



Asset Strategy Optimization (ASO)

V3.6.0.0.0



Meridium APM Asset Strategy Optimization V3.6.0.0.0

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About This Document

This file is provided so that you can easily print the **Asset Strategy Optimization** section of the Meridium APM Help system. This document is not meant to be read electronically using the PDF. If you want to read the documentation electronically, you should use the Help system. This file is set up to facilitate double-sided printing and includes blank pages between sections so that each section will begin on an odd page and will be printed on the *front* of the page.

Because this file represents an excerpt from the Help system, parts of this document may seem incomplete outside of the Help system itself. When you read the documentation via the Help system, you will see links which serve as cross-references to other areas of the documentation. These cross-references are not available in this document.

To access the Meridium APM Help, in the Meridium APM Framework application, click the **Help** menu, and then click **Meridium APM Framework Help**.

Documentation Conventions

Throughout the documentation, we use various stylistic conventions that make it easier to interpret information and instructions. The following table provides a list and description of the conventions that are used throughout the Meridium APM documentation.

Convention	Description	Example
Bold	Identifies labels that appear on the screen. Identifies folder paths and file names when the folder path or file name is included in step-by-step instructions.	The Save As dialog box appears. Click the Cancel button. In the Catalog folder <code>\\Public\Meridium\Modules\Core\Queries</code> , open the query Field History Records .
<code>\\</code>	Identifies the beginning of a folder path.	The query is located in the following Catalog folder: <code>\\Public\Meridium\Modules\Core\Queries</code> .
Courier New	Identifies text that you must type.	Type <code>root</code> .
<code><></code>	Indicates that the data inside the angle brackets is variable.	Click Expand/Collapse <Record>'s Children , where <code><Record></code> is the ID of the selected record.

Convention	Description	Example
[]	Indicates that the data inside the square brackets is optional.	<p>Type the following text: <Meridium APM Catalog Path>,[Query Parameters]</p> <p>...where:</p> <ul style="list-style-type: none">• <Meridium APM Catalog Path> is the Catalog path of the desired query.• [Query Prompt Value] is a value that you want to supply for a prompt in the query. If you do not pass in query prompt values, you will be prompted to supply them when you run the query.

Assumptions Made in This Documentation

Throughout this documentation, we assume that you are familiar with the terminology and concepts discussed in *Generating Availability Data System: Data Reporting Instructions* released by the North American Electric Reliability Corporation (NERC) and official terminology defined by the Energy Information Administration (EIA). The documentation for the NERC Data Reporting Instructions can be found at <http://www.nerc.com>, and the definitions of EIA terminology can be found at <http://www.eia.doe.gov/>.

In addition, we assume that you have not modified the baseline family- and field-level rules for the GM families and that you are using the workflows that are described in this documentation. If you modify the baseline rules or use workflows other than those described in this documentation, the field behavior and record functionality may differ from what we describe.

Basics

Overview of Asset Strategy Optimization

The Meridium APM Asset Strategy Optimization (ASO) module extends the analytical capabilities of the Asset Strategy Management (ASM) module by providing the additional ability to:

- Define planned and unplanned correction costs for each Risk.
- Define Resources, such as spare parts and human resources, that are needed to perform actions.
- Define Time to Failure (TTF) and Time to Repair (TTR) information based on Monte Carlo simulation results.
- Integrate with the Meridium APM Reliability Analytics module.
- Use a diagramming tool that allows you to represent the physical structure of pieces of equipment and locations.
- Define Global Events.

While ASO is its own separate module, it is intended to *extend* the capabilities available in ASM by providing a more detailed analysis of a particular strategy. You will, therefore, access ASO directly from an existing Asset Strategy, System Strategy, or Unit Strategy. In ASO, you can use the additional features in the preceding list to determine the most optimal strategy for a piece of equipment or location, which can then be viewed and managed further in ASM.

In other words, ASO and ASM work together to provide a more comprehensive view of your equipment and locations to help you determine the best way to manage them to reduce cost and risk.

Many of the features in ASO work similarly to or exactly the way they work in System Reliability Analysis. Throughout the ASO documentation, where applicable, links are provided to the System Reliability Analysis documentation to direct you to more details.

Note: You can access ASO only if the ASM module is active.

ASO System Requirements

The following licenses must be active to take advantage of ASO:

- *Asset Strategy Optimization*
- *ASM and ASI*

The *ASM and ASI* license activates the ASM module. This documentation assumes that you have deployed ASM. In addition, your system must contain the basic Meridium APM system architecture.

After you have installed and configured the basic system architecture, you will need to perform some configuration tasks specifically for the ASO module.

A Note About ASM Terms Used in the ASO Documentation

Many of the concepts in ASO build upon concepts in Asset Strategy Management (ASM), such as:

- Active Strategy
- Proposed Strategy
- Mitigated Risk
- Unmitigated Risk

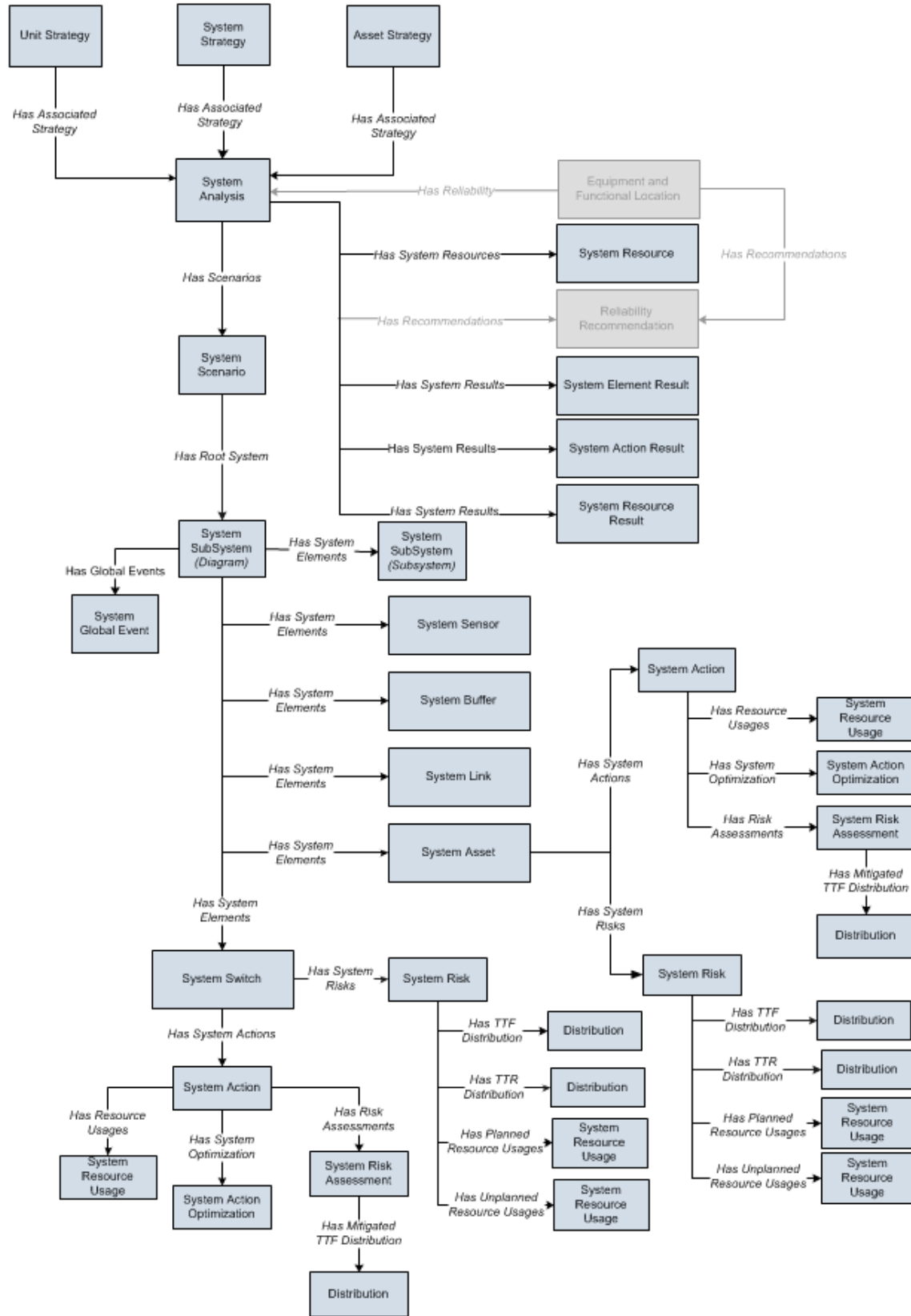
Throughout the ASO documentation, we use terms that are introduced and described in more detail in the ASM documentation. We assume that you are familiar with these terms and with the ASM functionality in general. Where applicable, the ASO documentation contains links to the ASM documentation to direct you to more details.

Data Structure

ASO Data Model

The following diagram shows the entity and relationship families that are used in an ASO Analysis. Throughout this documentation, we use the term *ASO Analysis* to mean the combination of the root System Analysis record and all records that are linked to it. Note that in the following image:

- Gray arrows and boxes represent entity families, relationship families, and associated relationship definitions that exist in the ASO data model but are not currently used in any ASO workflows.
- Black arrows and boxes represent entity families, relationship families, and associated relationship definitions that are configured in the baseline database and do not require customization for the baseline functionality to work.
- Gray arrows and boxes represent entity families, relationship families, and associated relationship definitions that may require customization.



While interpreting the image, note that:

- While only *one* System Scenario box appears in the image, each ASO Analysis will contain *multiple* System Scenario records.
- The image contains two System SubSystem boxes because in an ASO Analysis, System SubSystem records serve two purposes:
 - **They identify the Diagram.** Each ASO Analysis contains only one Diagram, but per Scenario, the database contains *two* separate System SubSystem records to represent this Diagram. In other words, for each Scenario that exists in the analysis, the *set* of System SubSystem records that represent the Diagram is duplicated. So, for an analysis that contains only an Active Scenario and Proposed Scenario, *four* identical System Subsystem records will exist. Two of the records will be linked to the Active Scenario record, and two of them will be linked to the Proposed Scenario record. Whenever a change is made to the properties of the Diagram itself, the Meridium APM system updates *all* System SubSystem records that represent the Diagram so that they are always identical.

