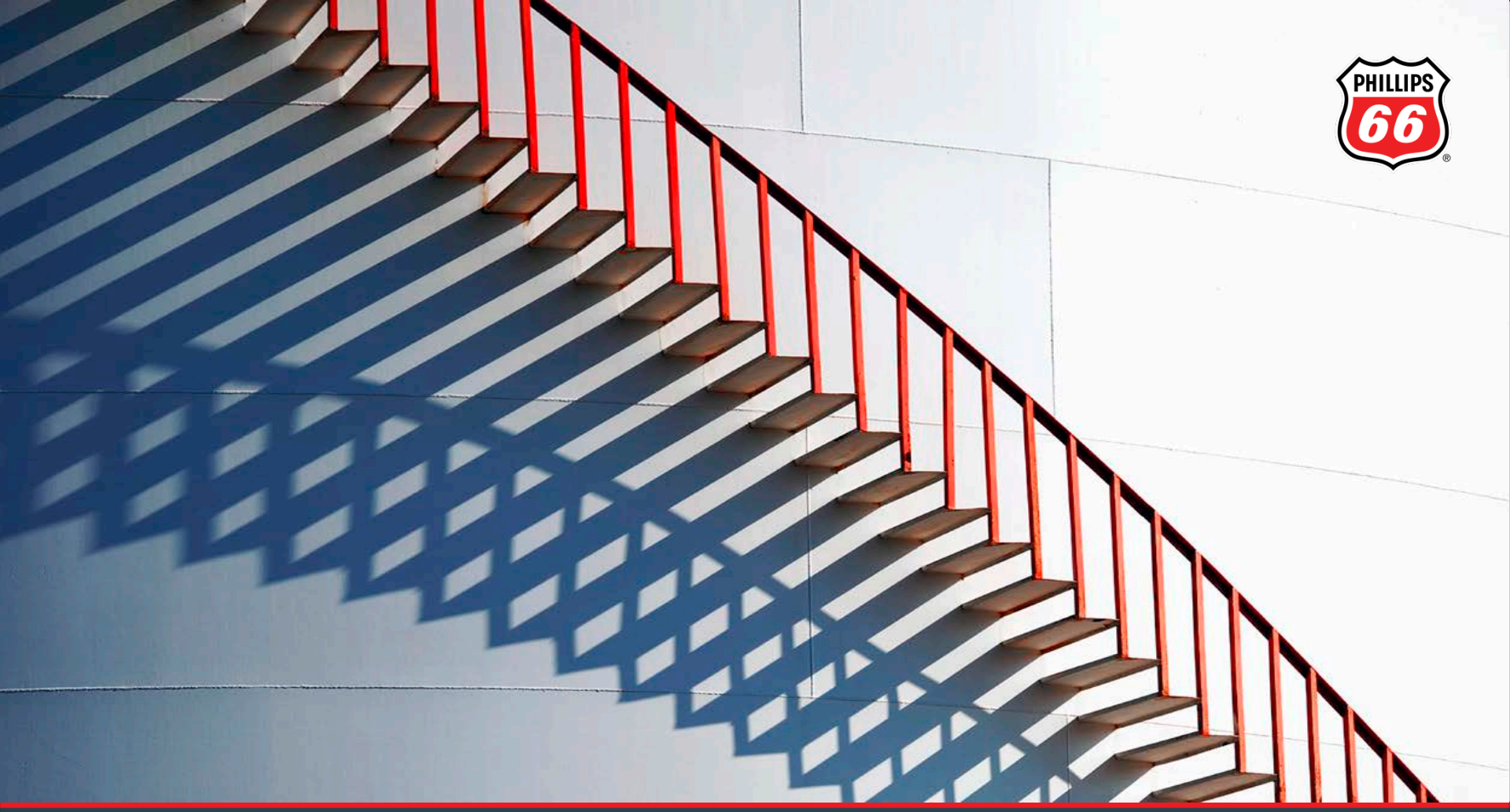


ONE OPERATOR'S USE OF A PIPELINE RISK MODEL

Aug 6-7, 2014 / PHMSA R&D Workshop / Chicago, IL

AGENDA

- How Do You Define a Pipeline Integrity Risk Model?
- What is Pipeline Integrity Risk?
- P66 Pipeline Integrity Risk Model
- Closing Comments

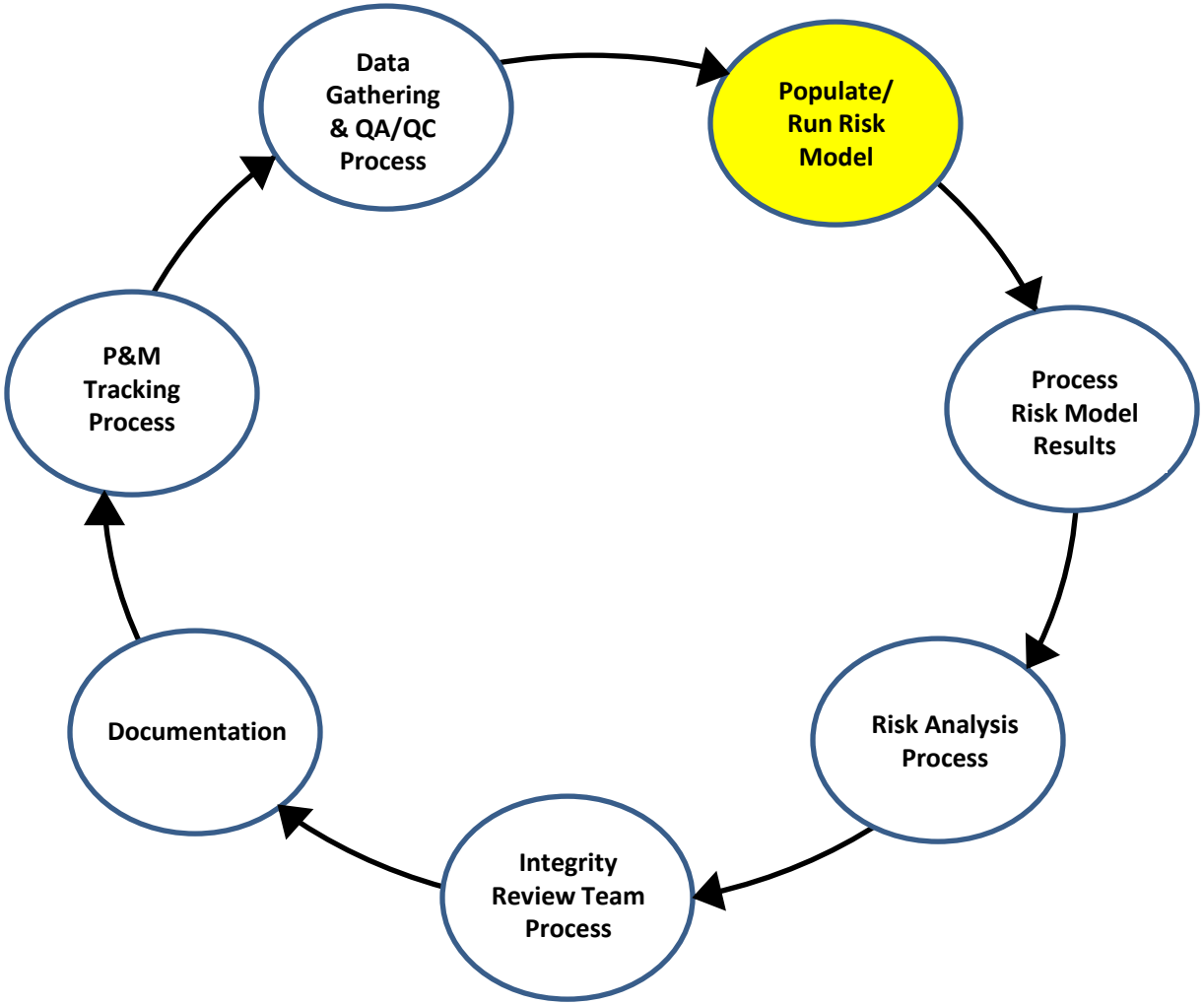
Integrity Management is Risk Management is Business Management

HOW DO YOU DEFINE A PIPELINE RISK MODEL?

- What is it?
- What exactly is it modeling?
- Where does it come from?
- What does it do?
- What's it's purpose?
- Do you need a model?
- What does it look like?
- What goes into it?
- What comes out of it?
- What do you want out of it?
- How do you know it's any good?
- Who uses it?
- When do you use it?
- Does it ever change? Why? When? How?

Integrity Management is Risk Management is Business Management

P66 PIPELINE INTEGRITY RISK ANALYSIS PROCESS



Back to Basics

WHAT'S OUR BUSINESS?

Move product from A to B

WHAT'S OUR GOAL?

Move product from A to B
with a minimum of interruption

HOW?

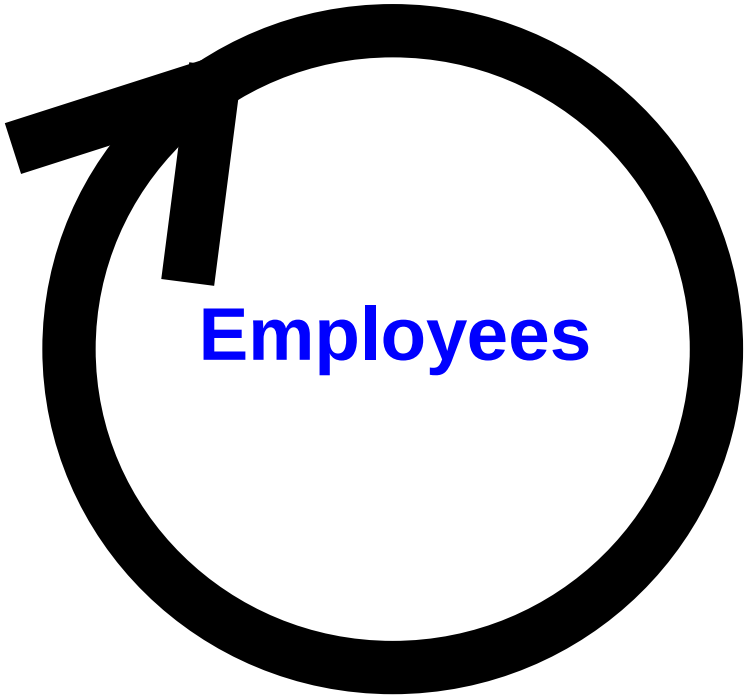
HOW DO WE ACHIEVE THAT GOAL?

A

Move product from A to B
with a minimum of interruption

B

WE HIRE EMPLOYEES



We hire employees to operate our business.

- Our business is to move product from A to B.
- Our goal is to do it with a minimum of interruption.
- We, all of us, come to work everyday to move product with a minimum of interruption.

HOW WELL CAN WE DO IT?
LET'S SEE .....

WHAT IS A BUSINESS INTERRUPTION?

