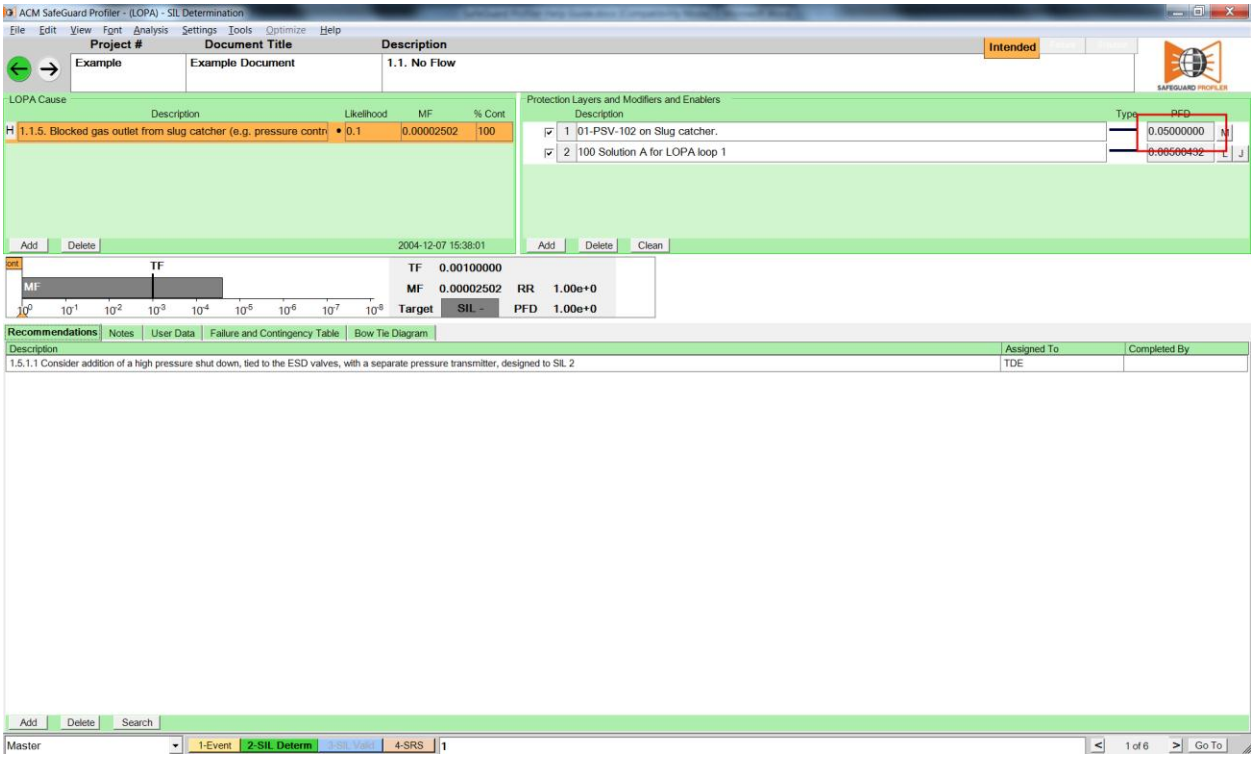
1. SIL Determination Using LOPA Scenario Analysis

1.1. The SIL Determination Page

Click “2-SIL Determ” at the bottom of the page to view the SIL Determination page.