Note: The Meridium APM system creates two identical System SubSystem records to represent the Diagram because the ASO and System Reliability Analysis modules share code and in System Reliability Analysis, each analysis can have multiple Diagrams.

- **They identify subsystems within the Diagram.** In an ASO Analysis, the Diagram can contain multiple subsystems. Per Scenario, the database contains *two* separate System SubSystem records to represent a single subsystem in the Diagram. In other words, for each Scenario that exists in the analysis, the *set* of System SubSystem records that represent a subsystem within the Diagram is duplicated. So, for an analysis that contains only an Active Scenario and a Proposed Scenario, if the Diagram contains only one subsystem, *four* identical System Subsystem records will exist to represent this subsystem. Two of the records will be linked to the Active Scenario record, and two of them will be linked to the Proposed Scenario record. Whenever a change is made to the properties of the subsystem element via the Diagram, the Meridium APM system updates *all* System Subsystem records that represent that subsystem so that they are always identical.

In other words, because each ASO Analysis must have an Active Scenario and a Proposed Scenario at all times, each ASO Analysis will contain at least four System SubSystem records, where these System SubSystem records represent the Diagram. Two of these records will be linked to the Active Scenario record, and two of them will be linked to the Proposed Scenario record. As additional Scenarios are created, other identical sets of System SubSystem records are created and linked to those Scenario records to represent the Diagram. In addition, if the Diagram includes subsystems, per Scenario, the ASO Analysis will contain *two* additional System SubSystem records to represent those subsystems.

- The System SubSystem family is related to the System SubSystem family through the Has System Elements relationship. In the image, the System SubSystem box that contains the text *Diagram* in parentheses represents the Diagram. The System SubSystem box that contains the text *Subsystem* in parentheses represents subsystems within the Diagram. This distinction is made so that you can see that the System Global Event record is linked to the System SubSystem records that represents the *Diagram*.

Note: In ASO Analyses, *all* System SubSystem records are linked to the successor System Element records. The boxes are separated in the image only to clarify the Has Global Events relationship.

Components in an ASO Analysis

An ASO Analysis is made up of records and links as defined by the ASO data model. Specifically, an ASO Analysis is a collection of Scenarios, Resources, and simulation results. An ASO Analysis is represented by a System Analysis record, which stores identifying information about the analysis and is linked to other records that make up the analysis. Beyond understanding an ASO Analysis at the entity level, it is helpful to visualize it at a conceptual level, where groups of records and links make up the main elements of the analysis. These elements are described in the following list:

- **Diagram:** A logical, visual representation of the physical structure of equipment and locations, including the connections between them. Each ASO Analysis contains one Diagram.

Note: If you create an ASO Analysis from an Asset Strategy, a Diagram will exist, but it will contain only an Asset element.

A Diagram is represented by a System Subsystem record, which can be linked to System Subsystem, System Sensor, System Buffer, System Link, System Asset, and System Switch records. The items that these records represent are referred to as elements, which are simply the components that make up the Diagram itself.

- **Scenario:** A representation of one possibility for managing the risk and cost for a given piece of equipment or location. A Scenario is represented by a System Scenario record, which contains all the identifying information for the Scenario and is linked to other records that help define the Scenario. Each ASO Analysis contains multiple Scenarios and will always contain at *least* the following Scenarios:
 - Active Scenario
 - Proposed Scenario
 - Unmitigated Scenario

Note: The Unmitigated Scenario cannot be manipulated in ASO. It represents the unmitigated strategy, or the strategy as it exists with *only* Risks and *no* Actions. The simulation results will include results for the Unmitigated Scenario, but you cannot modify the Unmitigated Scenario in ASO.

An ASO Analysis can contain additional Scenarios if you choose to create them. Except for the Unmitigated Scenario, each Scenario can contain the following components:

- **Risk:** A component that identifies a specific way that a piece of equipment or location can fail, specifies the consequences of the failure, and includes Time to Failure (TTF) and Time to Repair (TTR) distribution data. A Risk is represented by a System Risk record, which contains all of the identifying information for the risk.
- **Action:** A component that identifies a specific operation that can be performed against a piece of equipment or location. Actions include condition-based maintenance, procedures, redesigns, time-based maintenance, and training and may or may not mitigate Risks. Actions are represented by records in the System Condition Monitor, System Inspection, System Preventive Maintenance, or System Special Action families, which contain all the identifying information for the action.

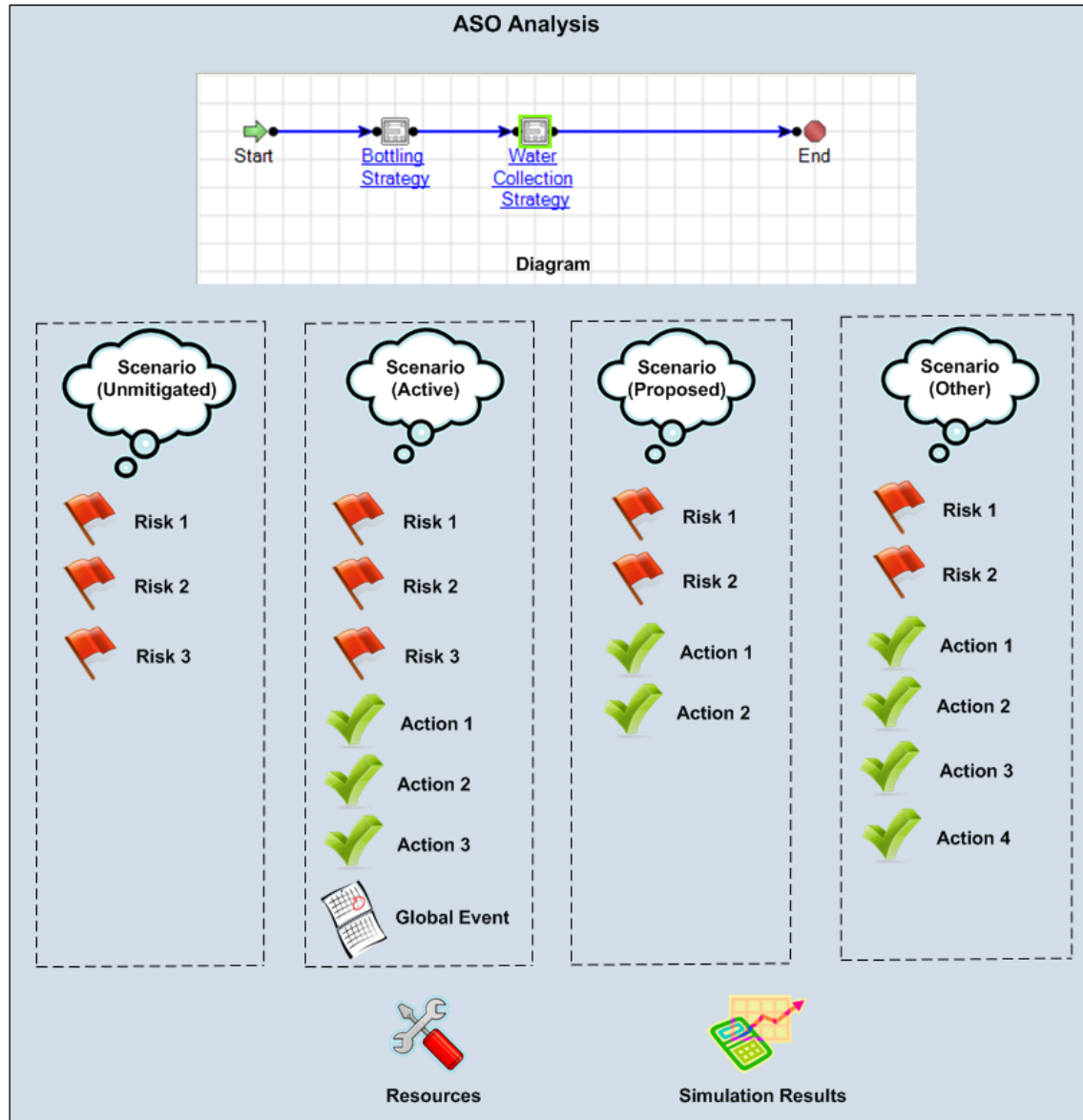
- **Global Event:** A component that groups together actions that require a shutdown. Scheduling a Global Event can make a system more efficient by providing more time in which to run while still allowing maintenance and other actions to take place. A Global Event is represented by a System Global Event record, which contains all the identifying information for the Global Event.
- **Resource:** A component of an ASO Analysis that associates a cost with an occurrence of an action or risk. Resources are represented by a System Resource record.
- **Simulation Results:** The outcome of running a simulation against all Scenarios included in a given ASO Analysis. Simulation results are stored in System Element Result, System Action Result, or System Resource Result records, which are linked to the root System Analysis record.

Visual Representation of ASO Analysis Components

The following image illustrates the components that make up an ASO Analysis. In the image, you can see that the analysis contains one Diagram and four Scenarios:

- **Unmitigated Scenario:** Contains only Risks.
- **Active Scenario:** Contains the same Risks as the Unmitigated Scenario, plus Actions and a Global Event.
- **Proposed Scenario:** Contains only two of the Risks and two of the Actions from the Active Scenario.
- **Other Scenario:** Contains two of the Risks and all three Actions from the Active Scenario, plus an additional Action.

In addition, the analysis contains Resources and Simulation Results.



ASO Workflow

The following steps represent a complete workflow for using ASO:

1. Open the Asset Strategy, System Strategy, or Unit Strategy from which you want to create an ASO Analysis.
2. Create an ASO Analysis from the strategy. When you do so, two Scenarios will be created automatically:

- An Active Scenario that represents the Active Strategy.
 - A Proposed Scenario that represents the Proposed Strategy.
3. Review the default simulation parameters, and modify them if needed.
 4. Review the Diagram that was created automatically from the information in ASM, and modify it if needed.
 5. In the Scenario that represents the *Active* Strategy:
 4.
 - a. Provide values that will be used to yield accurate simulation results.
 - b. Optimize Action intervals, define Resources, and define Global Events.
 - c. Run a simulation.
 - d. Evaluate the simulation results.
 5. In the Scenario that represents the *Proposed* Strategy:
 - a. Provide values that will be used to yield accurate simulation results.
 - b. Optimize Action intervals, define Resources, and define Global Events.
 - c. Add, modify, or remove Actions and Risks.
 - d. Run a simulation.
 - e. Evaluate the simulation results.
 6. If the simulation results indicate that neither the Active Scenario nor the Proposed Scenario represents an acceptable strategy, suggest a new strategy. To do so, you can:
 - Modify the Proposed Scenario until it represents the suggested strategy.

