



Barrier Based Approaches to Risk Modeling for Pipeline Safety: Making Regulations, Standards and Practices More Effective



Regulators Using Barrier Based Risk Modeling



**Health & Safety
Executive**



National Offshore Petroleum Safety
and Environmental Management
Authority



**PETROLEUM SAFETY AUTHORITY
NORWAY**



U.S. Department of Health and Human Services
Food and Drug Administration

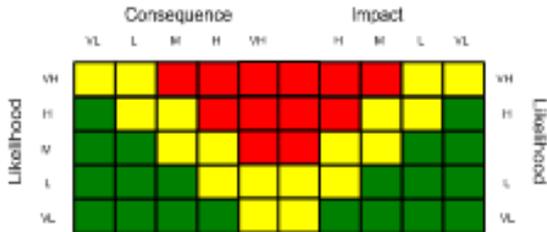


State Supervision of Mines
Ministry of Economic Affairs

Common Risk Tools are Poor at Communication



“Buried” information
in hard copy reports



Summary of Venezuelan Risk Scenarios
Current and Projected Change in Risk Factors for San Felipe Resources
(Fiscal Yea rs 1 to 5)

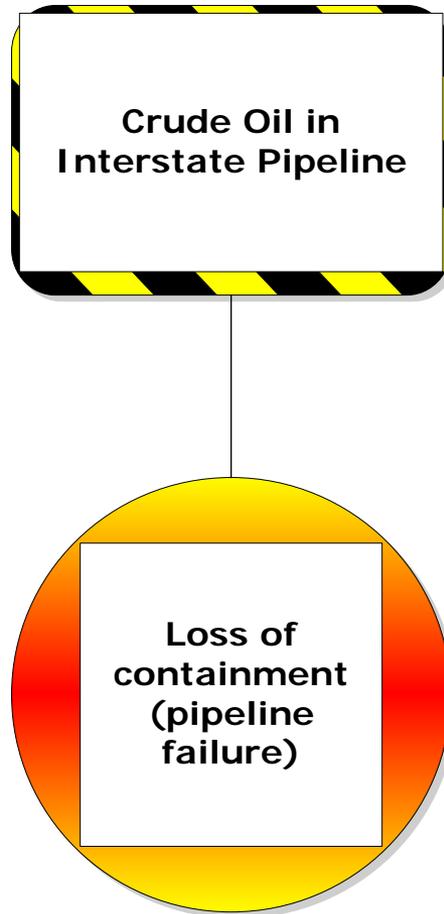
Risk Factor	Current Situation	Viva el Cacique!	Leadership by Committee	Return of the Puppet Rulers
Political Regulatory/		Worsening	Improvement	Improvement
Legal		Worsening	Improvement	Worsening
Tax/Government Take		Worsening	Stable	Improvement
Financial/Macro Economic		Worsening	Improvement	Worsening
Labor		Stable	Worsening	Stable
Corporate Governance Transparency		Improve	Stable	Stable
Currency		Improvement	Worsening	Stable
Personal Security of Employees		Improvement	Stable	Improvement

