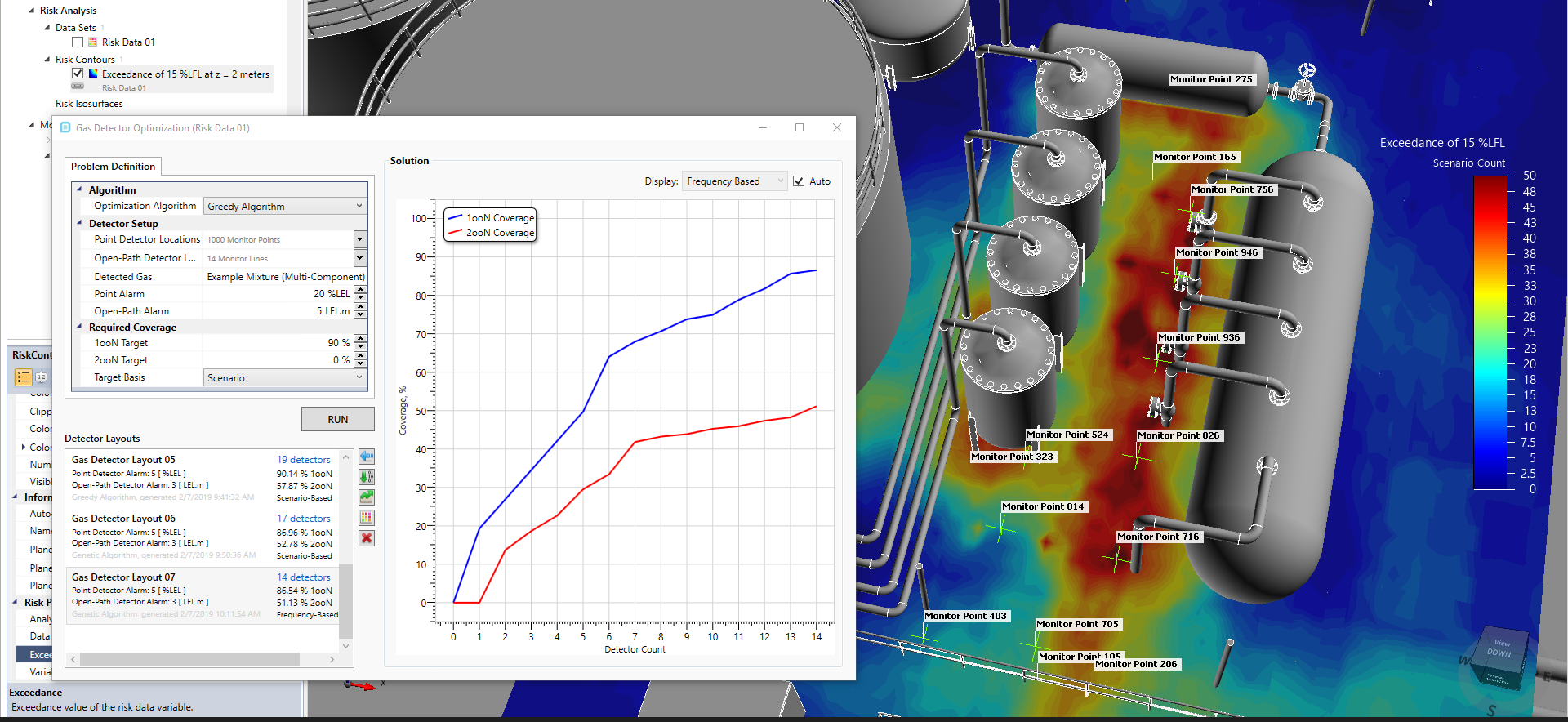

in:Flux – Gas Mapping Optimization

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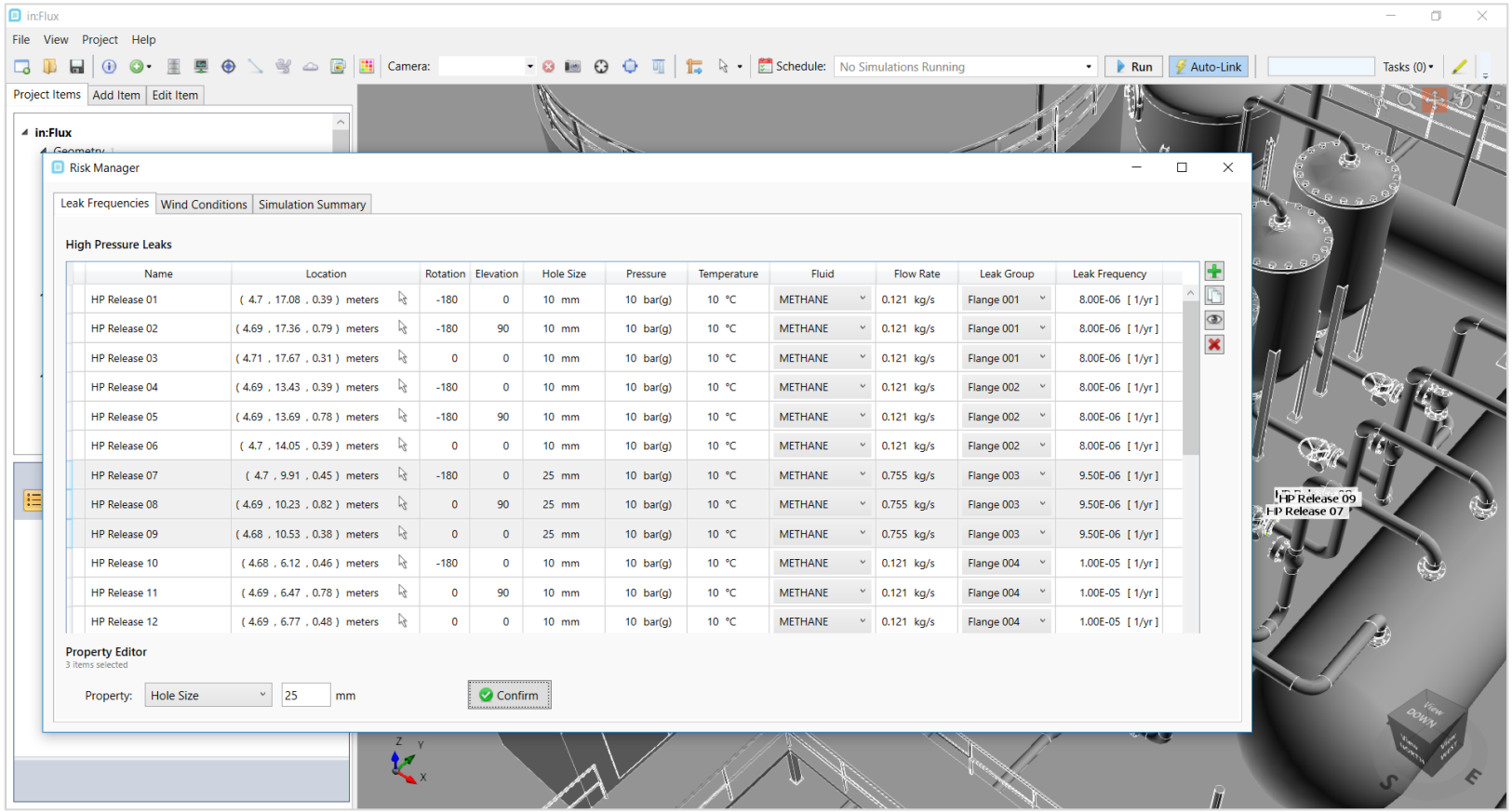
Gas Detector Optimization

- in:Flux has many in-built capabilities for performance-based gas mapping, including:
  - Interface for assigning leak frequencies
  - Input of wind rose with associated probabilities
  - Generation of the full matrix of simulations, each with a scenario frequency
  - Automatic setup, generation and run of the full matrix
  - Risk-based visualizations, such as exceedance of gas concentrations
  - Gas detector optimization using the Greedy Algorithm and the Genetic Algorithm to minimize detector counts while providing appropriate coverage.
- The gas detector layout can be exported to Detect3D for comparison between scenario and geographic methods.

