TOTALRISK 1.0 IN PLANNING FAQ

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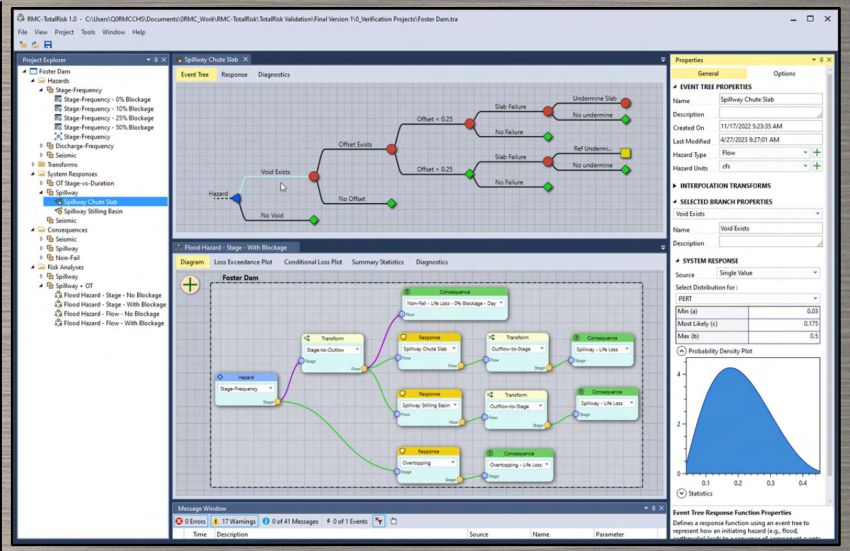
Acting Economics NTS

FRM-PCX

PCoP Webinar

28 Aug 2025



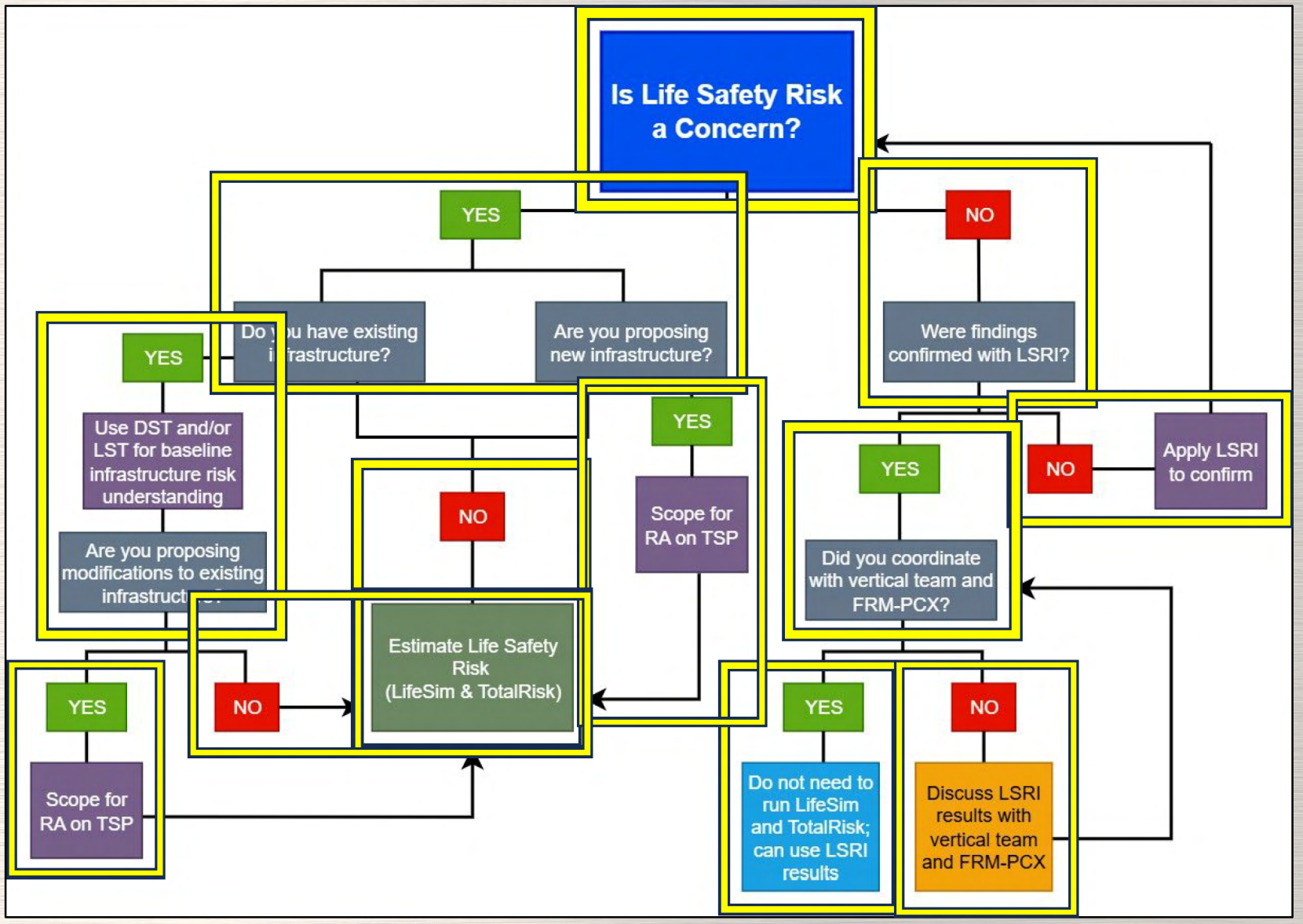
U.S. ARMY

US Army Corps of Engineers

FAQs

- Is TotalRisk certified?
  - YES! For life safety risk analysis only
- Does TotalRisk replace LifeSim?
  - NO!
  - LifeSim modeling results are a key INPUT for TotalRisk
  - LifeSim = Consequences model
  - TotalRisk = Risk engine
- Can I use TotalRisk for economic risk analysis?
  - TotalRisk is NOT certified for economic risk analysis
- Do all FRM studies need to use TotalRisk?
  - NO!

FAQ: When do I need to use TotalRisk?



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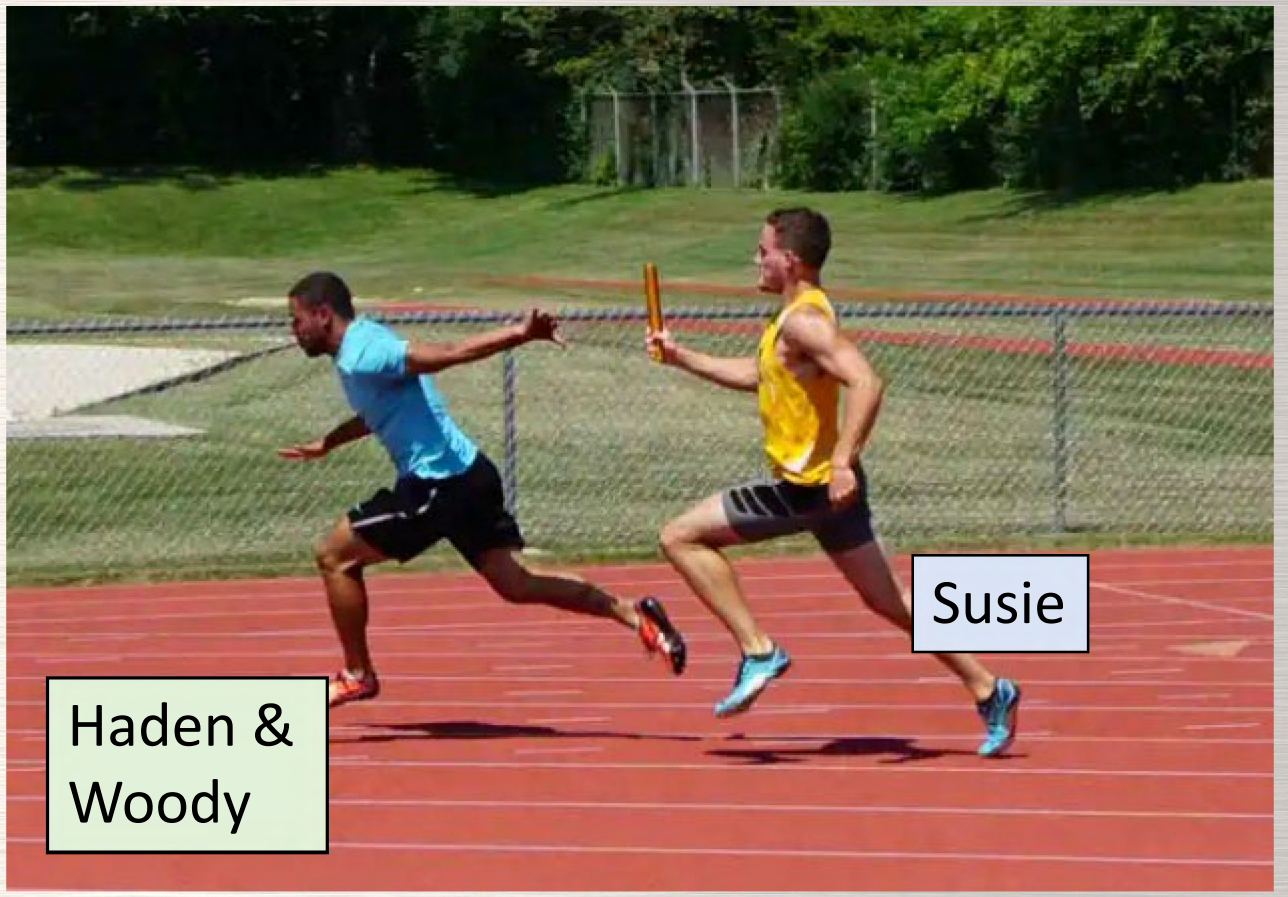
FAQ: How does TotalRisk work?