-OR-

- Create a new Scenario to represent the suggested strategy. You can create the new Scenario in either of the following ways:
 - Create it from scratch.
 - Create it by copying the existing Active or Proposed Scenario.
8. In the Scenario that represents the suggested strategy:
 - a. Provide values that will be used to yield accurate simulation results.
 - b. Optimize Action intervals, define Resources, and define Global Events.
 - c. Add, modify, or remove Actions and Risks.
 - d. Run a simulation.
 - e. Evaluate the simulation results.
 9. If you are not satisfied with the simulation results from the Scenario, continue suggesting new strategies (by modifying the Proposed Scenario or creating new Scenarios), running simulations, and evaluating the simulation results until you are satisfied with them.
 10. When you have determined which Scenario represents the most acceptable strategy, if it is not already the Proposed Scenario, set it as the Proposed Scenario.
 11. Navigate back to ASM to continue managing the strategy as needed.

ASO Analysis Example

Overview of the ASO Analysis Example

To make the ASO documentation easier to follow and to help explain how ASO Analyses can be created and used, we provide an example of an ASO Analysis. We will refer to this example as necessary throughout the ASO documentation.

Our ASO Analysis Example involves a water bottling facility, which contains equipment that performs the following steps in the water bottling process:

1. Collect water from a source via a pump.
2. Pump the collected water into a holding tank.
3. Extract water from the holding tank into a filling machine, which fills bottles.
4. Attach caps to the bottles.
5. Attach labels to the bottles.

Note: In this example, we assume that the bottles, labels, and caps are produced at a separate facility and used in this process.

In this example, the water bottling facility is a unit, which we refer to as the *Water Bottling Unit*. This unit contains two systems: *Water Collection System* and *Bottling System*. Each system contains equipment that work together to complete a single process.

The Water Collection System contains the following equipment:

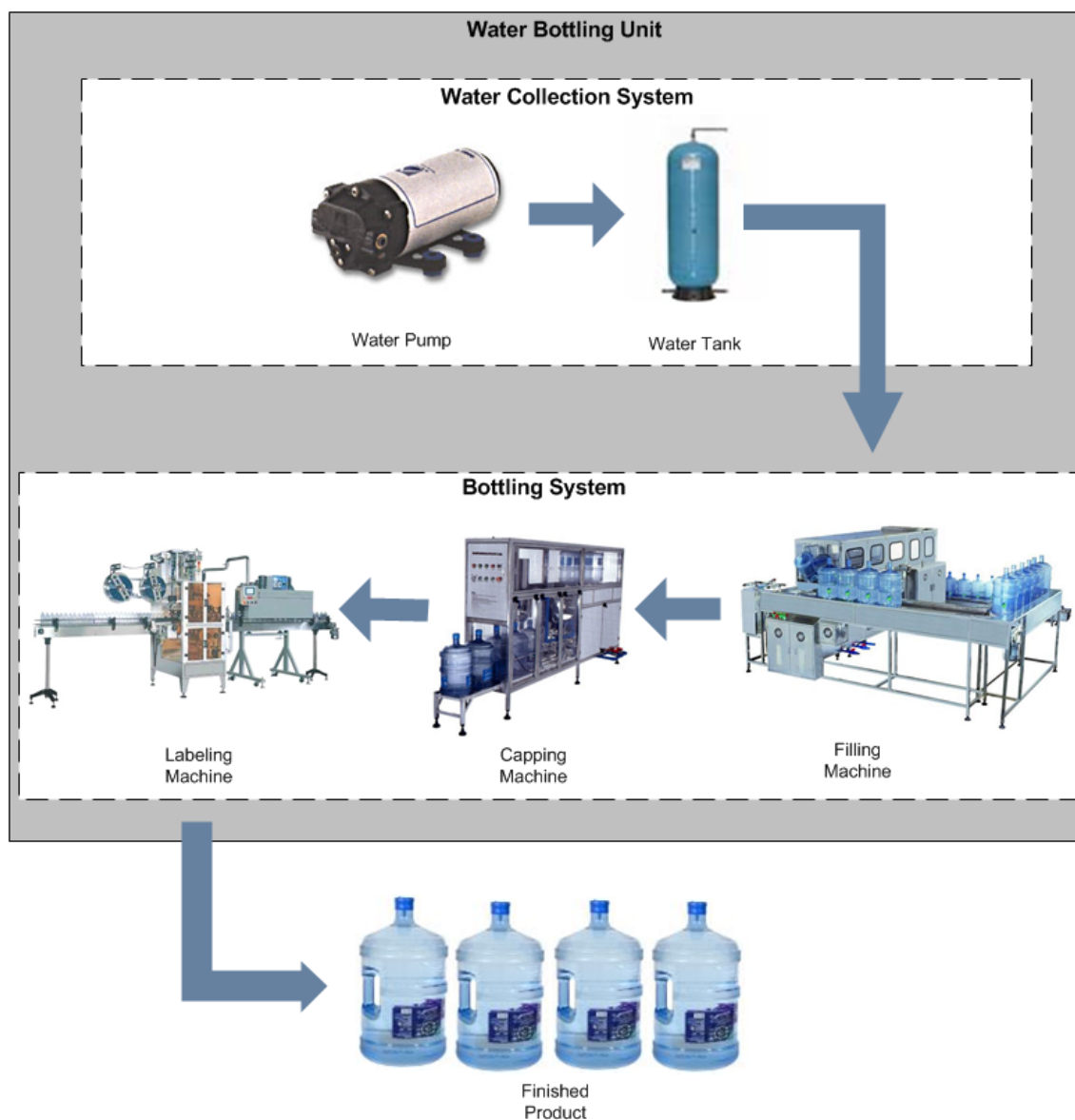
- Water Pump
- Water Tank

The Bottling System contains the following equipment:

- Filling Machine

- Capping Machine
- Labeling Machine

The unit, systems, and equipment and the process in which they are involved are illustrated in the following image.



Remember that an ASO Analysis begins with an Asset Strategy, System Strategy, or Unit Strategy. Therefore, our ASO Analysis Example includes the following strategies, where the indentation of the bullets indicates the structure of the strategies:

- Water Bottling Strategy (Unit Strategy)
 - Water Collection Strategy (System Strategy)
 - Water Pump Strategy (Asset Strategy)
 - Water Tank Strategy (Asset Strategy)
 - Bottling Strategy (System Strategy)
 - Filling Machine Strategy (Asset Strategy)
 - Capping Machine Strategy (Asset Strategy)
 - Labeling Machine Strategy (Asset Strategy)

Note: In our ASO Example, each Asset Strategy has an Active Strategy and a Proposed Strategy that are different from one another.

In our ASO Analysis Example, we will create an ASO Analysis from the Water Bottling Strategy (the Unit Strategy). Where we explain features that are specific to equipment, such as managing Risks and Actions, we focus on the equipment *Water Pump*.

Records and Links in Our Example

ASM Records and Links in Our Example

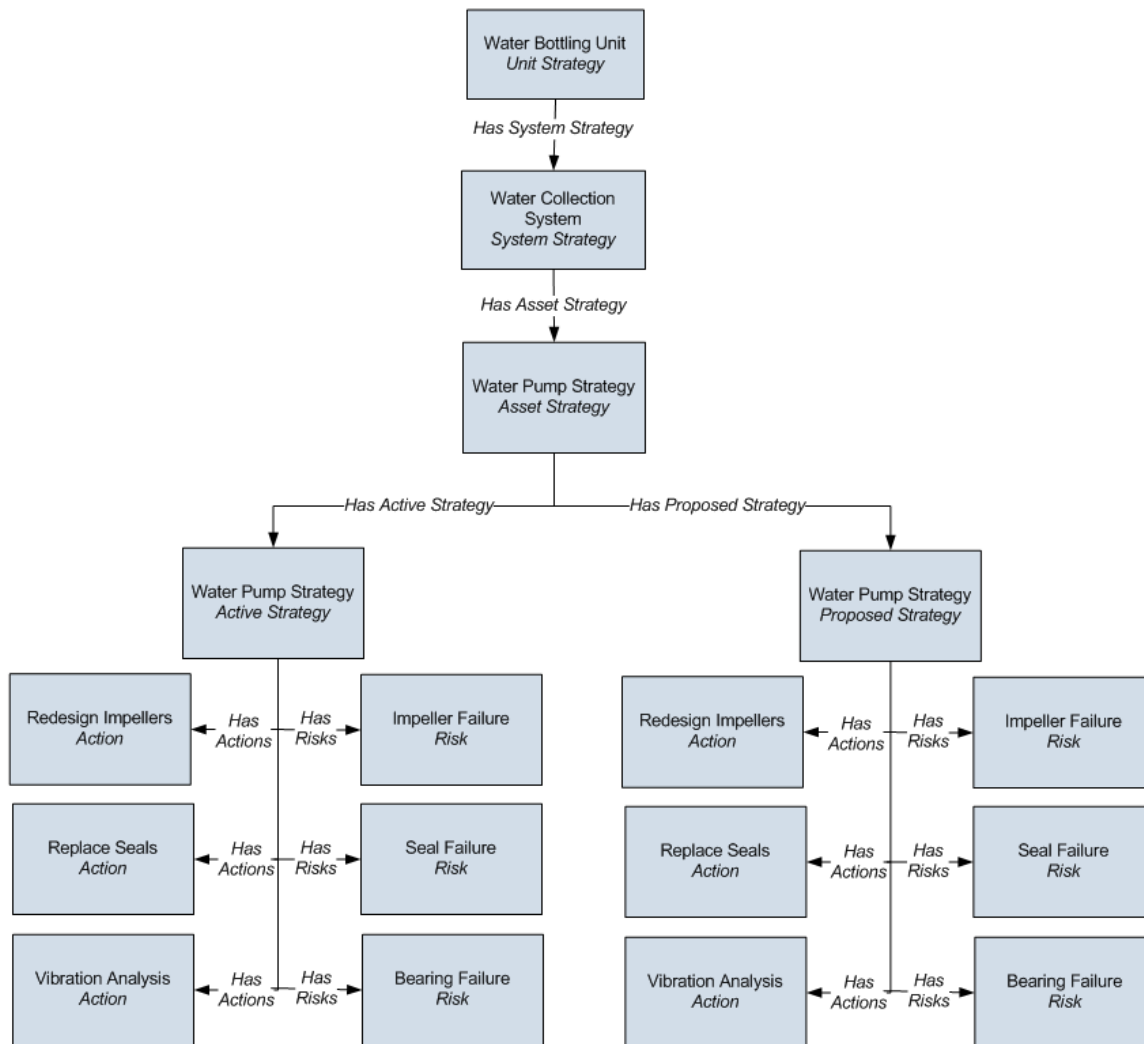
Remember that in our ASO Analysis Example, the following strategies exist:

- Water Bottling Strategy (Unit Strategy)
 - Water Collection Strategy (System Strategy)
 - Water Pump Strategy (Asset Strategy)
 - Water Tank Strategy (Asset Strategy)
 - Bottling Strategy (System Strategy)

- Filling Machine Strategy (Asset Strategy)
- Capping Machine Strategy (Asset Strategy)
- Labeling Machine Strategy (Asset Strategy)

The following image shows the records and links that are used to create the association between the Unit Strategy, *one* of its System Strategies, *one* of its Asset Strategies (Water Pump Strategy), and that Asset Strategy's Action and Risk records. Keep in mind that for *each* Asset Strategy in the previous list, a similar set of records and links exists. This image is meant to provide a visual indication of only the records and links that exist for the Water Pump Strategy.