Use of
incomprehensible
parameters

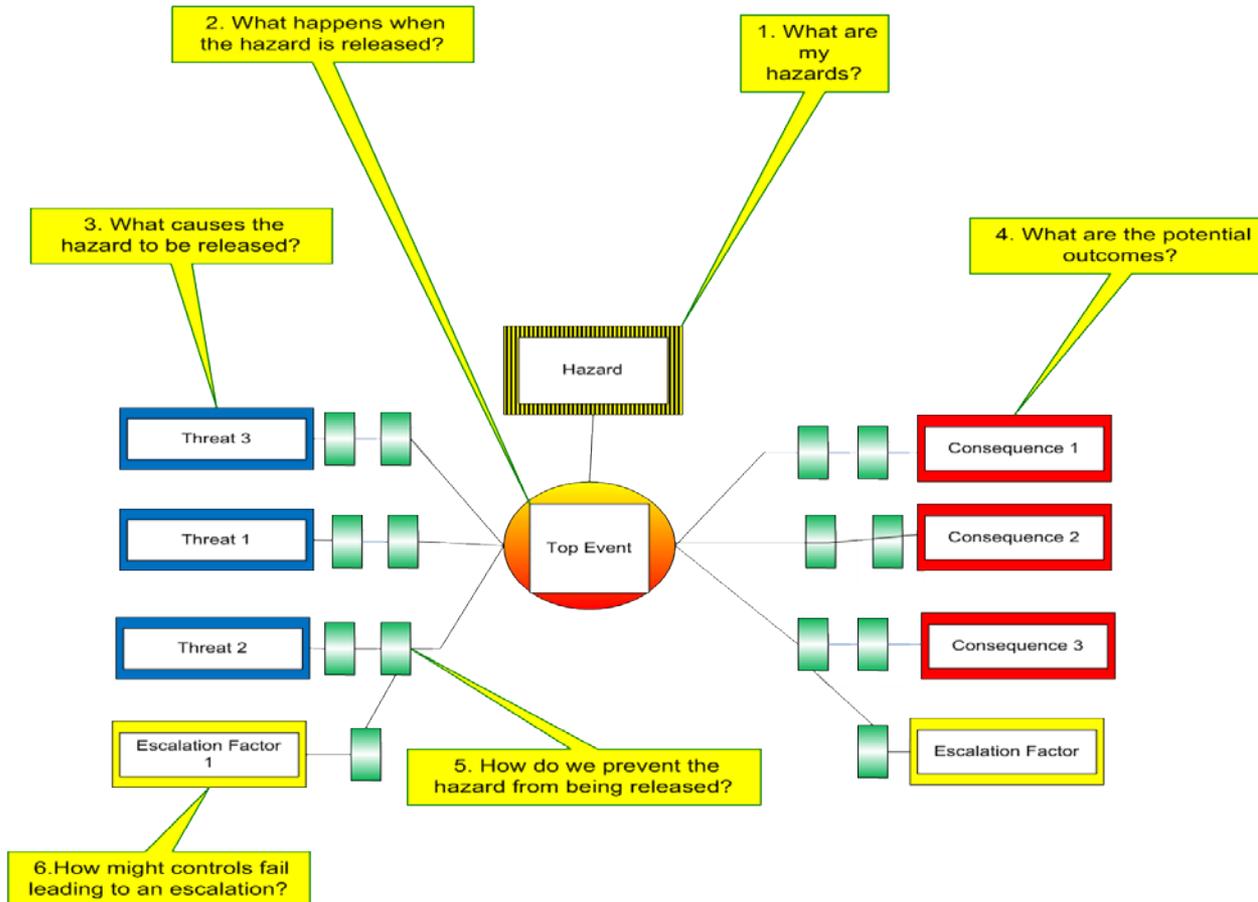
KRI	Status	Trend
Retail Occ	●	▼
RE Rental Market	●	▼
Change in Stores	●	▲
Big Box Exp	●	▲
Price Comp	●	▼
Debt Spreads	●	↔
Interest Rates	●	↔
Stock Perf.	●	▼
Constr. Progress	●	↔
Labor Market	●	↔
Govt. Emplmt.	●	↔
Unemployment	●	▼
Cons. Spending	●	▼

