Dynamic Risk

Impact (Consequence) Scenario Analysis

Information Gathering Meeting

Committee on Criteria for Installing Automatic and Remote-Controlled Valves on Existing Gas and Hazardous Liquid Transmission Pipelines

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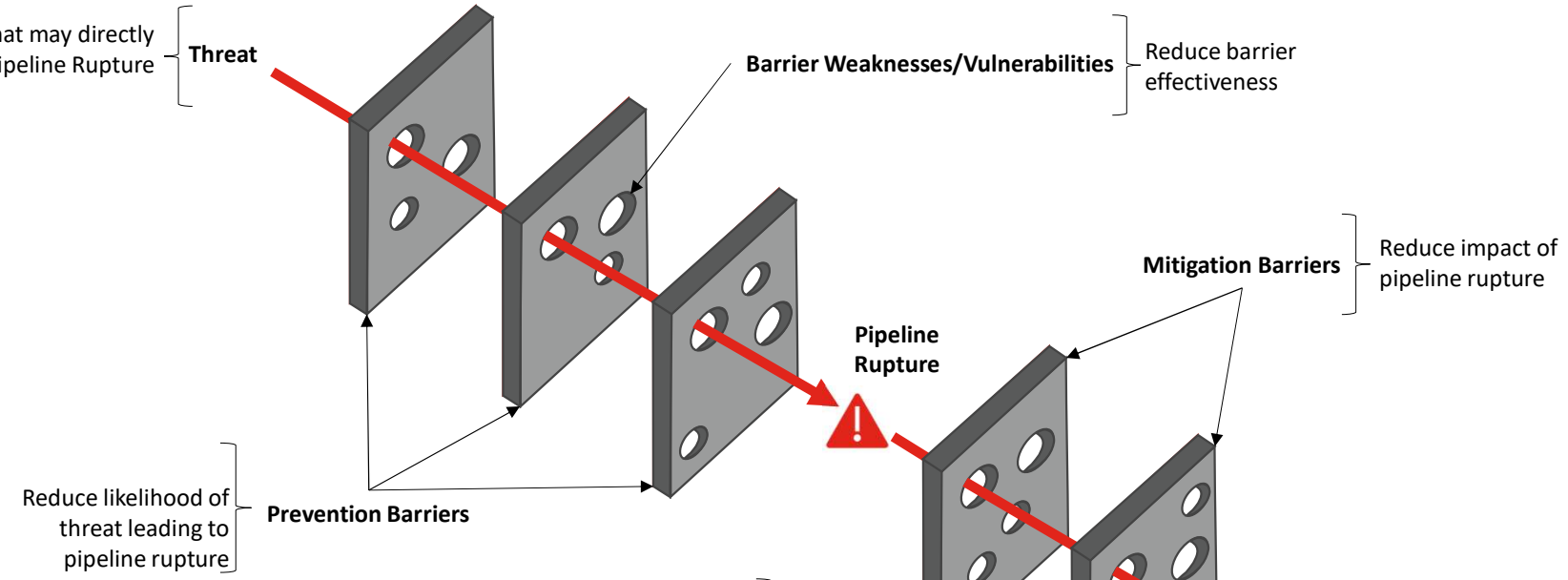
Rupture Mitigation