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of Engineers

RMC-TotalRisk

Quantitative Risk Analysis Software

August 2025

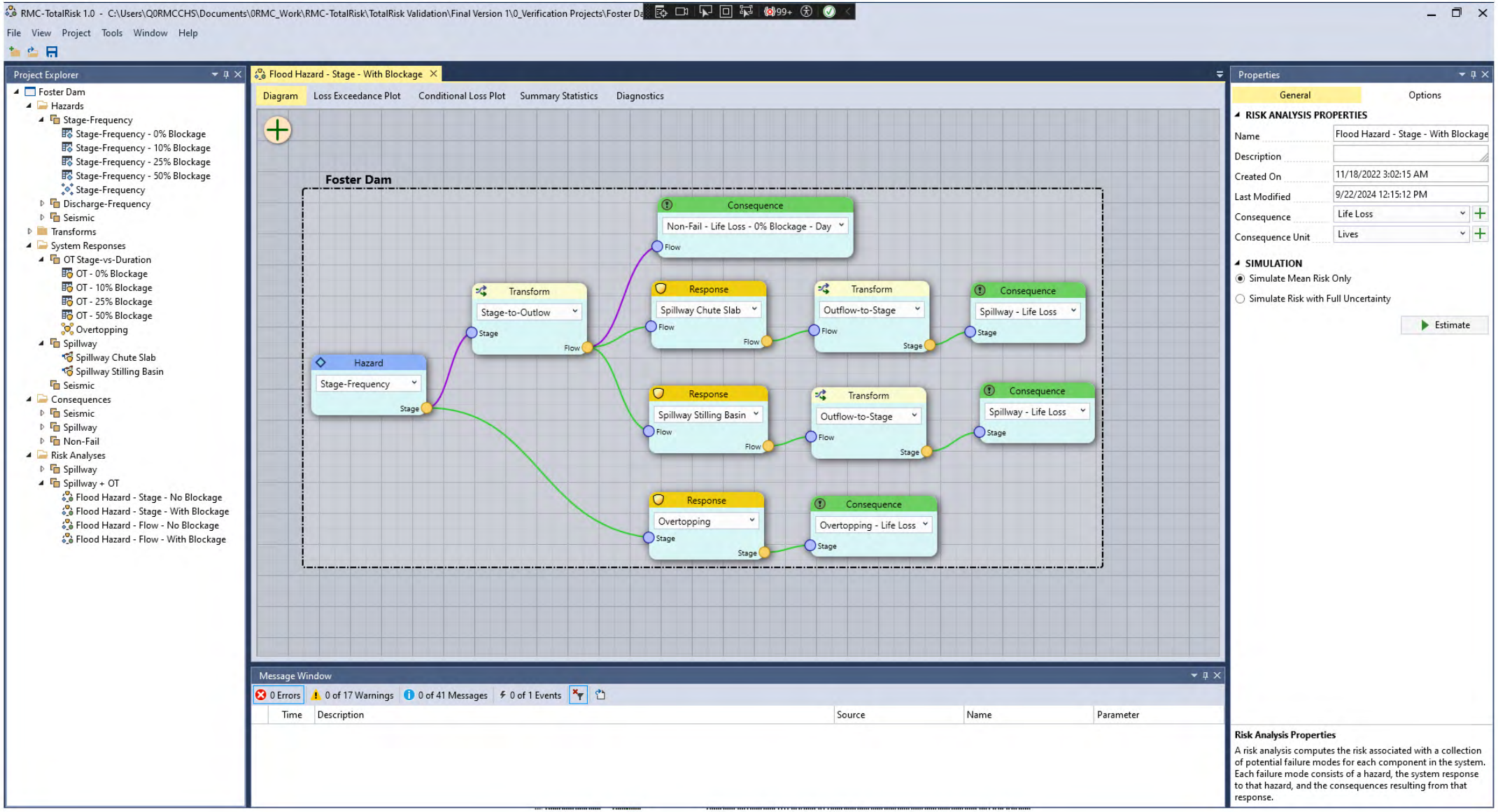
Haden Smith, Lead Engineer

Woody Fields, Senior Consequence Specialist

US Army Corps of Engineers®

Series #

Background

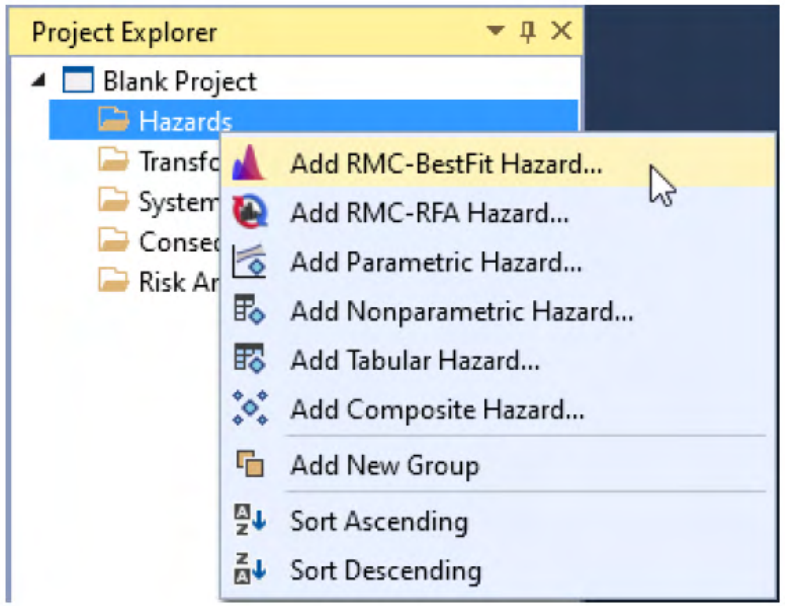

RMC-TotalRisk 1.0 - C:\Users\Q0RMCCHS\Documents\0RMC_Work\RMC-TotalRisk\TotalRisk Validation\Final Version 1\0_Verification Projects\Foster Da
File View Project Tools Window Help
Project Explorer
Foster Dam
Hazards
Stage-Frequency
Stage-Frequency - 0% Blockage
Stage-Frequency - 10% Blockage
Stage-Frequency - 25% Blockage
Stage-Frequency - 50% Blockage
Stage-Frequency
Discharge-Frequency
Seismic
Transforms
System Responses
OT Stage-vs-Duration
OT - 0% Blockage
OT - 10% Blockage
OT - 25% Blockage
OT - 50% Blockage
Overtopping
Spillway
Spillway Chute Slab
Spillway Stilling Basin
Seismic
Consequences
Seismic
Spillway
Non-Fail
Risk Analyses
Spillway
Spillway + OT
Flood Hazard - Stage - No Blockage
Flood Hazard - Stage - With Blockage
Flood Hazard - Flow - No Blockage
Flood Hazard - Flow - With Blockage
Flood Hazard - Stage - With Blockage
Diagram
Loss Exceedance Plot
Conditional Loss Plot
Summary Statistics
Diagnostics
Foster Dam
Hazard
Stage-Frequency
Stage
Transform
Stage-to-Outlow
Stage
Flow
Consequence
Non-Fail - Life Loss - 0% Blockage - Day
Flow
Response
Spillway Chute Slab
Flow