Visual “ Risk Status Reports” Lack Context

Nomenclature and Symbols

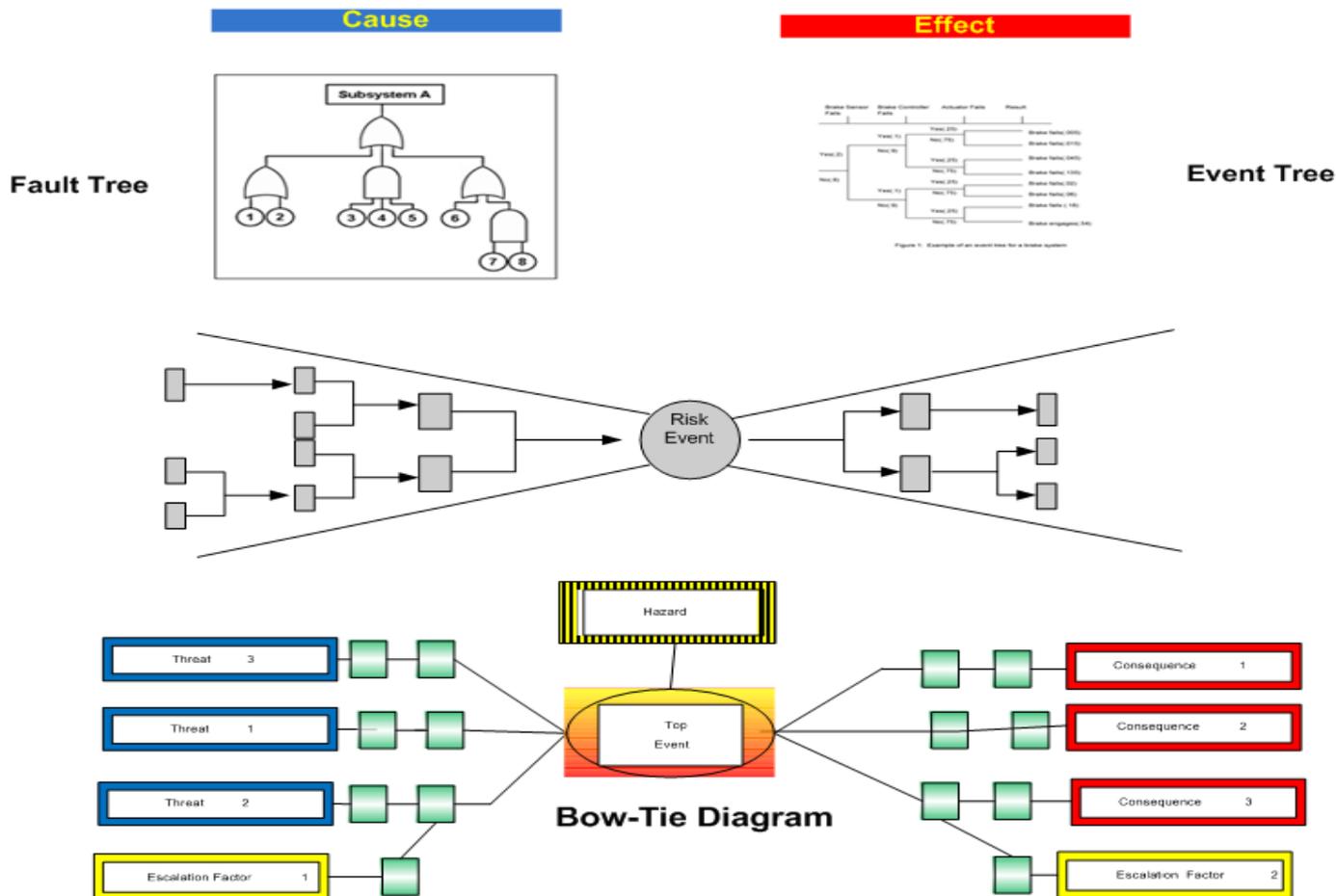


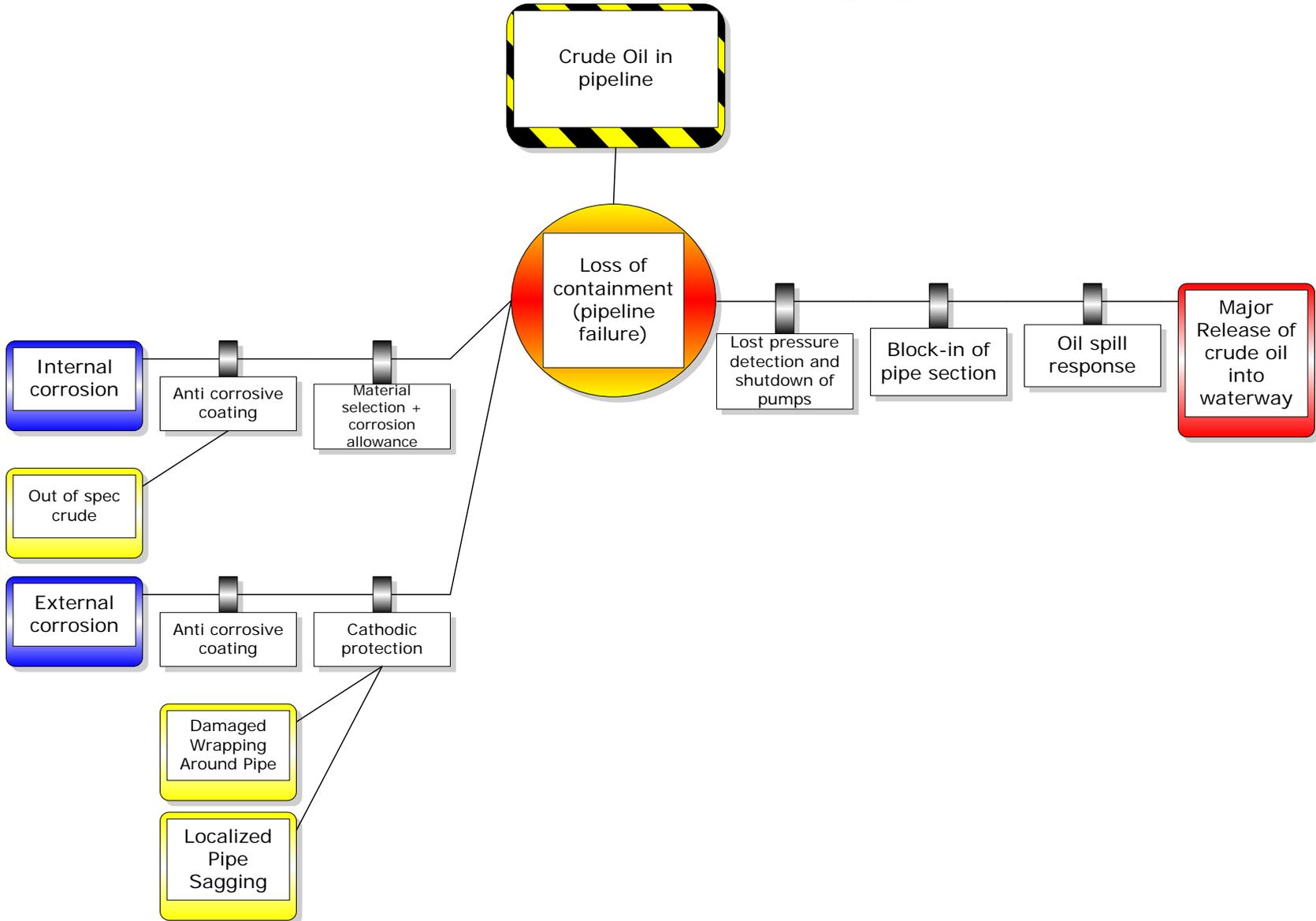
Methodology



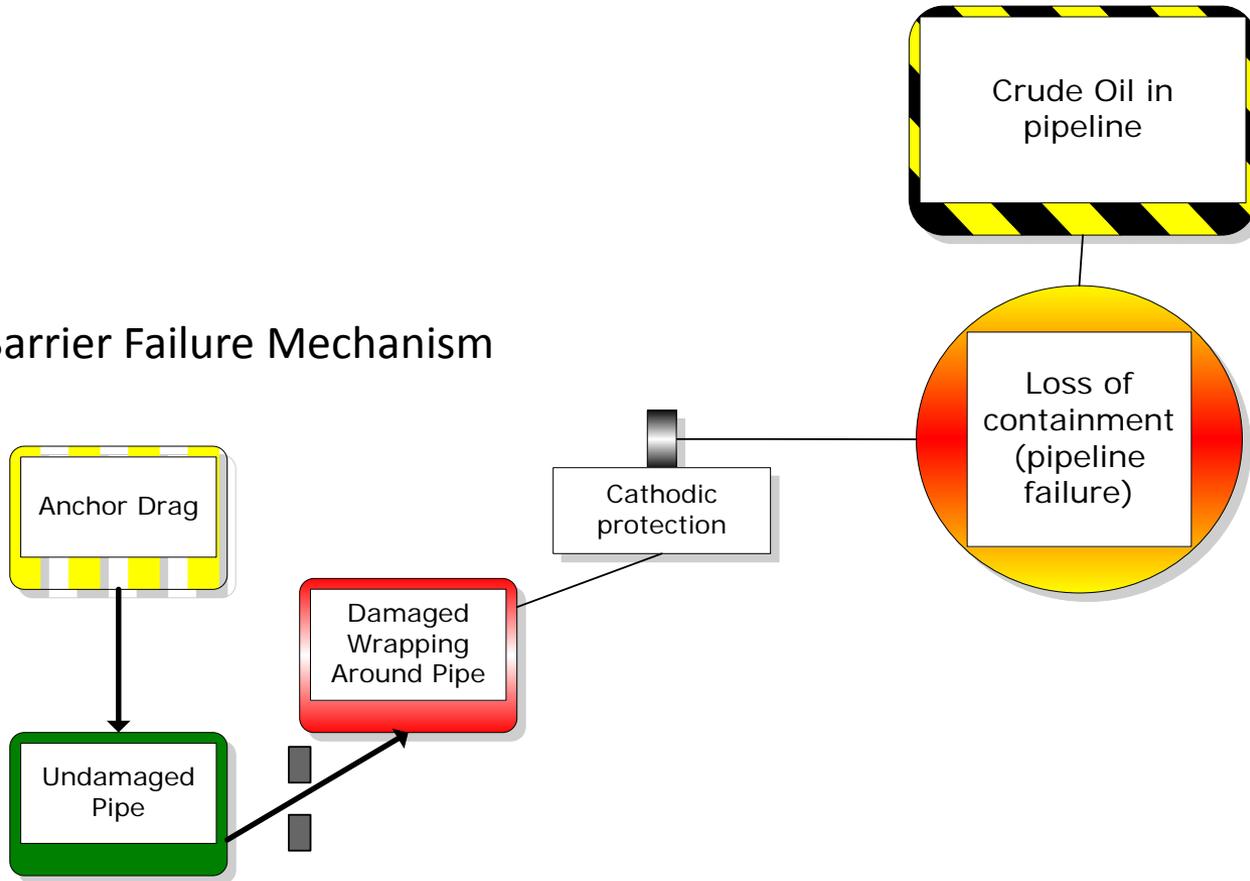
Bow-Tie Diagrams

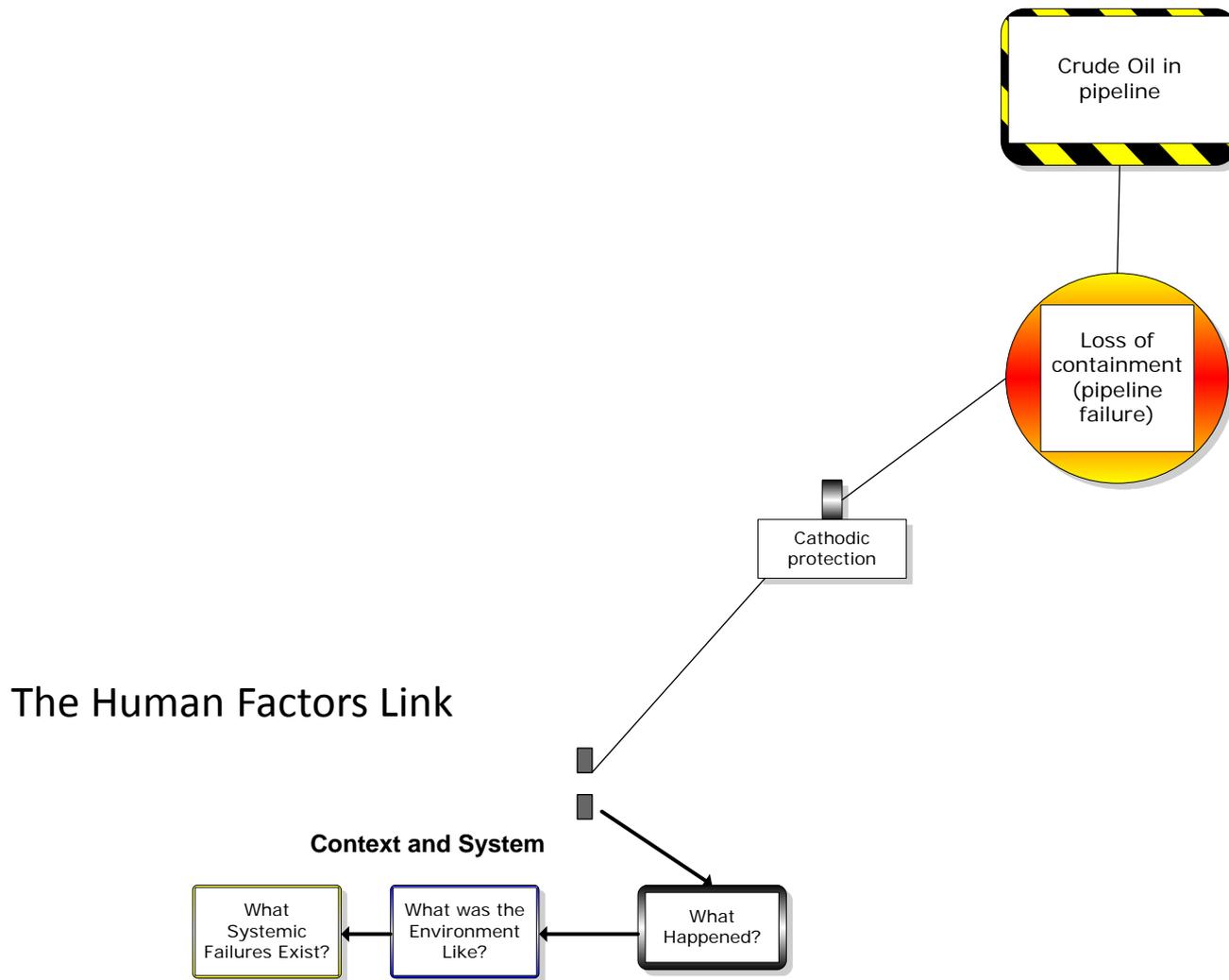
The Graphical Demonstration of Cause and Effect for Major Accidents and Events





Barrier Failure Mechanism





A photograph of a space shuttle's robotic arm extending over the Earth's horizon. The sun is shining brightly in the upper center, creating a lens flare effect. The Earth's surface is visible below, showing a mix of green and brown terrain.

Feedback: Questions, Comments

**Scott Randall,
Managing Director, North America
GBMC, LLC, Houston, TX
randall@bmc-global.com; tel. 713.780.2939**