



# Risk Alive Analytics Inc.

Are We Investing In The Right Risks?  
Rethinking PHA Recommendations for Maximum Safety Impact

Canadian Chemical Engineering Conference May 26<sup>th</sup>, 2026 | Risk Alive Analytics Inc.

# PROUDLY PART OF THE RSD GROUP OF COMPANIES

**RISK SCIENCES  
& DEVELOPMENT**



**ACM FACILITY SAFETY INC.  
CONSULTING**

**30** years working  
with energy,  
petro-chemical, and  
agro-chemical  
teams and leaders



**RISK ALIVE ANALYTICS INC.  
RISK ANALYSIS**

**51** million  
industry learnings embedded in  
5,600+ risk data sets



**INSTITUTE OF HAZARD  
PREVENTION INC.  
SAFETY TRAINING**

**4000+**  
people trained in 12 courses  
ranging from basic to advanced

**5,400**  
Processing Units

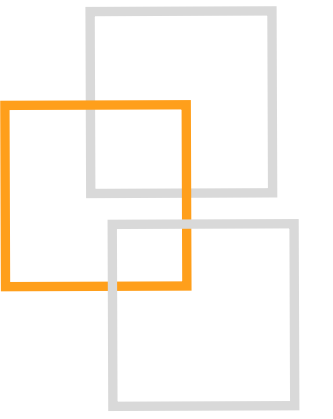
**262,000**  
Pieces of Equipment

**479**  
Unit Types

**500,000**  
Hazardous Scenarios

**21,000**  
Contributing Experts

# SIMPLE SOLUTIONS FROM COMPLEX DATA



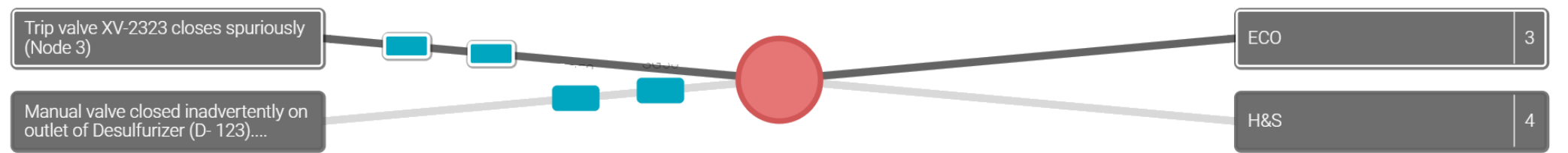
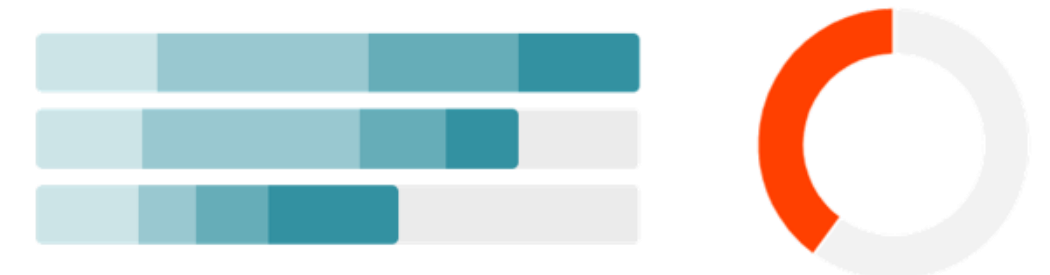
Turn 1000s of pages of worksheets. . .

into Visualized Learnings



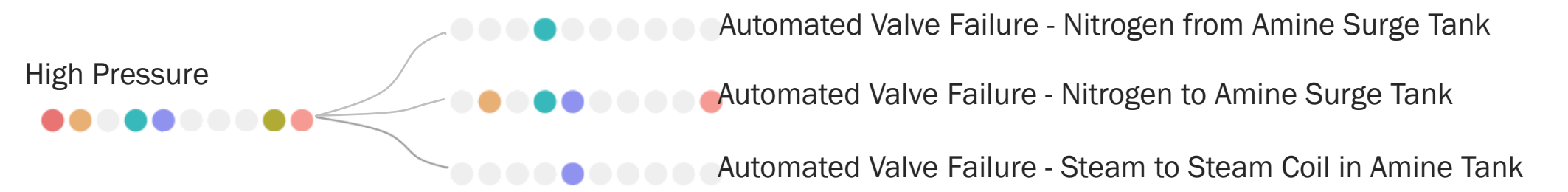
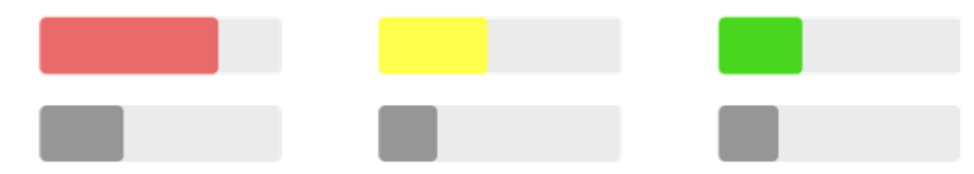
Causes (Before Safeguards)  
Most Significant Inherent Threats

1. Manual valve (V-XX) inadvertently closed
2. Automatic valve (FV-XXX) malfunctions open
3. Upset from Upstream Facility X.



Reliance on Personnel [Refinery Unit X]

Based on standards for Independent Protection Layers, human dependent safeguards have a large range of reliability. A higher reliance on human dependent safeguards may indicate an increased importance of routine training.