- Pipeline Release
- Downtime
- Pressure Reduction
- Government Intervention
- Competition
- Scarcity of Resource
- Oversupply/Inadequate Storage Capacity

SPECIFIC TO PIPELINE INTEGRITY …

- Pipeline Release
- Downtime
- Pressure Reduction
- Government Intervention
- Competition
- Scarcity of Resource
- Oversupply/Inadequate Storage Capacity

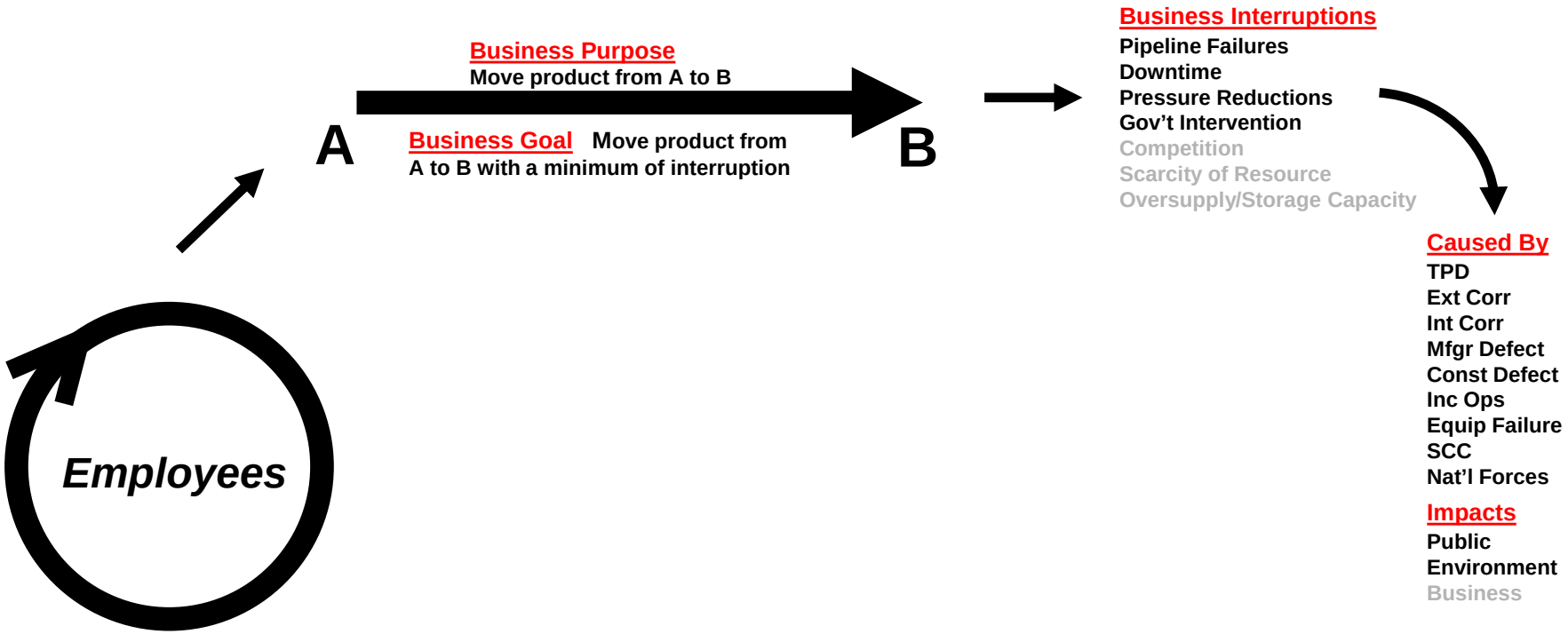
WHAT CAUSES BUSINESS INTERRUPTIONS?

- Hundreds of individual threats
- Can be grouped into a handful of threat categories
  - Third Party Damage
  - Internal Corrosion
  - External Corrosion
  - Manufacturing Defects
  - Construction Defects
  - Incorrect Operations
  - Equipment Failure
  - SCC
  - Natural Forces

(Variations of grouping exist, but all should contain the “Kiefner”, aka the B31.8S threats)

WHO'S IMPACTED ?