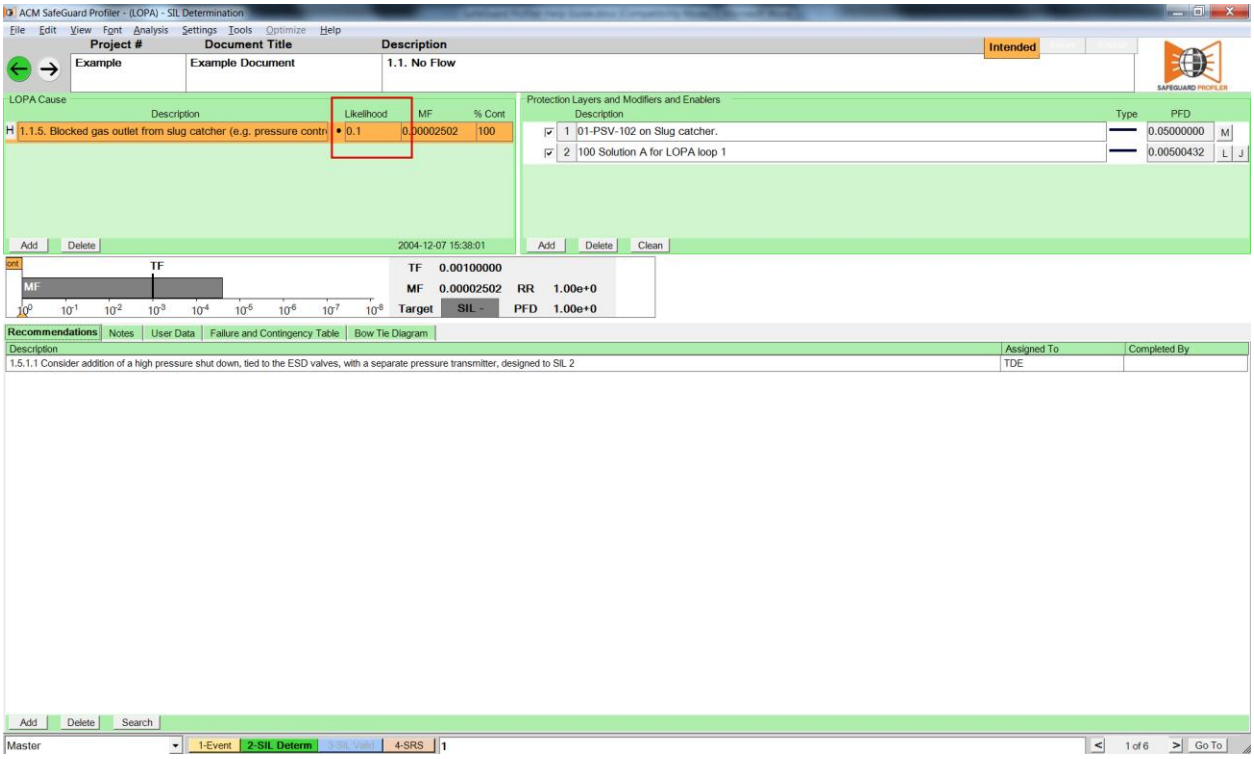


Confirm that all the relevant causes and safeguards from the HAZOP have been used in the creation of the loop.

Review the imported HAZOP to identify consequences that meet an agreed set of criteria for undergoing LOPA. Add new LOPA loops until the project contains a full set of scenarios for detailed analysis.

1.2. LOPA Causes: Likelihood

On the SIL Determination page, edit the likelihood values for the initiating events.



In the context of SafeGuard Profiler™, “likelihood” refers to “event frequency”. (IEC 61511 erroneously uses the terms “likelihood” and “frequency” synonymously.)

Likelihood ratings are usually available in the Risk Matrix document that the company or analyst chooses to guide the HAZOPs and LOPA studies. It is considered good practice for the first pass at the analysis to use conservative values.

