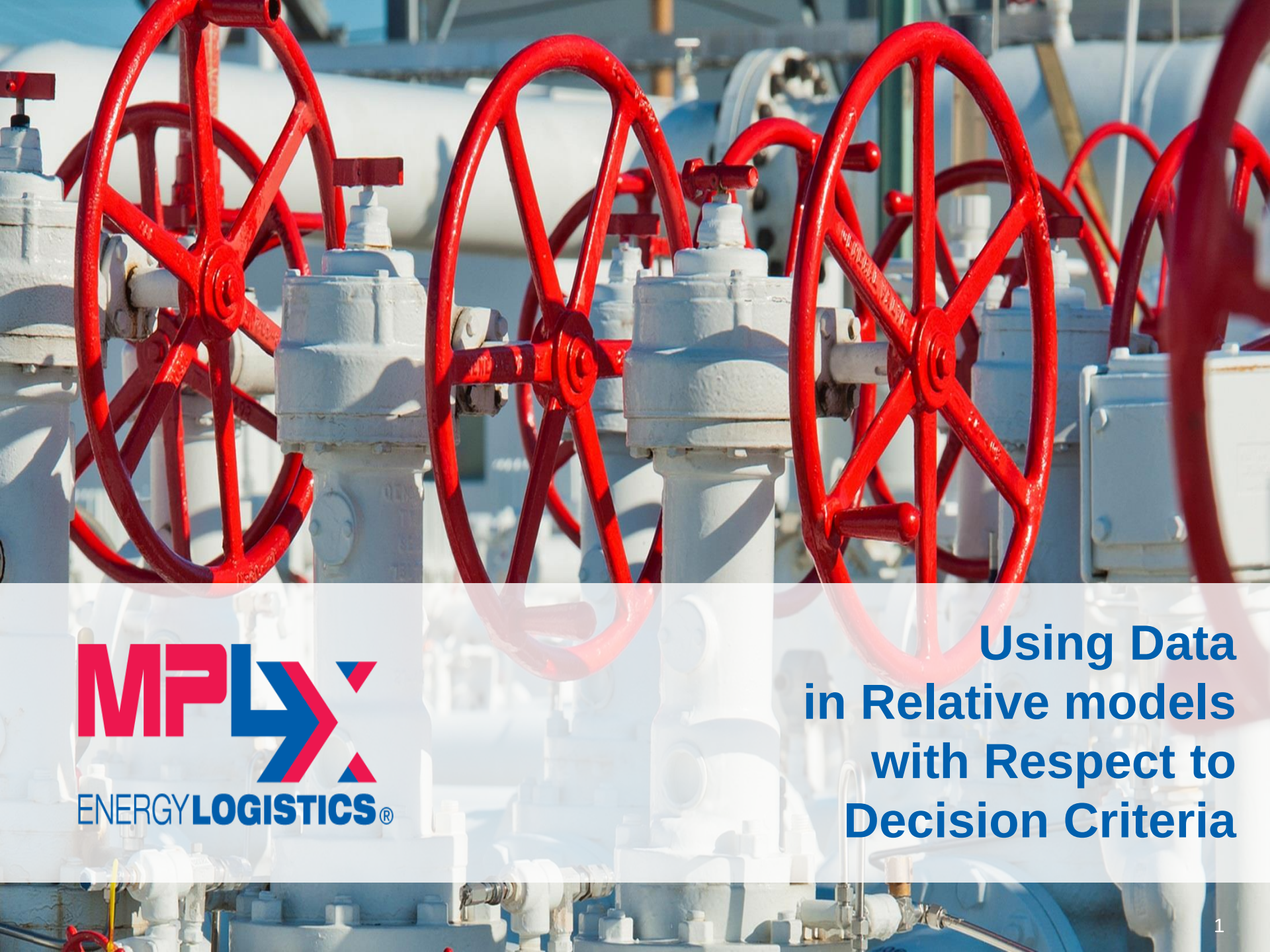


MPLX ENERGY LOGISTICS®

Using Data in Relative models with Respect to Decision Criteria

Main Topics

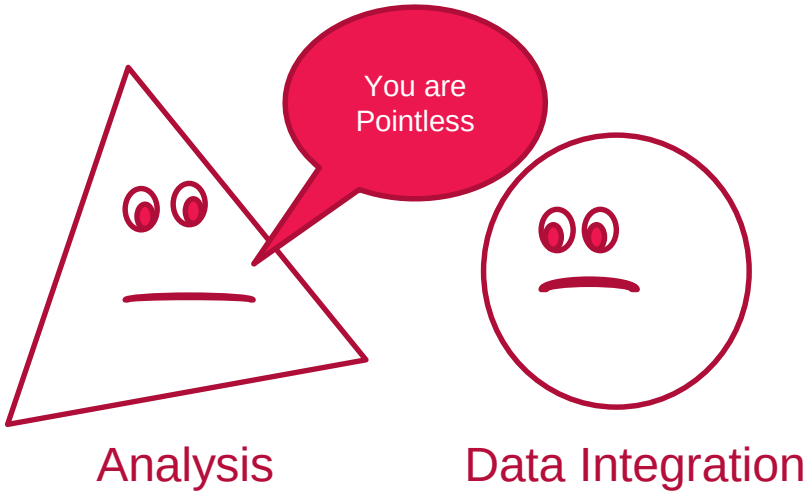
- **Data Integration** – Where does it fits in the integrity process?
- **Decision Criteria** – How can we use the results to make decisions?
- **Decision Examples** – Deeper dive into five data driven decisions from IMP

Risk Model Development

- Define the Objective
  - What question are we trying to answer?
- Identify Data Sources
- Choose a Modeling Technique
- Develop Model
  - Integrate data
  - Build algorithms
  - Perform calculations
- Validate Results
- Define Criteria
- Continuous Improvement

Define the Objectives

"Data Integration is Pointless without Analysis that Drives Decisions"



Modeling Objectives from IMP:

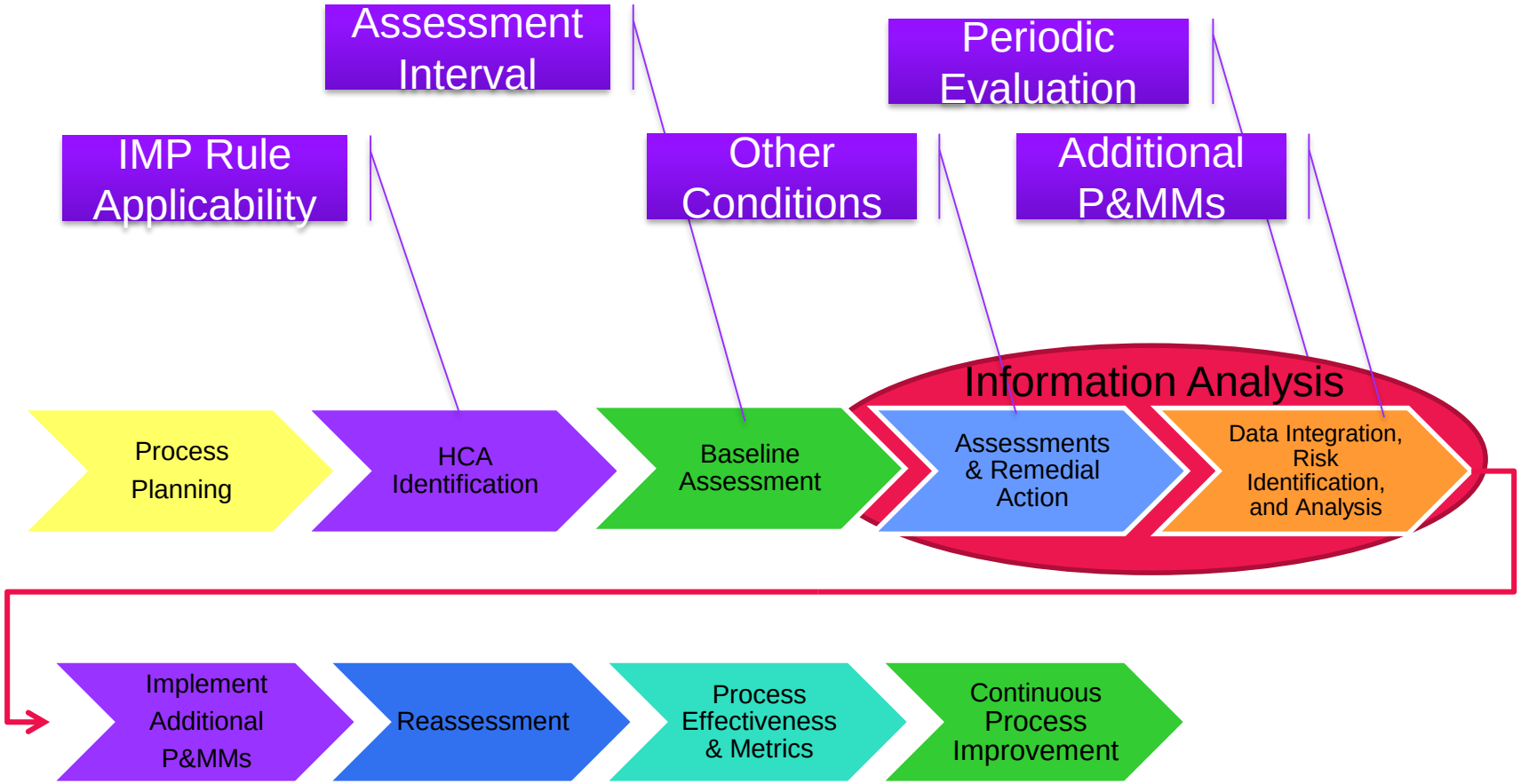
- IMP Rule Applicability
- Assessment Interval
- Other Conditions
- Additional P&MMs
- Periodic Evaluation

these objectives may be addressed by a single model or separate models

§195.452 objectives requiring data integration

- Determining IMP Rule applicability
  - Risk Factors for Evaluating Potential Impact on HCAs — § 195.452 (a) & Appendix C(I)
- Establishing an Assessment Schedule
  - Risk Factors for Establishing Frequency of Assessment — § 195.452 (e) & Appendix C(II)
- Identifying Other Conditions for remediation
  - Remediation of Other Conditions — § 195.452 (h)(4)(iv)&Appendix C(VII)
  - Information Analysis — § 195.452 (g)
- Periodic Evaluation of Integrity — § 195.452 (j)
  - Remediation of Anomalous Conditions — § 195.452 (h)(4)(i) through (iii)
  - Remediation of Other Conditions — § 195.452 (h) (iv)&Appendix C(VII)
  - Information Analysis — § 195.452 (g)
  - Evaluating need for additional P&MMs — § 195.452 (i)
- Evaluating need for additional P&MMs
  - General P&MMs - Risk Factors — § 195.452 (i)(2)
  - Evaluating Leak Detection — § 195.452 (i)(3)
  - Determining EFRDs needed — § 195.452 (i)(4)

§195.452 objectives requiring data integration



Identify Data Sources

Risk Factors from Appendix C (I) - abridged

(1) Terrain surrounding the pipeline.

(2) Drainage systems such as small streams and other smaller waterways

(3) Crossing of farm tile fields.

(4) Crossing of roadways with ditches along the side.

(5) The nature and characteristics of the product the pipeline is transporting (refined products, crude oils, highly volatile liquids, etc.)