Flow
Transform
Outflow-to-Stage
Flow
Stage
Consequence
Spillway - Life Loss
Stage
Response
Spillway Stilling Basin
Flow
Flow
Transform
Outflow-to-Stage
Flow
Stage
Consequence
Spillway - Life Loss
Stage
Response
Overtopping
Stage
Stage
Consequence
Overtopping - Life Loss
Stage
Message Window
0 Errors
0 of 17 Warnings
0 of 41 Messages
0 of 1 Events
Time
Description
Source
Name
Parameter
Properties
General
Options
RISK ANALYSIS PROPERTIES
Name
Flood Hazard - Stage - With Blockage
Description
Created On
11/18/2022 3:02:15 AM
Last Modified
9/22/2024 12:15:12 PM
Consequence
Life Loss
Consequence Unit
Lives
SIMULATION
Simulate Mean Risk Only
Simulate Risk with Full Uncertainty
Estimate
Risk Analysis Properties
A risk analysis computes the risk associated with a collection of potential failure modes for each component in the system. Each failure mode consists of a hazard, the system response to that hazard, and the consequences resulting from that response.

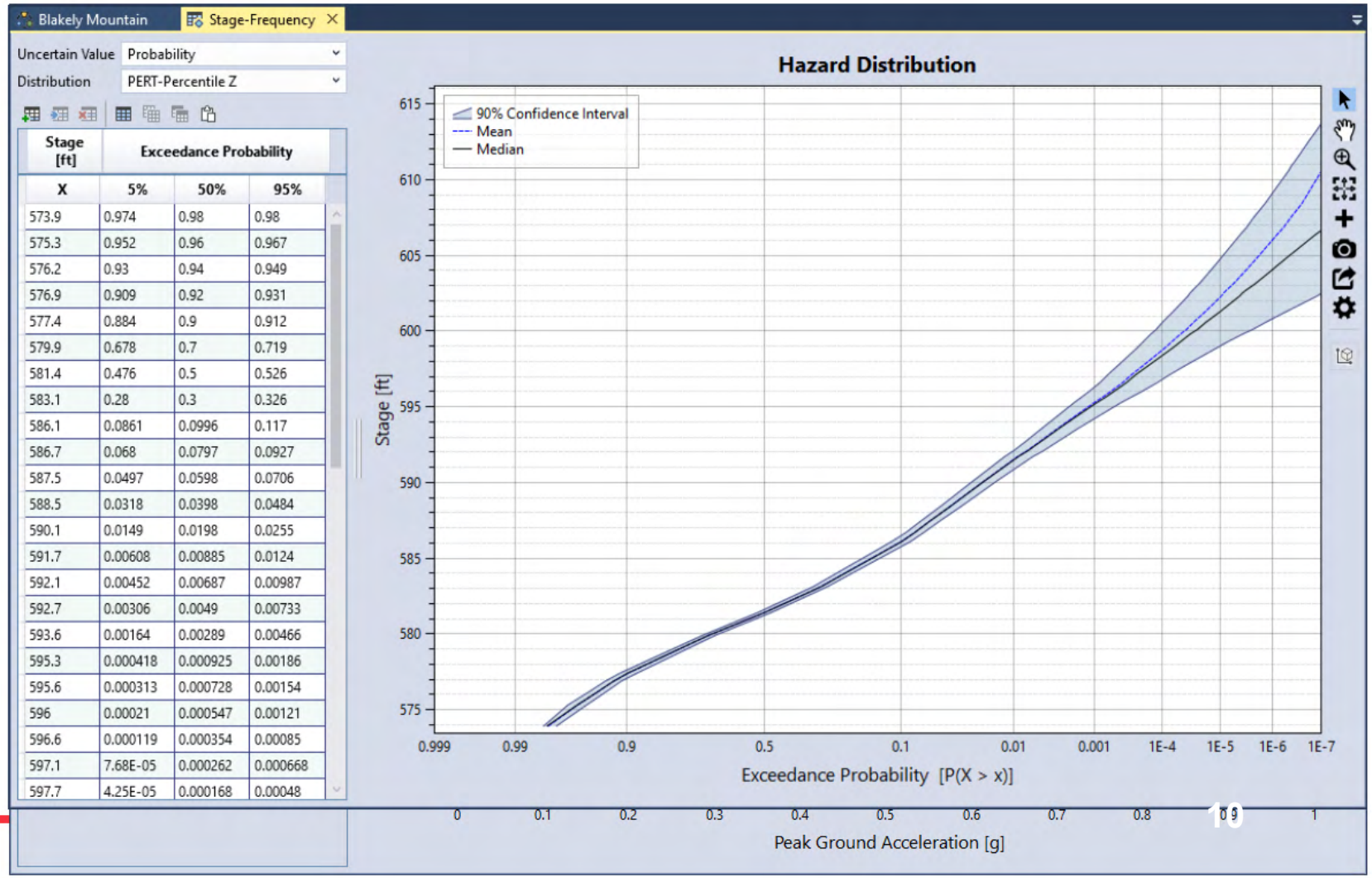
Goals of RMC-TotalRisk

- Key Principles:
  - Handle both simple systems and complex systems with multiple components and failure modes.
  - Support deterministic and probabilistic methods.
  - Be efficient to make modeling fast, intuitive, and repeatable.
  - Produce clear outputs that help communicate risk and uncertainty to decision makers and stakeholders.

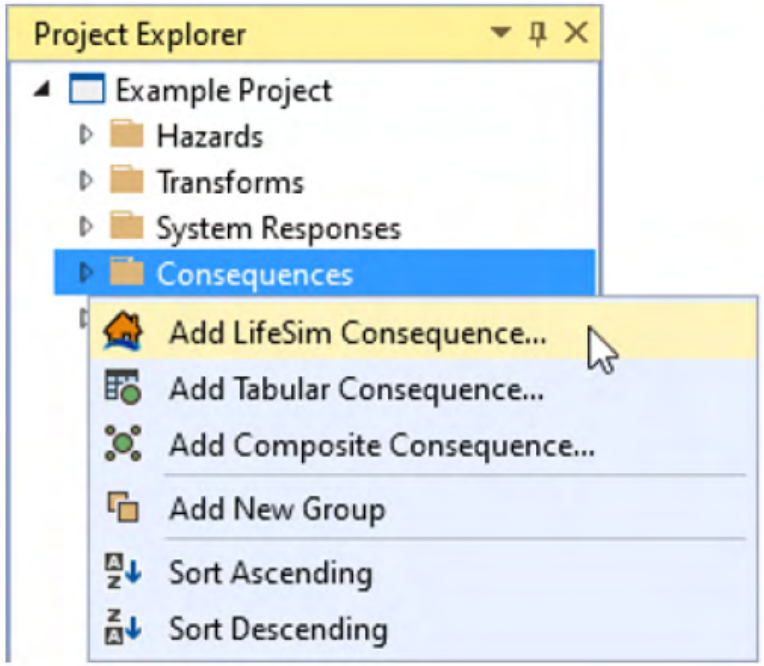
How is RMC-TotalRisk Unique?