1.3. Protection Layers: Probability of Failure on Demand (PFD)

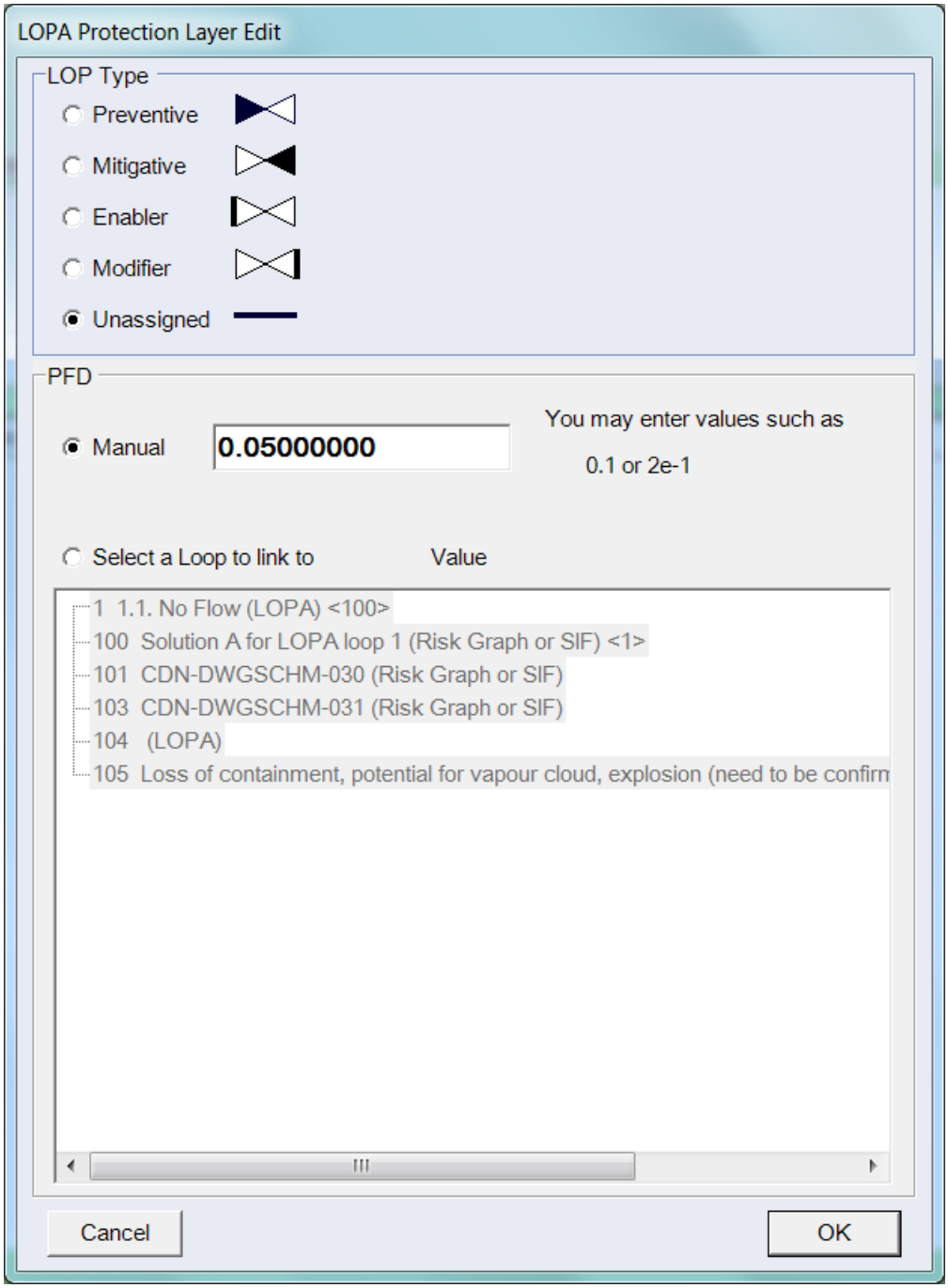
1.3.1. Database Normalization Concept

SafeGuard Profiler™ utilizes a normalized relational database. Normalized tables are suitable for general-purpose querying, as data is organized to minimize redundancy.

Ensure that PFD values created during the LOPA sessions are unique. This means that protection layer PFD values must be uniquely matched to the protection layer description at all times.

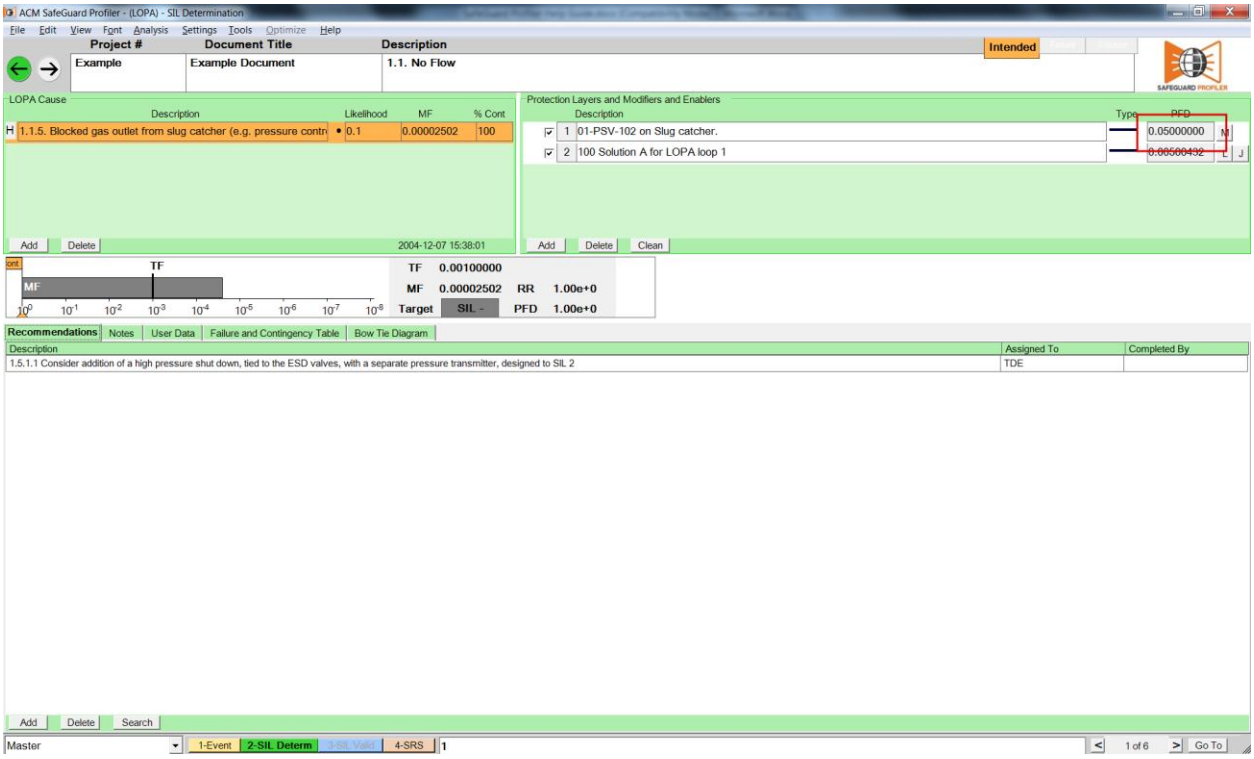
1.3.2. Probability of Failure on Demand (PFD)

To assign a PFD value to a protection layer, click the “M” button beside the protection layer description. This will open the the “LOPA Protection Layer Edit” window.