- In all cases
  - Our business
- Specific to Pipeline Integrity…
  - Public
  - Environment
  - Business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B
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Downtime
Pressure Reductions
Gov't Intervention
Competition
Scarcity of Resource
Oversupply/Storage Capacity
Caused By
TPD
Ext Corr
Int Corr
Mfgr Defect
Const Defect
Inc Ops
Equip Failure
SCC
Nat'l Forces
Impacts
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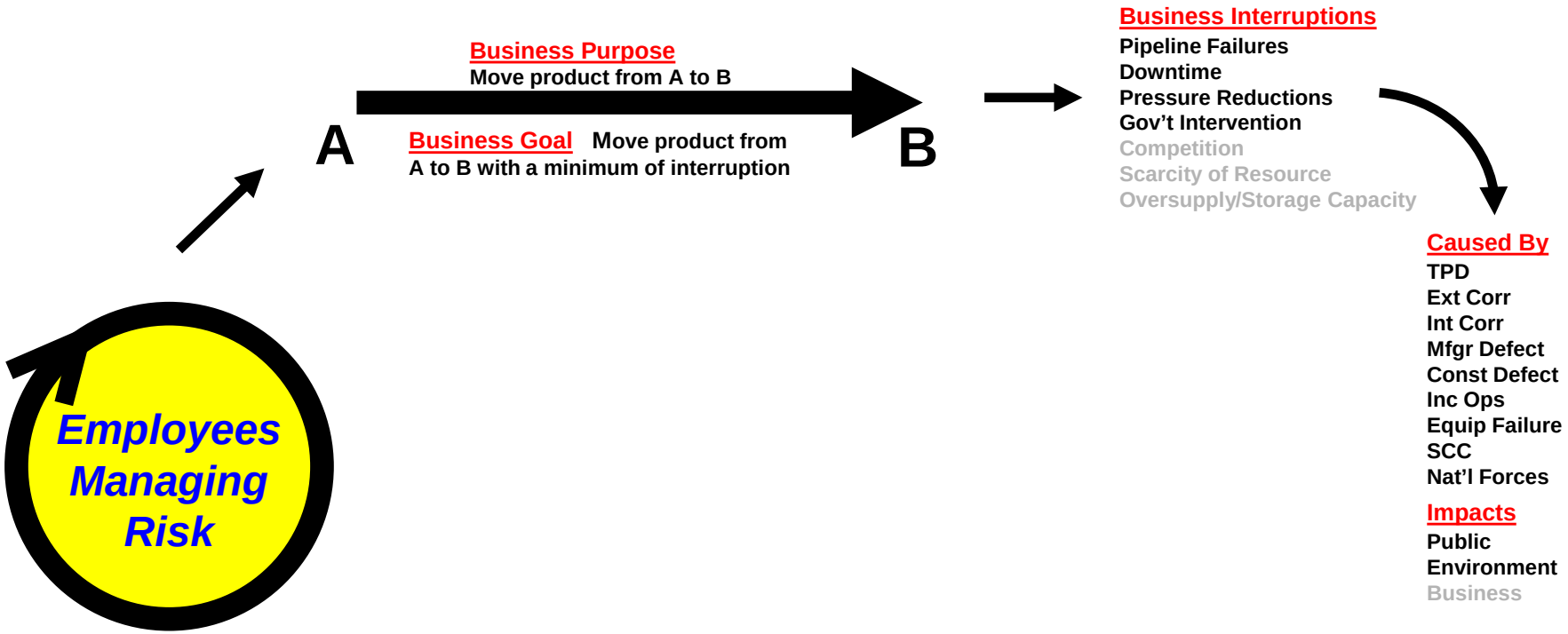
Environment
Business
Employees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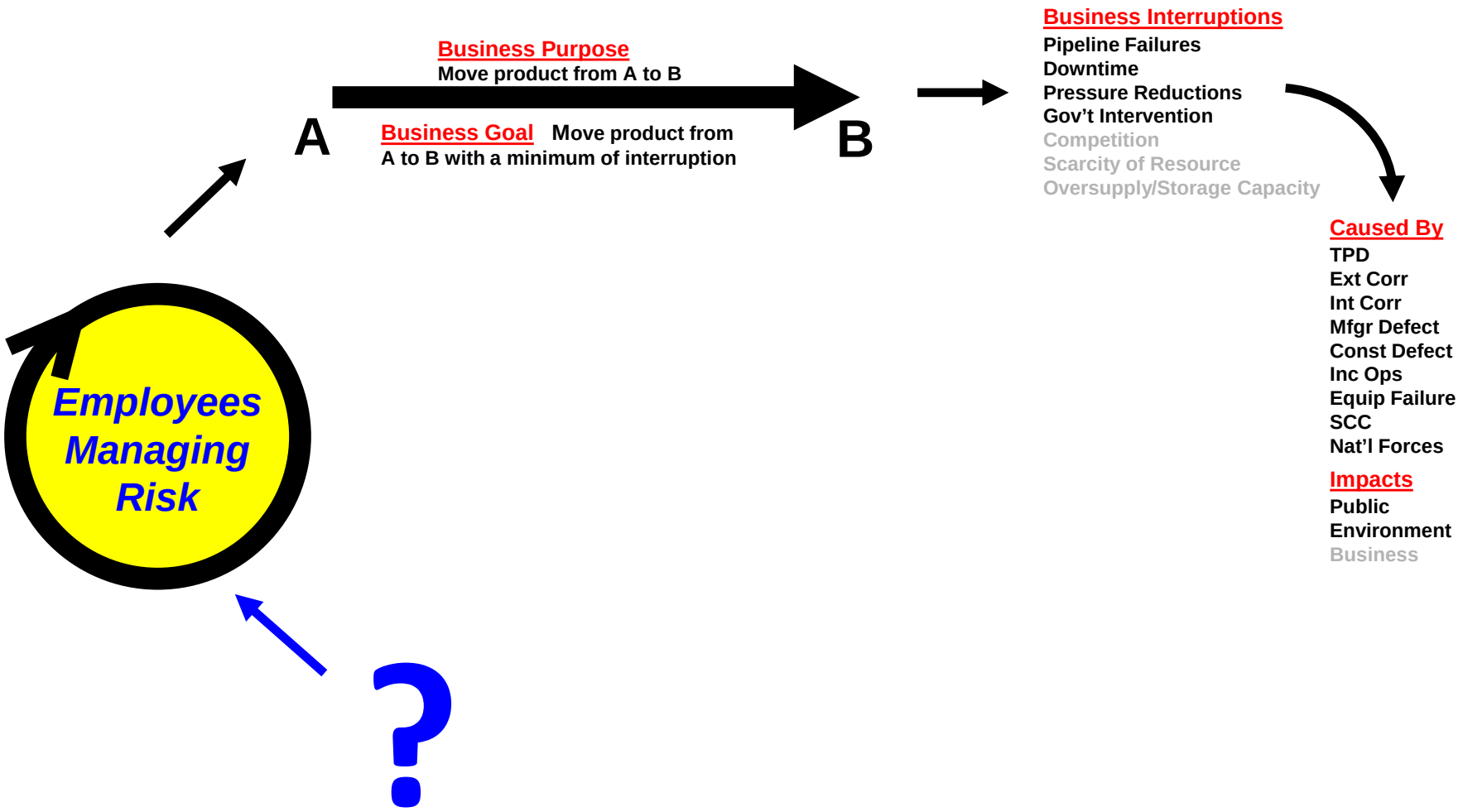
Employees Managing Risk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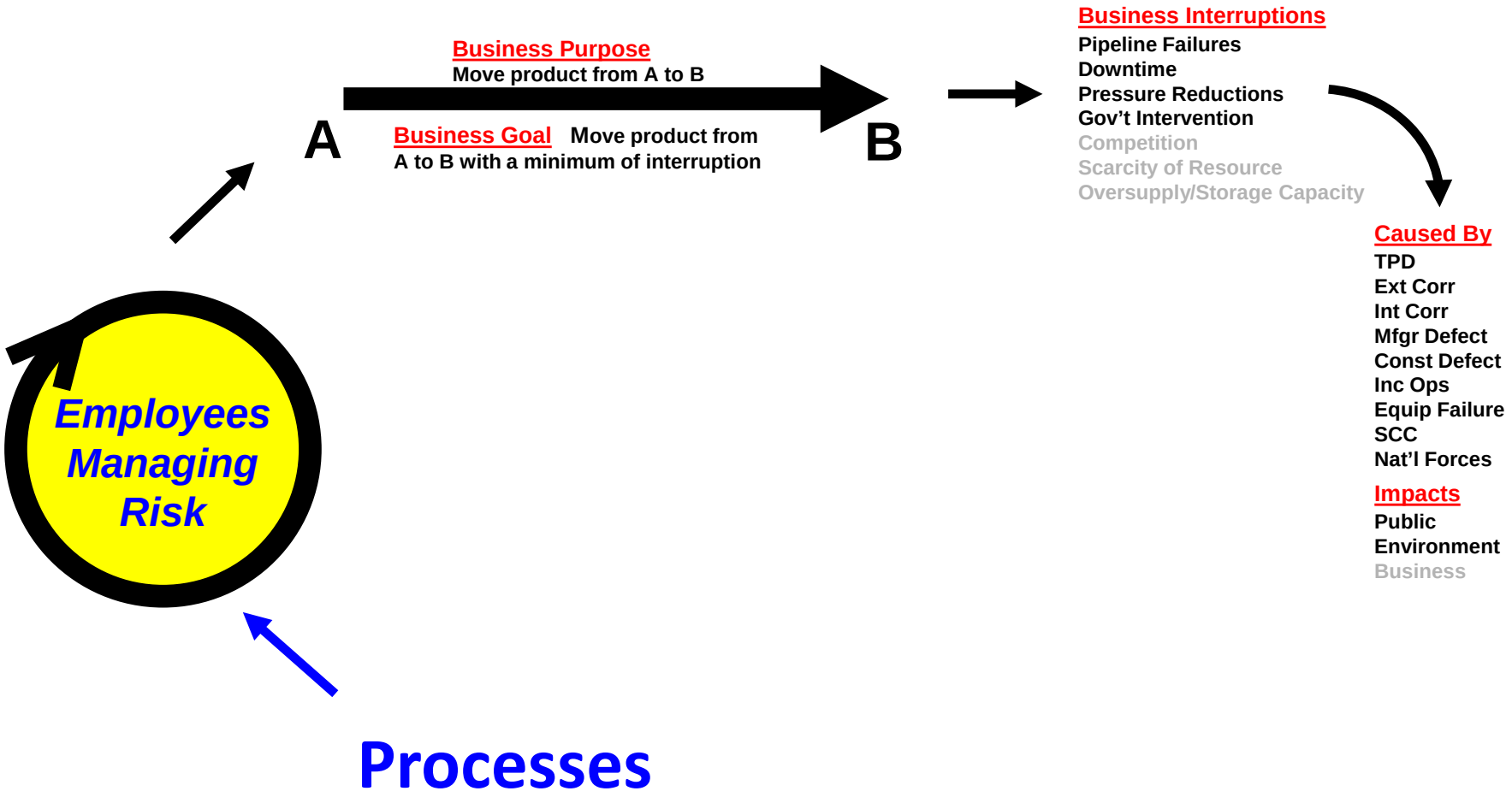
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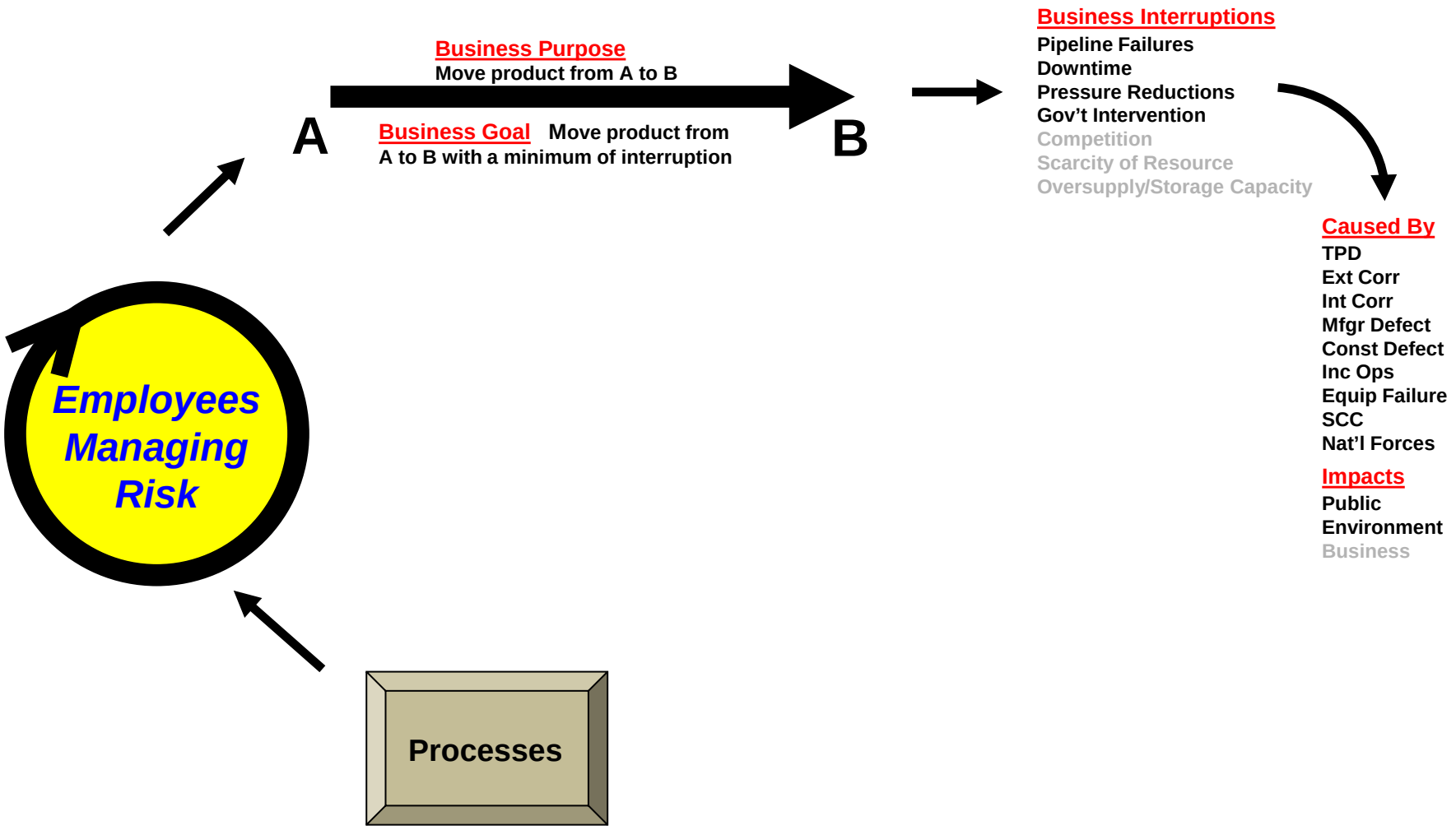
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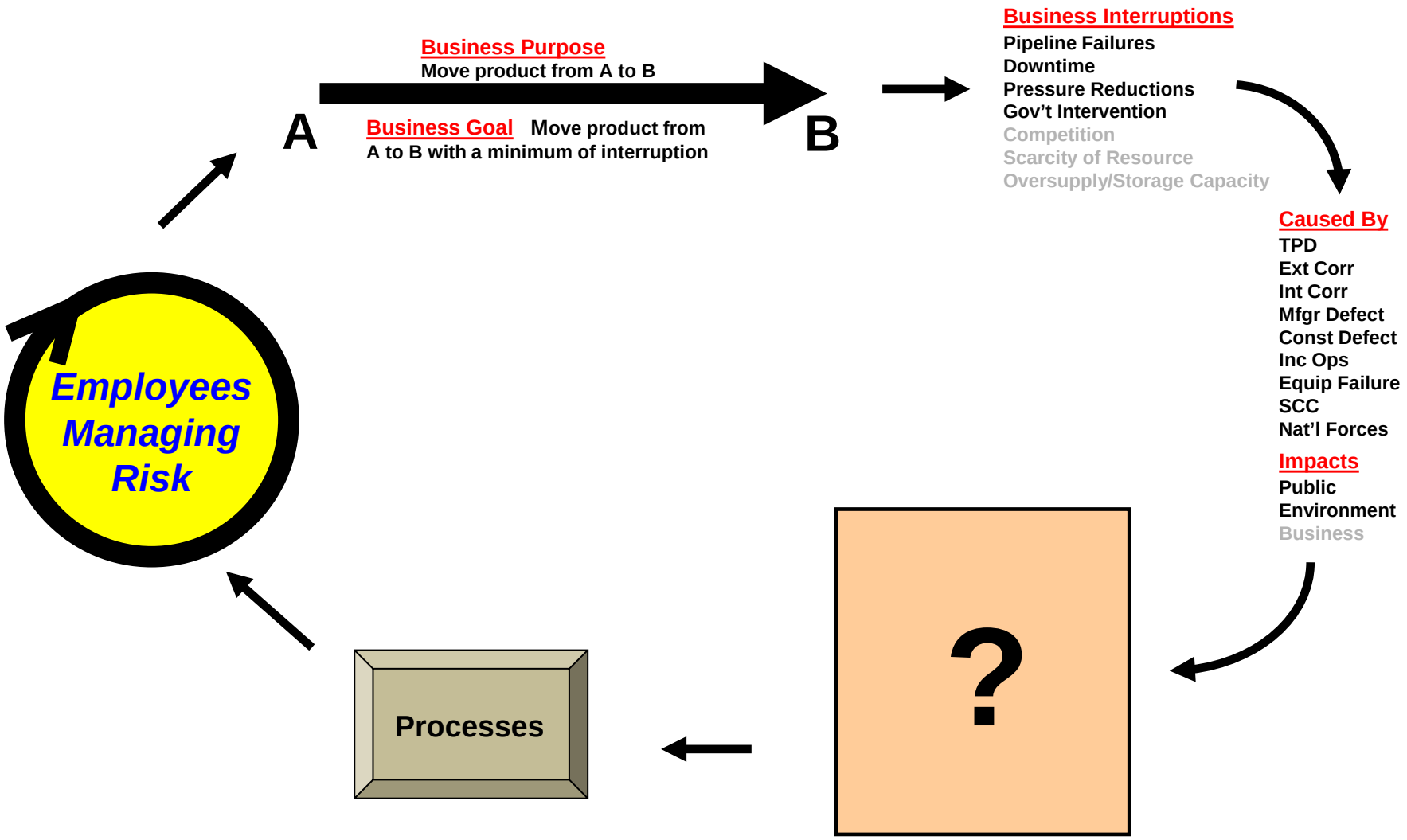
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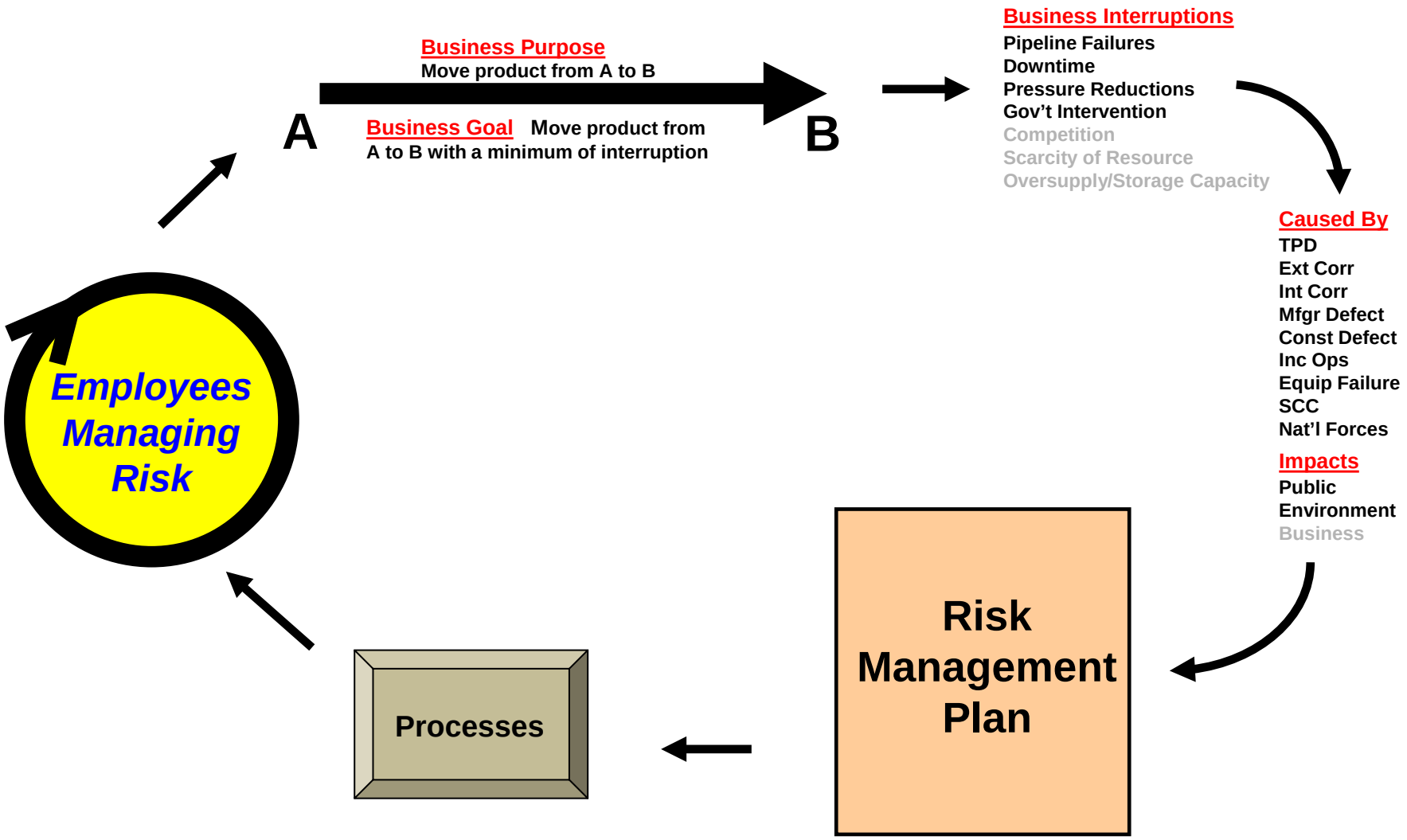
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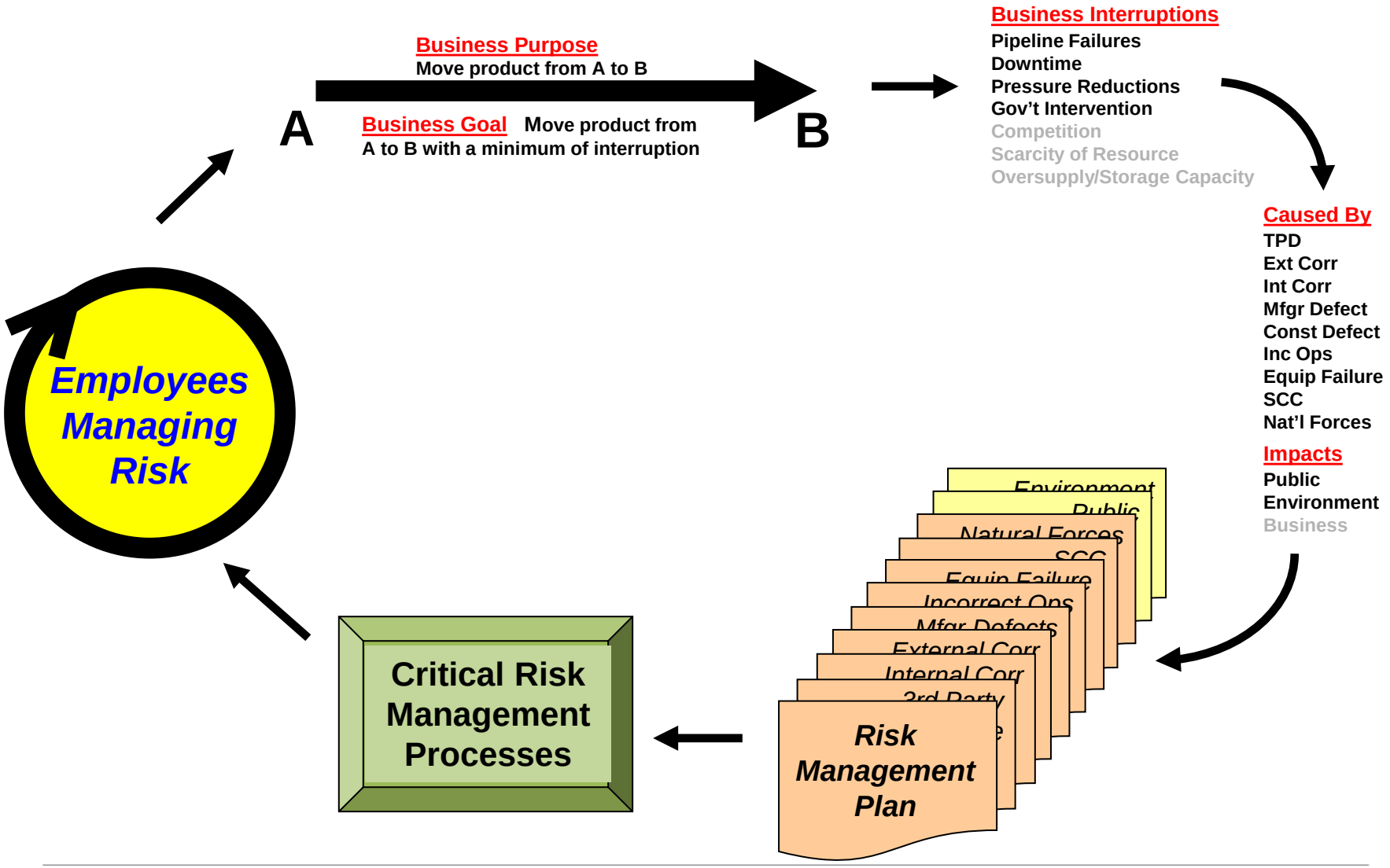
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Business
Employees Managing Risk
Critical Risk Management Processes
Risk Management Plan