Remember that throughout this documentation, although we explain how to create an ASO Analysis from the Unit Strategy, the majority of the focus is at the *Water Pump* level.



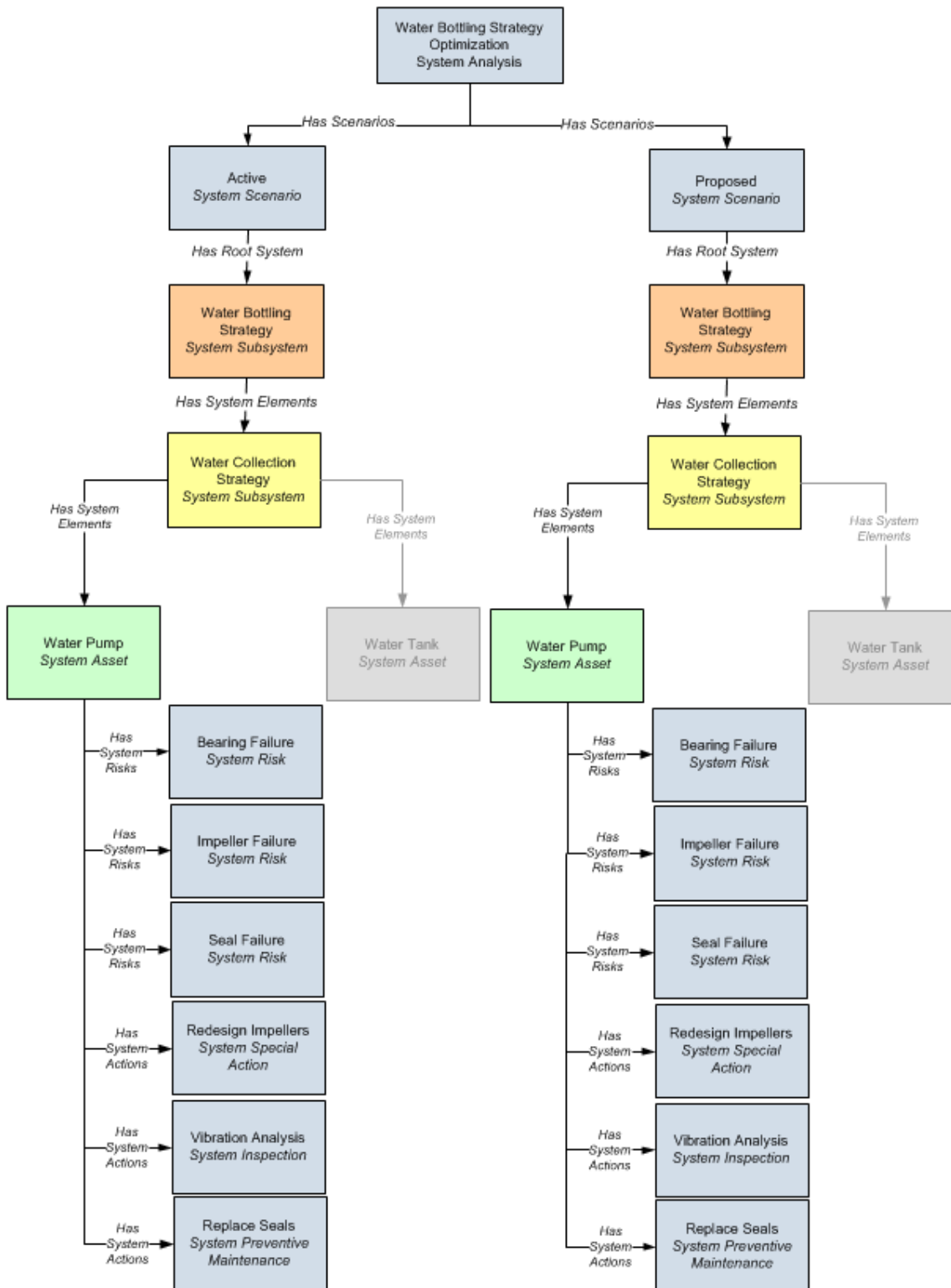
ASO Records and Links in Our Example

Remember that in our ASO Analysis Example, we create an ASO Analysis from the Unit Strategy *Water Bottling Strategy*, which includes the Asset Strategy *Water Pump Strategy*. This Asset Strategy includes the following Action and Risk records:

- Risk records: Impeller Failure, Bearing Failure, Seal Failure
- Action records: Redesign Impellers, Vibration Analysis, Replace Seals

Using this example, the following image illustrates the records and links that would exist in ASO after the ASO Analysis is created. The colors in the image have the following meanings:

- **Orange:** Identifies two separate *Water Bottling Strategy* System Subsystem records, which represent the *Diagram* in the ASO Analysis. Note that although two physical records exist in the database, ASO allows you to have only *one* Diagram per analysis. Therefore, whenever a change is made to the properties of the *Water Bottling Strategy* element via the Diagram, the Meridium APM code updates *both* System Subsystem records so that they are always identical.
- **Yellow:** Identifies two separate *Water Collection Strategy* System Subsystem records, which represent the *Water Collection Strategy* System Strategy. Note that these records are used to build the Diagram for the ASO Analysis. Although two physical records exist in the database, ASO allows you to have only *one* Diagram per analysis. Therefore, whenever a change is made to the properties of the *Water Collection Strategy* element via the Diagram, the Meridium APM code updates *both* System Subsystem records so that they are always identical.
- **Green:** Identifies two separate *Water Pump Strategy* System Asset records, which represent the *Water Pump Strategy* Asset Strategy. Note that these records are used to build the Diagram for the ASO Analysis. Although two physical records exist in the database, ASO allows you to have only *one* Diagram per analysis. Therefore, whenever a change is made to the properties of the *Water Pump Strategy* element via the Diagram, the Meridium APM code updates *both* System Asset records so that they are always identical.
- **Gray:** Identifies System Asset records that are part of the ASO Analysis but not the focus of this documentation. The image is meant to provide a visual indication of only the records and links that exist for the *Water Pump* System Asset record. Remember that throughout this documentation, although we explain how to create an ASO Analysis from the Unit Strategy, the majority of the focus is at the Water Pump level.



You can see that the *Water Pump* System Asset record is linked to three System Risk records. From the name of each System Risk record, you can infer the Risk record in ASM from which it was created. In addition, the *Water Pump* System

Asset record is also linked to records in the following families through the Has System Actions relationship:

- System Special Action
- System Inspection
- System Preventive Maintenance

If you remember from the ASO data model, these families are all subfamilies of the System Action family. While the subfamily to which these records belong differs, the three records were all created from an Action record in ASM. From the name of the record (e.g., Redesign Impellers), you can infer the Action record from which it was created.

Note: The subfamilies to which the records belong is determined by the System Action Mapping records that have been configured.

Data in Our Example

Asset Data

In our ASO Analysis Example, the Equipment record *Water Pump* contains the following values:

- Name: Water Pump
- Production Contribution: 100
- Fixed Cost: 5000
- Variable Cost: 50
- Variable Cost Units: Per Hour
- Lost Production Cost: 0
- Lost Production Cost Units: Per Day

Water Pump Asset Strategy

Asset Strategy Data

In our ASO Analysis Example, the Asset Strategy record that is linked to the Equipment record *Water Pump* contains the following values:

- **Strategy ID:** Water Pump Strategy
- **Description:** Asset Strategy for the Water Pump
- **Plan Length:** 5
- **Asset Name:** Water Pump
- **Asset Family:** Equipment

Active Strategy

Action Data

The following table shows the example data stored in the Action records that are linked to the Active Strategy record with the ID *Water Pump Strategy*.

Action	Values
Redesign Impellers	Name: Redesign Impellers Action Type: Redesign (DSM) Interval: 2 Interval Units: Years Nonrecurring: Yes Cost: 1,600 Shutdown Required: Yes
Replace Seals	Name: Replace Seals Action Type: Time-Based Maintenance (Preventive) (PM) Interval: 2 Interval Units: Years Nonrecurring: No Cost: 2,000 Shutdown Required: Yes

Action	Values
Vibration Analysis	Name: Vibration Analysis Action Type: Condition-Based Maintenance (Predictive) (CM) Interval: 3 Interval Units: Weeks Nonrecurring: No Cost: 0 Shutdown Required: No

Risk Data

The following table shows the example data stored in the Risk records (and the corresponding Risk Assessment records) that are linked to the Active Strategy record with the ID *Water Pump Strategy*. It also shows which Action records represent actions that mitigate the risk.

Risk	Risk Values	Mitigating Action Values
Seal Failure	Name: Seal Failure Unmitigated Risk Rank: 150.6 Unmitigated Financial Risk: \$690.00	Name: Replace Seals Mitigated Risk Rank: 3.6 Mitigated Financial Risk: \$230.00
Bearing Failure	Name: Bearing Failure Unmitigated Risk Rank: 306 Unmitigated Financial Risk: \$1,080.00	Name: Vibration Analysis Mitigated Risk Rank: 3.6 Mitigated Financial Risk: \$360.00
Impeller Failure	Name: Impeller Failure Unmitigated Risk Rank: 156 Unmitigated Financial Risk: \$165.00	Name: Replace Seals Mitigated Risk Rank: 1.5 Mitigated Financial Risk: \$55.00

Proposed Strategy

Action Data

The following table shows the example data stored in the Action records that are linked to the Proposed Strategy record with the ID *Water Pump Strategy*.