Select “Manual” and set the PFD value (e.g. “0.05”).

Click OK.



As with the LOPA Cause likelihood values, it is considered good practice to assign conservative order-of-magnitude values to the PFD values for the protection layers.

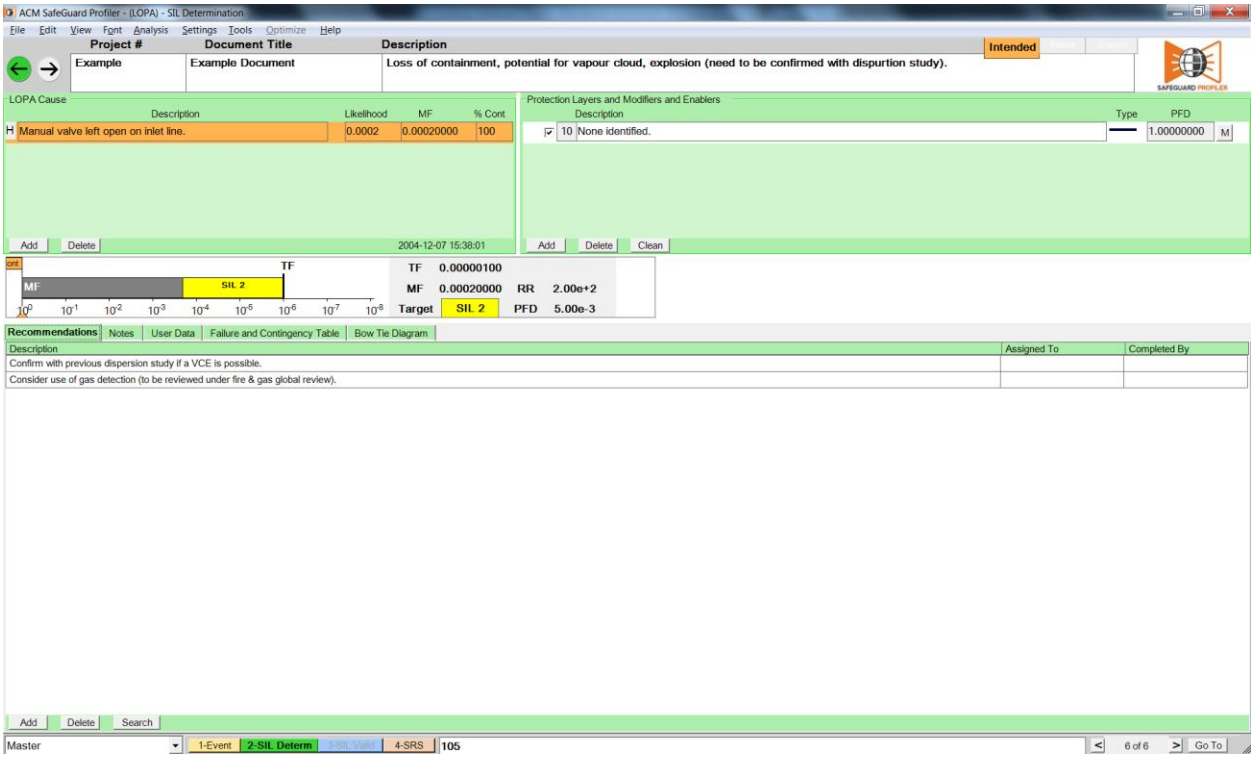
2. Analyzing Alternate LOPA Scenarios

2.1. The Alternate Scenario Concept

SafeGuard Profiler™ lets you examine alternate scenarios that could stem from a set of causes leading to a particular consequence.

Alternate scenarios are often used to examine the effects of implementing recommendations, either from the original HAZOP or from the LOPA process itself.

The following diagram shows another loop from the example file, where the tolerable frequency was not met and where a recommendation was made to further mitigate the problem.