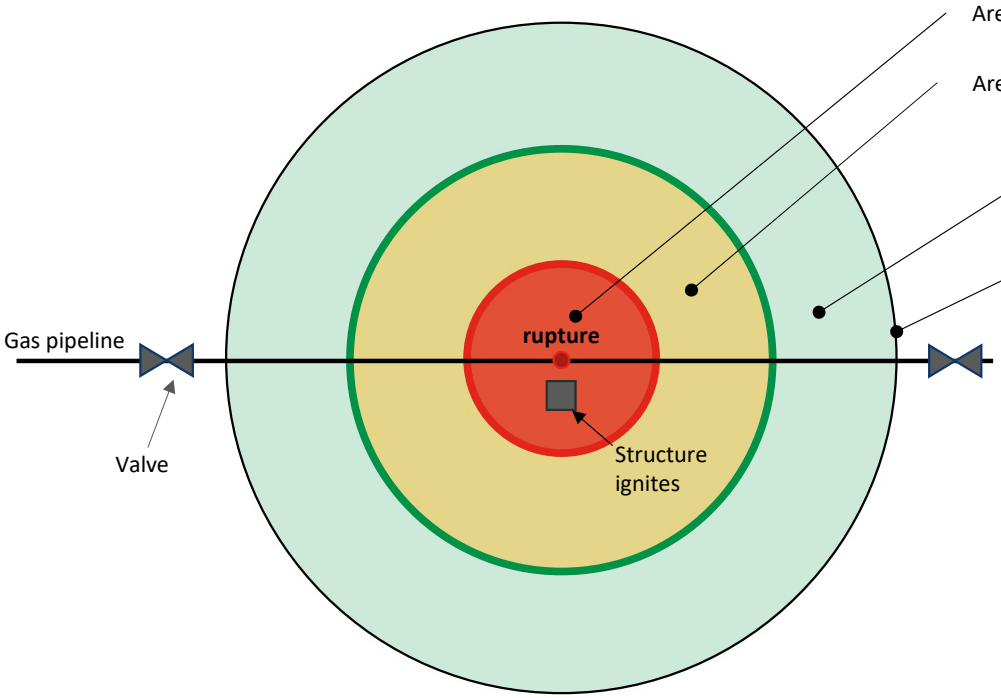
Based on James Reason's Swiss Cheese Model

Gas Pipelines – Impact from Ignited Rupture

Potentially Affected	Impact
People	• Exposure to thermal radiation • Damage to structure providing shelter due to thermal radiation
Environment	• CO2 (ignited) or methane (unignited) emissions to atmosphere
Property	• **Damage to structure due to thermal radiation**

Gas Pipeline – Impact from Thermal Radiation due to Ignited Rupture

Rupture with Instantaneous Gas Ignition



Top View

Majority of Thermal Radiation Impact

Impact = Initial Impact (instantaneous at rupture) + Impact from continuous gas release