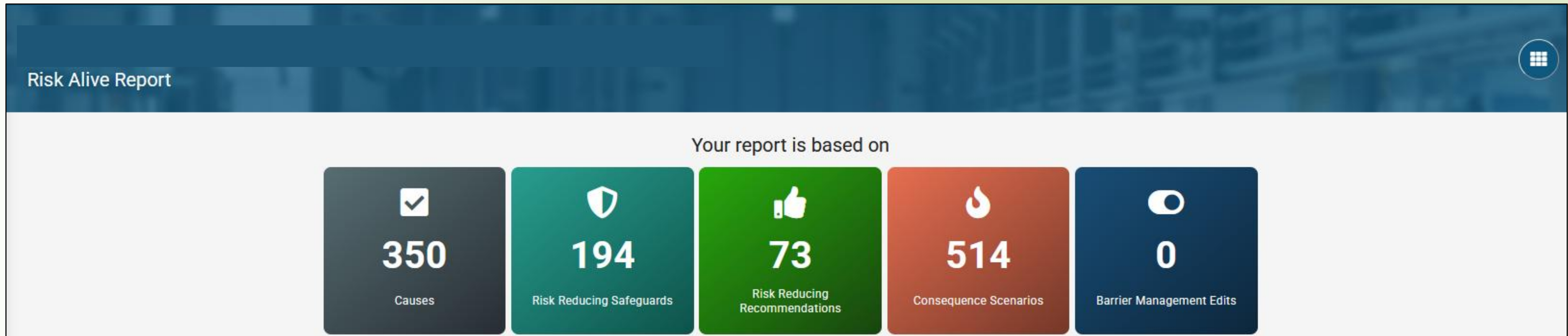
# PHA Analytics Overview



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Safer Together

## Sulfuric Acid Alkylation HAZOP/LOPA

Total of 73 “Risk Reducing” recommendations out of 145 proposed in PHA



**Do we really need to implement all of these recommendations?**  
**How do we know which to do first?**



# Risk Matrix & Definitions



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Risk Matrix					
Matrix	Name	Matrix Columns (x-axis)			
Severity	Likelihood				
	A	B	C	D	E
	Risk Ranking	Risk Ranking	Risk Ranking	Risk Ranking	Risk Ranking
1	1	1	2	3	4
2	1	2	3	4	AR
3	2	3	4	AR	AR
4	3	4	AR	AR	AR
5	4	AR	AR	AR	AR

## Definitions:

**Risk Ranking: 1 and 2** considered unacceptable high-risk

**Risk Ranking: 3** considered as moderate to ALARP region

**Risk Ranking: 4 and AR** considered low-risk

Risk Ranking		
Values	Name	Tools
High ↑	Code	
	1	Level 1
	2	Level 2
	3	Level 3
	4	Level 4
AR	Acceptable Risk - No risk control measures are needed	

# ALARP DIAGRAM

Before Safeguards



After Safeguards



After Recommendations



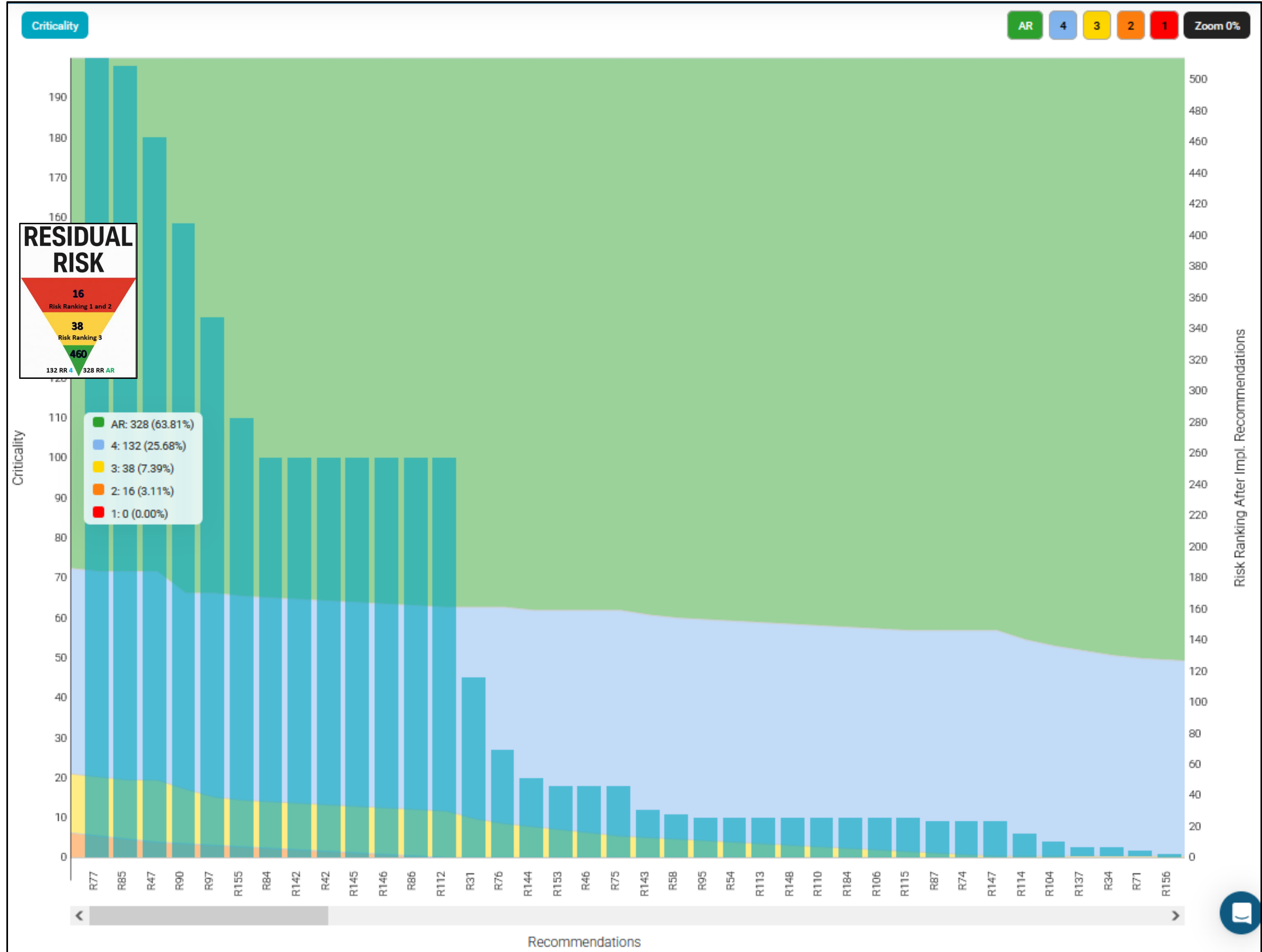


# Optimal Recommendation Sequencer



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## Pre-Recommendation Sequencer Implementation:

Risk Ranking 1: 0

Risk Ranking 2: 16

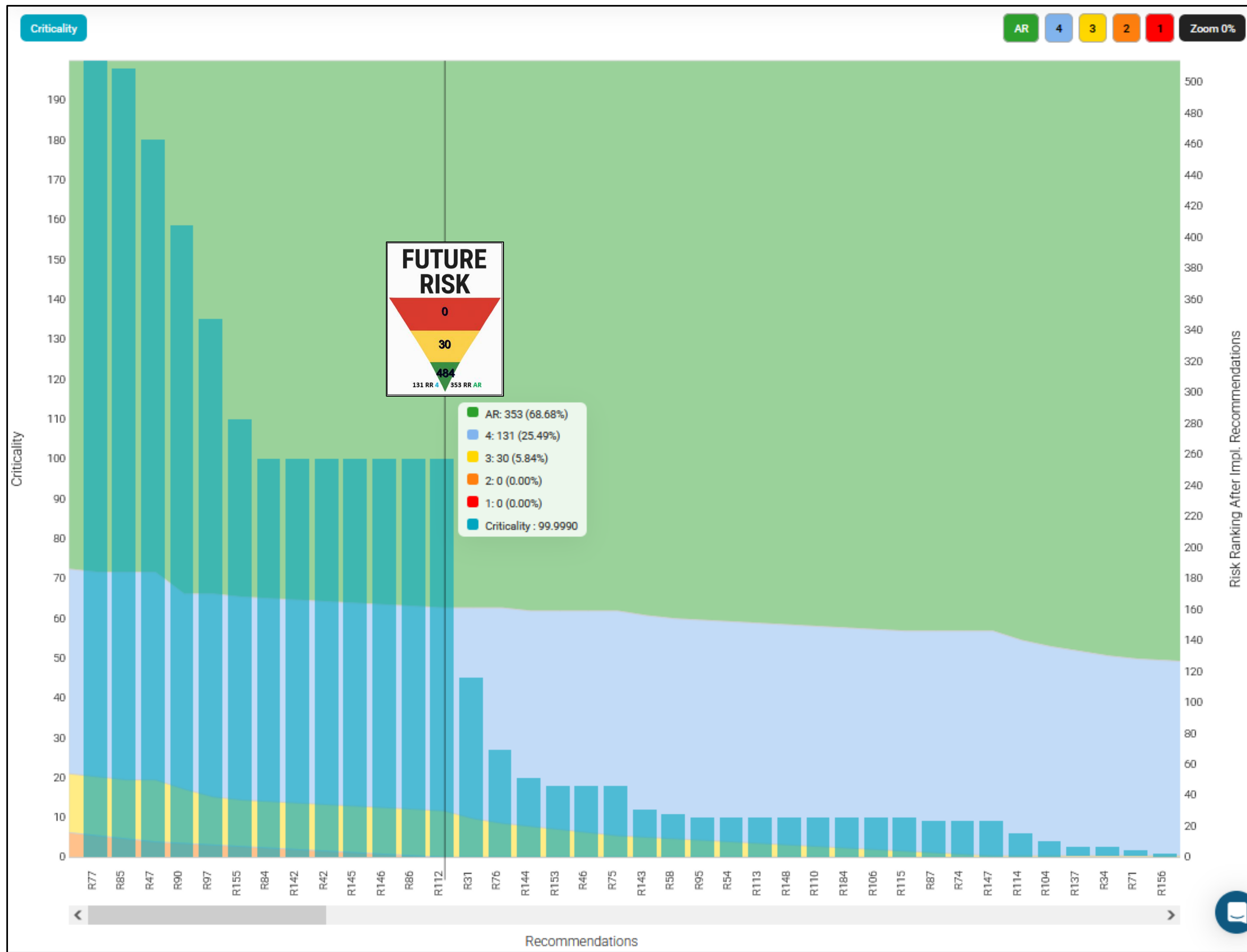
Risk Ranking 3: 38

**i.e., Plant Residual Risk State**

The following slides will demonstrate the impact of applying suggested recommendations based on the Risk Alive® “Optimal Recommendation Sequencer”.



# Implementation of 13<sup>th</sup> Recommendation



## Post 13<sup>th</sup> Recommendation Implementation:

- Risk Ranking 1: 0
- Risk Ranking 2: 0 (16 Reduced)
- Risk Ranking 3: 30 (8 Reduced)