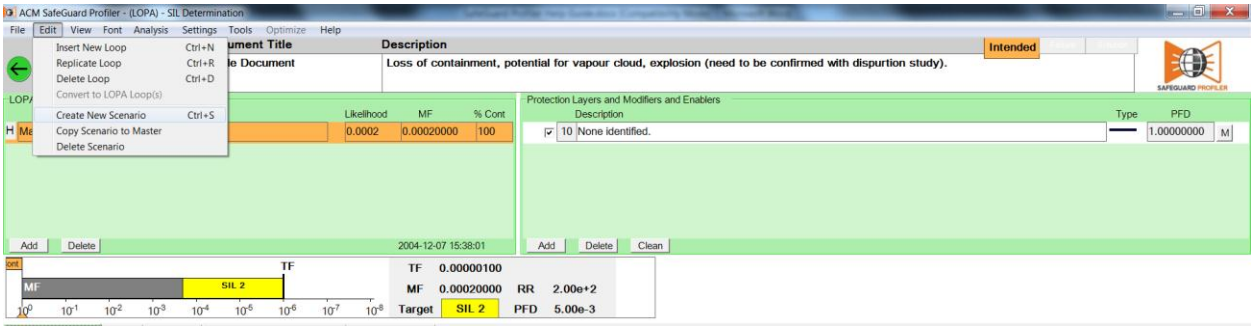
2.2. Creating Alternate Scenarios

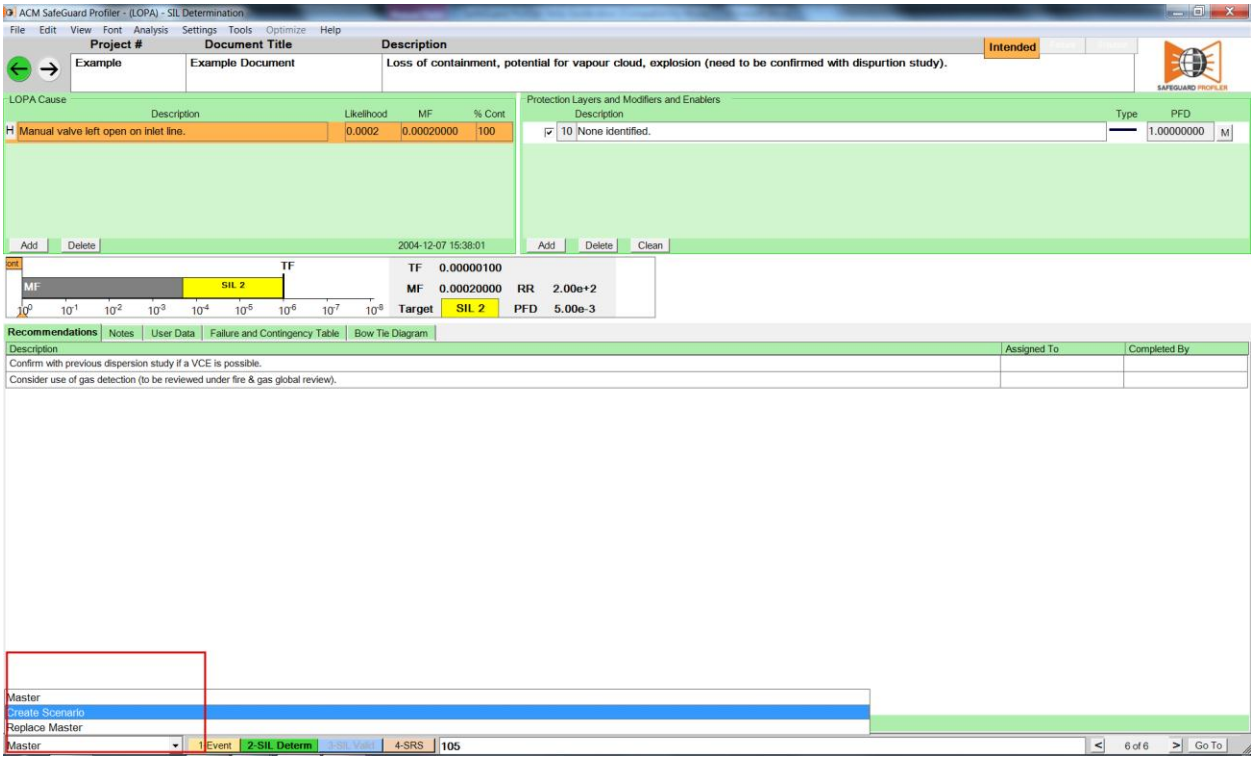
To create an alternate scenario, either:

Select Edit > Create New Scenario from the top menu.

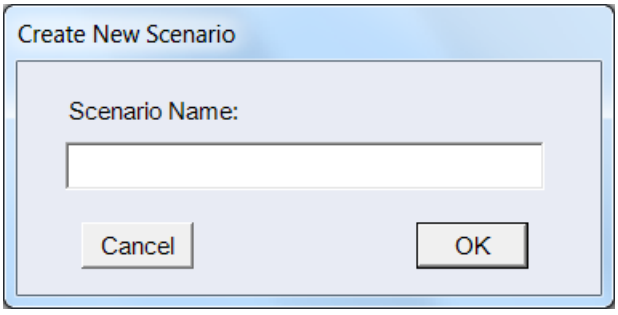
Use the hot keys Ctrl + S

Use the scenario dropdown menu at the bottom left of the application window.