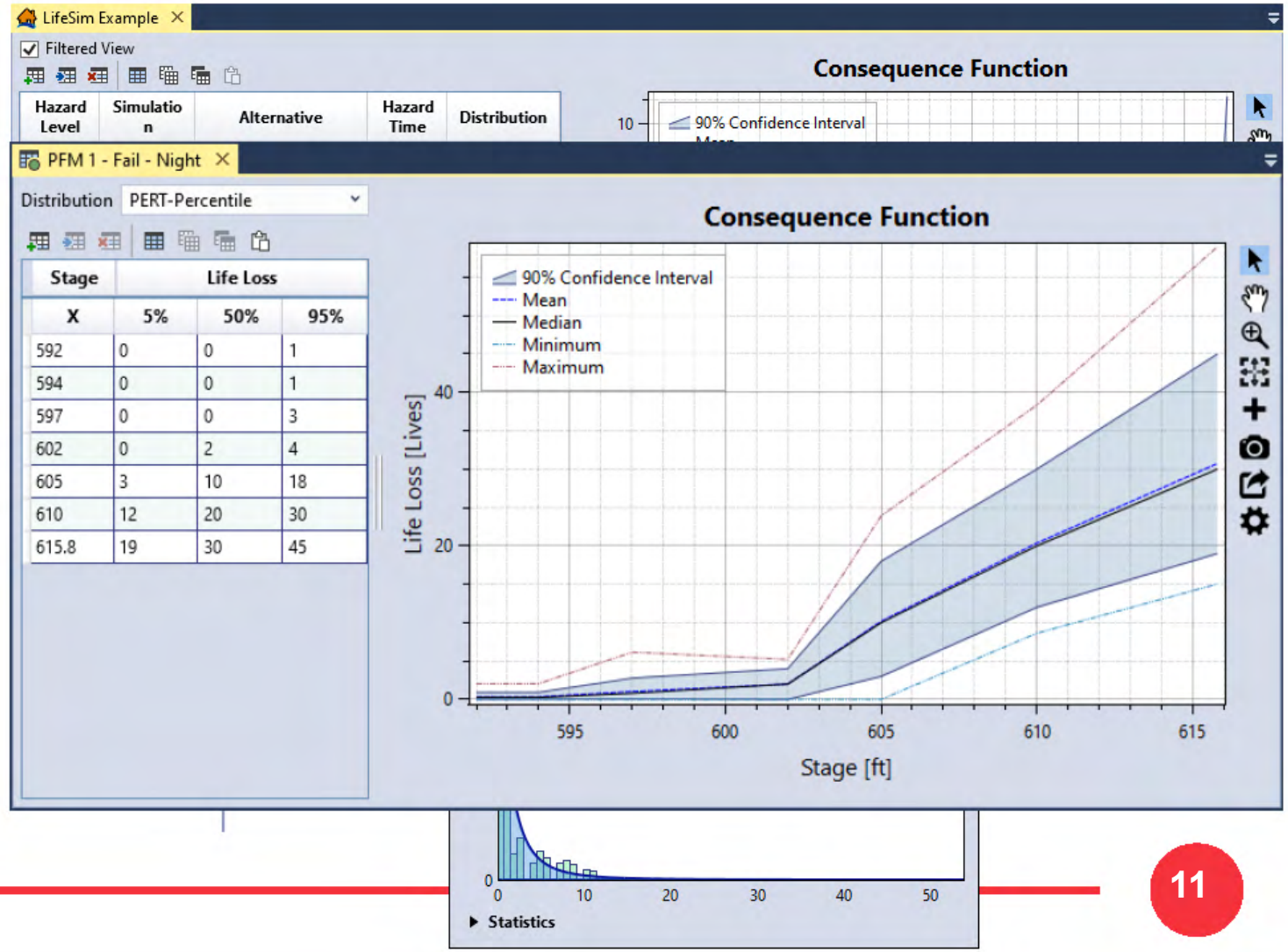
Hazards


Project Explorer
Blank Project
Hazards
Transfo
System
Conse
Risk Ar
Add RMC-BestFit Hazard...
Add RMC-RFA Hazard...
Add Parametric Hazard...
Add Nonparametric Hazard...
Add Tabular Hazard...
Add Composite Hazard...
Add New Group
Sort Ascending
Sort Descending

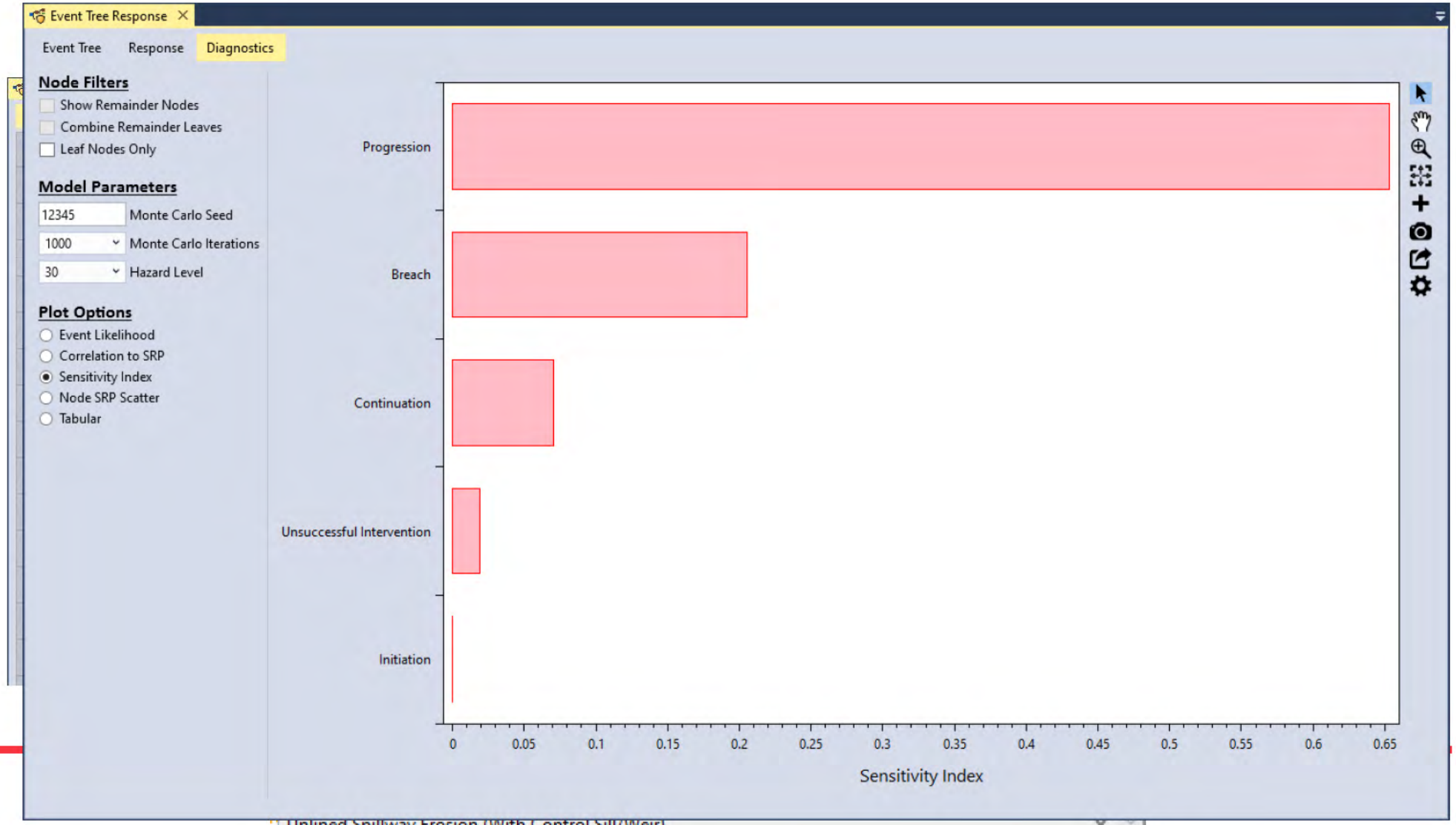

Blakely Mountain
Stage-Frequency
Uncertain Value
Probability
Distribution
PERT-Percentile Z
Stage [ft]
Exceedance Probability
X
5%
50%
95%
573.9 0.974 0.98 0.98
575.3 0.952 0.96 0.967
576.2 0.93 0.94 0.949
576.9 0.909 0.92 0.931
577.4 0.884 0.9 0.912
579.9 0.678 0.7 0.719
581.4 0.476 0.5 0.526
583.1 0.28 0.3 0.326
586.1 0.0861 0.0996 0.117
586.7 0.068 0.0797 0.0927
587.5 0.0497 0.0598 0.0706
588.5 0.0318 0.0398 0.0484
590.1 0.0149 0.0198 0.0255
591.7 0.00608 0.00885 0.0124
592.1 0.00452 0.00687 0.00987
592.7 0.00306 0.0049 0.00733
593.6 0.00164 0.00289 0.00466
595.3 0.000418 0.000925 0.00186
595.6 0.000313 0.000728 0.00154
596 0.00021 0.000547 0.00121
596.6 0.000119 0.000354 0.00085
597.1 7.68E-05 0.000262 0.000668
597.7 4.25E-05 0.000168 0.00048
Hazard Distribution
90% Confidence Interval
Mean
Median
Stage [ft]
615
610
605
600
595
590
585
580
575
0.999
0.99
0.9
0.5
0.1
0.01
0.001
1E-4
1E-5
1E-6
1E-7
Exceedance Probability [P(X > x)]
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Peak Ground Acceleration [g]