RISK MANAGEMENT PROGRAMS

Third Party Damage
Excess Load/Strength Design
Depth of Cover/ Mech Protect. Program
Aboveground Site Security
ROW Clearing and Marking Program
ROW Encroachment Survey
ROW Patrol Program
One-Call Program
Public Awareness Program
TPD Integrity Assessment
Incident Investigation Program
etc, etc

External Corrosion
External Coating Program
Cathodic Protection Program
Corrosion Damage Analysis
Metal Loss Integrity Assessment
Incident Investigation Program
etc, etc

Internal Corrosion
Product Type
Flow Regime
Internal Coating
Internal Cleaning Program
Chemical Treatment Program
Internal Corrosion Monitoring Program
Metal Loss Integrity Assessment
Incident Investigation Program
etc, etc

Mfgr Defects
Pipe Purchasing Procedures
Mill Inspection Procedures
Pre-Service Hydrotest
LSW Susceptibility Analysis
Fatigue Analysis
Operating Conditions
Mfgr Defect Integrity Assessment
Incident Investigation Program
etc, etc

Stress Corrosion Cracking
SCC Management Program
Incident Investigation Program
etc, etc

Construction Defects
Type of Pipe Joint
Girth Weld Quality
Acetylene Weld Replacement Program
Movement of Acetylene Welded Pipe
Fitting & Fabrication Weld Quality
Past Practices
Integrity Assessments (lesser extent)
Incident Investigation Program
etc, etc

Incorrect Operations
Procedures, Programs, Policies
Training
Records and Maps
GIS
MOC
Incident Investigation Program
etc, etc

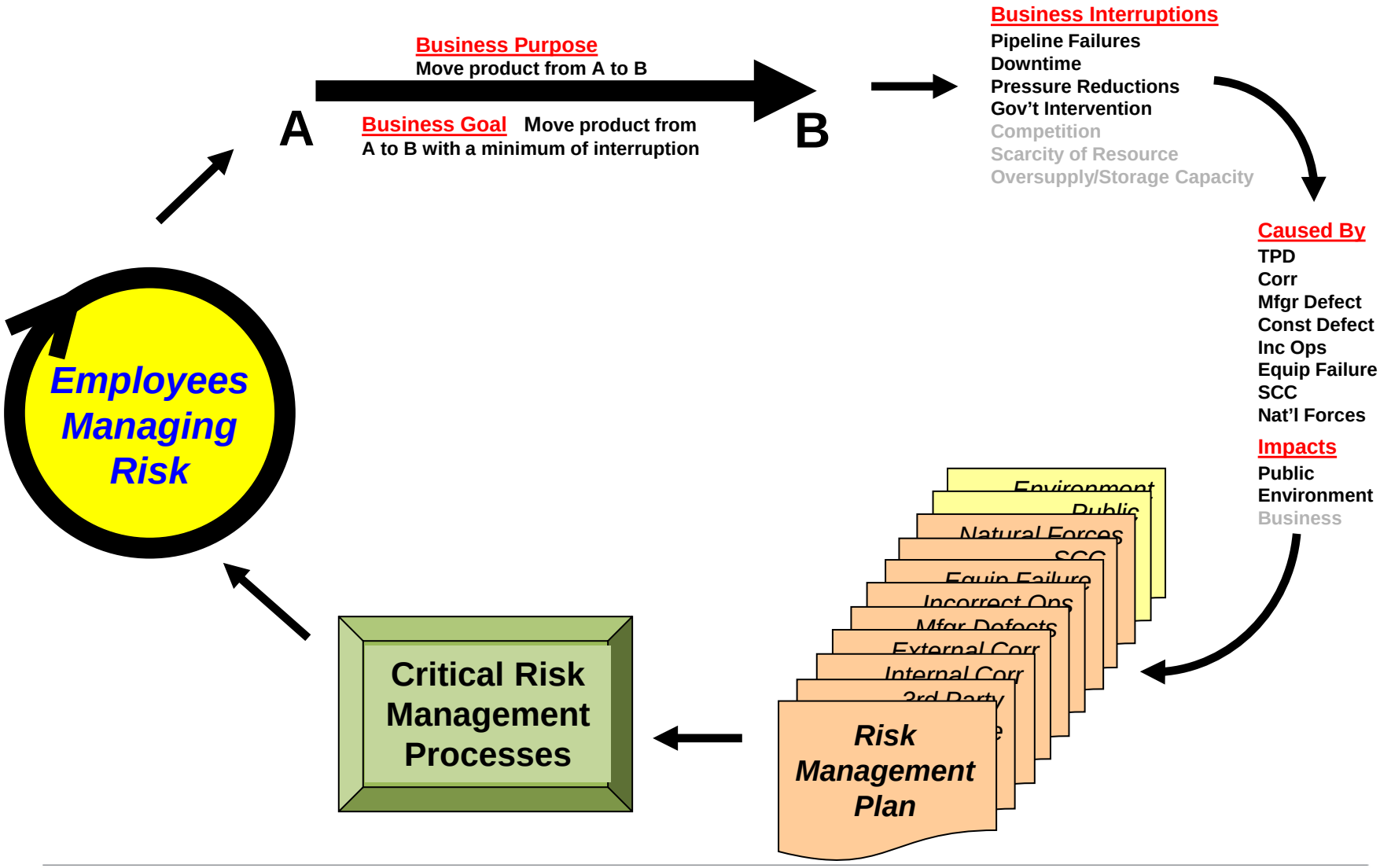
Natural Forces
Winterization Program
Hurricane Preparedness Program
Erosion Control Program
River Inspection Program
Acetylene Weld Replacement Program
Earth Movement Monitoring
ROW Patrol
Storm Damage Patrols
Incident Investigation Program
etc, etc