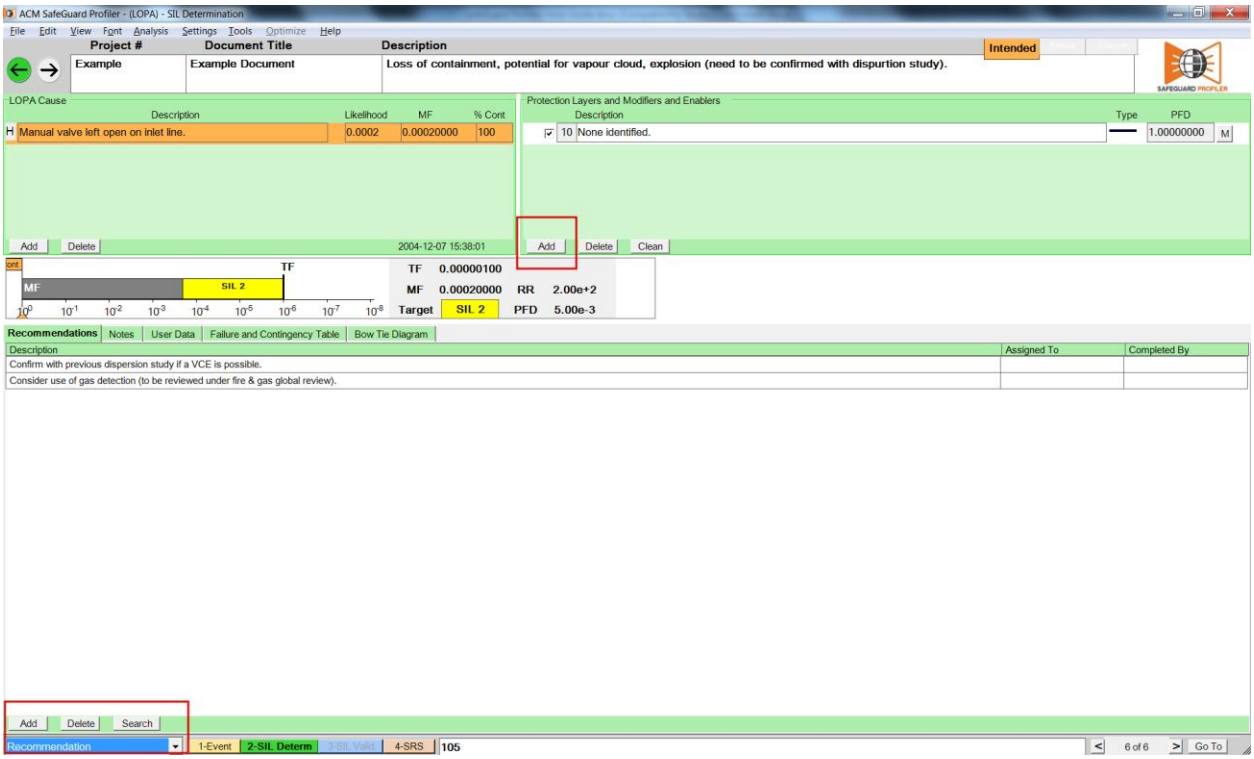


In the “Create New Scenario” dialog, enter a scenario name and click OK. For this example, type “Recommendation”.