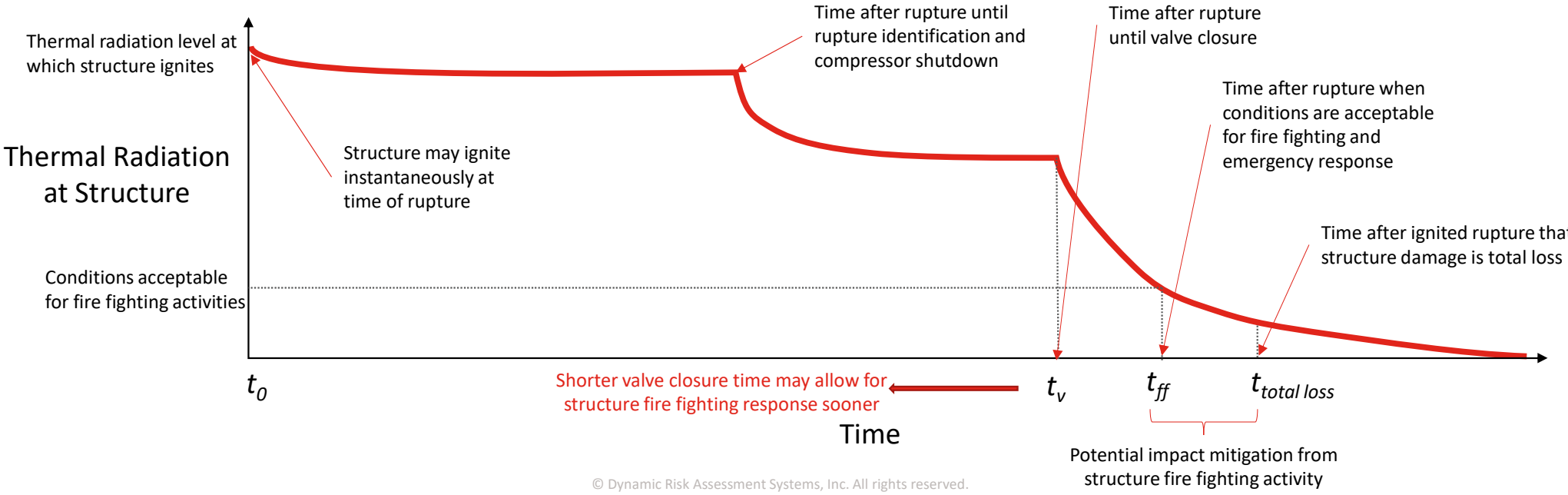
Not mitigated by valve closure

Potentially mitigated by valve closure and sooner fire fighting and emergency response