Consequences

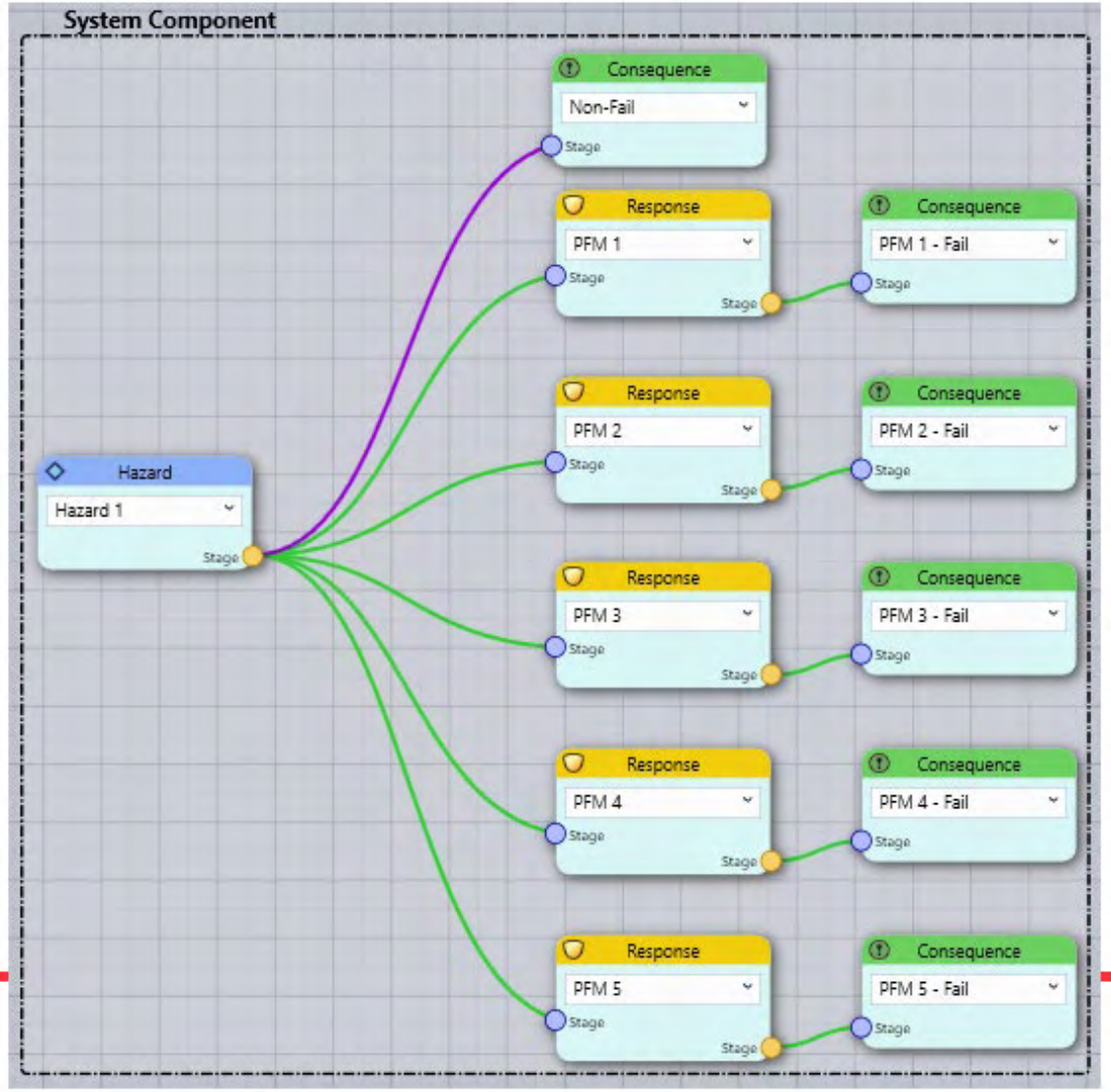


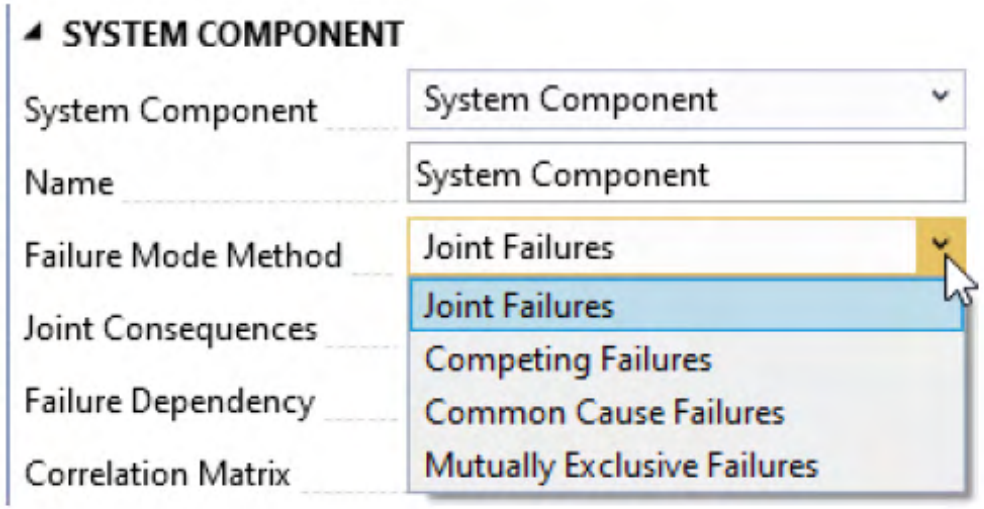


Event Tree Analysis

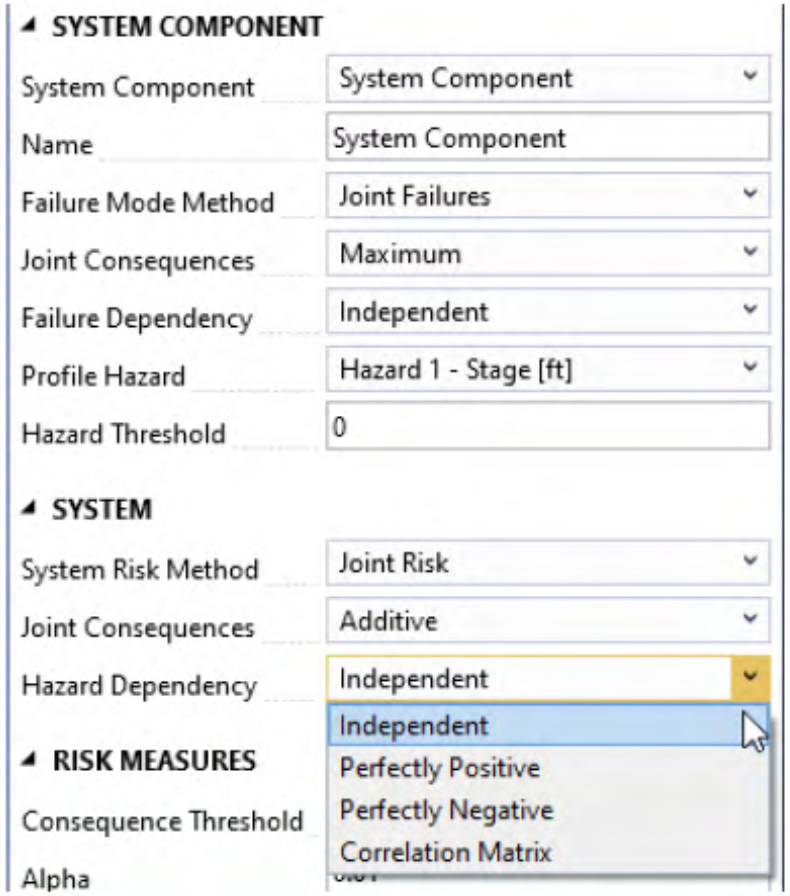


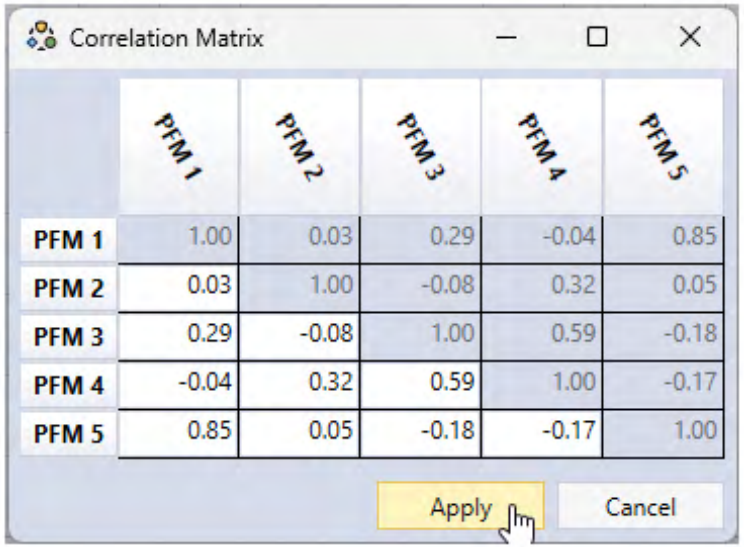
Multiple Failure Modes

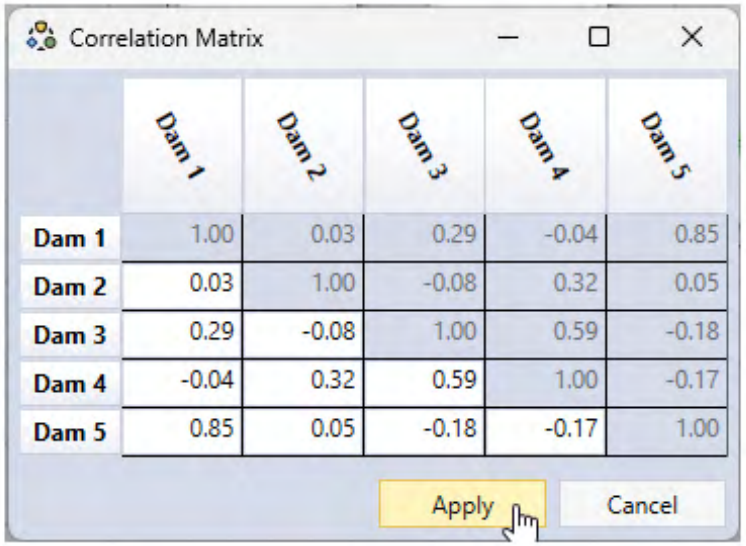




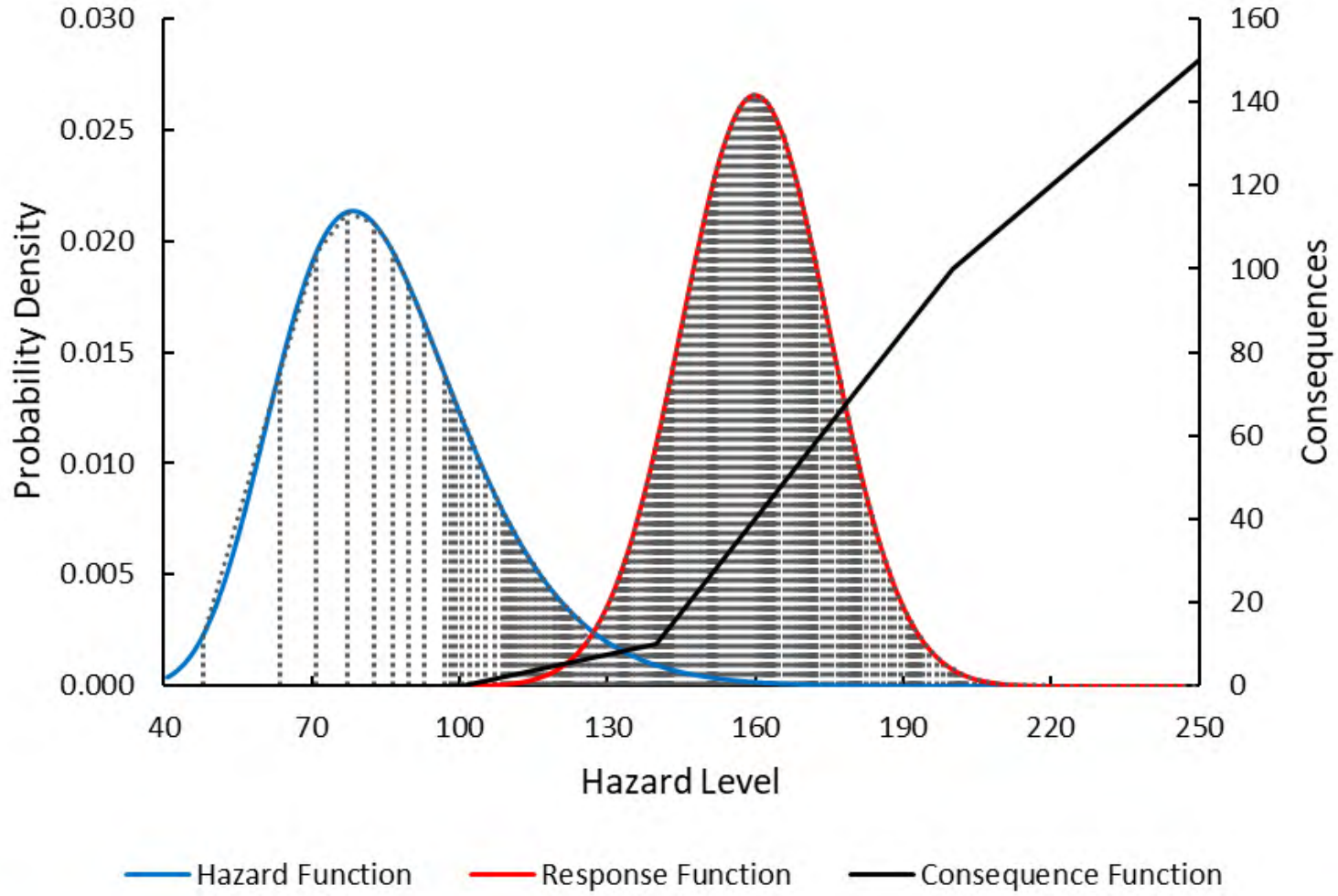
Dependency


SYSTEM COMPONENT
System Component
System Component
Name
System Component
Failure Mode Method
Joint Failures
Joint Consequences
Maximum
Failure Dependency
Independent
Profile Hazard
Hazard 1 - Stage [ft]
Hazard Threshold
0
SYSTEM
System Risk Method
Joint Risk
Joint Consequences
Additive
Hazard Dependency
Independent
Independent
Perfectly Positive
Perfectly Negative
Correlation Matrix
RISK MEASURES
Consequence Threshold
Alpha


Correlation Matrix
PFM 1
PFM 2
PFM 3
PFM 4
PFM 5
PFM 1 1.00 0.03 0.29 -0.04 0.85
PFM 2 0.03 1.00 -0.08 0.32 0.05
PFM 3 0.29 -0.08 1.00 0.59 -0.18
PFM 4 -0.04 0.32 0.59 1.00 -0.17
PFM 5 0.85 0.05 -0.18 -0.17 1.00
Apply
Cancel