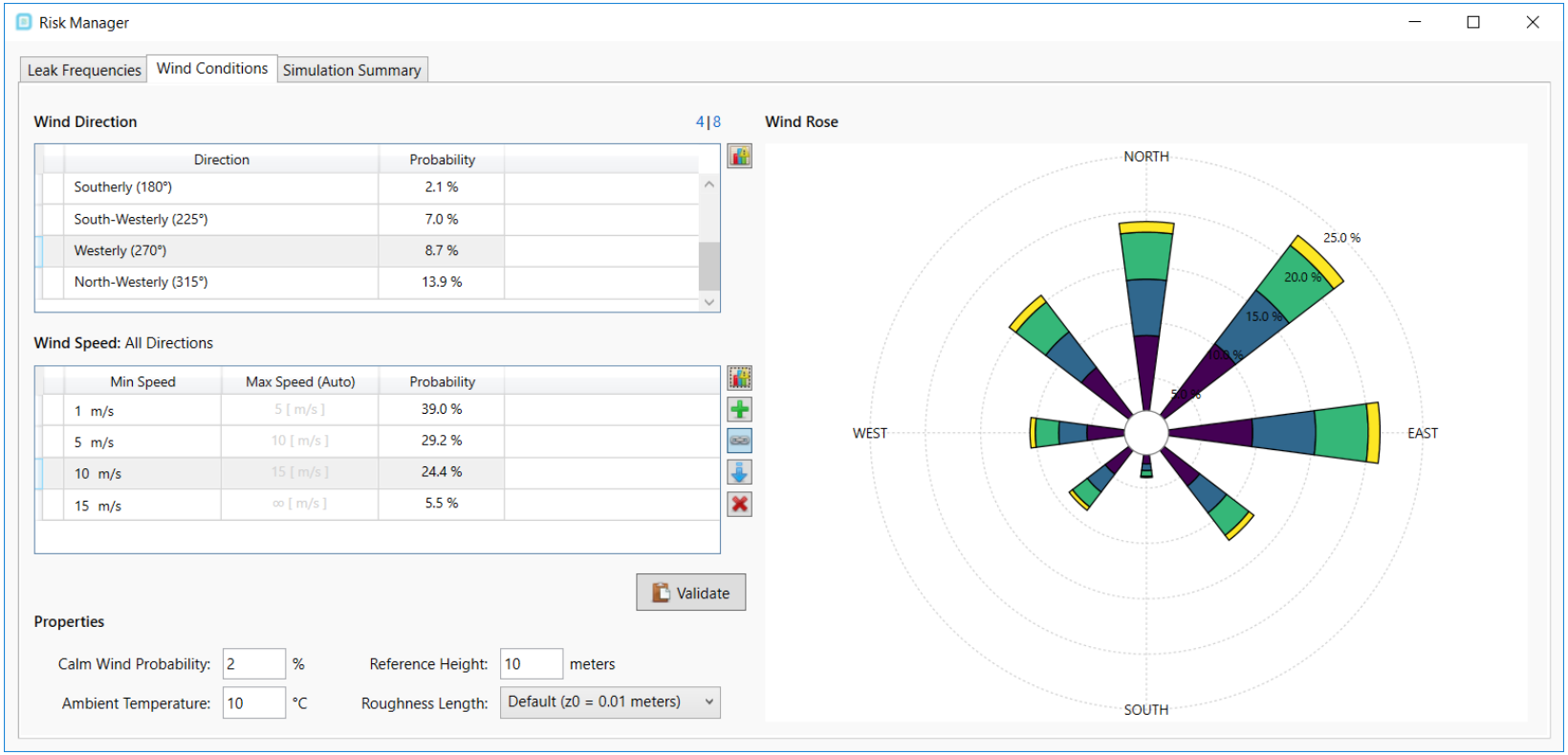
Risk Manager: Leak Frequencies

- The Risk Manager window coordinates the leaks frequencies, wind rose, and scenario matrices. Here, leaks are shown for the simulation.



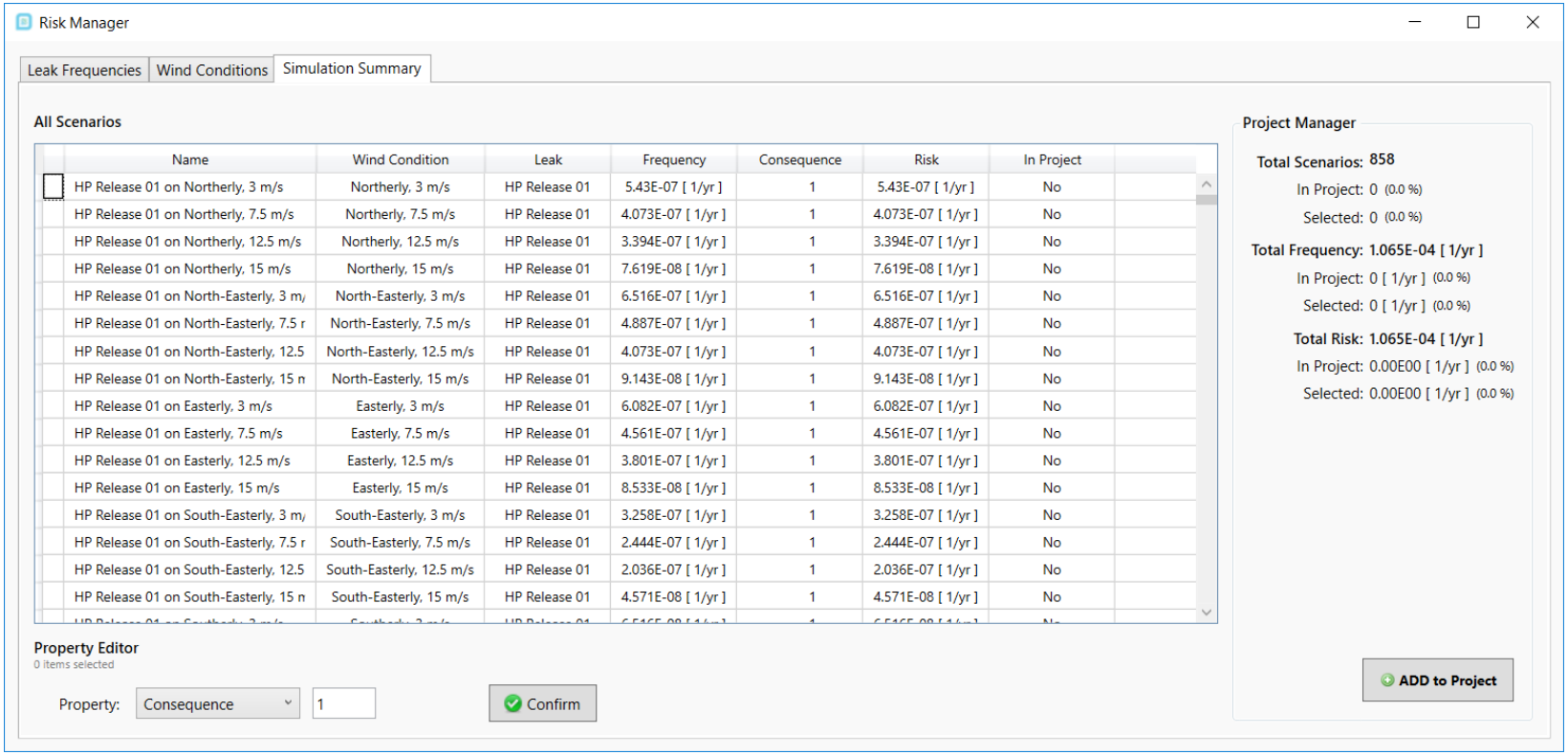
Risk Manager: Wind Rose

- The Wind Rose tab can be used to set the environmental conditions on the site. Wind speed data can be entered for all directions, or for each direction individually.