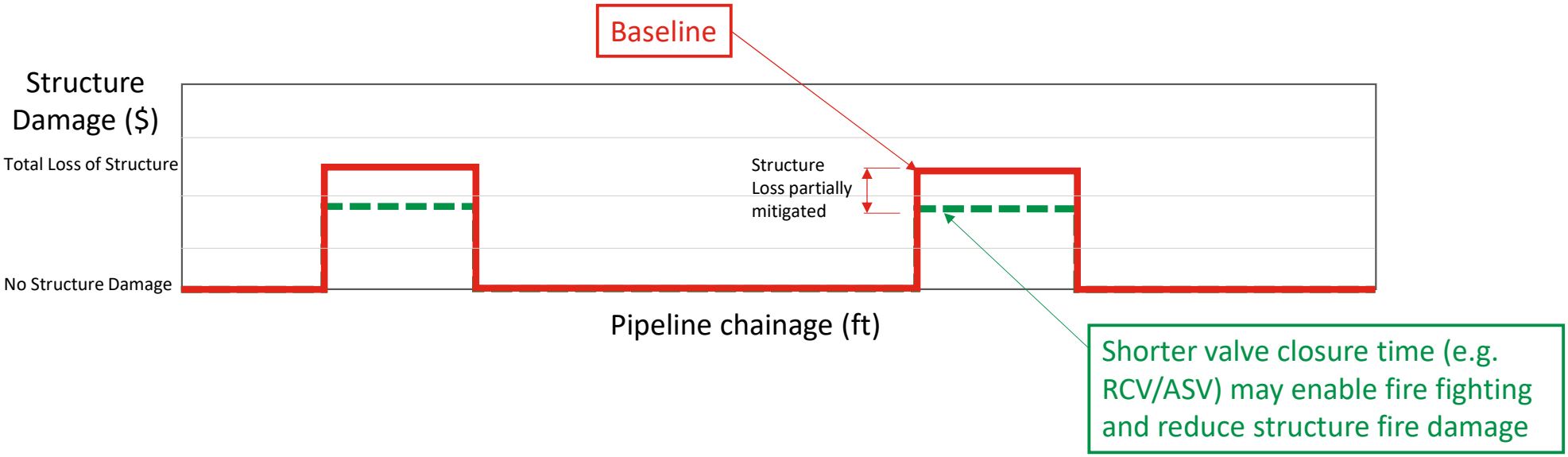
Gas Pipeline – Post-Rupture Phases

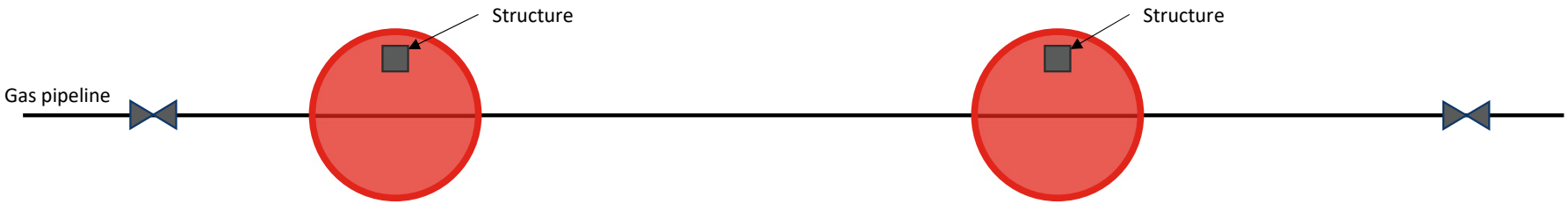
Rupture

Full Operation → Compressor Shutdown → Block Valve Closure → Segment Blowdown



Gas Pipeline – Illustration of Impact (Consequence) Scenario Analysis

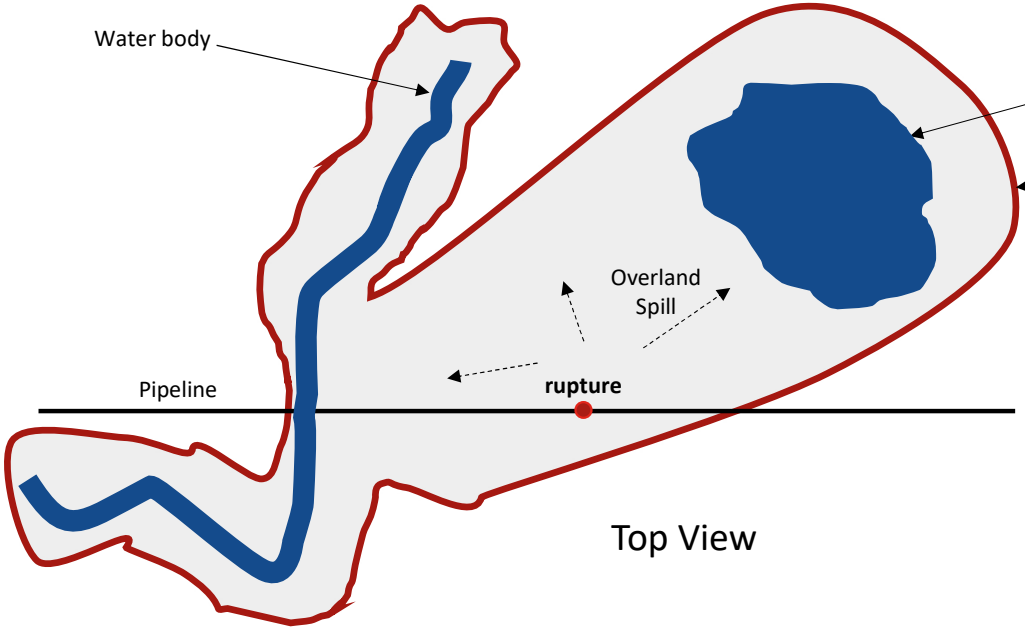




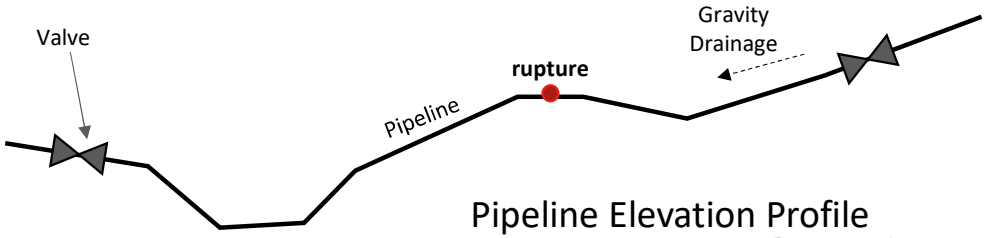
Hazardous Liquid Pipelines – Impact from Rupture and Product Release