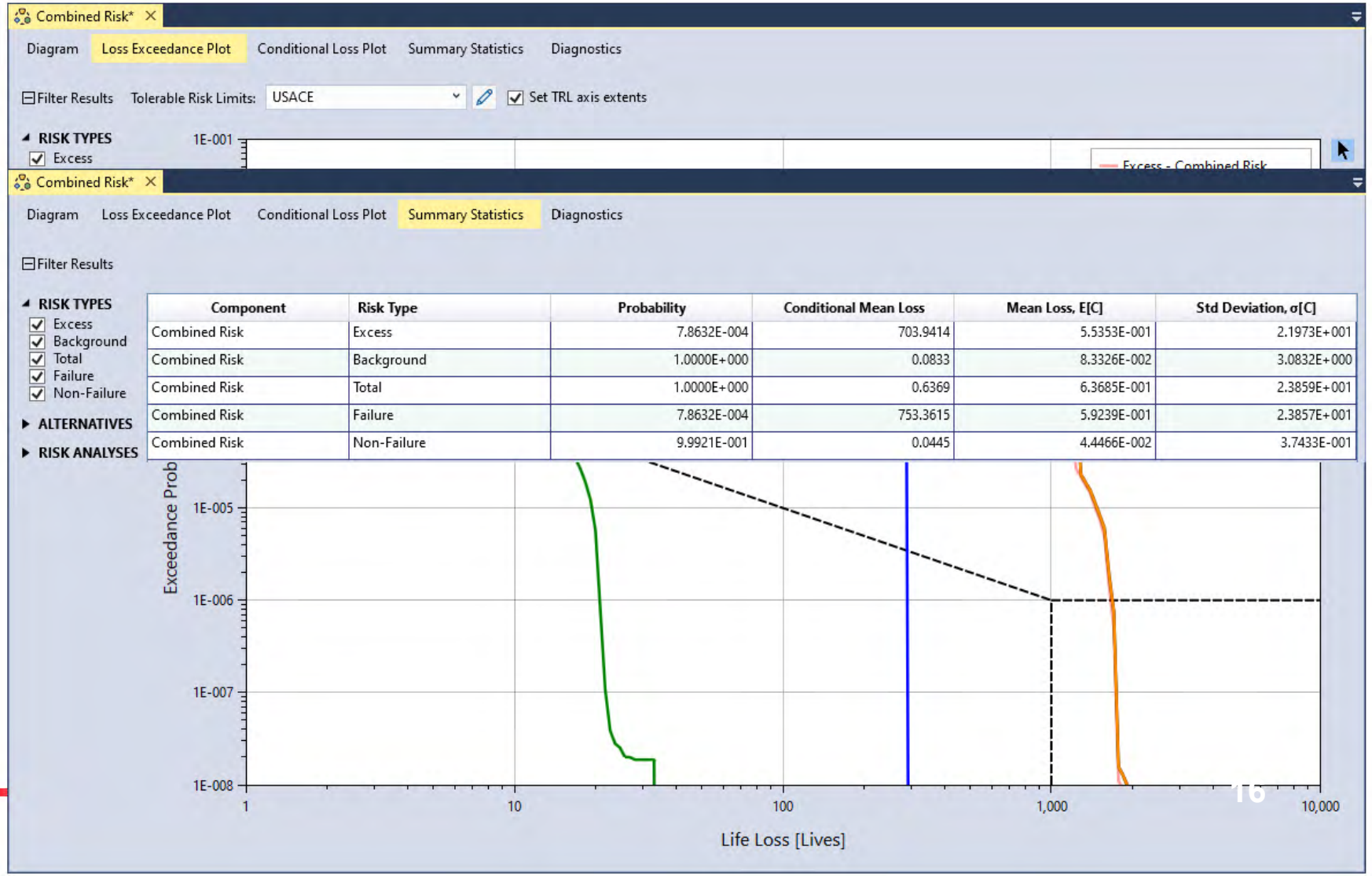

Correlation Matrix
Dam 1
Dam 2
Dam 3
Dam 4
Dam 5
Dam 1 1.00 0.03 0.29 -0.04 0.85
Dam 2 0.03 1.00 -0.08 0.32 0.05
Dam 3 0.29 -0.08 1.00 0.59 -0.18
Dam 4 -0.04 0.32 0.59 1.00 -0.17
Dam 5 0.85 0.05 -0.18 -0.17 1.00
Apply
Cancel