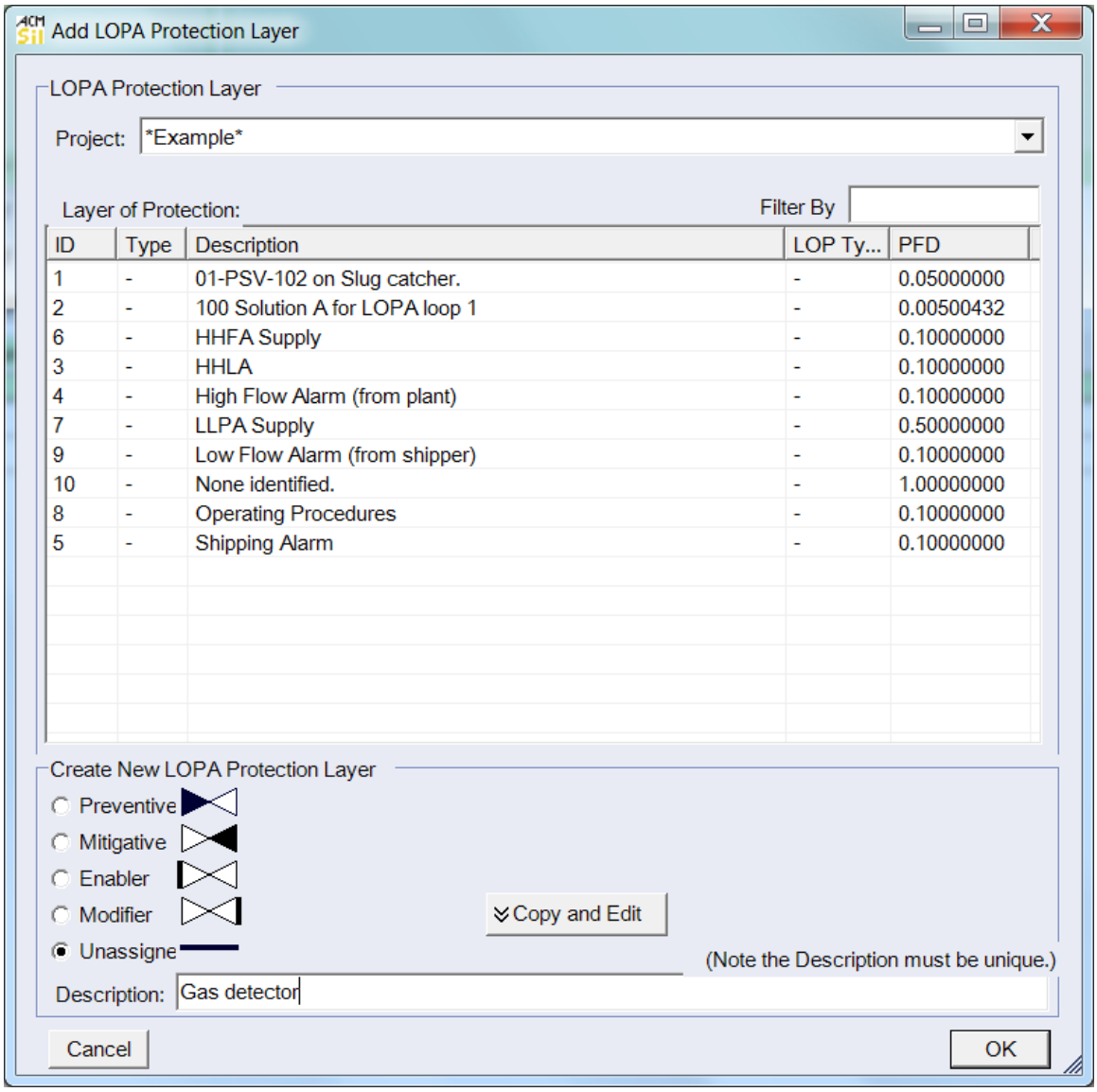
This is a simple duplicate of the original master scenario except that the name “Recommendation” appears in the scenario dropdown box. Any changes made to this alternate scenario will not affect the Master scenario.

To examine the effect of implementing the recommendation, go to the “Protection Layer” section and click “Add”.

