risk score algorithms.*
1. Technical Presentation #8: Relative Risk Model Applications at Southwest Gas (Mary Bartholomew; Southwest Gas)

*Started with Bass-Trigon (now American Innovations) relative risk model. Have continued improvements and customization (additional B31.8S inputs, SWG-specific changes).*

*SME’s are used to LOF and COF estimates annually.*

*Have process for continual data improvement – additions to current data sets, addition of new sets.*

*Use of outputs – HCA addition assessment prioritization, system-wide PMM benefit evaluation.*

*Prioritization of HCAs – Use method 2, bring in new identified sites on annual basis – post baseline. Have 10 years to bring in, but use to plan on bringing in on an orderly basis.*

*PMM Analysis – Part of risk analysis process (using the AI risk model). Goal is to obtain adequate spread in values to demarcate benefit rankings of PMMs – PMM index (based on regulatory drivers; simple sum relative index), Threat index (calculated by threat (EC, IC, etc.)), P/D (Prevention/Detection) Method Value index (utilizes LOF weighting from risk model; accounts for cost of implementation via a Value Index). Apply a “Goodness Ratio” for benefit/cost – Value Index\*ROF. Done for each HCA; top P/D methods determined both system-wide and HCA-specific. Then evaluate if already in place or something additional is needed.*

*Continuing Improvement Areas – More data, interactive threats (NYSEARCH), and additional statistical methods. Continuing to move in a quantitative direction, addressing data gaps, determining true system risk and areas of focus (current model is fairly static, looking for additional insights beyond regulatory/standards base requirements).*

*Team discussion:*

* *Use of term “flush” data? What that means is a complete reload of the risk model input data annually to make sure have that all updates are used in the model re-runs.*
* *How maintain consistency between scores? Use definitions to define scoring to help consistency.*
* *Application of NYSEARCH interactive threat study – Apply the results to the index model as recommended, or use differing values? Unique operating environment make a difference? Already have some interactivity in their models, so are looking to adjust existing algorithm to account for the NYSEARCH interactivity; will rerun the model and see if results make sense.*
* *Data quality mechanisms? Have put a lot of data QA into the new ESRI system (drop-down menus, etc.) to help with consistency.*
* *How model set up to differentiate between threat levels (i.e., all threats are not the same)? Use SME-based weightings.*
* *Do SMEs provide effectiveness ratings of the PMM measures? Yes, only use full coverage, 50%, or no coverage options.*
1. Technical Presentation #9: Risk Acceptability/Tolerance (Probabilistic Models): Application of Probabilistic Risk Model Results (Alex Tomic; TransCanada)

*[Note: These examples contained probabilistic approaches.]*

*Use individual risk, societal risk*

*Target risk levels – quantitative methods can achieve more consistent levels of risk. [Risk targets are smeared (statistical distribution) which makes it more appropriate for segment risk.]*

*Target reliability levels – deterministic methods have implicit reliability targets. Reliability methods have explicit reliability targets (what is max allowable?). Reliability targets are more location specific and appropriate for site specific and defect specific management.*

* *Societal acceptance level for TransCanada in system wide risk assessments*
	+ *Individual risk – calculated using predicted failure frequencies and consequences*
		- *Use 1% lethality zone (probability of lethality is at least 1%). Can use PIR (edge of PIR is 1%) or PIPESAFE approach (both apply to non-sheltered person).*
		- *Includes “interaction length” – length of pipeline that can affect individual, per the 1% criteria.*
		- *Frisk(s,r)-LoF\*Pign\*Pf(s,r). Individual Risk is the integral of Frisk over the distance from the pipeline.*
		- *Lethality based on TransCanada-specific analysis.*
		- *Calculated regardless of whether or not any people are known to be present.*
		- *Acceptability criterion for IR is 1E-4/yr (higher is intolerable, less is tolerable).*
	+ *Societal risk – calculated for residents*
		- *Includes risk aversion – lower tolerance to high consequence incidents (F/N curve)*
		- *Includes “evaluation length” concept – sliding length that can affect any particular structure.*
		- *Use a 15-minute length of release (past that time consequences are not much different)*
		- *Use a 1% lethality n each structure*
		- *F=LoF\*Pign\*Linterval*
		- *Acceptability for SR is taken from the Irish CER approach (is normalized to a 1km length)*
	+ *Reliability (LOF or POF) (pipelines/km/yr)*
		- *Failure Pressure Ratio (FPR) = Rupture Pressure Ratio (RPR)*
		- *FPR=Predicted burst pressure/MOP; Remediation criterion: FPR ≤ SF (safety factor)*
		- *Reliability=(1-POF)*
		- *Deterministic compliance leads to high variable risk levels*
		- *Risk and LOF are not equal concepts (difference in consequences), but still desire a LOF criteria for non-safety risk criteria and push for zero failures/year.*
		- *LOF for gas is 1E-3/km-yr (based on an interpretation of class location values)*
		- *Reliability-Based criteria for rupture is pipeline and ILI specific , and location-class specific. Define a POF threshold for each ILI run.*
		- *For leak, criteria is 1E-3/yr (per defect) – is equivalent to 72%wt ILI depth*
	+ *Developing a similar approach for crack defects*
	+ *Reliability targets for engineering assessments – two types:*
		- *Defined targets*
		- *Relative targets*