## Key Finding:

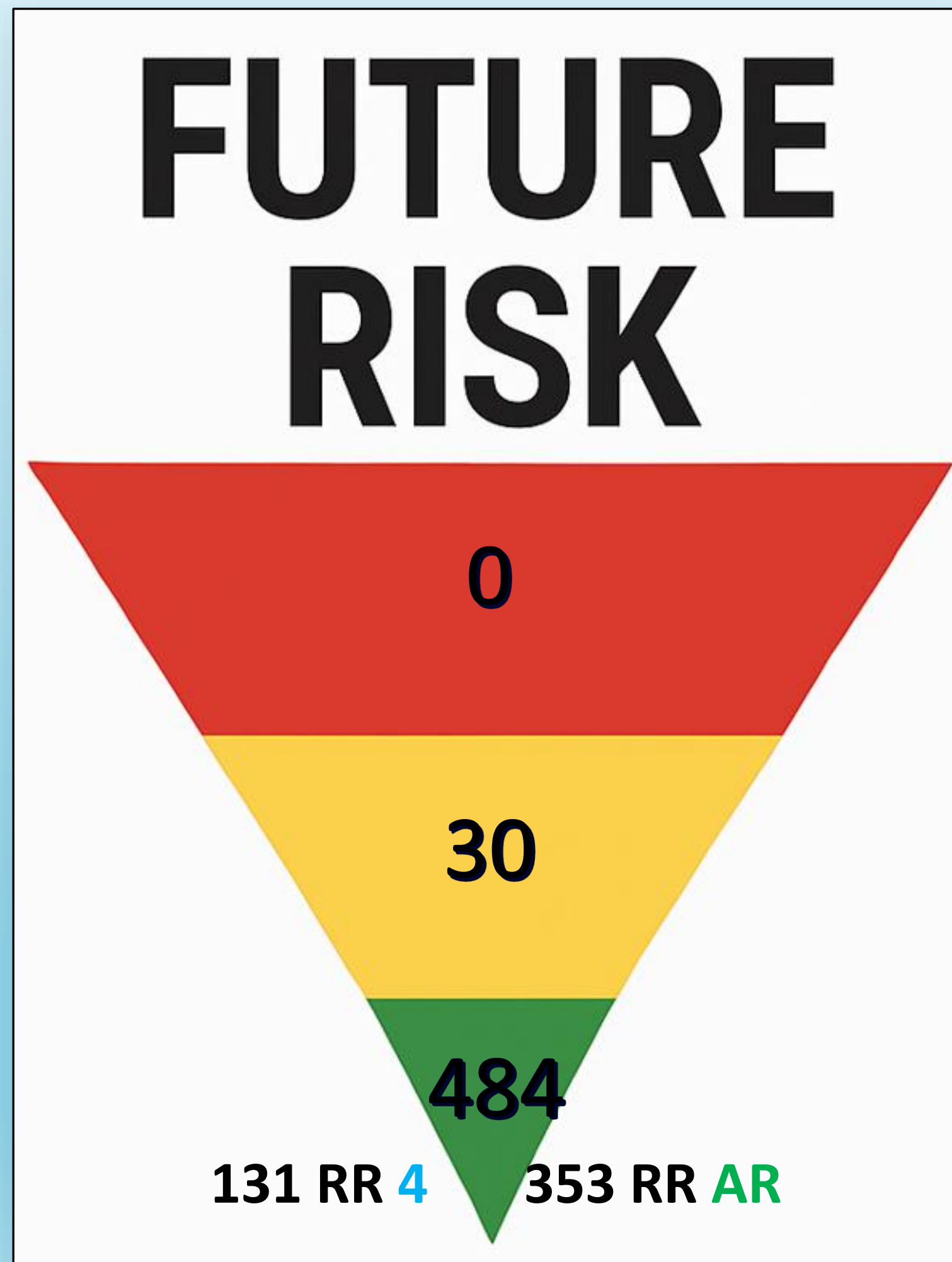
Implementation of **Top 13 (~9%)** recommendations from “Optimal Recommendation Sequencer” moves maximum “High Risk” Level **1** and **2** scenarios identified in the PHA to a lower risk zone.

Estimated cost ~ **\$155,000**

# ALARP DIAGRAM

With Risk Alive Optimal Sequencer  
Top 13 Recommendations

Implementing all **145 Recommendations**

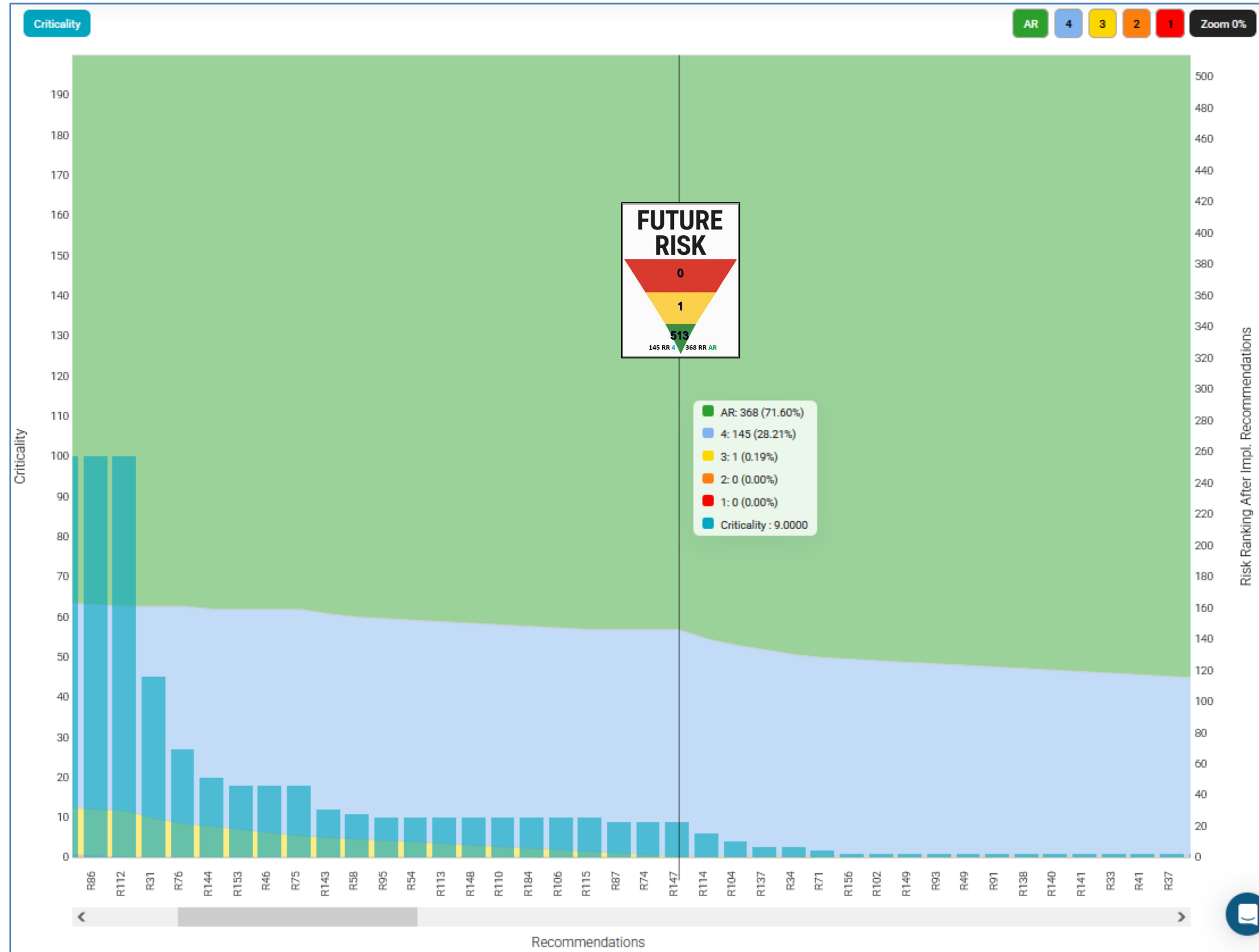




# Implementation of 32<sup>nd</sup> Recommendation



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## Post 32<sup>nd</sup> Recommendation Implementation:

Risk Ranking 1: 0

Risk Ranking 2: 0 (16 Reduced)

Risk Ranking 3: 1 (37 Reduced)

## Key Finding:

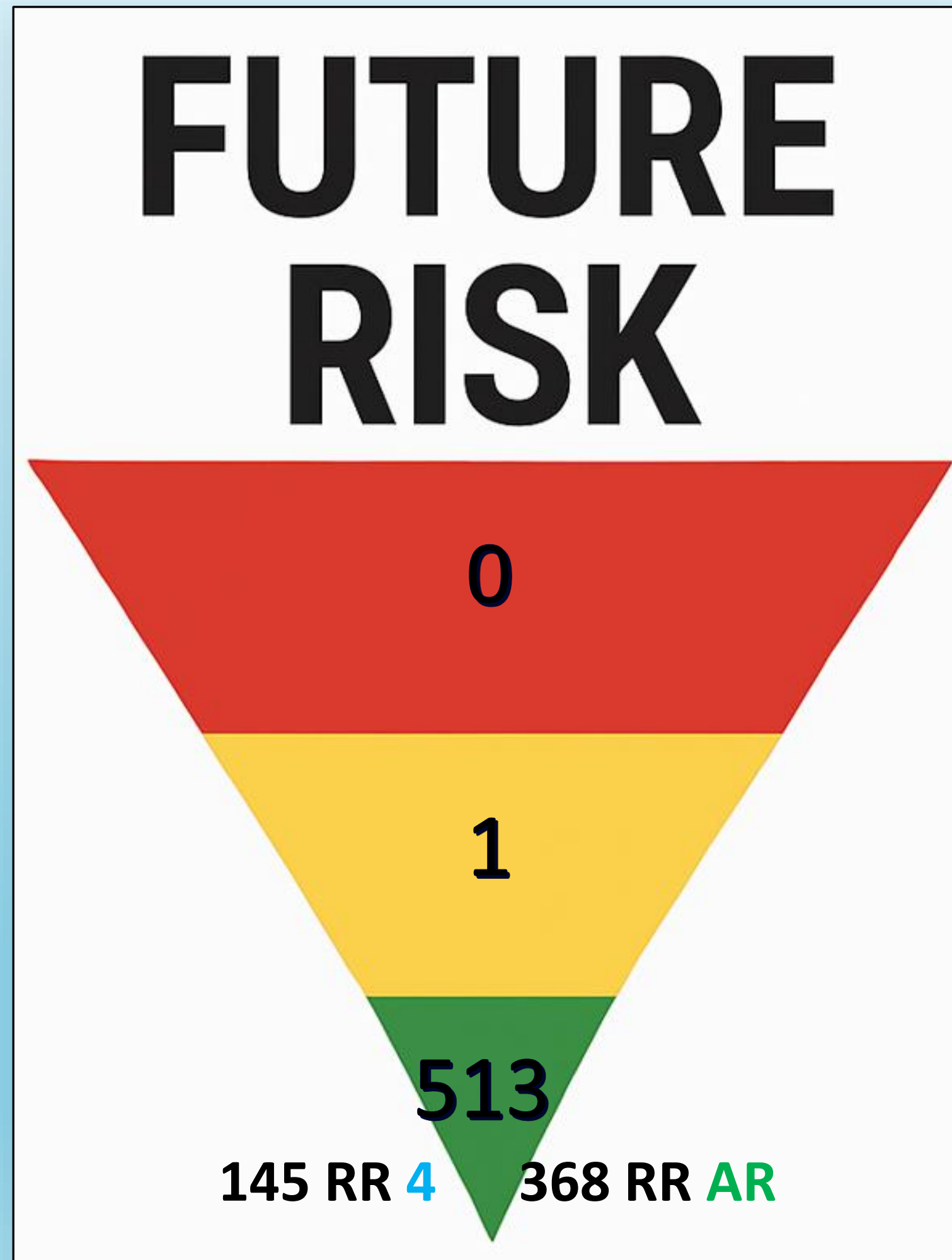
Implementation of **Top 32 (~22%)** recommendations from “Optimal Recommendation Sequencer” moves maximum Level **3** identified in the PHA to a lower risk zone.