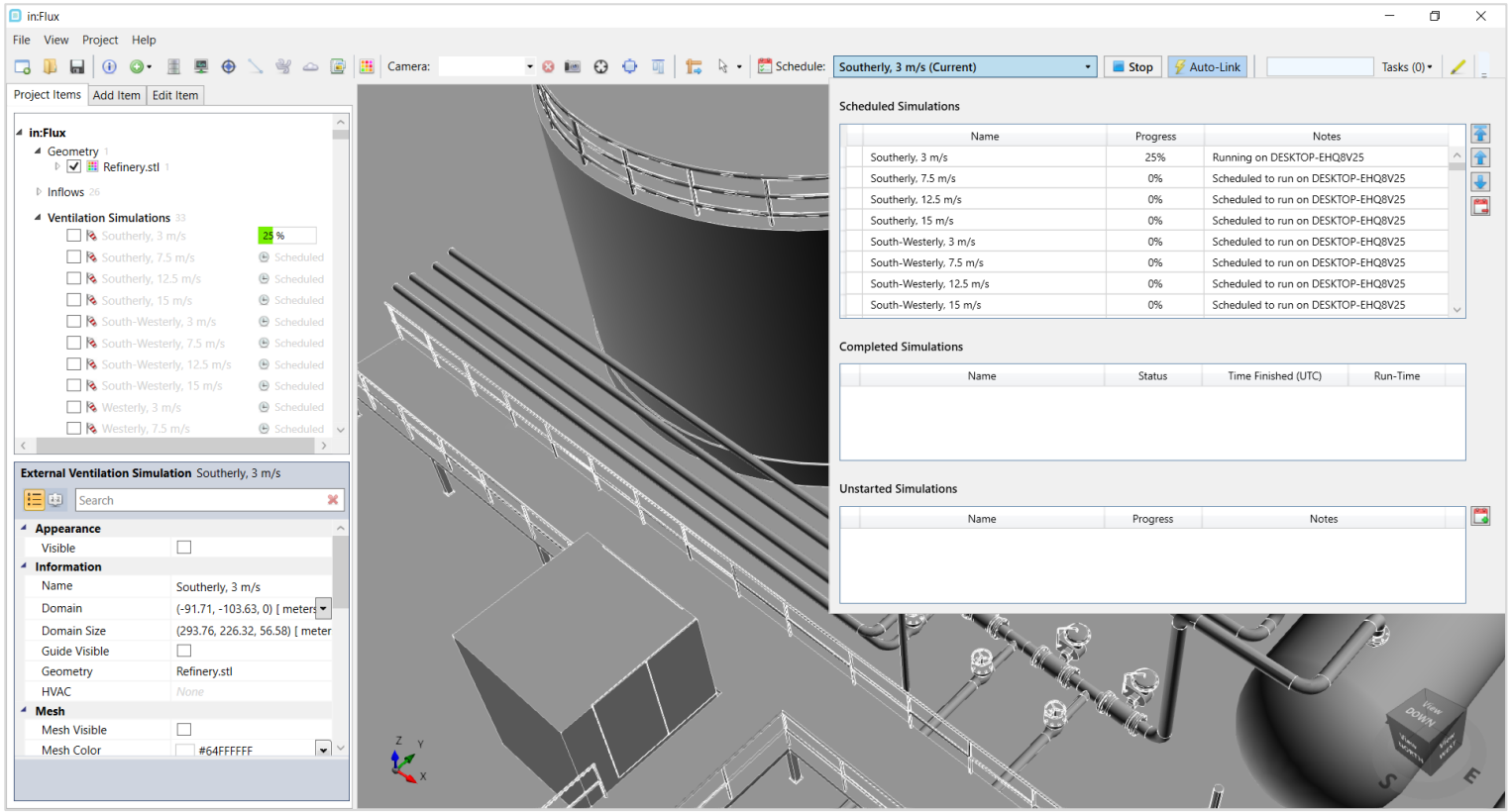
Risk Manager: Scenario Matrix

- The full scenario matrix is shown on the final tab. The user can select all simulations to be added, or a sub-set containing only the highest frequency events.