Note: Values that differ from the values in the corresponding Action record that is linked to the Active Strategy record are colored red.

Action	Values
Redesign Impellers	Name: Redesign Impellers Action Type: Redesign (DSM) Interval: 3 Interval Units: Years Nonrecurring: Yes Cost: 1,800 Shutdown Required: Yes
Replace Seals	Name: Replace Seals Action Type: Time-Based Maintenance (Preventive) (PM) Interval: 2 Interval Units: Years Nonrecurring: No Cost: 1,500 Shutdown Required: Yes
Vibration Analysis	Name: Vibration Analysis Action Type: Condition-Based Maintenance (Predictive) (CM) Condition Monitoring Type: Periodic Interval: 4 Interval Units: Weeks Nonrecurring: No Cost: 0 Shutdown Required: No

Risk Data

The following table shows the example data stored in the Risk records (and the corresponding Risk Assessment records) that are linked to the Proposed Strategy record with the ID *Water Pump Strategy*. It also shows which Action records represent actions that help mitigate the risk.

Note: Values that differ from the values in the corresponding Risk record that is linked to the Active Strategy record are colored red.

Risk	Risk Values	Mitigating Action Values
Seal Failure	Name: Seal Failure Unmitigated Risk Rank: 150.6 Unmitigated Financial Risk: \$690.00	Name: Replace Seals Mitigated Risk Rank: 3.6 Mitigated Financial Risk: \$225.00

Risk	Risk Values	Mitigating Action Values
Bearing Failure	Name: Bearing Failure Unmitigated Risk Rank: 306 Unmitigated Financial Risk: \$1,080.00	Name: Vibration Analysis Mitigated Risk Rank: 3.2 Mitigated Financial Risk: \$360.00
Impeller Failure	Name: Impeller Failure Unmitigated Risk Rank: 306 Unmitigated Financial Risk: \$165.00	Name: Replace Seals Mitigated Risk Rank: 1.5 Mitigated Financial Risk: \$55.00

ASO Values

Active Scenario

Action Data

The following table shows the example data that is used in the Actions that are defined for the Water Pump Strategy and belong to the *Active* Scenario. Because the Active Scenario always reflects data that was mapped from ASM and these values cannot be changed, this table includes only the values that are specific to ASO and were not mapped from ASM. For a list of values that exist in the corresponding Action records in the Active Strategy with the ID Water Pump Strategy, [click here](#).

Note: The Source column identifies the family name of the record in which the associated data is stored. The data from ALL source records is combined to create comprehensive Action data.

Action	Mitigated Risk	Source	Values
Redesign Impellers	Impeller Failure	System Special Action	Duration: 2 Duration Units: Weeks Replace Failure Consequence: Yes Replace TTF Distribution: Yes
		System Risk Assessment	Mitigated Unplanned Correction Cost: 1000'

Action	Mitigated Risk	Source	Values
		Weibull	Name: New TTF Distribution Distribution Type: Weibull Time Unit: Months Beta: 4 Eta: 48 Gamma: 0
Replace Seals	Seal Failure	System Preventive Maintenance	Duration: 1 Duration Units: Days
Vibration Analysis	Bearing Failure	System Inspection	Duration: 1 Duration Units: Hours Detection Probability (%): 90

When you click a hyperlinked Action name, the Mitigated Unplanned Correction Cost field appears on the Mitigated Risks tab and is labeled *Fixed Unplanned Correction Cost*.

Risk Data

The following table shows the example data that is used in the Risks that are defined for the Water Pump Strategy and belong to the *Active* Scenario. Note that this table includes only the values that are specific to ASO and were not mapped from ASM. For a list of values that exist in the corresponding Risk records in the Active Strategy with the ID Water Pump Strategy, [click here](#).

Note: The **Source** column identifies the family name of the record in which the associated data is stored. The data from ALL source records is combined to create comprehensive Risk data.

Risk	Mitigating Action	Source	Values
Seal Failure	Replace Seals	System Risk	Last Failure: 1/1/1999 12:00:00 AM Fixed Unplanned Correction Cost: 1500 Variable Unplanned Correction Cost: 1000 Variable Unplanned Correction Cost Units: Per Day Planned Correction Cost: 1000 Planned Correction Duration: 12 Planned Correction Duration Units: Hours Is Active: Yes Is Latent: No Failure Without Replacement: No Number of Subcomponents: 1 PF Interval: 30 PF Interval Units: Days Repair Immediately: Yes Percentage of PF Interval to Wait (%): 0
		Weibull	Name: TTF Distribution Distribution Type: Weibull Time Unit: Years Beta: 4 Eta: 3 Gamma: 0 Enable Distribution Association: No
		Normal	Name: TTR Distribution Distribution Type: SingleValue Time Unit: Hours Value: 12 Enable Distribution Association: No

Risk	Mitigating Action	Source	Values
Bearing Failure	Vibration Analysis	System Risk	Last Failure: 1/1/1999 12:00:00 AM Fixed Unplanned Correction Cost: 2000 Variable Unplanned Correction Cost: 1000 Variable Unplanned Correction Cost Units: Per Day Planned Correction Cost: 1000 Planned Correction Duration: 4 Planned Correction Duration Units: Hours Is Active: Yes Is Latent: No Failure Without Replacement: No Number of Subcomponents: 1 PF Interval: 6 PF Interval Units: Weeks Repair Immediately: Yes Percentage of PF Interval to Wait (%): 0
		Exponential	Name: TTF Distribution Distribution Type: Exponential Time Unit: Months Value: 60 Enable Distribution Association: No
		Exponential	Name: TTR Distribution Distribution Type: Exponential Time Unit: Hours MTTR: 8 Enable Distribution Association: No

Risk	Mitigating Action	Source	Values
Impeller Failure	Redesign Impellers	System Risk	Last Failure: 1/1/1999 12:00:00 AM Fixed Unplanned Correction Cost: 1500 Variable Unplanned Correction Cost: 1000 Variable Unplanned Correction Cost Units: Per Day Planned Correction Cost: 1000 Planned Correction Duration: 4 Planned Correction Duration Units: Hours Is Active: Yes Is Latent: No Failure Without Replacement: No Number of Subcomponents: 1 PF Interval: 0 PF Interval Units: Days Repair Immediately: Yes Percentage of PF Interval to Wait (%): 0
		Exponential	Name: TTF Distribution Distribution Type: Exponential Time Unit: Months Value: 24 Enable Distribution Association: No
		Normal	Name: TTR Distribution Distribution Type: SingleValue Time Unit: Hours Value: 12 Enable Distribution Association: No

Proposed Scenario

Action Data

The following table shows the example data that is used in the Actions that are defined for the Water Pump Strategy and belong to the *Proposed* Scenario. Because you can change the values that were originally mapped from ASM to a Proposed Scenario, this table includes the values that are specific to ASO and those that were mapped from ASM. In our example, however, we have not changed these values from their original ASM values. To distinguish between the two types of values, values that were mapped from ASM are colored gray in the table.

Note that values that differ from the values in the corresponding Action in the Active Scenario are colored red.

Note: The **Source** column identifies the family name of the record in which the associated data is stored. The data from ALL source records is combined to create comprehensive Action data.

Action	Mitigated Risk	Source	Values
Redesign Impellers	Impeller Failure	System Special Action	Name: Redesign Impellers Action Type: Redesign (DSN) Action Cost: 1600 Interval: 2 Interval Units: Years Duration: 1.5 Duration Units: Weeks Shutdown Required: Yes One Time Action: Yes Replace Failure Consequence: Yes Replace TTF Distribution: Yes
		System Risk Assessment	Mitigated Unplanned Correction Cost: 1000 ¹

Action	Mitigated Risk	Source	Values
		Weibull	Name: New TTF Distribution Distribution Type: Weibull Time Unit: Months Beta: 4 Eta: 48 Gamma: 0
Replace Seals	Seal Failure	System Preventive Maintenance	Name: Replace Seals Action Type: Time-Based Maintenance (Preventive) (PM) Action Cost: 2000 Interval: 2 Interval Units: Years Duration: .5 Duration Units: Days Shutdown Required: Yes One Time Action: No
Vibration Analysis	Bearing Failure	System Inspection	Name: Vibration Analysis Action Type: Condition-Based Maintenance (Predictive) (CM) Condition Monitoring Type: Periodic Action Cost: 0 Interval: 3 Interval Units: Weeks Duration: 1 Duration Units: Hours Shutdown Required: No One Time Action: No Detection Probability (%): 100

When you click a hyperlinked Action name, the Mitigated Unplanned Correction Cost field appears on the Mitigated Risks tab and is labeled *Fixed Unplanned Correction Cost*.

Risk Data

The following table shows the example data that is used in the Risks that are defined for the Water Pump Strategy and belong to the *Proposed Scenario*. Because you can change the values that were originally mapped from ASM to a

Proposed Scenario, this table includes the values that are specific to ASO and those that were mapped from ASM. In our example, however, we have not changed these values from their original ASM values. To distinguish between the two types of values, values that were mapped from ASM are colored gray in the table.

Note that values that differ from the values in the corresponding Risk in the Active Scenario are colored red.

Note: The Source column identifies the family name of the record in which the associated data is stored. The data from ALL source records is combined to create comprehensive Risk data.