Estimated cost ~ **\$515,000**

# ALARP DIAGRAM

With Risk Alive Optimal Sequencer  
Top 32 Recommendations

Implementing all **145 Recommendations**



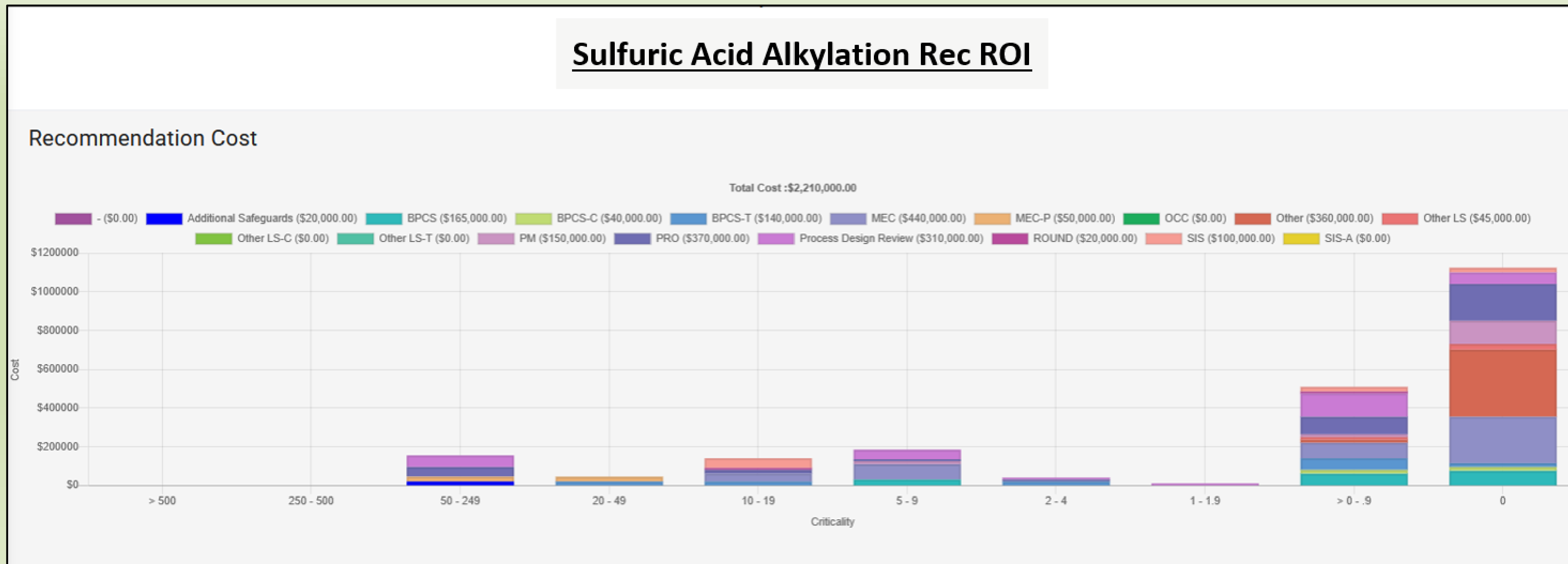


# Estimated Recommendation Cost

**Total General Estimated Cost (Implementing All 145 PHA Recommendations) ~ \$2.21M**

*Estimates may vary based on your specific company.*

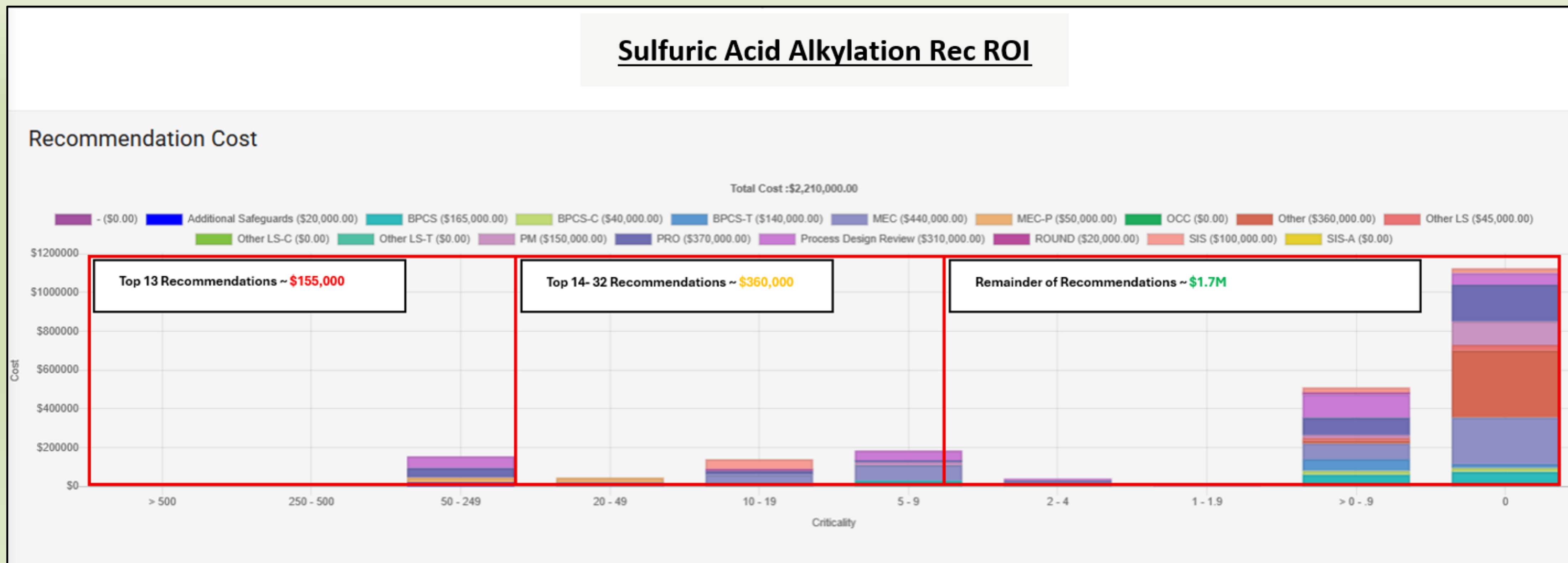
*Cost of recommendation can be adjusted within Risk Alive Platform (i.e., Alarm Typical Cost = \$X, Trip Typical Cost = \$Y)*





# Estimated Cost Savings

- Implementation of only the Top 13 (~9%) recommendations results in estimated savings of ~ **\$2.06M**
- Implementation of only the Top 32 (~22%) recommendations results in estimated savings of ~ **\$1.7M**