Consequences
Identification of Populated Areas
Identification of Critical Drinking Water
Identification of Critical Ecological Areas
Identification of Waterways
Spill Modeling
Site Accessibility Survey
Leak Detection Program
EFRD Program
Public Awareness Program
Emergency Response Program
Incident Investigation Program
etc, etc

EXAMPLE – DETAILS BEHIND TPD PROGRAMS

Aboveground Site Security
Agricultural Areas
Blasting Policy
Boring/Directional Drills
Commercial Areas
Commercial Fish Farms / Fish Hatcheries
Commercial Nurseries/Tree Farms - augers/digging
Community Engagement
Construction/Developing Areas
Deformation Inspection Tools
Depth of Cover
Depth of Cover Survey Program
Design Factors
Drainage Ditches
Easements/Restrictions/Legal
Encroachment Program
Encroachment Surveys
Established Areas
Field Tiles
Foreign Pipeline Crossings
Future Development Areas
Heavy Equipment Crossing ROW
High Risk Analysis
Hunting Areas (target practice/aboveground site)
Hydrotests
Incident History
Industrial Areas
JSA's (1st & 2nd parties)
Landfills
Landowner Meetings
Leak Detection - pressure drops
Leak Reporting
Line Lowerings
Load Stress Analysis
Major/Minor TP Projects
Mechanical Damage Evaluation
MFL Inspection Tools
Min Wall Standards
NPMS posting
Number of One-Calls
Oil & Gas Production Fields - Active and Abandoned
OneCall Program
Over-design (e.g, thicker wall pipe)
Parallel Lines
Participation in CGA / other industry groups such as PRCI
Patrols
Planning/Permitting
Power Line Installations
Public Awareness
Pump Stations, Valve Sites
Quarries/Mining/Blasting
Ranching/Fencing (augers/digging)
Residential Areas
Road Ditch Maintenance
Road/Hwy/Bridge Construction
ROW Clearing
ROW Marking
ROW Patrol
Security Assessments
Security Inspections
Seismic Surveys
Shared ROW Corridor
Span Inspections
Technolocy Advancements / PRCI
TPD Integrity Assessment
Train De-railments
Tree Voucher Program
Type of Land use
Utility Crossings
Vehicular Traffic Accidents
Vibration Studies/Analysis - e.g., pilings/driving
Waterways - dredging, anchors, vessel impact
etc, etc,etc

PIPELINE INTEGRITY RISK MANAGEMENT



P66 PIPELINE RISK MODEL DRIVERS

- Capture the company's pipeline integrity risk mgmt plan

- Answer three questions about each threat/conseq along each pipeline:
  - Where does the threat/conseq apply and to what extent?
  - What are we doing about it?
  - Is what we're doing working?

- Keep it simple, clear, and concise

P66 PIPELINE RISK MODEL - OVERVIEW

P66 Pipeline Risk Model Overview

Threat / Consequence	Risk Factors Used to Assess Each Threat / Consequence
1. Third Party Damage	
2. External Corrosion	
3. Internal Corrosion	
4. Manufacturing Defects	
5. Construction Defects	
6. Operational Error	
7. Equipment Failure	
8. Stress Corrosion Cracking	
9. Natural Forces	
10. Consequences	

1. Third Party Damage
1. Third Party Activity
2. Depth of Cover
3. Aboveground Site Security
4. ROW Condition
5. ROW Patrol
6. One-Call Response
7. Public Awareness Prog.
8. TPD Integrity Assessment
9. TPD Incident History

2. External Corrosion
1. Soil Conditions
2. Coating
3. Ext Corr Program Eval.
3. Ext Corr Integrity Assmt
4. Ext Corr Release History

3. Internal Corrosion
1. Product Corrosivity
2. Int Corr Program Eval.
3. Int Corr Integrity Assmt
4. Int Corr Incident History

4. Manufacturing Defects
1. Age of Pipe
2. Pipe Manufacturer
3. Seam Susceptibility
4. Pre-Service Hydrotest
5. Operating Pressure
6. Mfgr Defect Integrity Assmt
7. Mfgr Defect Failure History

5. Construction Defects
1. Girth Joint Quality
2. Thin Wall Pipe
3. Fitting/Attachement Quality
4. Const-Related Incident History

6. Operational Error
1. System Operating Complexity
2. Max Operating Pressure
3. Surge Potential
4. Processes and Training
5. Operational Incident History

7. Equipment Failure
1. Potential for Equip Failure
2. Equip Incident History

8. Stress Corr. Cracking
1. SCC Susceptibility
2. SCC Incident History

9. Natural Forces
1. Hurricanes
2. Earthquakes
3. Freezing Temperatures
4. River Crossings
5. Heavy Rains & Floods
6. Landslide, Creep, Subsidence

10. Consequences
1. Population Impact
2. Drinking Water Impact
3. Ecological Impact
4. Waterway Impact
5. Market Supply
6. Leak Detection Capability
7. Release Volume
8. EFRD Spacing
9. EFRD Analysis
10. Emergency Response

Total Relative Risk Score = ∑(Threat Scores) x Consequence Score

P66 PIPELINE RISK MODEL - OVERVIEW

P66 Pipeline Risk Model Overview

Threat / Consequence	Risk Factors Used to Assess Each Threat / Consequence
1. Third Party Damage	**1. Third Party Damage** 1. Third Party Activity 2. Depth of Cover 3. Aboveground Site Security 4. ROW Condition 5. ROW Patrol 6. One-Call Response 7. Public Awareness Prog. 8. TPD Integrity Assessment 9. TPD Incident History
2. External Corrosion	**2. External Corrosion** 1. Soil Conditions 2. Coating 3. Ext Corr Program Eval. 3. Ext Corr Integrity Assmt 4. Ext Corr Release History
3. Internal Corrosion	**3. Internal Corrosion** 1. Product Corrosivity 2. Int Corr Program Eval. 3. Int Corr Integrity Assmt 4. Int Corr Incident History
4. Manufacturing Defects	**4. Manufacturing Defects** 1. Age of Pipe 2. Pipe Manufacturer 3. Seam Susceptibility 4. Pre-Service Hydrotest 5. Operating Pressure 6. Mfgr Defect Integrity Assmt 7. Mfgr Defect Failure History
5. Construction Defects	**5. Construction Defects** 1. Girth Joint Quality 2. Thin Wall Pipe 3. Fitting/Attachement Quality 4. Const-Related Incident History
6. Operational Error	**6. Operational Error** 1. System Operating Complexity 2. Max Operating Pressure 3. Surge Potential 4. Processes and Training 5. Operational Incident History
7. Equipment Failure	**7. Equipment Failure** 1. Potential for Equip Failure 2. Equip Incident History
8. Stress Corrosion Cracking	**8. Stress Corr. Cracking** 1. SCC Susceptibility 2. SCC Incident History
9. Natural Forces	**9. Natural Forces** 1. Hurricanes 2. Earthquakes 3. Freezing Temperatures 4. River Crossings 5. Heavy Rains & Floods 6. Landslide, Creep, Subsidence
10. Consequences	**10. Consequences** 1. Population Impact 2. Drinking Water Impact 3. Ecological Impact 4. Waterway Impact 5. Market Supply 6. Leak Detection Capability 7. Release Volume 8. EFRD Spacing 9. EFRD Analysis 10. Emergency Response

Total Relative Risk Score = ∑(Threat Scores) x Consequence Score

P66 PIPELINE RISK MODEL – EXAMPLE DETAILS

Third Party Damage - xxx pts

1. Third Party Activity xx pts

- Land Use xx pts
  - Developing Area = xx pts
  - Agricultural Area = xx pts
  - Established Industrial = xx pts
  - Established Commercial = xx pts
  - Established Urban/Suburban = xx pts
  - Established Rural = xx pts
  - Pasture, Range, Parkland, Forest, etc = xx pts
  - Wetlands, Swampland = xx pts
- Density of One Calls xx pts
  - High-High (> 1000 per KT zone) = xx pts
  - High (400 - 1000 per KT zone) = xx pts
  - Moderate (50 - 400 per KT zone) = xx pts
  - Low (<50 per KT zone) = xx pts
  - Unknown = xx pts
- Density of Foreign Xngs xx pts
  - High (> 5 xngs in a 100 ft interval) = xx pts
  - Modetate (2 < xngs ≤ 5 in a 100 ft interval) = xx pts
  - Low (0 < xngs ≤ 2 in a 100 ft interval) = xx pts
  - None = xx pts
- Shared ROW Corridor xx pts
  - Multiple Parallel Third Party Usage = xx pts
  - Single Parallel Third Party Usage = xx pts
  - n/a - ROW Not Shared w/ Third Parties = xx pts
- Other Significant Activity xx pts
  - Yes = xx pts
  - No = xx pts

2. Depth of Cover xx pts

- Depth of Cover xx pts
  - Less than 18" = xx pts
  - 18" to 36" = xx pts
  - Greater than 36" = xx pts
  - Unknown = xx pts

3. Aboveground Site Security xx pts

- Type of Aboveground Site xx pts
  - Aboveground Pipeline = xx pts
  - Aboveground Span = xx pts
  - Remote Valve Site = xx pts
  - Remote Pump/Meter Station = xx pts
  - Other (e.g, abovegrnd Jct, etc) = xx pts
  - n/a - no aboveground site = xx pts
- Adequacy of Third Party Security xx pts
  - Current TP Security Needs Improvement = xx pts
  - Current TP Security is Adequate = xx pts
  - n/a - no aboveground site

4. ROW Condition xx pts

- Visibility of ROW xx pts
  - Good = xx pts
  - Fair = xx pts
  - Poor = xx pts
  - Unknown = xx pts
- Marking of ROW xx pts
  - Good = xx pts
  - Fair = xx pts
  - Poor = xx pts
  - Unknown = xx pts

5. ROW Patrol xx pts

- Type of Patrol xx pts
  - Helicopter = xx pts
  - Fixed Wing = xx pts
  - Ground = xx pts
- Frequency of Patrol xx pts
  - Bi-weekly = xx pts
  - Weekly = xx pts
  - More often than weekly = xx pts
  - Daily = xx pts
- Adequacy of Patrol xx pts
  - Type and/or Freq of Patrol Should be Modified = xx pts
  - Type and Frequency of Patrol Are Adequate = xx pts