Risk	Mitigating Action	Source	Values
Seal Failure	Replace Seals	System Risk	Name: Seal Failure Last Failure: 1/1/1999 12:00:00 AM Fixed Unplanned Correction Cost: 1500 Variable Unplanned Correction Cost: 1000 Variable Unplanned Correction Cost Units: Per Day Planned Correction Cost: 1000 Planned Correction Duration: 8 Planned Correction Duration Units: Hours Is Active: Yes Is Latent: No Failure Without Replacement: No Number of Subcomponents: 1 PF Interval: 30 PF Interval Units: Days Repair Immediately: Yes Percentage of PF Interval to Wait (%): 0

Risk	Mitigating Action	Source	Values
		Weibull	Name: TTF Distribution Distribution Type: Weibull Time Unit: Years Beta: 4 Eta: 3 Gamma: 0 Enable Distribution Association: No
		Normal	Name: TTR Distribution Distribution Type: SingleValue Time Unit: Hours Value: 12 Enable Distribution Association: No
Bearing Failure	Vibration Analysis	System Risk	Name: Bearing Failure Last Failure: 1/1/1999 12:00:00 AM Fixed Unplanned Correction Cost: 2000 Variable Unplanned Correction Cost: 1000 Variable Unplanned Correction Cost Units: Per Day Planned Correction Cost: 800 Planned Correction Duration: 2 Planned Correction Duration Units: Hours Is Active: Yes Is Latent: No Failure Without Replacement: No Number of Subcomponents: 1 PF Interval: 6 PF Interval Units: Weeks Repair Immediately: Yes Percentage of PF Interval to Wait (%): 0

Risk	Mitigating Action	Source	Values
		Exponential	Name: TTF Distribution Distribution Type: Exponential Time Unit: Months Value: 60 Enable Distribution Association: No
		Exponential	Name: TTR Distribution Distribution Type: Exponential Time Unit: Hours MTTR: 8 Enable Distribution Association: No
Impeller Failure	Redesign Impellers	System Risk	Name: Impeller Failure Last Failure: 1/1/1999 12:00:00 AM Fixed Unplanned Correction Cost: 1500 Variable Unplanned Correction Cost: 1000 Variable Unplanned Correction Cost Units: Per Day Planned Correction Cost: 600 Planned Correction Duration: 3 Planned Correction Duration Units: Hours Is Active: Yes Is Latent: No Failure Without Replacement: No Number of Subcomponents: 1 PF Interval: 0 PF Interval Units: Days Repair Immediately: Yes Percentage of PF Interval to Wait (%): 0

Risk	Mitigating Action	Source	Values
		Exponential	Name: TTF Distribution Distribution Type: Exponential Time Unit: Months Value: 24 Enable Distribution Association: No
		Normal	Name: TTR Distribution Distribution Type: SingleValue Time Unit: Hours Value: 12 Enable Distribution Association: No

Accessing ASO

About Accessing ASO

ASO must be accessed from within the context of an Asset Strategy, System Strategy, or Unit Strategy. You can access ASO by:

- Creating a new ASO Analysis for an existing strategy.
- OR-
- Opening an existing ASO Analysis for an existing strategy.

Each time you access ASO, the Meridium APM system validates the strategy to determine if it contains sufficient information to run a simulation. To run a simulation, the Meridium APM system needs certain information from the Action and Risk records that belong to the strategy. All of the required information is stored in fields in Action and Risk records, but not all of the fields are displayed on the baseline Action and Risk datasheets. Therefore, assuming that you are using the baseline datasheets, some of this information might already exist in your Action and Risk records, and other information can

be provided only after you initiate the action of creating or opening an ASO Analysis.

Therefore, when you choose to create a new ASO Analysis or open an existing ASO Analysis that is missing some information, the **Validate Strategy** window appears, prompting you to provide the information that is missing.

- For values that are missing and can be provided using the baseline Action and Risk datasheets, you must type or select the desired values in this window or close the window and provide the values using the datasheets. You cannot proceed with creating or opening the ASO Analysis until the values are provided. In the **Validate Strategy** window, these values are grouped together under the *Error* heading.
- For values that are missing but *cannot* be provided using the baseline Action and Risk datasheets, you can type or select the desired values in the window or proceed without providing any values. If you proceed without providing any values, the Meridium APM system will assume certain default values. In the **Validate Strategy** window, these values are grouped together under the *Warning* heading.

If you are creating a new ASO Analysis, after you provide the missing information, the **Asset Strategy Optimization Builder** will appear. You can use this builder to provide additional information about the analysis that you are creating and specify whether or not you want the Meridium APM system to run a simulation before displaying the analysis. When you complete the steps in the builder, depending upon whether you chose the **Advanced** option in the builder, the ASO Analysis will appear on the **ASO - Asset Strategy Optimization Summary - <Analysis Name>** page or the **ASO - Asset Strategy Optimization Analysis Definition - <Analysis Name>** page, where <Analysis Name> is the name of the ASO Analysis.

A Note About Your Point of Access

An ASO Analysis can be created or opened from an Asset Strategy, System Strategy, or Unit Strategy. Remember that in our ASO Analysis Example, the following collection of strategies exists, where the indentation of the bullets indicates the structure of the strategies:

- Water Bottling Strategy (Unit Strategy)
 - Water Collection Strategy (System Strategy)

- Water Source Strategy (Asset Strategy)
- Water Pump Strategy (Asset Strategy)
- Water Tank Strategy (Asset Strategy)
- Bottling Strategy (System Strategy)
 - Filling Machine Strategy (Asset Strategy)
 - Capping Machine Strategy (Asset Strategy)
 - Labeling Machine Strategy (Asset Strategy)

The strategy level from which you create the ASO Analysis determines which elements the Diagram and Scenarios contain.

If you create an ASO Analysis from the highest level, the Unit Strategy, one ASO Analysis will exist to represent data in ALL of the strategies below it in the collection. If, however, an ASO Analysis does not yet exist for the Unit Strategy and you create an ASO Analysis from one of the System Strategies, one ASO Analysis will exist to represent data in that System Strategy and any Asset Strategies that it contains. Likewise, if an ASO Analysis does not yet exist for the Unit Strategy or its System Strategies and you create an ASO Analysis from one of the Asset Strategies, one ASO Analysis will exist to represent data in that Asset Strategy.

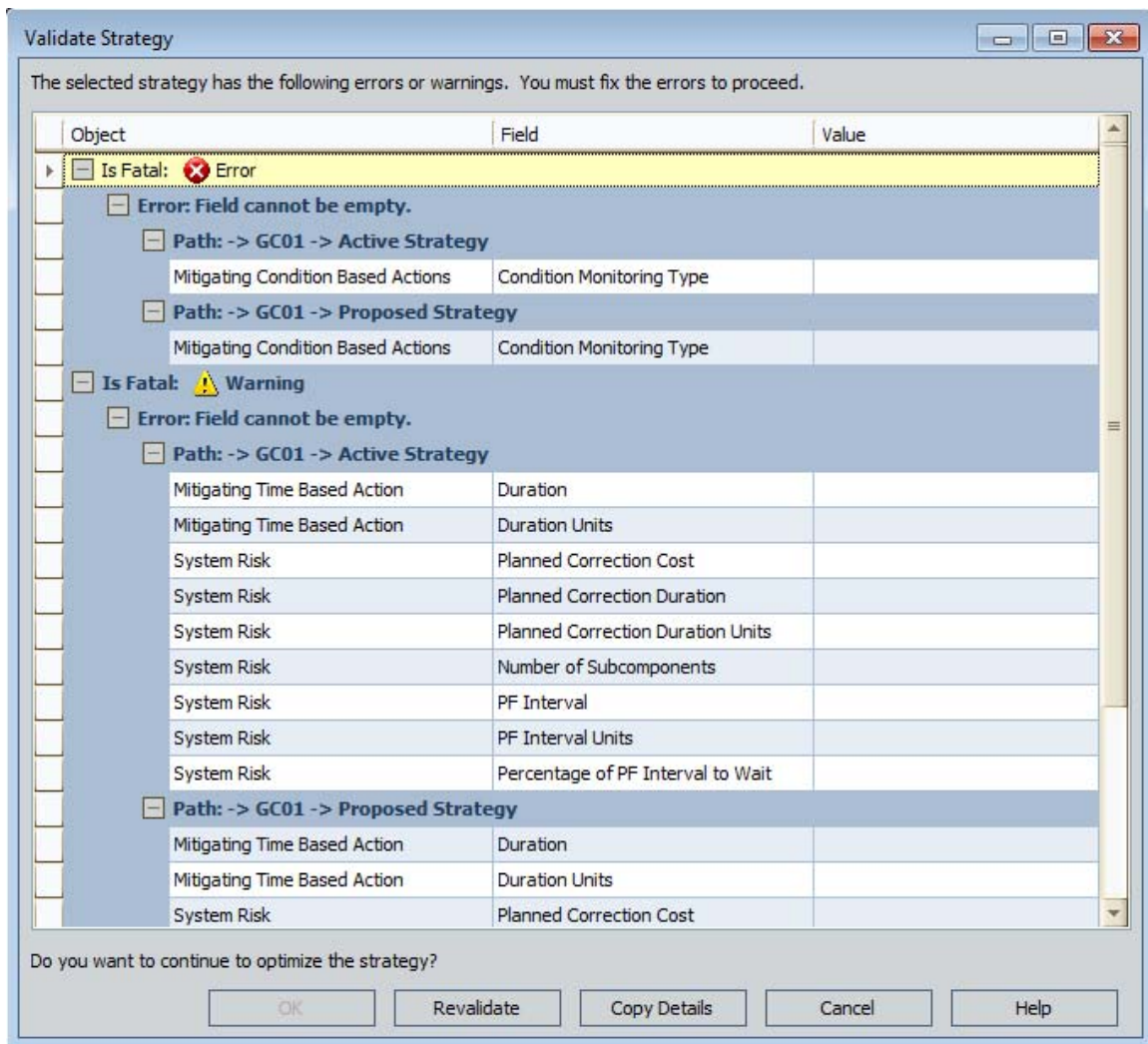
In other words, when you create an ASO Analysis, the Meridium APM system creates the analysis from the current strategy and any strategies that it contains. After an ASO Analysis exists for a strategy that contains other strategies, if you access ASO from a lower-level strategy that it contains, a new ASO Analysis will not be created for that lower-level strategy. Instead, the ASO Analysis for the higher-level strategy will be displayed.

The System Analysis record in the ASO Analysis will always be linked to *only* the Asset Strategy, System Strategy, or Unit Strategy record from which the ASO Analysis was originally *created*.

Throughout this documentation, we use the phrase *included in an ASO Analysis* to refer to any Unit Strategy, System Strategy, or Asset Strategy whose values are used in the ASO Analysis simulation, regardless of which strategy was used to create the analysis.

Aspects of the Validate Strategy Window

The **Validate Strategy** window appears when you choose to create a new ASO Analysis or open an existing ASO Analysis.



The window contains a grid, where each row represents a field that is used to yield simulation results but is missing a value. Each row represents a field in an Action record or a Risk record.