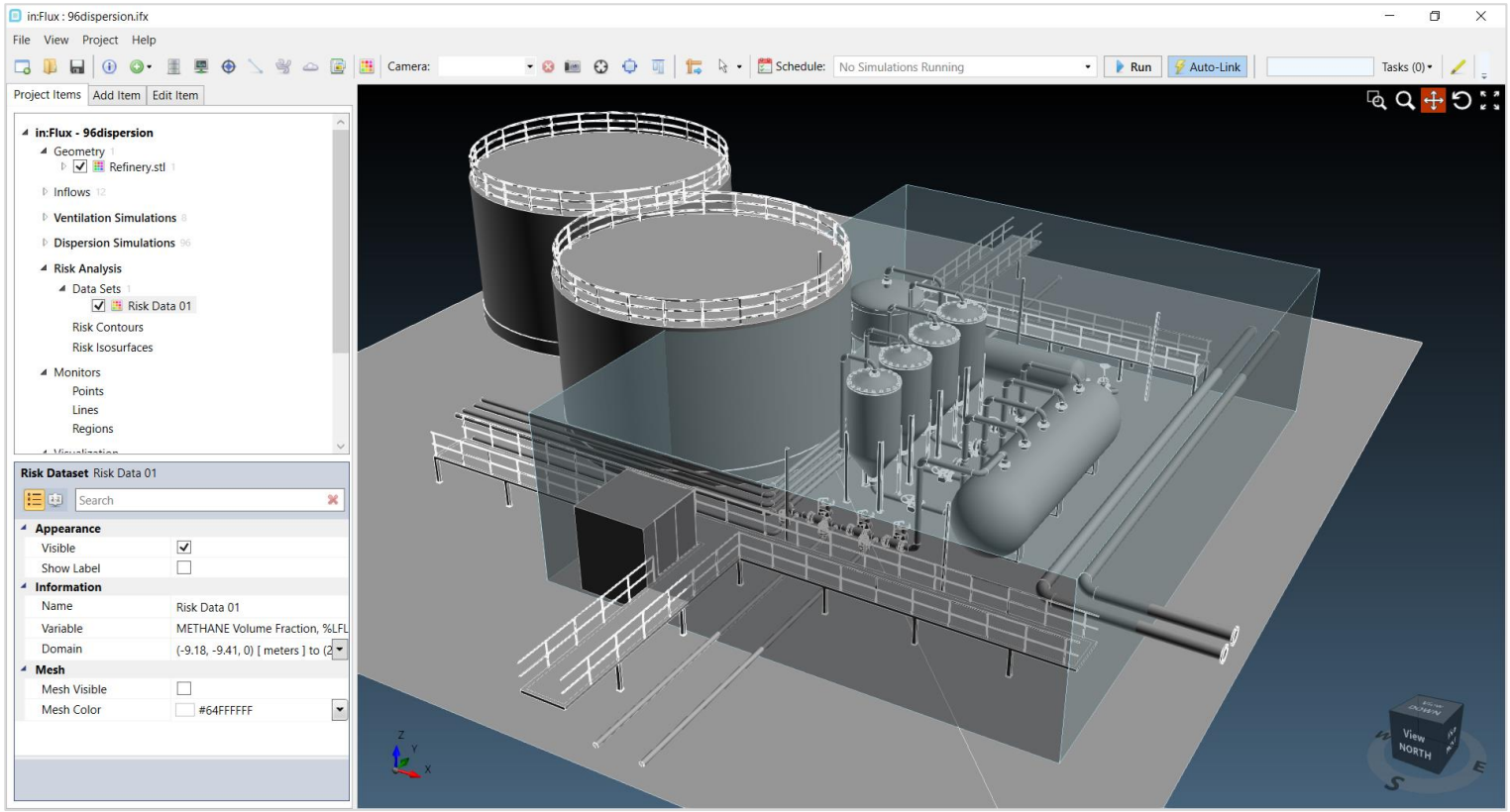
Risk CFD Simulations

- Once the simulations are added to the project, they are automatically scheduled and need no further input from the user. Thousands of CFD simulations can be added at this time.