6. One-Call Response xx pts

- Response Area Performance xx pts
  - No One-Call incidents in past 12 months = xx pts
  - One One-Call incident in past 12months = xx pts
  - Multiple One Call incidents in past 12 months = xx pts

7. Public Awareness Program xx pts

- Program Requirements xx pts
  - Program Requirements Not Met = xx pts
  - Program Requirements Met = xx pts
  - Program Requirements + Supplemental Activities = xx pts

8. TPD Integrity Assessment xx pts

- Type of TPD Assmt in Past 5 yrs xx pts
  - MFL and Caliper = xx pts
  - MFL or Caliper = xx pts
  - Hydrotest = xx pts
  - Other or None = xx pts
- Assessment Results xx pts
  - Mech Damage Indicative of TPD = xx pts
  - No TPD Indications = xx pts
  - No TPD Assmt Performed in Past 5 yrs = xx pts
  - Results Pending = xx pts
- Years Since Last TPD Assmt xx pts
  - < 1 year = xx pts
  - 1 to 2 yrs = xx pts
  - 2 to 3 yrs = xx pts
  - 3 to 5 yrs = xx pts
  - More than 5 yrs, None, or Unknown = xx pts

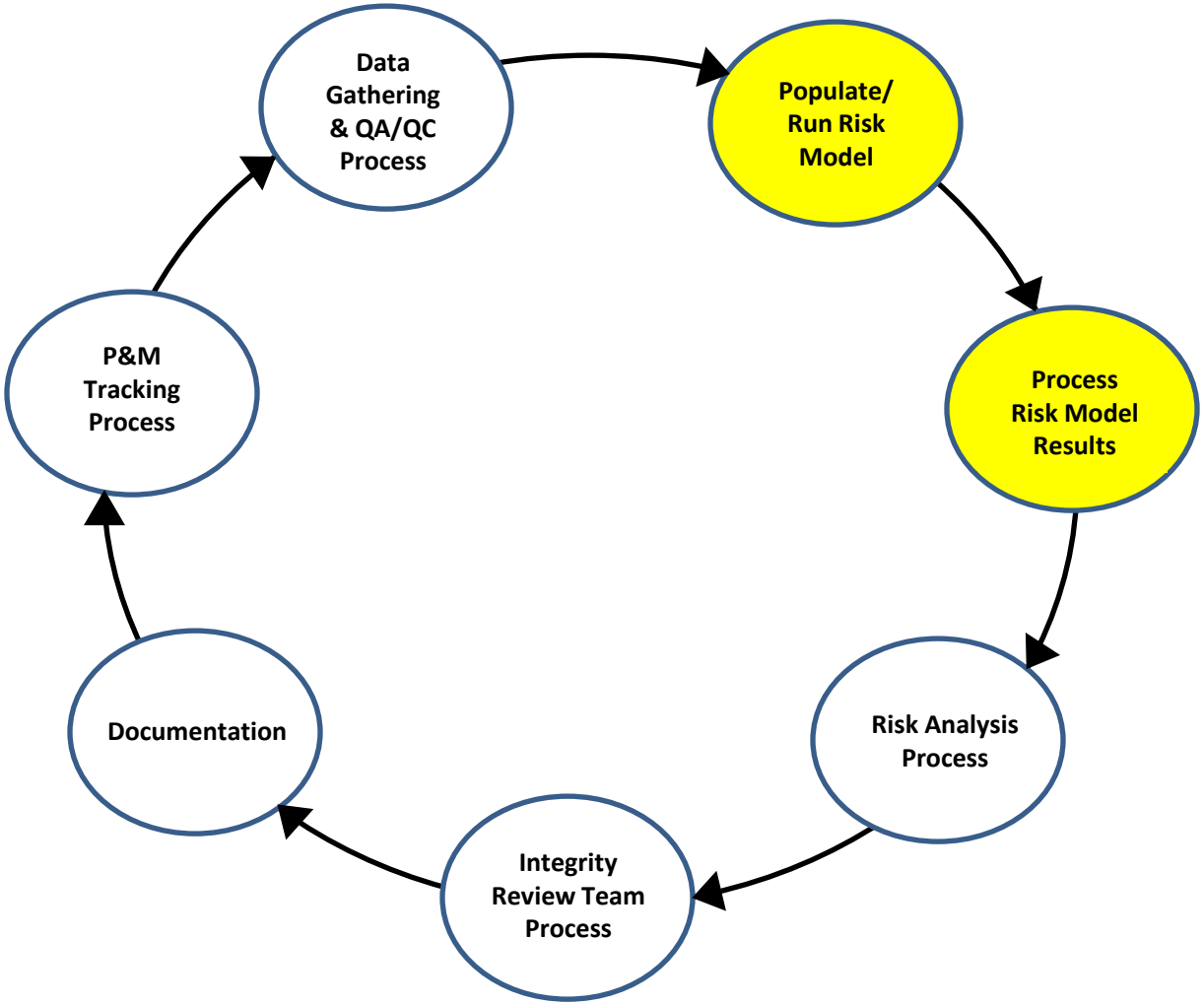
9. Third Party Incident History xx pts

- TP Incidents Since Last Assmt xx pts
  - Rupture or Leak = xx pts
  - Hit w/ no Release = xx pts
  - Near Miss = xx pts
  - None = xx pts

THE "SOFTWARE" BEHIND THE MODEL

- VBA Macro
  - Integrates and dynamically segments the data that is input into the model.
  - Performs the simple addition/multiplication of the numeric relative weightings assigned to the data in the model.
  - Outputs contiguous elementary pipeline integrity risk segments, with relative risk scores, for each pipeline.
- That's it. That's the "software".