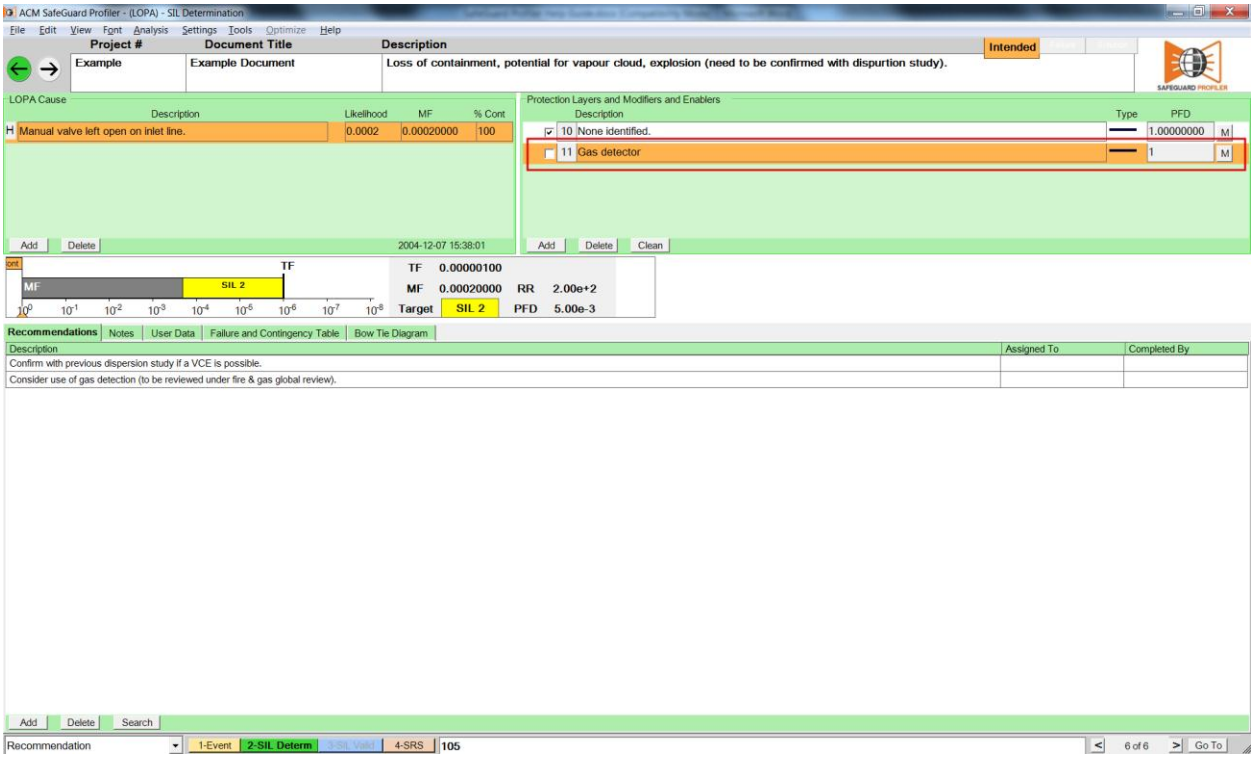


In the Add LOPA Protection Layer window, you may choose between:

- selecting an existing protection layer, used elsewhere in the project; or
- creating a new protection layer.



For a new protection layer, enter a unique description to identify it and click OK.



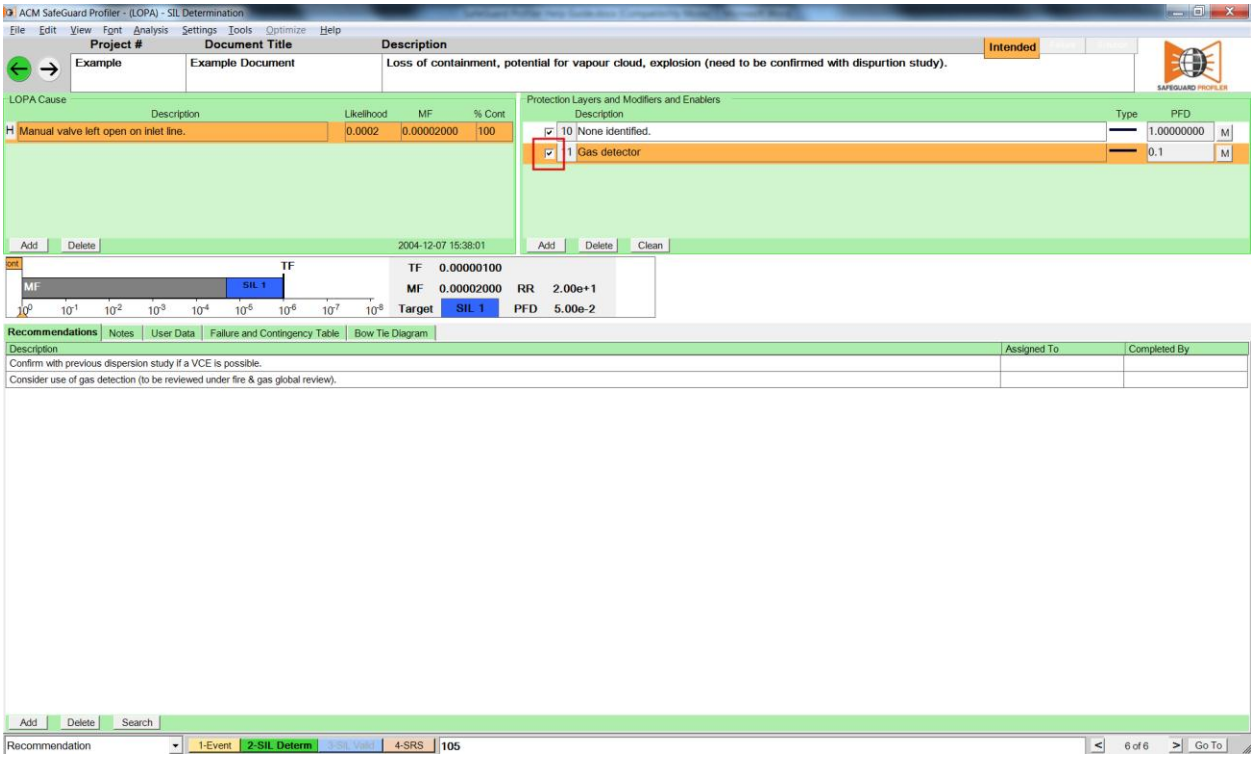
This new protection layer is determined to be effective for mitigating all three initiating events. Following conservative practice, its PFD is assigned a manual value of 0.1.

To change the protection layer's PFD value, click the "M" button to the right of the PFD field. This will launch the "LOPA Protection Layer Edit" window.

Apply the protection layer to all the LOPA causes:

1. Click to highlight each cause in the LOPA Cause list; and

2. In the "Protection Layer" list, ensure the checkbox for the new protection layer is checked.



The results show that the mitigated frequency is now very close to the tolerable frequency. More in-depth analysis of initiating event likelihoods and PFDs for protection layers could show that the tolerable frequency is actually met.