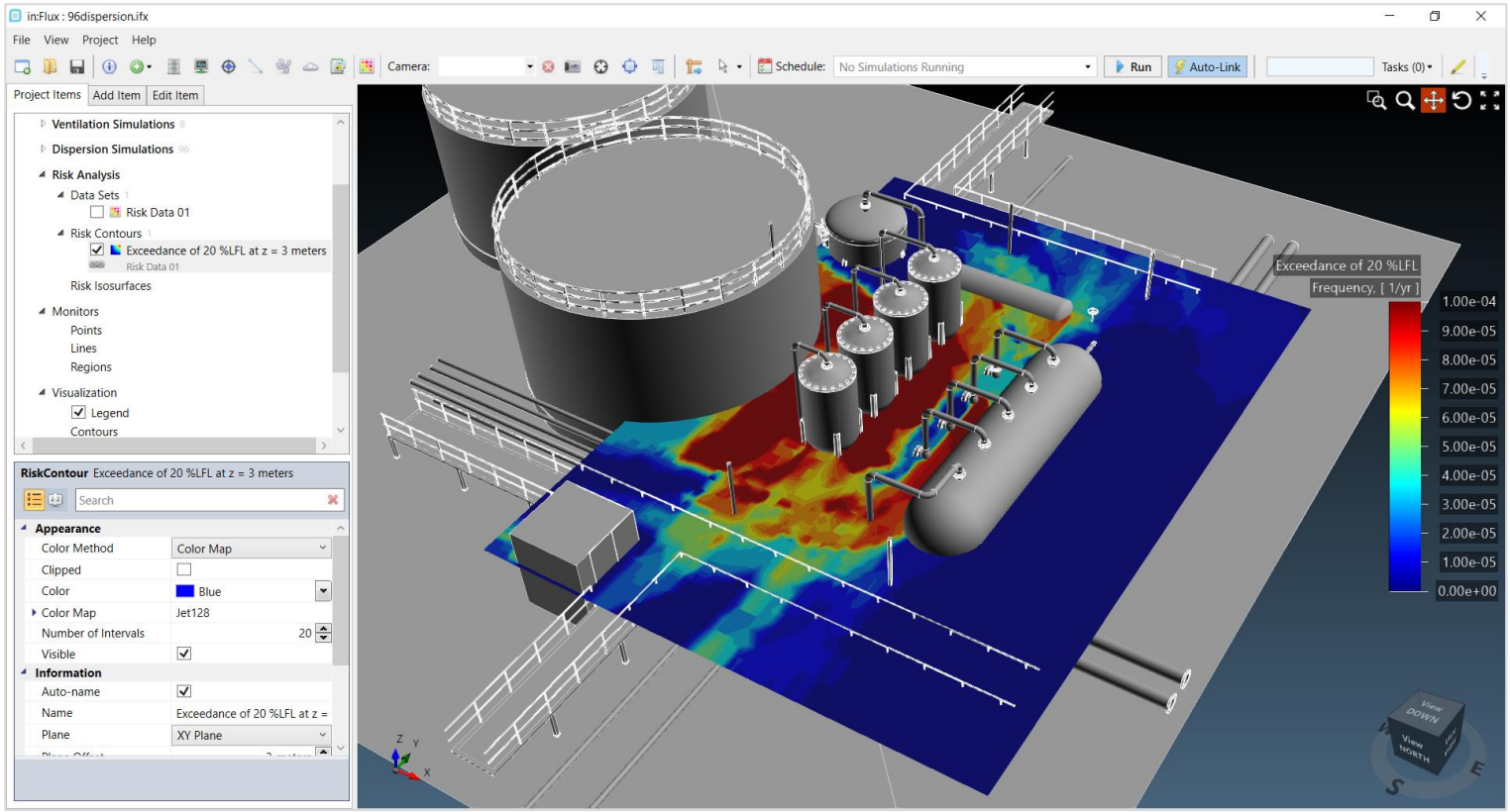
Post-Processing

- Once the simulations are complete, a risk data-set can be added to the project. This combines the data from all the selected simulations and allows for further analysis.



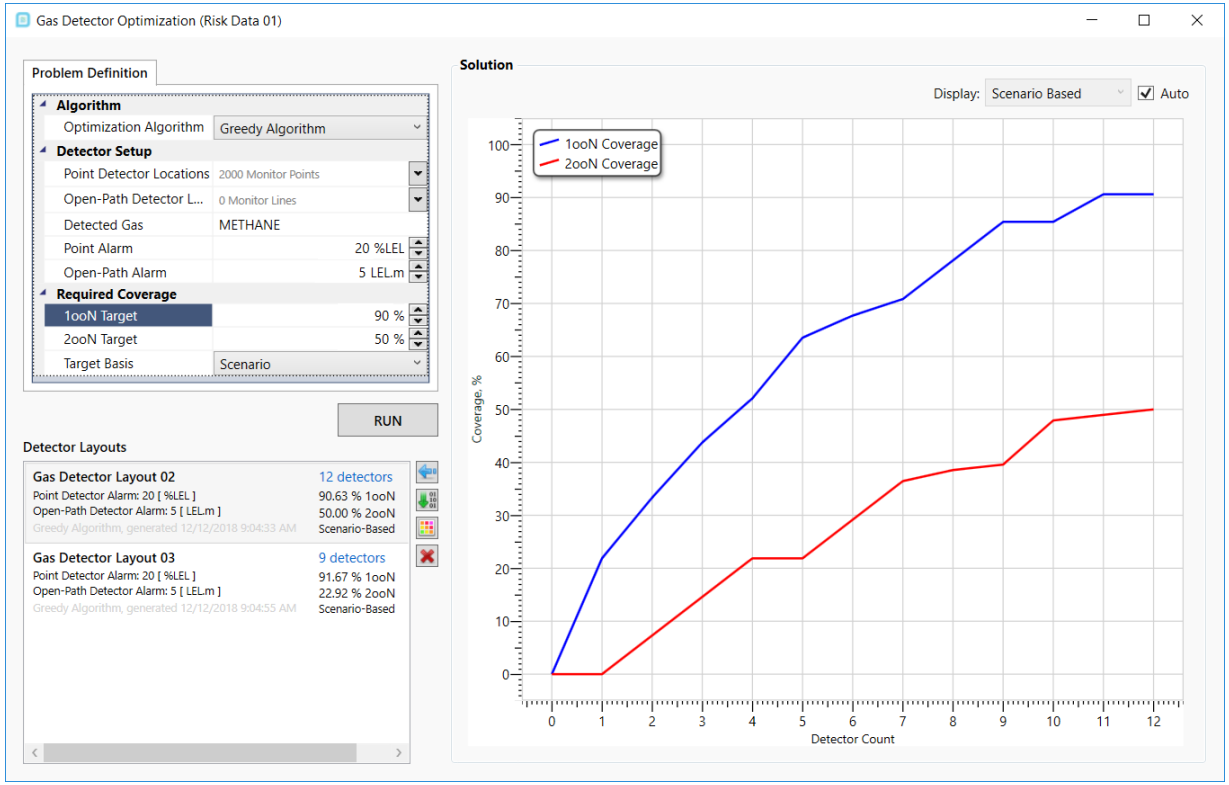
Exceedance Contours

- Contours of exceedance of the selected property in the risk data set can be used. The contour below shows exceedance of 20% LFL methane concentration by frequency.