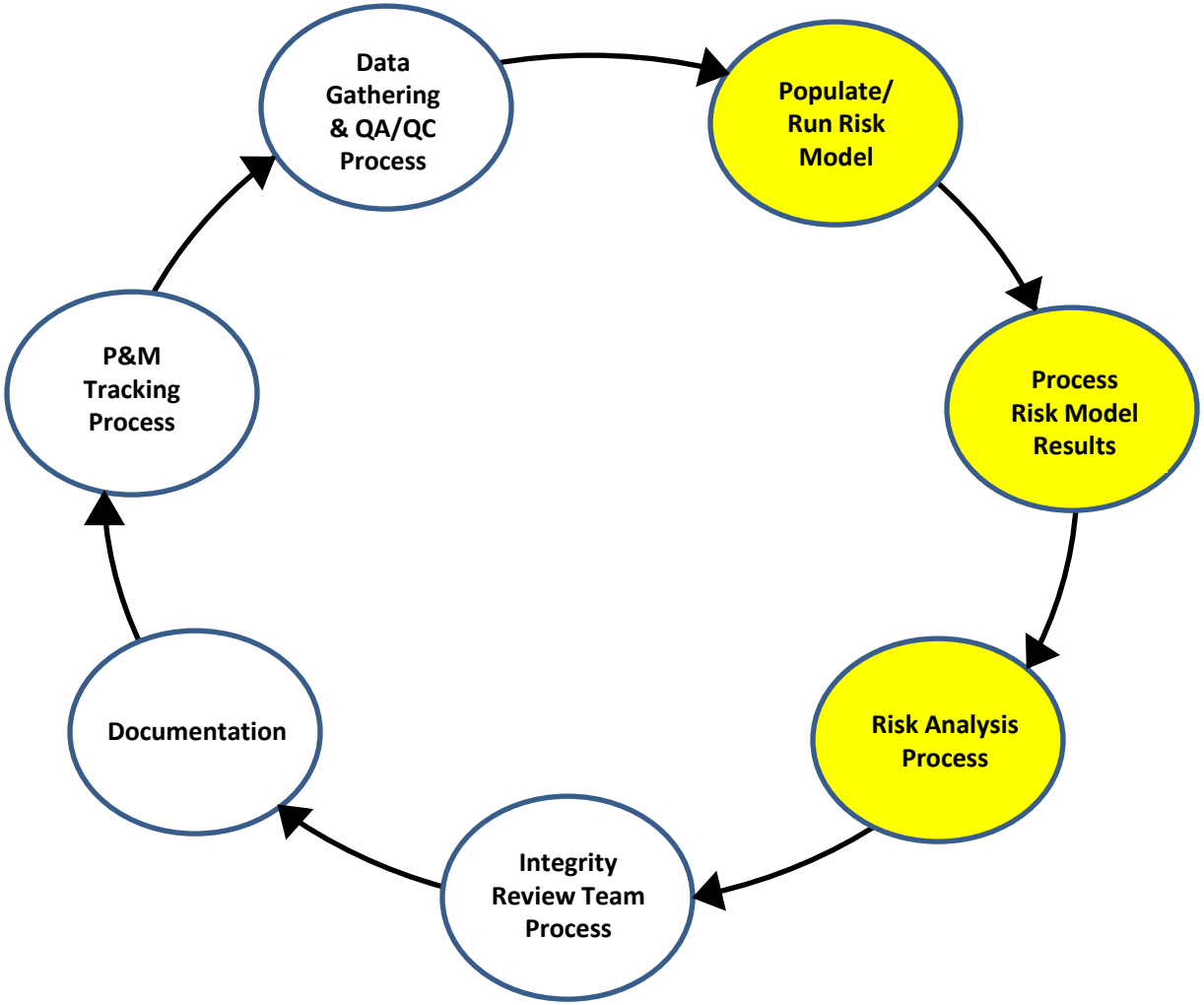
OVERALL RISK ANALYSIS PROCESS



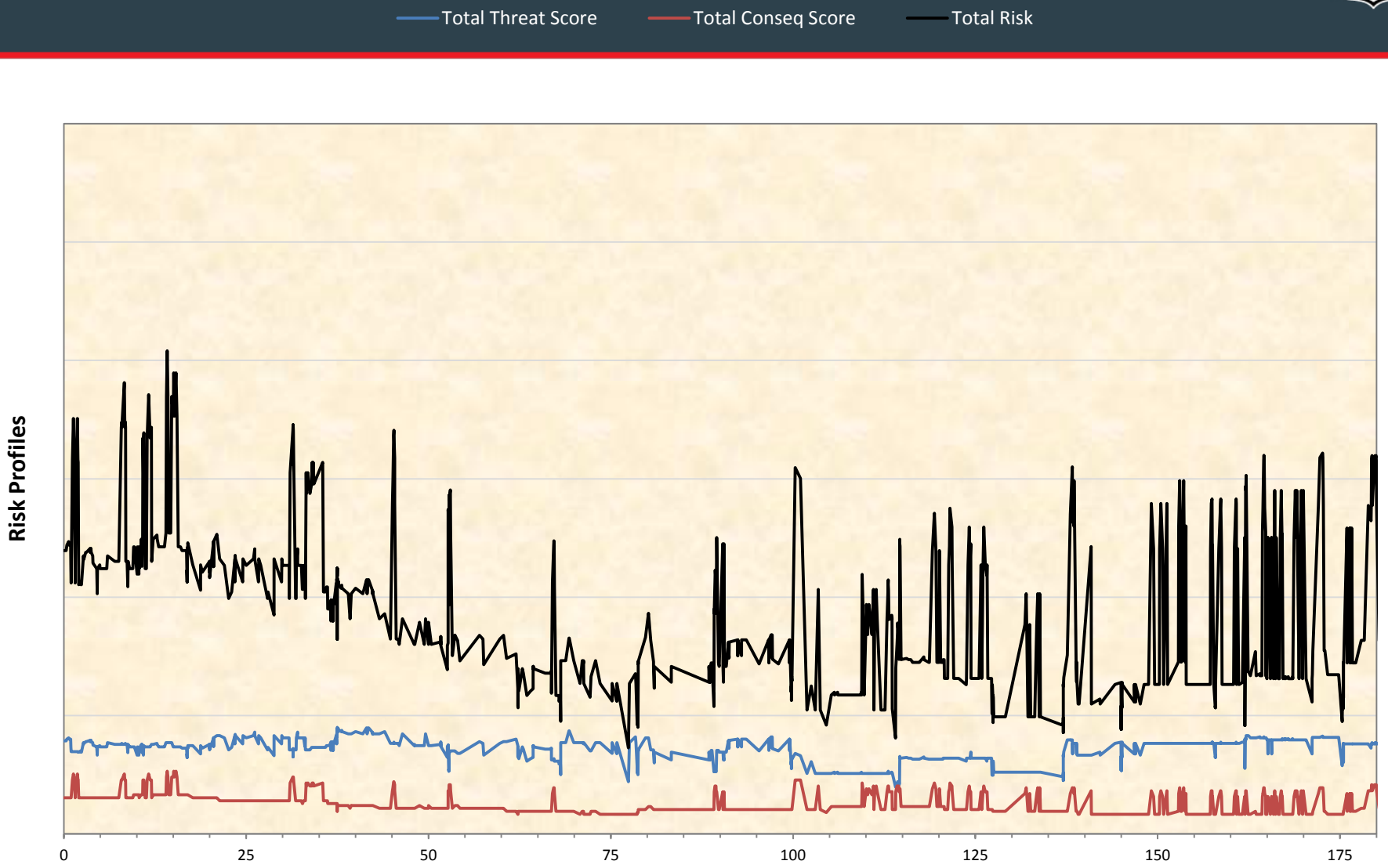
PROCESSING RISK MODEL RESULTS

- From the elementary risk segments we generate
  - Risk Rankings
  - Risk Profiles
- Risk Rankings
  - Used in validation of risk model
  - Used in prioritization of pipeline risk analysis schedule
  - Other prioritization
  - Top 5% used as placeholders in LRP
- Risk Profiles
  - Used as the basis for the pipeline risk analysis process
  - Used as communication tool