(6) Physical support of the pipeline segment such as by a cable suspension bridge. An operator should look for stress indicators on the pipeline (strained supports, inadequate support at towers), atmospheric corrosion, vandalism, and other obvious signs of improper maintenance.

(7) Operating conditions of the pipeline (pressure, flow rate, etc.).

(8) The hydraulic gradient of the pipeline.

(9) The diameter of the pipeline, the potential release volume, and the distance between the isolation points.

(10) Potential physical pathways between the pipeline and the high consequence area.

(11) Response capability (time to respond, nature of response).

(12) Potential natural forces inherent in the area (flood zones, earthquakes, subsidence areas, etc.)

Categories of Data vs. Actual Data

…an operator must base the assessment schedule on all risk factors that reflect the risk conditions on the pipeline segment. The factors an operator must consider include, but are not limited to:

- (ii) Pipe size, **material**, manufacturing information, coating type and condition, and seam type;

- Wall Thickness?
- Wall Thickness Tolerance?
- Grade?
- Minimum Yield Strength?
- Allowable Yield Strength?
- Minimum Tensile Strength?
- Elongation?

- Modulus of Elasticity?
- Thermal Expansion Coefficient?
- Chemical Composition?
- Heat Number?

Group Data by Purpose (objective / model)

- Discharge Volume and / or Rate
  - Pipe Diameter
  - Operating Conditions
  - Distance Between Isolation Points
- Overland Transport
  - Terrain
  - Nature Drainage (waterways)
  - Man-Made Drainage (ditches, field tile, physical pathways)
  - Response Capabilities (nature of response, time to respond)
  - Product Hazard Level (nature, characteristics)
- Air Dispersion
  - Product Hazard Level (nature & characteristics)
- Receptors
  - Population Areas (HPA, OPA)
  - Commercially Navigable Waterways
  - Unusually Sensitive Areas
- Likelihood Factors – Seem out of place here
  - Potential Natural Forces (flood zones, earthquakes, subsidence areas,…)
  - Physical Supports (stress indicators, atmospheric corrosion, vandalism,…)
  - Hydraulic Gradient

Group Data by Purpose (objective / model)

- Discharge Volume and / or Rate
  - Pipe Diameter
  - Elevation Profile
  - Operating Conditions
  - Distance Between Isolation Points
  - Operator Time to Respond (Detection, Shut-down, Isolation)
- Overland Transport
  - Terrain
  - Nature Drainage Channels (waterways)
  - Man-Made Drainage Channels (ditches, field tile, physical pathways)
  - Absorption Factor
  - Response Capabilities (nature of response, time to respond)
- Air Dispersion
  - Product Hazard Level (nature & characteristics)
  - Thermal Radiation Endpoint
  - Overpressure Endpoint
  - Toxic Endpoint
- Receptors
  - Population Areas (HPA, OPA)
  - Commercially Navigable Waterways
  - Unusually Sensitive Areas

Data Sources

P&MMs

Damage Prevention Practices
Corrosion Management
Pressure Cycle Management
Inspections
Remediation
Pipe Replacement
Leak Detection
EFRDs
Emergency Response

Data Quality

Dimensions of Data Quality

- **Believability**
- **Value Added**
- **Relevancy**
- **Accuracy**
- **Interpretability**
- **Ease of Understanding**
- **Accessibility**
- **Objectivity**
- **Timeliness**
- **Completeness**
- **Traceability**
- **Reputation**
- **Representational Consistency**
- **Cost Effective**
- **Ease of Operation**
- **Variety of Data & Data Sources**
- **Concise**
- **Access Security**
- **Appropriate Amount of Data**
- **Flexibility**

"Dimensions of Data Quality: *Toward Quality Data by Design"; Wang, Guarascio (1991)*