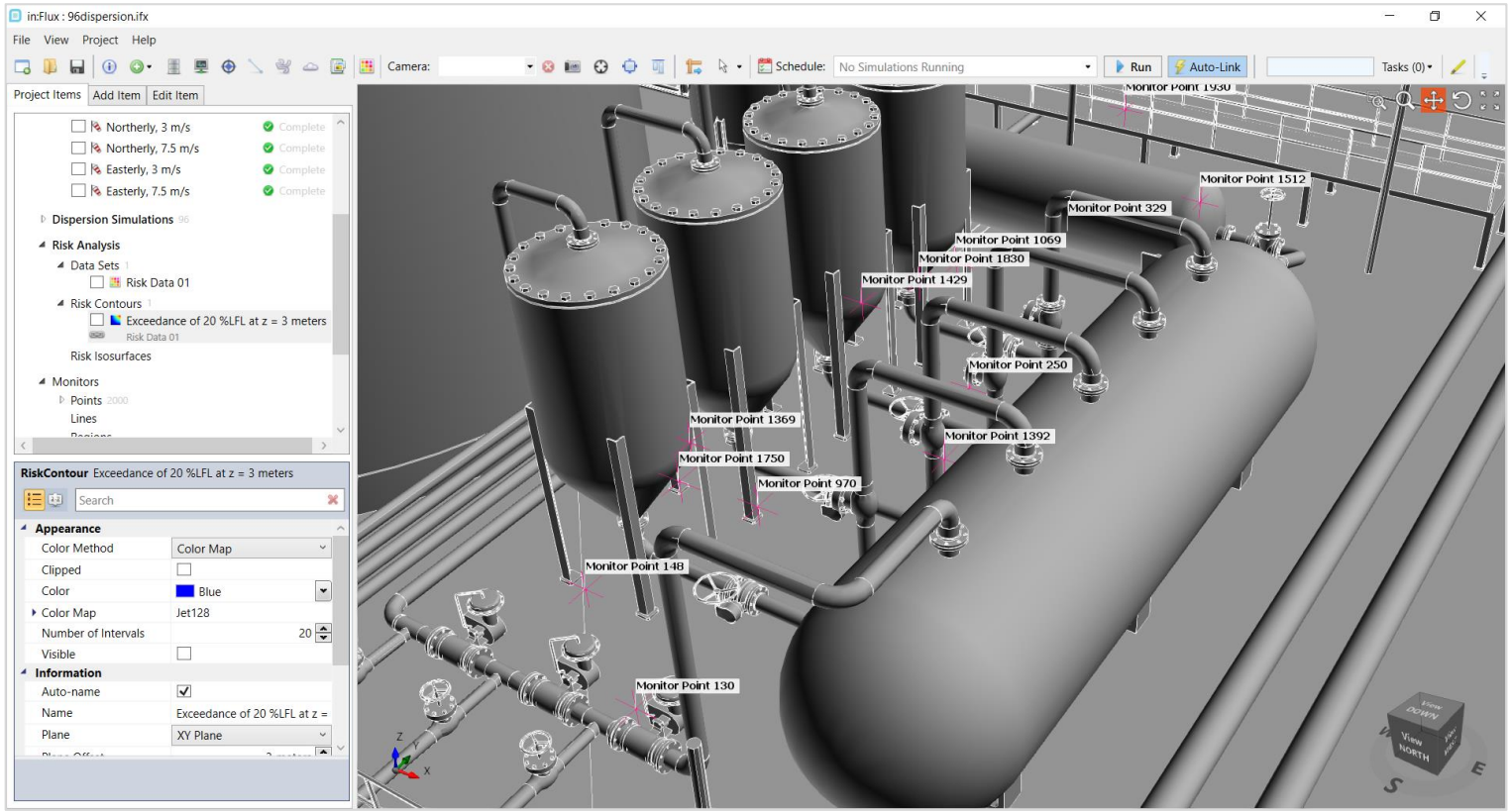
Gas Detector Optimization

- The Greedy Algorithm or Genetic Algorithm can be used to output the scenario coverage dependency on the number of detectors. The analysis is instant, and the graph can be read to get the proposed detector layout.