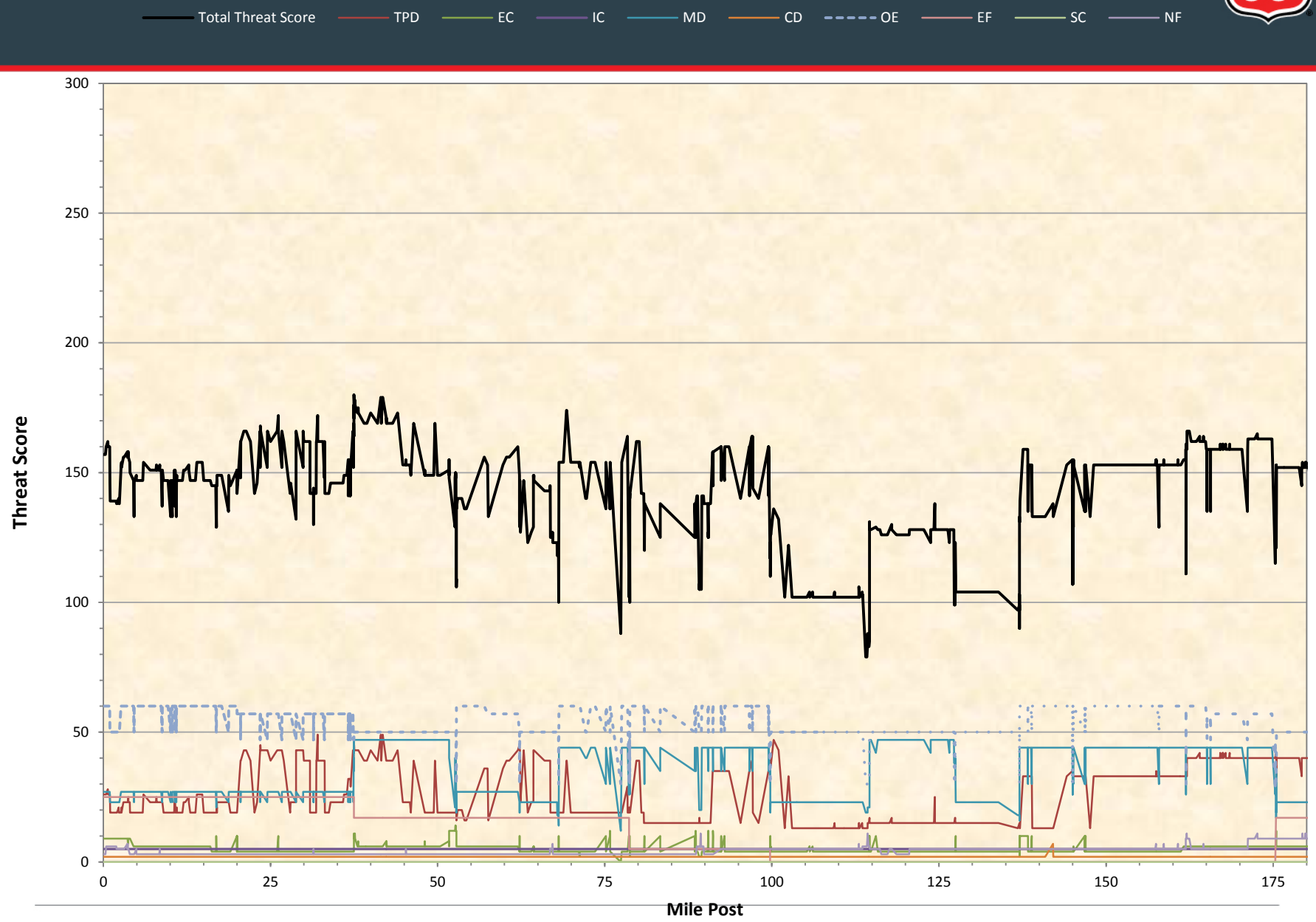
OVERALL RISK ANALYSIS PROCESS



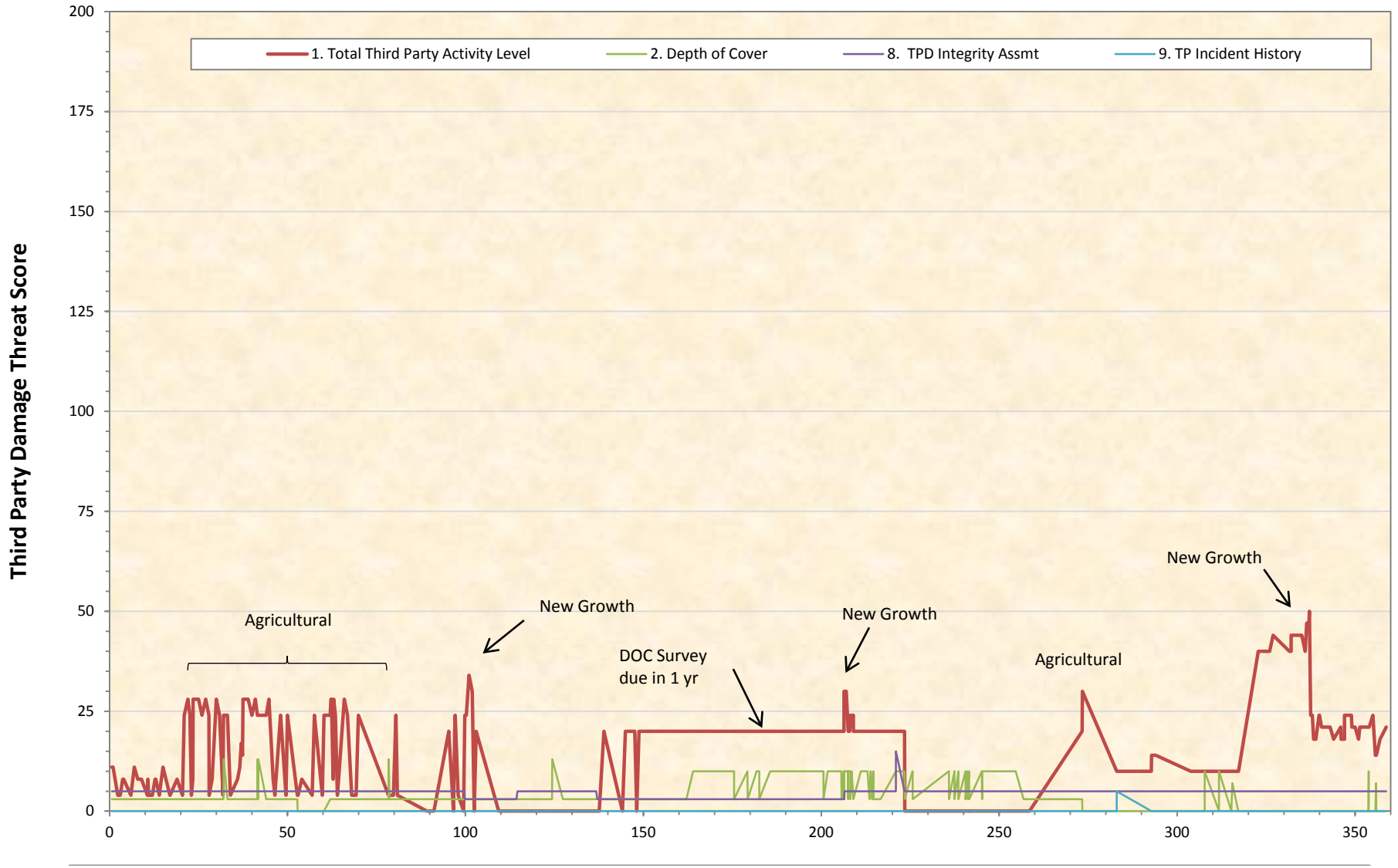
XYZ Pipeline - Risk Profiles



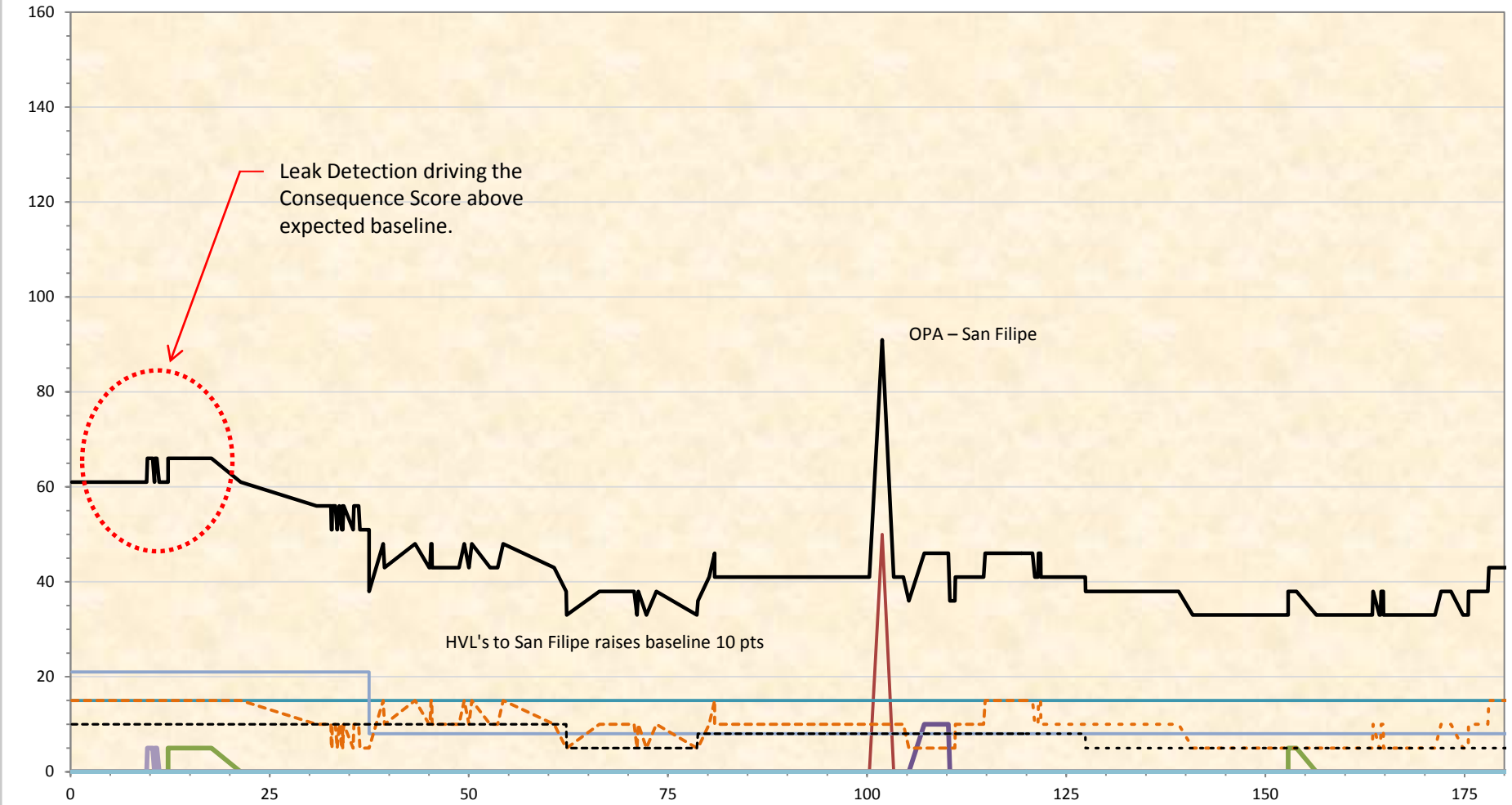
XYZ Pipeline - Threat Profiles



Third Party Damage Threat Profile



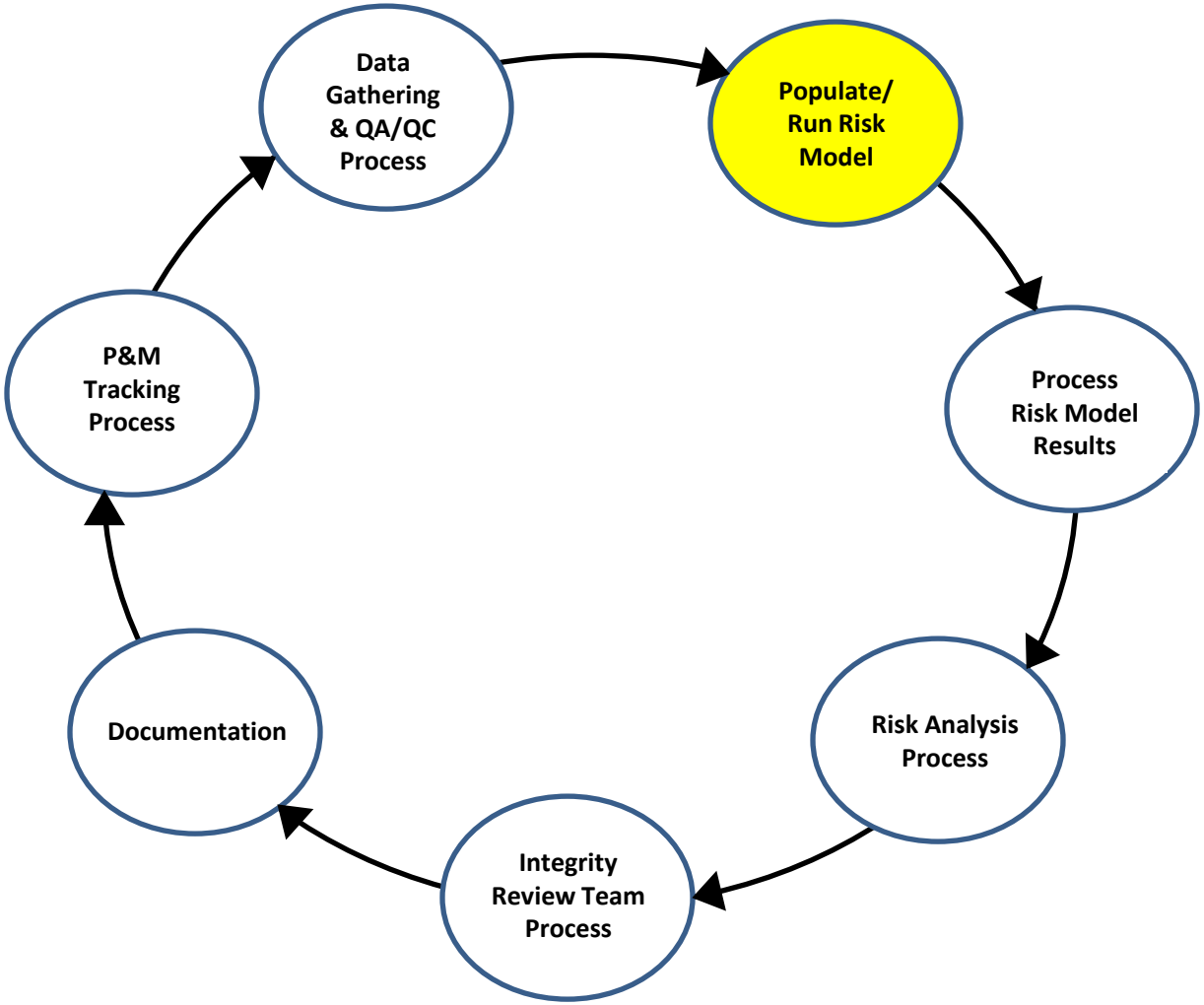
Consequence Profile w/o Wtrway Impact



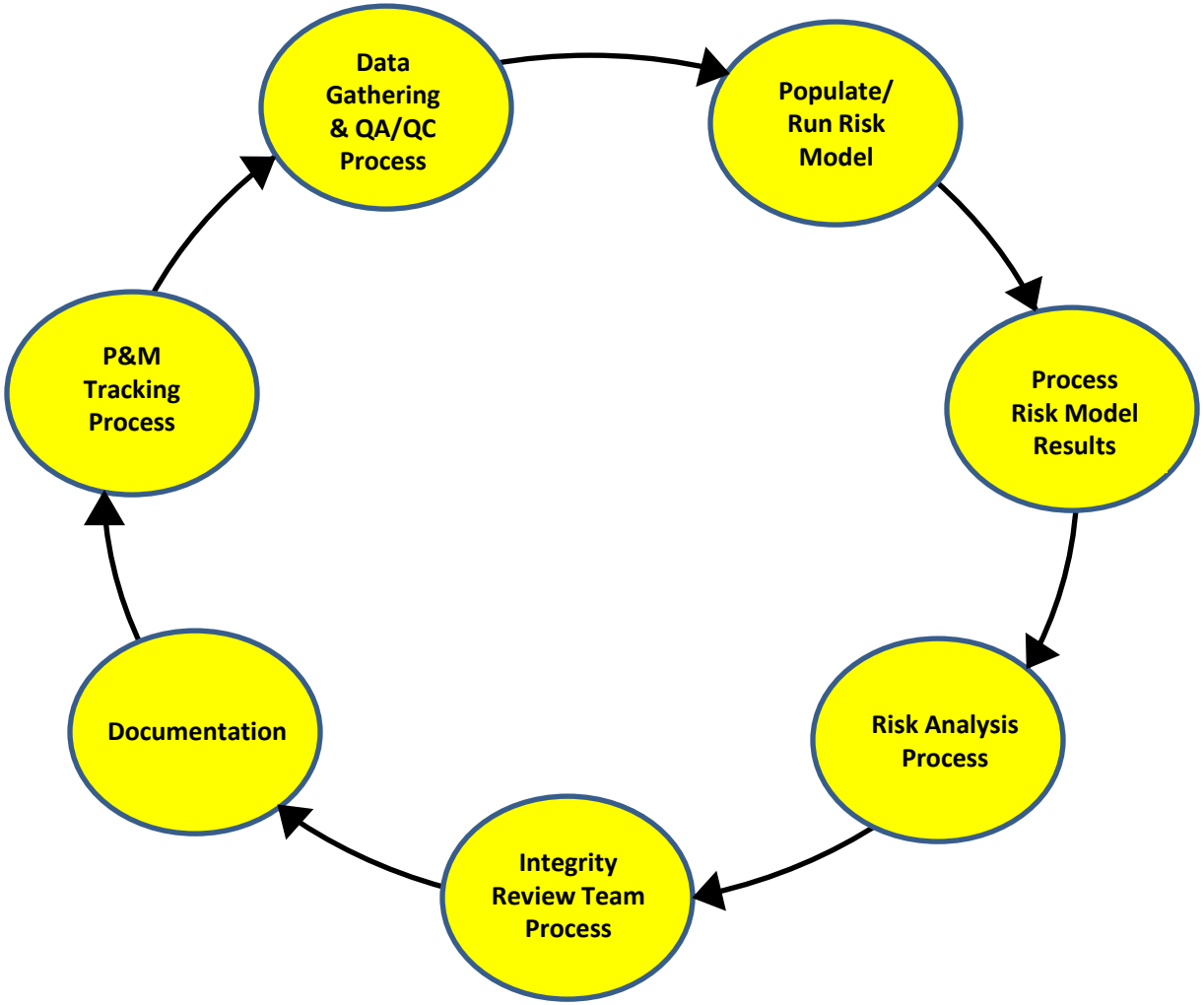
HOW DO YOU DEFINE A PIPELINE RISK MODEL?

- What is it?
  - At P66, it's a document that captures and communicates our company's pipeline integtity risk management plan
- What drives it?
  - At P66, three questions about each threat and conseq along each of our pipelines drives what goes into the model:
    - Where does the threat (conseq) apply, and to what extent?
    - What are we doing about it?
    - Is what we're doing working?
- What's in it?
  - At P66, the risk factors, risk attributes, risk data, and their relative risk weightings, go into the model
- What does the model actually "do'?
  - At P66, it integrates and dynamically segments the risk data into elementary pipeline integrity risk segments with relative risk scores
- At this point, we leave the risk model and move into the next steps of our overall risk analysis process:
  - Process the risk model results
    - Generate relative risk rankings and risk profiles
  - Perform risk analysis on each pipeline
    - Risk profiles used a basis for analysis
    - Analysis of the profile baselines and excursions – what's driving them, do they make sense, where can we improve or add P&M to drive the risk profiles down?
  - Collaboration and review by entire IRT
  - P&M Tracking and Feedback into risk input data

A RISK MODEL IS ONLY ONE PIECE …



… OF THE OVERALL RISK ANALYSIS PROCESS



CLOSING COMMENTS

- Misguided focus on risk models themselves.
- Risk models are only one piece of the overall risk analysis process, and the extent to which they are used varies.
- Focus should be on the adequacy of the risk analysis/risk management process as a whole.

Integrity Management is Risk Management is Business Management

Thank You !

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