Data Quality

4 Simplified Data Dimensions:

- **Useful** – relevant and timely; fits requirements for making the decision
- **Accessible** – data is available and user has the means and privilege to get the data
- **Believable** – complete, consistent, credible, and accurate
- **Interpretable -** user understands the syntax and semantics of the data

3 Practical Buckets:

- **Useable Data** – Useful, available, and mostly believable
- **Desired Data** – Useful and fairly accessible, but not yet available or believable
- **Useless Data** – Either not useful or not accessible

Choose a Modeling Technique(s)

- Air Dispersion
- Bow-Tie
- Consequence/Probability Matrix
- Cost / Benefit
- Decision Tree
- Discharge Modeling
- Event Trees
- Fatigue Analysis
- Fault Trees
- FMEA
- Human Reliability Analysis
- Monte Carlo
- Overland Transport
- Remaining Life
- Risk Indices
- Structural Reliability

Guidance for Developing Models

- choose between differentiation or normalizing as a strategy
- choose aggregation strategy
- research algorithms
  - evaluate data required vs. current data quality
  - document sources
- design for incomplete data
- make assumptions, if
  - effects on uncertainty are understood
  - assumptions are appropriately conservative
  - assumptions are documented
- review frequency distribution of results
- calibrate range of results

Guidance for Validating Results

- Compare high risk segments, low risk segments, and probability distribution to expert instinct (“gut feel”)
- risk level predicted by environmental conditions compared to damage measured by assessment
- model historical events and compare to real life results

Decision Criteria

How can the results be used?

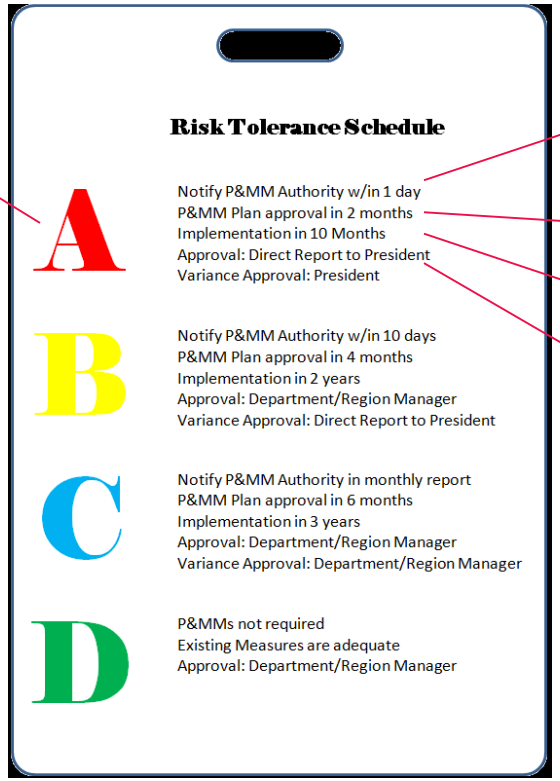
Relative scores used to prioritize efforts

Scores provided to other parts of the organization:

Absolute risk – determined by Experts

Risk Level determined using consequence / probability matrix

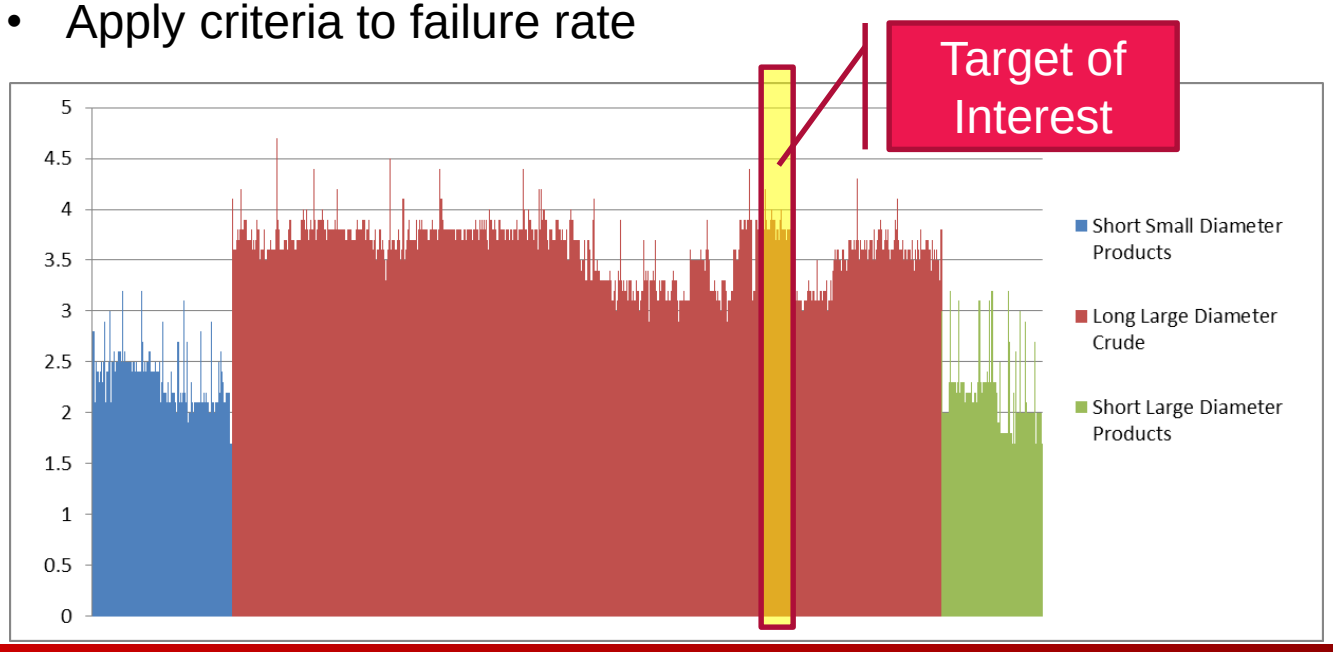
- Recommended Action Levels



- Notification Requirements
- Evaluation Deadline
- Mitigation Deadline
- Decision Maker Authority Levels

Absolute risk – allocated from indices scores

- Variable sized rectangles represent risk (Y) and distance (X)
- Total area of all rectangle represents company failure rate
- Estimate company failure rate considering:
  - Industry failures / industry mileage * company mileage
  - Company failures / company mileage
- Determine failure rate for target of interest
  - Company failure rate * area for target / total area
- Apply criteria to failure rate



Assumptions:

Scores increase linearly with risk

Decision Criteria

Deeper dive into five data driven decisions from IMP

Determining IMP Rule applicability

RESULT: Systems that Could Affect HCAs

- Decision is Consequence-based, not Risk-based
- Complex Modeling
  - Discharge Volume and / or Rate
  - Overland Transport
  - Air Dispersion (radiant heat, overpressure)
- Guidelines identify some risk factors
- High degree of conservatism is appropriate
  - Failure to identify IMP status correctly circumvents all other requirements of the rule
- Decision Criteria is simple

Establishing an Assessment Schedule

RESULT: Time-To-Reassessment (TTR) Interval

- § 195.452 (e) identifies Likelihood factors
- Guidelines identify consequence factors
  - HCA Impacts
  - Impediments to Leak Detection and Emergency Response
  - Customer Impacts (security of throughput)
- Time-To-Reassessment (TTR)
  - Remaining Life Analysis of time-dependent threats acting on known features
  - Safety Factor adjusted based on…
    - consequence and
    - threats without identified features
      - estimated using environmental conditions

Identifying Other Conditions for remediation

RESULT: Risk-Informed Dig Locations

- Anomalous conditions - § 195.452 (h)(4)(i) through (iii)
  - Requirements are prescriptive
  - Does not allow for risk-informed decision