# Remaining Critical Vulnerabilities



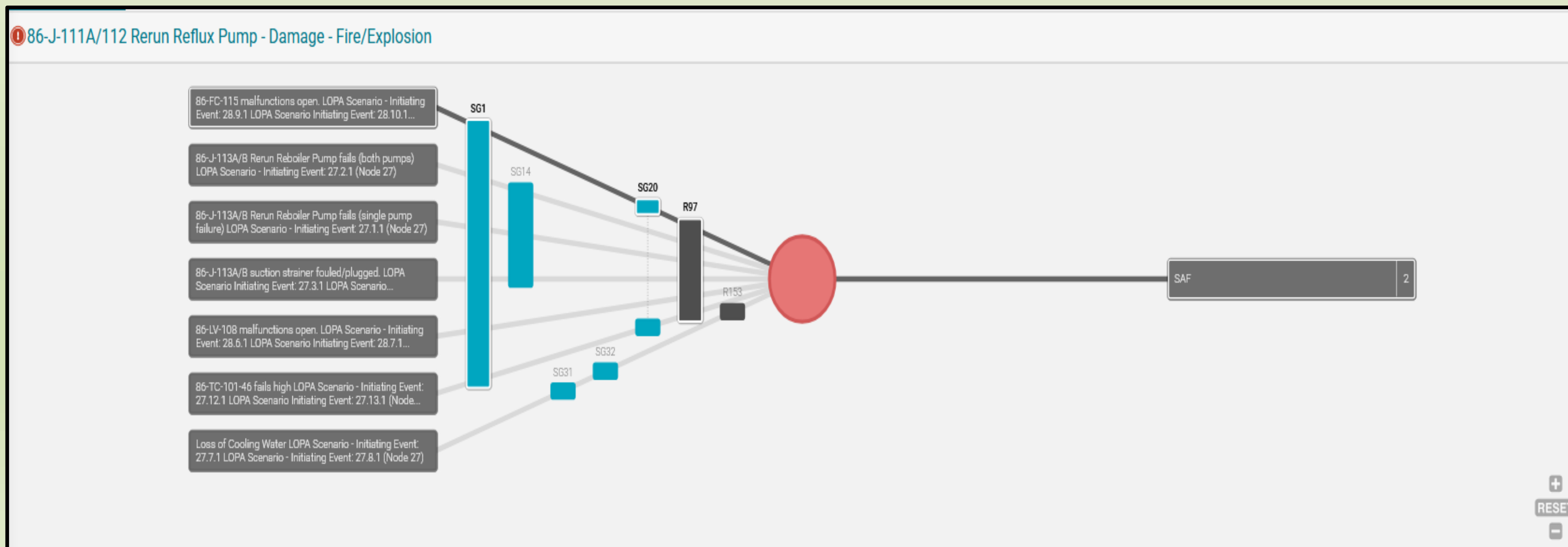
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## After Top 32 Recommendations:

High Severity Vulnerability Bowtie Center Remaining

86-J-111A/112 Rerun Reflux Pump - Damage - Fire/Explosion



# Safeguard Bypass Module

## What It Does & Why It Matters

- Simulates safeguards that are defeated, bypassed, or out of service
- Provides real-time insight into critical vulnerabilities
- Process Safety Risk Awareness: Highlights when critical protection layers are compromised
- Operational Planning: Enables teams to schedule work only when sufficient safeguards are in place

## Key Benefits:

- Reduces unintentional risk exposure during maintenance and start-up/shutdown
- Integrates bypass data with overall barrier health metrics
- Enables proactive decision-making in control rooms and planning meetings

## Outcome:

- Stronger Process Safety Management (PSM) through risk-informed operational discipline



# How Risk Alive® Supports Alarm Rationalization



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- Analyze which alarms are most frequently associated with high-risk scenarios
- Identify alarms triggered in ineffective or redundant safeguards
- Prioritize alarms based on true risk relevance, not just count
- Optimize alarm strategies to reduce noise and increase operator effectiveness

## Alarm Management

### Alarm Rationalization



# Enhancing Preventative Maintenance



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- Highlight equipment tied to high-risk safeguard failures
- Prioritize maintenance on safety-critical assets
- Justify maintenance budgets with data-driven risk profiles
- Reduce unplanned downtime by focusing on preventive actions with the most impact

## Preventive maintenance



Making repairs before a piece of equipment malfunctions or exhibits notable problem

# Critical Spare Parts & Inventory Management



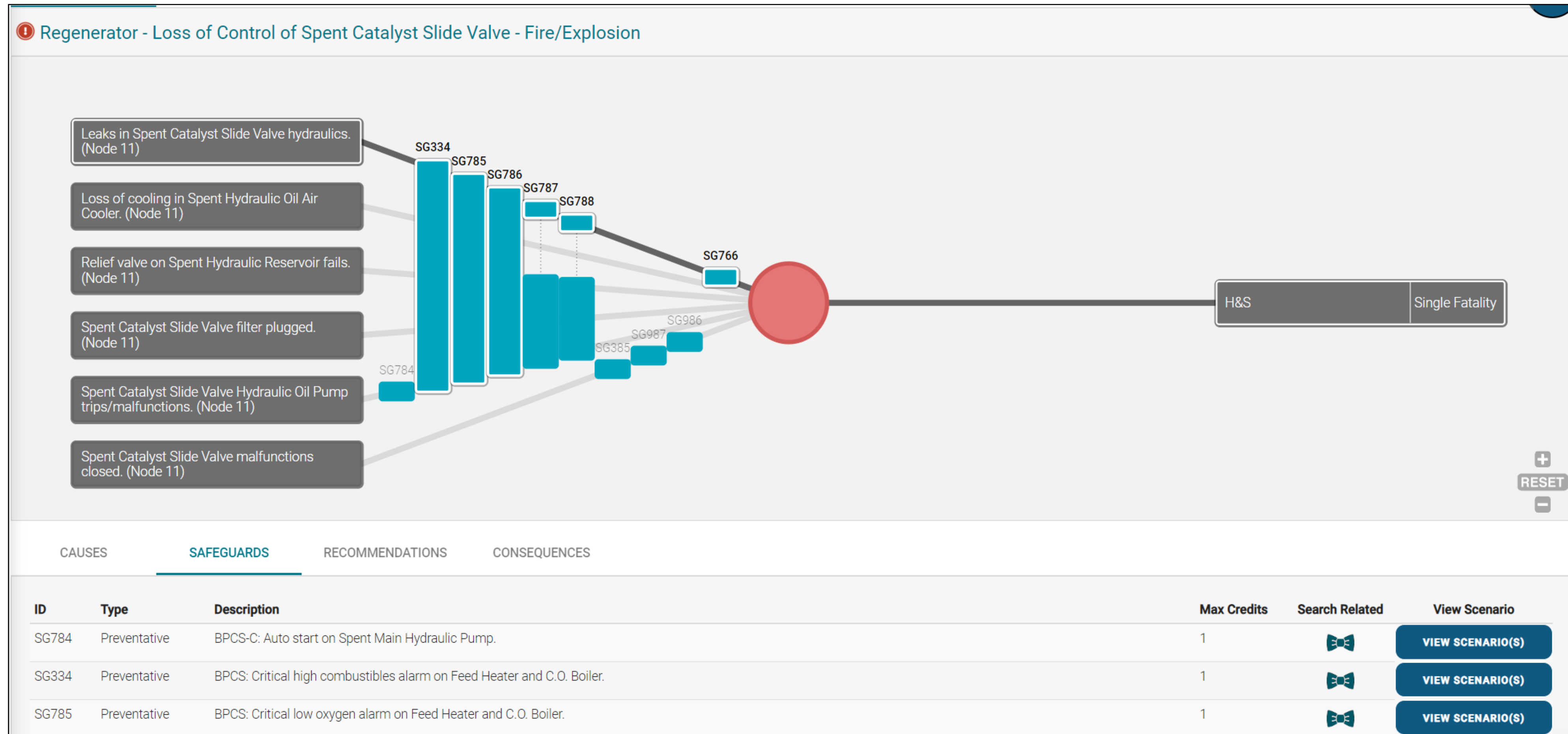
- Identify frequently stressed equipment components from safeguard data
- Prioritize stocking of spares tied to high-severity or high-frequency risks
- Reduce downtime by ensuring availability of critical components
- Optimize inventory with actual risk-based demand data