Note: You can infer whether the field belongs to an Action or Risk record from the value in the **Object** column, which comes from the Name field in the record. For example, in the preceding image, in the first row, you can infer that the *Planned Correction Duration* field belongs to the Risk record *Impeller Failure* because the phrase *Failure* suggests a risk. There is no other visual indicator to identify the type of record to which the field in each row belongs.

For each row, the following columns appear:

- **Object:** Displays the name of the Action or Risk record that is missing a value.
- **Field:** Displays the caption of the field that is missing a value.
- **Value:** Contains an empty cell where you can type or select the desired value.

The rows are grouped by multiple levels, where:

- The first (highest) level indicates one of the following conditions:
 - **Error:** Indicates that the field value is missing and can be provided using the baseline Action and Risk datasheets. For these rows, you must type or select the desired values in the **Value** cell or close the window and provide the values using the datasheets. You cannot proceed with creating or opening the ASO Analysis until the values are provided.
 - **Warning:** Indicates that the field value is missing but *cannot* be provided using the baseline Action and Risk datasheets. For these rows, you can type or select the desired values in the **Value** cell or proceed without providing any values. If you proceed without providing any values, the Meridium APM system will assume certain default values.
- The second level always contains the text *Error*, even if the first level indicates a warning condition.
- The third level indicates the strategy that contains the Action or Risk record that is missing a value. The group header contains the following text:

Path -> <Unit Strategy> -> <System Strategy> -> <Asset Strategy> ->
<Strategy Type>

...where:

- <Unit Strategy> is the name of the Unit Strategy containing the Asset Strategy with the Action or Risk record that is missing a value.

- **<System Strategy>** is the name of the System Strategy containing the Asset Strategy with the Action or Risk record that is missing a value.
- **<Asset Strategy>** is the name of the Asset Strategy with the Action or Risk record that is missing a value.
- **<Strategy Type>** is the type of Asset Strategy: *Active* or *Proposed*.

The level of the strategy from which you access the window determines which values appear in this path. For instance, if you access the window from a Unit Strategy, all values appear in the path. If you access it from a System Strategy, the **<Unit Strategy>** value is omitted from the path. Likewise, if you access the window from an Asset Strategy, the **<Unit Strategy>** and **<System Strategy>** values are omitted from the path.

Consider the following example, where the window was accessed from the Unit Strategy with the ID *Water Bottling Strategy*.

Object	Field	Value
<input type="checkbox"/> Is Fatal: ✘ Error		
<input type="checkbox"/> Error: Field cannot be empty.		
<input type="checkbox"/> Path: -> Water Bottling Strategy-> Bottling Strategy-> Capping Machine Strategy -> Active Strategy		

Below the grid, the following buttons appear:

- **OK:** Closes the **Validate Strategy** window. If you are creating a new ASO Analysis, after you click OK, the **Asset Strategy Optimization Builder** appears, where you will need to provide additional information about the ASO Analysis that you are creating. If you are opening an existing ASO Analysis, after you click OK, the ASO Analysis appears.

Note: The OK button is disabled until you have provided values for all fields that are grouped under the Error heading.

- **Revalidate:** Revalidates the information in the strategy to determine if any values that are used to yield simulation results are missing.
- **Copy Details:** Copies the information that appears in the window so that you can paste it to an external file (e.g., a Microsoft Word document). If a significant number of fields are missing values, you might want to copy the information, paste it into an external file, and use the file as a guide

for entering values in the Action or Risk datasheets before you try to access ASO again from that strategy.

- **Cancel:** Closes the window and disregards any values that you have entered in the **Value** column.
- **Help:** Displays the context-sensitive Help topic for the **Validate Strategy** window.

Installation, Upgrade, and Configuration

First-Time Deployment Workflow

Deploying and configuring ASO for the first time includes completing multiple steps, which are outlined in the table in this topic. The steps in this section of the documentation provide all the information that you need to deploy and configure ASO on top of the basic Meridium APM system architecture.

Whether a step is required or option is indicated in the **Required/Optional** cell. Steps are marked as *Required* if you must perform the step to take advantage of ASO functionality.

The person responsible for completing each task may vary within your organization. We recommend, however, that the steps be performed in relatively the same order in which they are listed in the table.

Step	Task	Required/Optional
1	Assign Security Users to ASO Security Groups via the Configuration Manager application.	Required

Upgrade Workflow

Upgrade Workflow

You can upgrade to V3.6.0.0.0 using the instructions that are provided in this section of the documentation. To access these instructions, click the starting version from which you are upgrading:

- V3.5.1
- V3.5.0 SP1 LP

- V3.5.0
- V3.4.5

Upgrading ASO from V3.5.1 to V3.6.0.0.0

ASO will be upgraded from V3.5.1 to V3.6.0.0.0 automatically when you upgrade the components in the basic Meridium APM system architecture.

Upgrading ASO from V3.5.0 SP1 LP to V3.6.0.0.0

ASO will be upgraded from V3.5.0 SP1 LP to V3.6.0.0.0 automatically when you upgrade the components in the basic Meridium APM system architecture.

Upgrading ASO from V3.5.0 to V3.6.0.0.0

ASO will be upgraded from V3.5.0 to V3.6.0.0.0 automatically when you upgrade the components in the basic Meridium APM system architecture.

Upgrading ASO from V3.4.5 to V3.6.0.0.0

ASO will be upgraded from V3.4.5 to V3.6.0.0.0 automatically when you upgrade the components in the basic Meridium APM system architecture.

Installation, Upgrade, and Configuration Steps

Configuring Security for ASO

The Meridium Asset Strategy Optimization module leverages the baseline Meridium Asset Strategy Management Security Groups. To use ASO, a user must be a member of one of the following Security Groups:

- MI ASM Administrator

- MI ASM Analyst
- MI ASM Reviewer
- MI ASM Viewer

User Instructions

Navigating ASO Features

About Navigating ASO Features

From ASM, you can open an existing ASO Analysis or create a new one. When you do so:

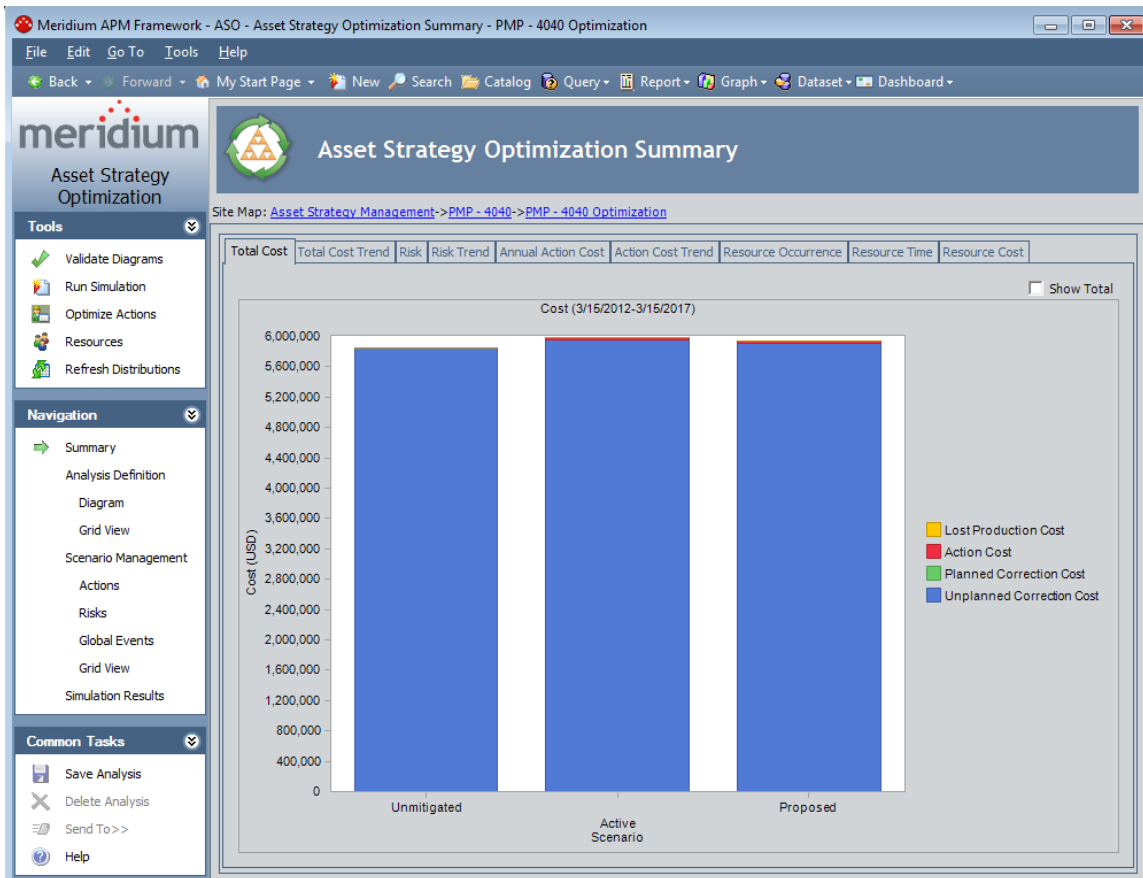
- If you are creating a new analysis (and you selected the **Advanced** option in the builder) or opening an existing analysis for which the simulation has not yet been run, the **Asset Strategy Optimization Analysis Definition** page will be displayed.
- If you are creating a new analysis (and you selected the **Run Simulation** option in the builder) or opening an existing analysis for which the simulation has been run, the **Asset Strategy Optimization Summary** page will be displayed.

You can use either of these pages to perform tasks and access additional pages related to the analysis.

Note: Each page title is prefixed with the text *ASO* and appended with the name of the ASO Analysis. For example, if you are viewing the *Water Bottling Strategy Optimization* analysis on the **Asset Strategy Optimization Summary** page, the page title will be **ASO - Asset Strategy Optimization Summary - Water Bottling Strategy Optimization**. Throughout the documentation, we refer to the page names *without* the text *ASO* or the analysis name. Continuing with the example, we would refer to the **ASO - Asset Strategy Optimization Summary - Water Bottling Strategy Optimization** page simply as the *Asset Strategy Optimization Summary page*.

Aspects of the Asset Strategy Optimization Summary Page

The **Asset Strategy Optimization Summary** page displays a summary of the simulation results that currently exist for an ASO Analysis.