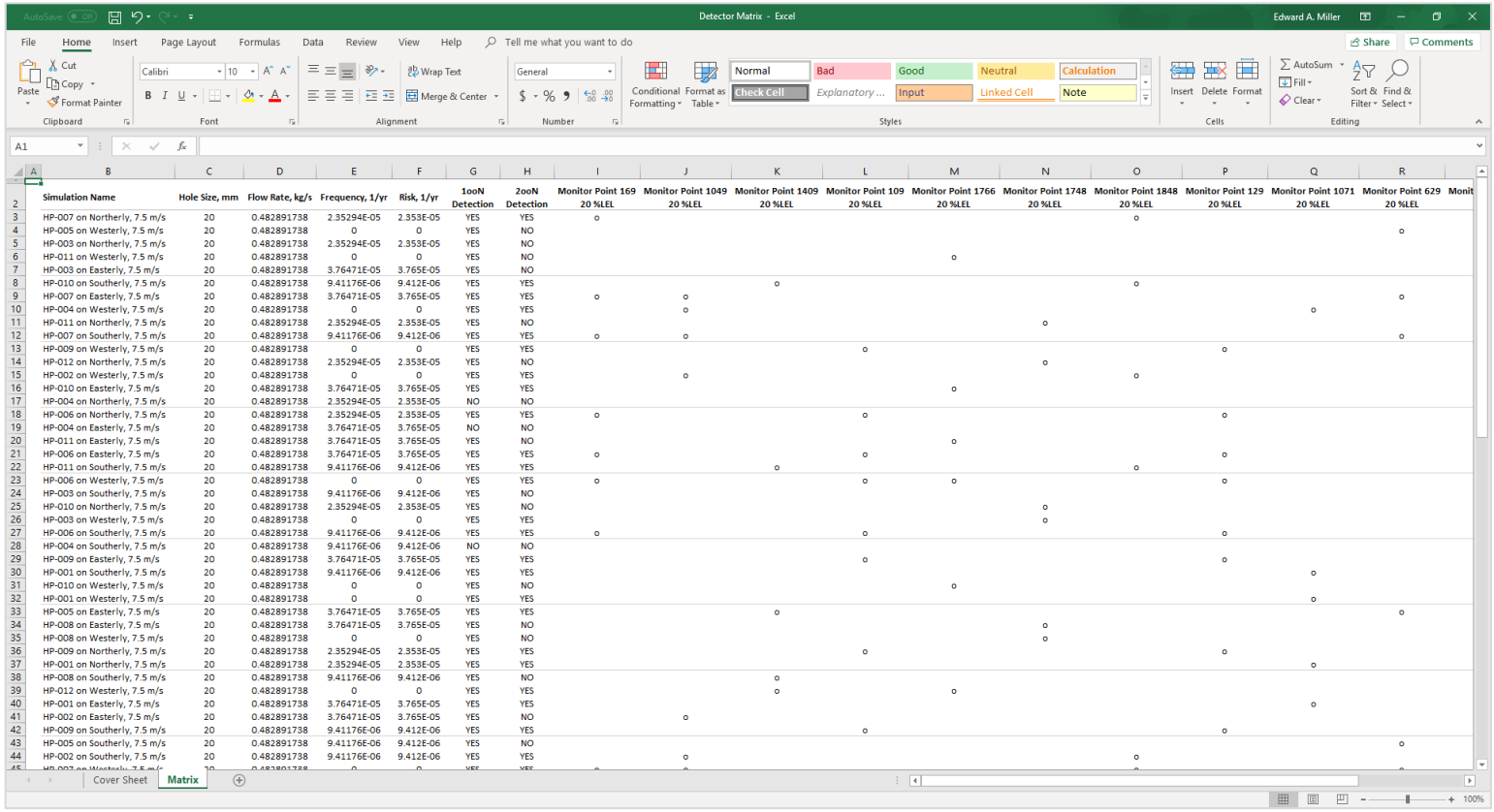
Gas Detector Optimization

- The layout is based on the optimization algorithm chosen, which takes proposed detector locations and calculates the optimal arrangement.



Gas Detector Matrix

- For each optimized layout, users may export the associated detector matrix or Detect3D project file. The matrix shows which detectors go into alarm for each of the completed simulations in the in:Flux project.



Detector Matrix - Excel

Simulation Name	Hole Size, mm	Flow Rate, kg/s	Frequency, 1/yr	Risk, 1/yr	1ooN Detection	2ooN Detection	Monitor Point 169 20 %LEL	Monitor Point 1049 20 %LEL	Monitor Point 1409 20 %LEL	Monitor Point 109 20 %LEL	Monitor Point 1766 20 %LEL	Monitor Point 1748 20 %LEL	Monitor Point 1848 20 %LEL	Monitor Point 129 20 %LEL	Monitor Point 1071 20 %LEL	Monitor Point 629 20 %LEL	Monit
HP-007 on Northerly, 7.5 m/s	20	0.482891738	2.35294E-05	2.353E-05	YES	YES	o						o				
HP-005 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	NO										o	
HP-003 on Northerly, 7.5 m/s	20	0.482891738	2.35294E-05	2.353E-05	YES	NO											
HP-011 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	NO					o						
HP-003 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	NO											
HP-010 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	YES			o				o				
HP-007 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	YES	o	o								o	
HP-004 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	YES		o							o		
HP-011 on Northerly, 7.5 m/s	20	0.482891738	2.35294E-05	2.353E-05	YES	NO						o					
HP-007 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	YES	o	o								o	
HP-009 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	YES				o				o			
HP-012 on Northerly, 7.5 m/s	20	0.482891738	2.35294E-05	2.353E-05	YES	NO						o					
HP-002 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	YES		o					o				
HP-010 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	YES					o						
HP-004 on Northerly, 7.5 m/s	20	0.482891738	2.35294E-05	2.353E-05	NO	NO											
HP-006 on Northerly, 7.5 m/s	20	0.482891738	2.35294E-05	2.353E-05	YES	YES	o			o				o			
HP-004 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	NO	NO											
HP-011 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	NO					o						
HP-006 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	YES	o			o				o			
HP-011 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	YES			o				o				
HP-006 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	YES	o			o	o			o			
HP-003 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	NO											
HP-010 on Northerly, 7.5 m/s	20	0.482891738	2.35294E-05	2.353E-05	YES	NO						o					
HP-003 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	YES						o					
HP-006 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	YES	o			o				o			
HP-004 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	NO	NO											
HP-009 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	YES				o				o			
HP-001 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	YES									o		
HP-010 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	NO					o						
HP-001 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	YES									o		
HP-005 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	YES			o							o	
HP-008 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	NO						o					
HP-008 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	NO						o					
HP-009 on Northerly, 7.5 m/s	20	0.482891738	2.35294E-05	2.353E-05	YES	YES				o				o			
HP-001 on Northerly, 7.5 m/s	20	0.482891738	2.35294E-05	2.353E-05	YES	YES									o		
HP-008 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	NO			o								
HP-012 on Westerly, 7.5 m/s	20	0.482891738	0	0	YES	YES			o		o						
HP-001 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	YES									o		
HP-002 on Easterly, 7.5 m/s	20	0.482891738	3.76471E-05	3.765E-05	YES	NO		o									
HP-009 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	YES				o				o			
HP-005 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	NO										o	
HP-002 on Southerly, 7.5 m/s	20	0.482891738	9.41176E-06	9.412E-06	YES	YES		o					o				

Conclusions

- The optimized gas detector layout can be exported to Excel or Detect3D (.d3d) project files.
- Both point and open-path detectors can be used.
- Many different layouts can be generated, to compare variables such as performance target and alarm settings.
- Users can compare optimization results from the Greedy Algorithm and the Genetic Algorithm
- Just like Detect3D which included optimization algorithms for flame detection, in:Flux bases the layout on user input for potential locations for detectors.
- This analysis does not require any expertise in CFD, and typical setup times are less than 1 hour.