Adaptive Integration

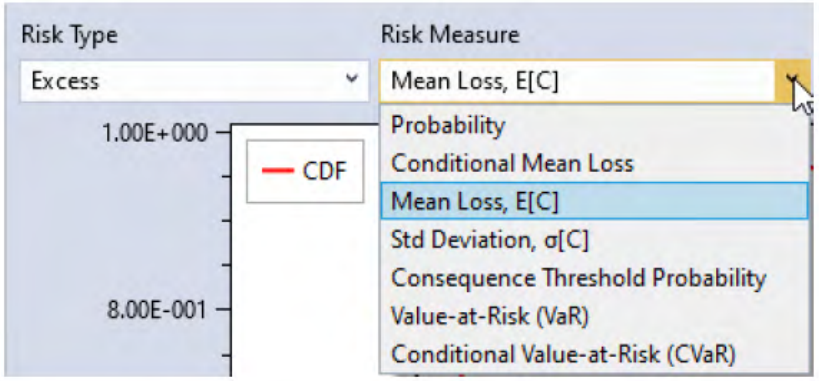


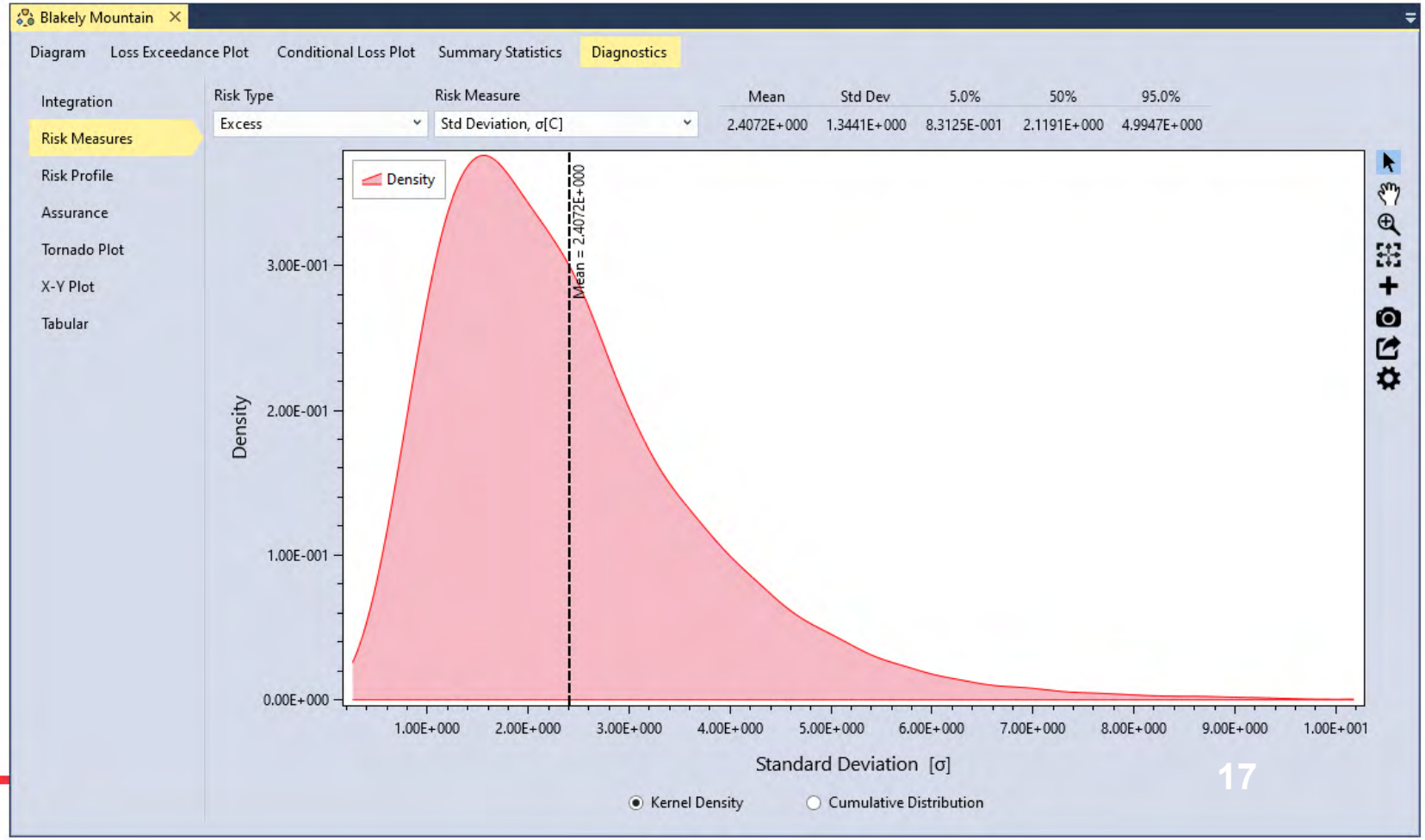
Risk Types

- Excess
- Background
- Total
- Failure
- Non-Failure

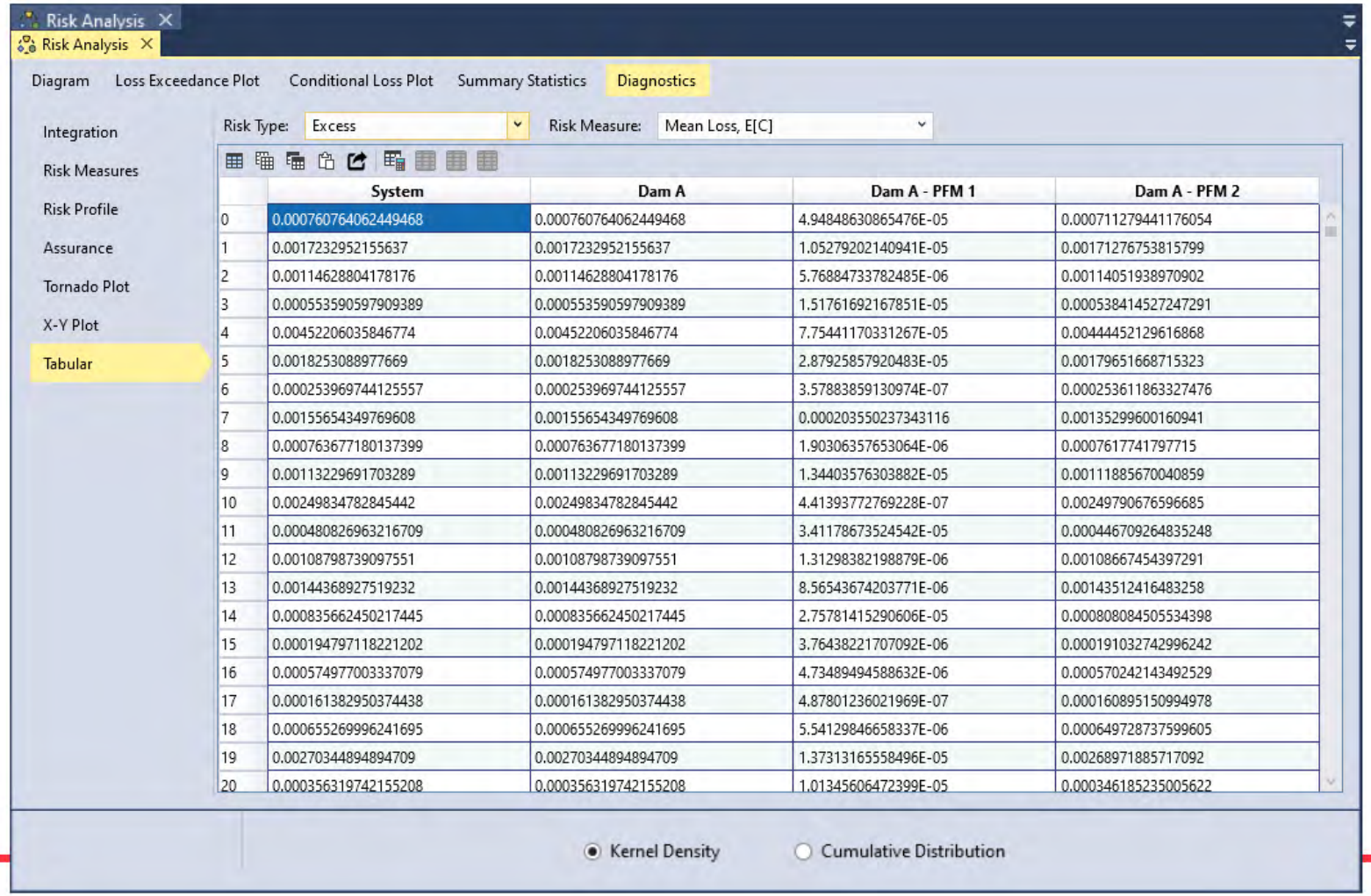


Risk Measures and Outputs





Diagnostics



	System	Dam A	Dam A - PFM 1	Dam A - PFM 2
0	0.000760764062449468	0.000760764062449468	4.94848630865476E-05	0.000711279441176054
1	0.0017232952155637	0.0017232952155637	1.05279202140941E-05	0.00171276753815799
2	0.00114628804178176	0.00114628804178176	5.76884733782485E-06	0.00114051938970902
3	0.000553590597909389	0.000553590597909389	1.51761692167851E-05	0.000538414527247291
4	0.00452206035846774	0.00452206035846774	7.75441170331267E-05	0.00444452129616868
5	0.0018253088977669	0.0018253088977669	2.87925857920483E-05	0.00179651668715323
6	0.000253969744125557	0.000253969744125557	3.57883859130974E-07	0.000253611863327476
7	0.00155654349769608	0.00155654349769608	0.000203550237343116	0.00135299600160941
8	0.000763677180137399	0.000763677180137399	1.90306357653064E-06	0.0007617741797715
9	0.00113229691703289	0.00113229691703289	1.34403576303882E-05	0.00111885670040859
10	0.00249834782845442	0.00249834782845442	4.41393772769228E-07	0.00249790676596685
11	0.000480826963216709	0.000480826963216709	3.41178673524542E-05	0.000446709264835248
12	0.00108798739097551	0.00108798739097551	1.31298382198879E-06	0.00108667454397291
13	0.00144368927519232	0.00144368927519232	8.56543674203771E-06	0.00143512416483258
14	0.000835662450217445	0.000835662450217445	2.75781415290606E-05	0.000808084505534398
15	0.000194797118221202	0.000194797118221202	3.76438221707092E-06	0.000191032742996242
16	0.000574977003337079	0.000574977003337079	4.73489494588632E-06	0.000570242143492529
17	0.000161382950374438	0.000161382950374438	4.87801236021969E-07	0.000160895150994978
18	0.000655269996241695	0.000655269996241695	5.54129846658337E-06	0.000649728737599605
19	0.00270344894894709	0.00270344894894709	1.37313165558496E-05	0.00268971885717092
20	0.000356319742155208	0.000356319742155208	1.01345606472399E-05	0.000346185235005622

Compatibility

- DAMRAE
- QRACalcs
- LST
- HEC-FDA

	Ex. Probability, α	Conditional Mean, η	Mean, $\mathbb{E}[N]$
DAMRAE©	3.150E-07	1010	3.180E-04
RMC-TotalRisk	3.146E-07	1010	3.177E-04
% Difference	0.1%	0.0%	0.1%

Risk Type	LST, $\mathbb{E}[N]$	RMC-TotalRisk, $\mathbb{E}[N]$	% Difference
Excess	9.426E-02	9.345E-02	0.9%
Background	3.042E-02	3.026E-02	0.5%
Total	1.247E-01	1.237E-01	0.8%

Study	HEC-FDA 1.4.3	RMC-TotalRisk	% Difference
Muncie	$ 3,886.49	$ 3,699.06	4.8%
North DeSoto	$ 3,715.31	$ 3,707.50	0.2%
Glendive	$ 900.27	$ 900.42	0.0%
River Des Peres	$ 6,857.77	$ 6,945.00	1.3%
Tarfuna	$ 10,479.56	$ 9,970.00	4.9%
London Orleans	$ 43,389.16	$ 42,074.40	3.0%
Beargrass Creek	$ 952.48	$ 934.45	1.9%

Demonstration