Potentially Affected	Impact
People	• Exposure to thermal radiation • Damage to structure due to thermal radiation that is providing shelter for people
Environment	• CO2 or emissions to atmosphere • **Damage to sensitive land to water bodies from product spill**
Property	• Damage to structure due to thermal radiation

Hazardous Liquid Pipeline – Environmental Impact from Release



Top View



Pipeline Elevation Profile

Majority of Environmental Impact

Impact = Initial Impact (instantaneous at rupture) + Impact from continuous release

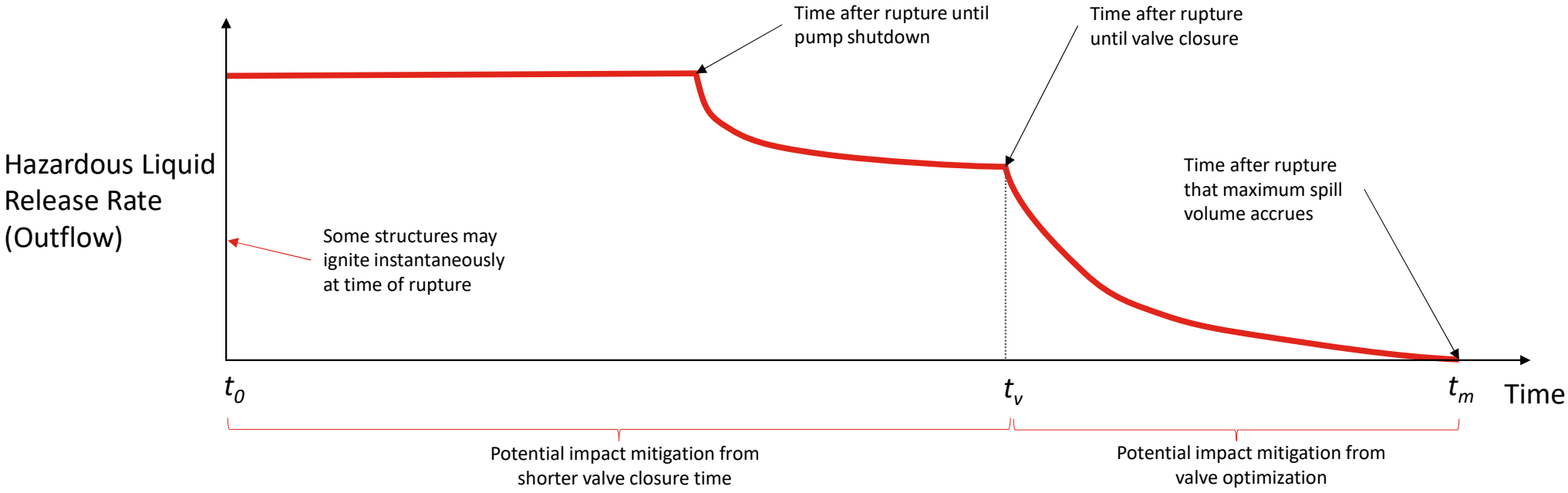
Not mitigated by valve closure

Potentially mitigated by valve closure

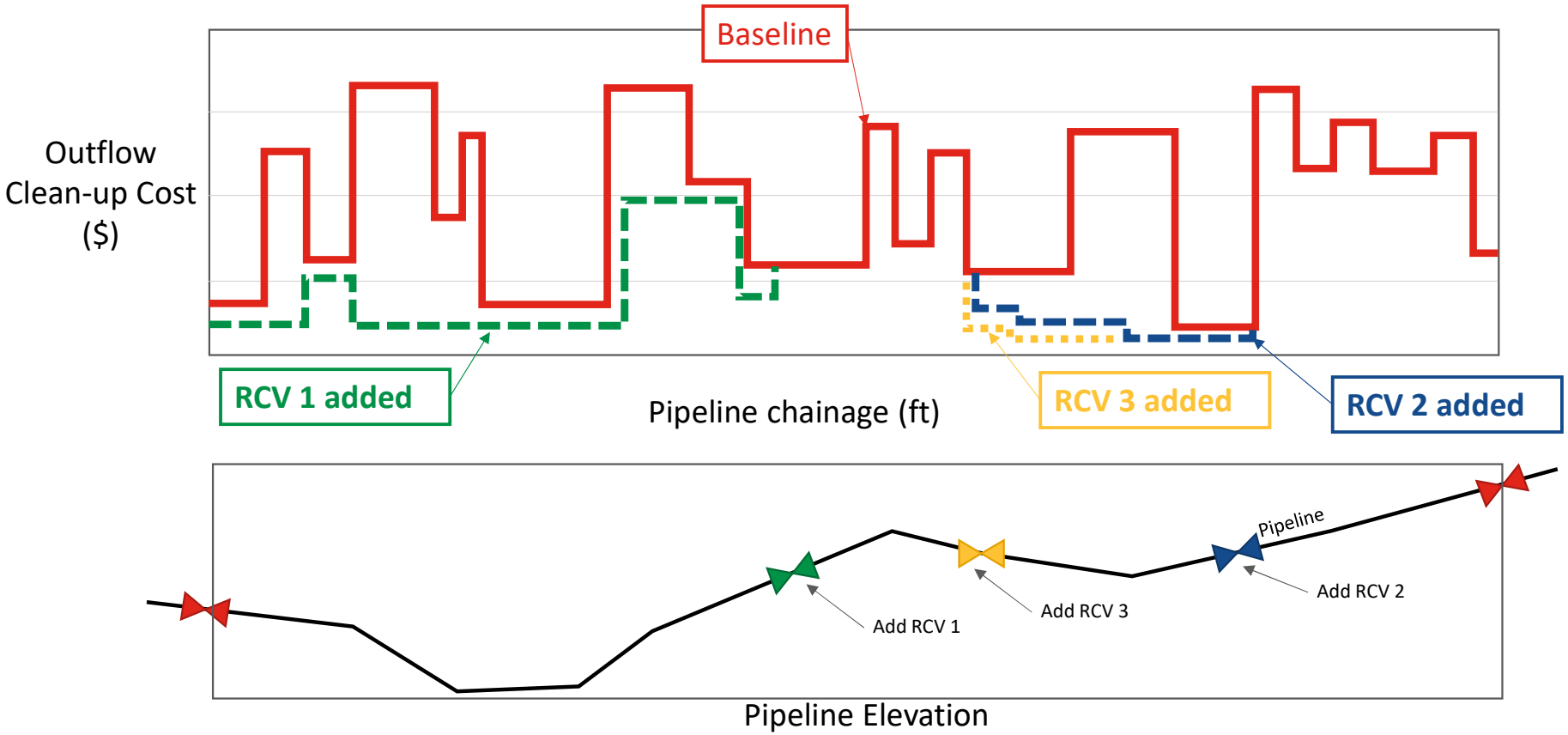
Liquid Pipeline – Post-Rupture Outflow Phases

Rupture

Full Operation → Pump Shutdown → Valve Closure → Gravity Drainage



Liquid Pipeline – Illustration of Consequence Scenario Analysis



Summary

- **Risk Management**
  - RCV/ASV technology does not prevent likelihood of pipeline rupture occurring
  - RCV/ASV technology can be used in emergency shutdown to potentially mitigate consequences of a rupture

- **Natural Gas Pipelines**
  - Primary hazard of rupture is thermal radiation that may impact property or people
  - RCV/ASVs may enable sooner access for fire fighting and emergency response to minimize property damage
  - Valve location/spacing generally has minimal effect on reducing time to blowdown

- **Hazardous Liquid Pipelines**
  - Primary hazards of rupture are contamination that may impact environment as well as thermal radiation that may impact property or people
  - RCVs may reduce product spill volumes and minimize environmental impact
  - Valve location/spacing optimization can help to minimize environmental impact

Thank You

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