- Other conditions - § 195.452 (h)(4)(iv)
  - Information Analysis integrates…
    - identified features
    - with other risk factors
    - to drive Risk-informed decisions
  - Lagging form of Risk Analysis

Other Conditions considered

- Depth POE greater than depth threshold (metal loss)
- Pressure POE greater than pressure threshold (metal loss)
- Deformation located on the bottom of the pipeline (below 4 and 8 o'clock position)
- Deformation on pipeline with a high D/t ratio
- External metal loss affecting a girth weld
- External metal loss inside a casing
- A stray appurtenance not associated with a valve or station piping
- Deformation located at a foreign crossing
- External metal loss in an area with suspect cathodic protection
- External metal loss in FBE coated pipe
- Metal loss where IDP is greater than limiting component (i.e. valve, flange, etc.)
- Deformation affecting a girth weld or long seam.
- Deformations within close proximity of one another

Other Conditions considered

- Anomaly within close proximity of a target item
- Anomaly previously remediated in an ineffective method
- A change beyond acceptable thresholds since the previous assessment
- Dent prioritization via API 579, estimated strain and other analysis methods
- Metal loss failing Tier 1 analysis
- Manufacturing indications identified due to data correlation
- Crack type features used for tool validation
- KMAP features
- Coincident features (metal loss, crack type features, deformation)
- Metal loss in the vicinity of close and touching metal objects
- Legacy repair prioritization
- Metal loss at bends
- Metal loss at air to soil interfaces (spans)
- Metal loss in areas of suspected shielding coating
- Anomalies located at water crossings or suspect depth of cover

Periodic Evaluation

RESULT: Verify pipeline integrity;
Identify additional P&MMs to lower risk

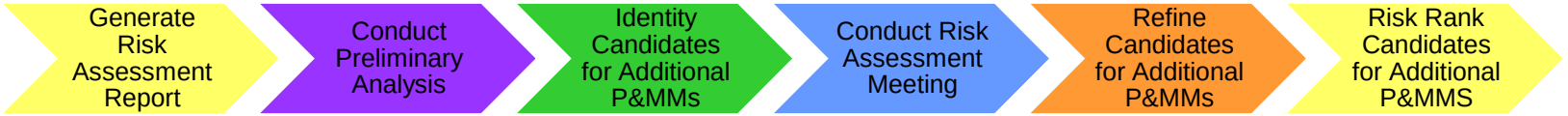
- *Risk Identification*
  - Integrate all available information
    - environmental conditions
    - operating conditions
    - existing P&MM practices
    - inspection and testing of the pipeline
    - consequences of a failure
  - Calculate risk score
  - Risk scores used to identify high risk areas

Periodic Evaluation

- *Risk Analysis*
  - Build scenarios around identified risks
  - Estimate Consequence
    - reasonably foreseeable worst case
  - Estimate Likelihood
    - elicitation of Subject Matter Experts
  - Apply Consequence / Probability Matrix

- *Risk Evaluation*
  - Determine course of action (risk-informed decision)

- *Risk Treatment*
  - Additional P&MMs or change in P&MM interval
  - Process / Program improvements



Evaluating need for additional P&MMs (Leak Detection and EFRDs)

RESULT: Improvement opportunities for Leak Detection

- Conducted as a standalone study
- Uses output from risk model
- Objectives
  - Verify acceptability of current leak detection type
  - Identify leak detection improvements
  - Evaluate new technologies

RESULT: New EFRD locations

- Conducted as a standalone study
- Consequence modeling (baseline and with proposed valves)
- Absolute likelihood in protected area derived from relative risk scores
- Cost-to-benefit based on consequence reduction

Conclusions

Data integration occurs throughout integrity process

Make the most of the data currently available

Pursue data desired to improve the model in the future

All integrity can functions benefit from risk prioritization

Without criteria, won't know whether enough has been done

Criteria should be set to coincide with company risk tolerance

?