*POF reduction values come from differing techniques (CFER, etc.)*

*Team discussion:*

* *How update results between ILI runs? Monte Carlo analysis assumes a corrosion growth rate based on past ILI history (or assumed rate based on similar conditions) for that location.*
* *Predictive side to approach? All risk estimates are inherently predictive in the analytical approach, consider defect growth in acceptance criteria, etc.*
* *Where have ILI history, have a joint-specific corrosion growth rate? Yes. For some vendors, do a defect growth rate estimate.*
* *Criteria for re-route? Is done on a case-specific basis.*
* *How big department working on this? 15 people doing risk; is relatively automated.*
1. Technical Report Overview: Overview of BSEE-2016-XXX Probabilistic Risk Assessment Procedures Guide for Offshore Applications (Partial Draft) (Robert Youngblood (Idaho National Laboratory)

*BSEE is developing a PRA Procedures Guide (NASA helping develop, INL assisting that effort)*

*Consensus standards also exist to help industry prepare PRAs (in prep for regulatory submittal)*

*Starting point is the NASA PRA Procedures Guide*

* *How safe is the facility?*
* *How do we manage risk?*

*Do risk analysis – to support decisions.*

*BSEE approach covers both risk analysis techniques and results presentation/interpretation*

*Have a running example that runs throughout the document as a way to have a common thread in the document.*

*Continuing to develop document in 2017. When anticipate final document? Planned for 2017. Really have a five-year program that started last year.*

*Team discussion:*

* *Data: Appendix related to data discussed different data sources. If use generic industry data, need to at least compare with local data to see if generally valid.*
* *Risk-informed definition in document; basis? Came from historical nuclear industry evolution, where risk-informed came as one additional element of the decision process.*
1. Conclusion of RMWG Activities

*Need for additional meeting to discuss relative risk models – e.g., how being used now, and how to improve?*

*Team discussion:*

*- Erin Kurilla: Need to better define what want risk models to do. Does not want to see the work industry has done to-date pushed aside.*

*- Steve Nanney: Not sold on one approach or the other; need to recommend when to apply certain models in the guidance document. AGA – Need to have better guidance on what is needed at an additional meeting.*

*- Steve Allen: Some basic things needed to be discussed such as basic data quality, etc.*

*- Dane Spillers: Having some material related to SME/expert solicitation in the report would be helpful.*

*Steve Nanney:*

* *Need a relative risk meeting? Will query team via Doodle poll.*
* *Draft document – Will let team know when next draft will be released in the next week or so.*
* *Expect a “final” meeting with the full team to discuss the next draft document.*
* *May interact with NTSB to see if any additional perspective would be helpful*
1. Exit De-briefing (Steve Nanney)
	1. Any needs from scribe for exit notes? *None identified.*
	2. Any group member comments on the conduct of the meeting and any improvements that could be implemented? *None identified.*

**Attachment 1 – Meeting Participants (\* indicates remote participant)**

|  | **Name** | **Company**  |
| --- | --- | --- |
|  | Allen, Steve | URC of Indiana (NAPSR) |
|  | Bartholomew, Mary | Southwest Gas |
|  | Beets, John | TRC |
|  | Borener, Sherry | PHMSA |
|  | Brush, Ron | New Century |
|  | Cavendish, Brandon | Colonial |
|  | Childs, Charlie | Kinder Morgan  |
|  | Clayton, Mark | CenterPoint Energy  |
|  | Cross, Robert | NASA |
|  | Dupuis, Bruce | TransCanada |
|  | Elaoudiy, Mohamed | Phillips 66  |
|  | Hereth, Mark | P-PIC |
|  | Holohan, Vincent | PHMSA |
|  | Kuhtenia, David | Cycla |
|  | Kurilla, Erin | AGA |
|  | LaMont, Mike | New Century |
|  | Leewis, Keith | Leewis & Associates (B31.8 & B31.8S) |
|  | Lever, Ernest | GTI |
|  | McClymont, Andy | Cycla |
|  | McLaren, Chris | PHMSA |
|  | Nanney, Steve | PHMSA |
|  | Osman, CJ\* | INGAA |
|  | Rizk, Tony | Boardwalk Partners |
|  | Saulters, Stuart | API |
|  | Scrivner, J. | Boardwalk Partners |
|  | Spillers, Dane | PHMSA |
|  | St. Germain, Shawn | Idaho National Lab |
|  | Steere, Jacob\* | Consumers |
|  | Tooley, Jared\* | Kinder Morgan |
|  | Tomic, Aleksandar | TransCanada |
|  | Veenstra, Peter | TRC Solutions |
|  | Westrick, Patrick | Marathon Pipeline |
|  | Youngblood, Robert | Idaho National Laboratory |