# PHA Critical Industry Data



## Risk Management: Identify and Manage Enterprise Risk

- Use **Industry PHA data** from to identify common high risk scenarios to ensure important Critical scenarios are considered & discussed.



# PHA Analytics Poster



## Most Significant Safeguards

Safeguards Reducing Likelihood of Hazardous Events		H&S Impact	Env. Impact	Fin. Impact	Reg. Impact
1	<b>Relief Valve</b> Relief valve RV-E-4801A designed for the case.				
2	<b>Relief Valve</b> RV-E-4802 without CSO on the 2 valves on line IN-101. Set point at 57 psig. Valve adequately sized.				
3	<b>Ball Bearing</b> Injection pump with ball bearing at inlet and outlet to prevent backflow.				

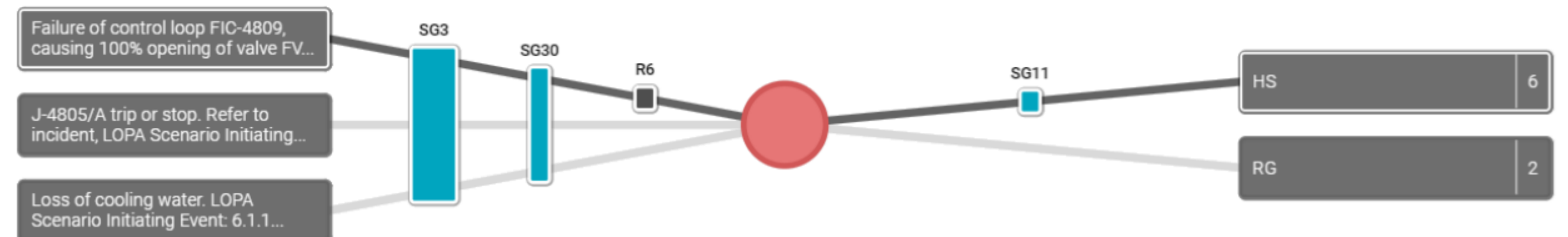
## You are a Safeguard! Top 10 Human Dependent Safeguards in this Unit

<b>BPCS Alarm</b>	Priority 1 H2S detection alarm AIT-4804-03, U1CP06 UR4804.	<b>BPCS Alarm</b>	Priority 1 H2S detection alarm AIT-4804-04 U1CP06 board UR4803, with operational action.
<b>BPCS Alarm</b>	Priority 1 H2S detection alarm AIT-4804-04 U1CP06 board UR4803, with operational action.	<b>SIS Alarm</b>	SG30: Priority 1 high pressure alarm at PI-4831A, with operational action. Triconex via communication U1CP09.
<b>SIS Alarm</b>	SG30: Priority 1 high pressure alarm at PI-4831A, with operational action. Triconex via communication U1CP09.	<b>Round</b>	Operational walkabout validating the proper operation of the warm-up line.
<b>Round</b>	Level validated manually during operational walkabout 1x per shift.	<b>Round</b>	Operational walkabout 1x per work shift, with verification of scaling inhibitor injection rate as well as of the level in the tote.
<b>BPCS Alarm</b>	Priority 1 H2S detection alarm AIT-4805-1 U1CP06 UR4804 AIT-4804-5 U1CP06 UR4803.	<b>BPCS Alarm</b>	Priority 2 high level alarm LAHH-2625 in knockout drum F-2613. 2nd alarm after more than 10 minutes of the LT-4801's alarm. U1CP06 UR4802

## Most Significant Threats

Threat Leading to Hazardous Event	H&S Impact	Env. Impact	Fin. Impact	Reg. Impact	Importance of Top 3
1 <b>E-4802 NH3 Stripper - Overpressure</b> Loss of cooling water.					Percentage of risk in the unit from these 3 causes alone: 30.15% Risk Contribution
2 <b>F-4807 Drum - Overflow</b> Shutdown of pump J-4810.					
3 <b>J-4803/A Pump - Damage</b> Failure of the control loop that closes valve FV-4802. TV-4804 in automatic flowrate control will shut down U1CP06 UR4814.					

## Hazardous Scenario #1 – E-4802 NH3 Stripper - Damage - Loss of Containment



### Top 3 Safeguards for Event:

SG3: RV-E-4802 without CSO on the 2 valves on line IN-101. Set point at 57 psig. Valve adequately sized. SG30: Priority 1 high pressure alarm at PI-4831A, with operational action. Triconex via communication U1CP09. SG11: Priority 1 H2S detection alarm AIT-4804-04 U1CP06 board UR4803, with operational action.

**Thank  
You**



**Thank  
You**



**Thank  
You**