The Asset Strategy Optimization Summary page contains the following features:

- **Task menus:** Displays the task menus that are common to most pages in ASO: **Tools** menu, **Navigation** menu, and **Common Tasks** menu.
- **Asset Strategy Optimization Summary workspace:** Displays the simulation results on the following tabs:
 - **Total Cost:** Displays the Total Cost graph that exists for the ASO Analysis.
 - **Total Cost Trend:** Displays the Total Cost Trend graph that exists for the ASO Analysis.
 - **Risk:** Displays the Risk graph that exists for the ASO Analysis.
 - **Risk Trend:** Displays the Risk Trend graph that exists for the ASO Analysis.

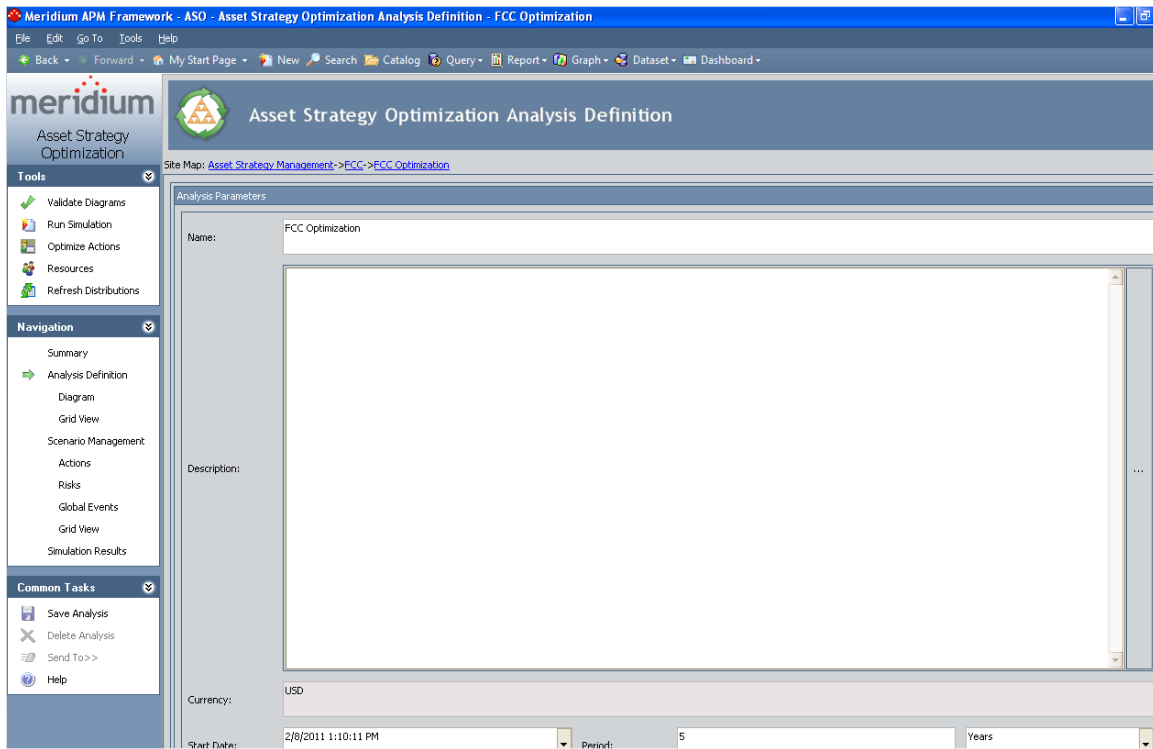
- **Annual Action Cost:** Displays the Annual Action Cost graph that exists for the ASO Analysis.
- **Action Cost Trend:** Displays the Action Cost Trend graph that exists for the ASO Analysis.
- **Resource Occurrence:** Displays the Resource Occurrence graph that exists for the ASO Analysis.
- **Resource Time:** Displays the Resource Time graph that exists for the ASO Analysis.
- **Resource Cost:** Displays the Resource Cost graph that exists for the ASO Analysis.

You can right-click a graph to display a submenu of options that you can use to customize the graph.

Note: If values that will affect the simulation results have been modified since the simulation was last run, a message will be displayed at the top of the page indicating that the simulation must be rerun. Whenever this message appears, we recommend that you rerun the simulation to ensure that valid results are displayed.

Aspects of the Asset Strategy Optimization Analysis Definition Page

The **Asset Strategy Optimization Analysis Definition** page contains features that allow you to define basic properties of an ASO Analysis.

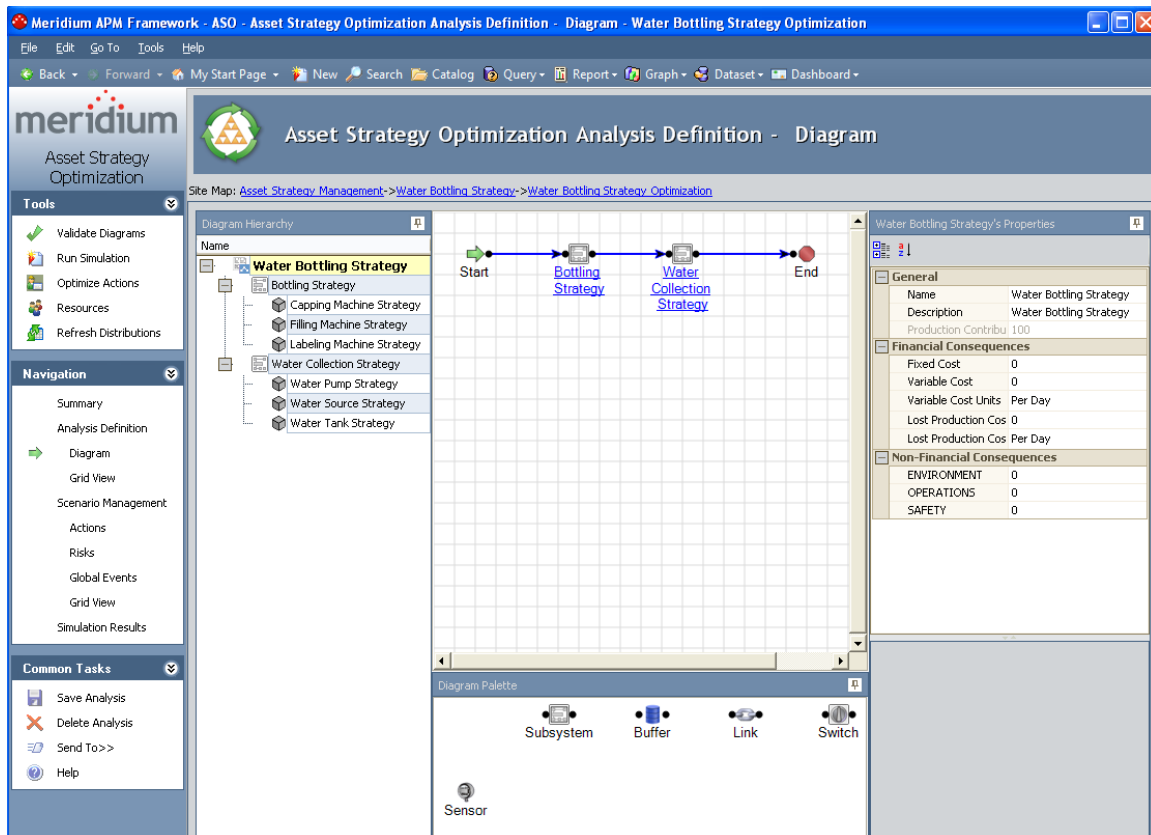


The Asset Strategy Optimization Analysis Definition page is divided into the following areas:

- **Task menus:** Displays the task menus that are common to most pages in ASO: Tools menu, Navigation menu, and Common Tasks menu.
- **Analysis Parameters section:** Displays fields that you can use to define the properties of an ASO Analysis. The content of this pane is controlled by the default datasheet that is defined for the System Analysis family.

Aspects of the Asset Strategy Optimization Analysis Definition - Diagram Page

The Asset Strategy Optimization Analysis Definition - Diagram page displays the Diagram for an ASO Analysis.



The Asset Strategy Optimization Analysis Definition - Diagram page contains the following features:

- **Task menus:** Displays the task menus that are common to most pages in ASO: Tools menu, Navigation menu, and Common Tasks menu.
- **Asset Strategy Optimization Analysis Definition - Diagram workspace:** Serves as the main display area and contains the following features:
 - **Diagram Hierarchy pane:** Provides a hierarchical view of the elements that are included in the Diagram.
 - **Diagram Canvas:** Serves as an interactive drawing interface where you can build a Diagram. You can drag elements from the **Diagram Palette** pane to the Diagram Canvas to display the elements within the Diagram. You can then rearrange the elements by dragging them to different locations on the Diagram Canvas.
 - **Diagram Palette pane:** Displays the available Diagram elements that you can drag onto the Diagram Canvas to include in the Diagram.

- **Properties pane:** Displays the information associated either with the entire Diagram or a selected element.

Aspects of the Asset Strategy Optimization Analysis Definition - Grid Page

The Asset Strategy Optimization Analysis Definition - Grid page displays a grid view of the Diagram. The grid view facilitates a global view of the entire Diagram and its properties.

Name	Production Cont...	Fixed Cos...	Variable Cos...	Variable Co...	Lost Production Cos...	Lost Production Co...	ENVIRO...	OPER...
Water Bottling Strategy	100.00	0.00	0.00	Per Day	0.00	Per Day		
Bottling Strategy	100.00	0.00	0.00	Per Day	0.00	Per Day		
Capping Machine Str...	100.00	0.00	0.00	Per Day	0.00	Per Day		
Filling Machine Str...	100.00	0.00	0.00	Per Day	0.00	Per Day		
Labeling Machine Str...	100.00	0.00	0.00	Per Day	0.00	Per Day		
Water Collection Strategy	100.00	0.00	0.00	Per Day	0.00	Per Day		
Water Pump Strategy	100.00	5,000.00	50.00	Per Hour	0.00	Per Day		
Water Source Strategy	100.00	0.00	0.00	Per Day	0.00	Per Day		
Water Tank Strategy	100.00	0.00	0.00	Per Day	0.00	Per Day		

Note: The Asset Strategy Optimization Analysis Definition - Grid page displays Asset, Buffer, Distribution, Link, Risk, Subsystem, and Switch elements. Sensor elements can be viewed only on the Asset Strategy Optimization Analysis Definition - Diagram page.

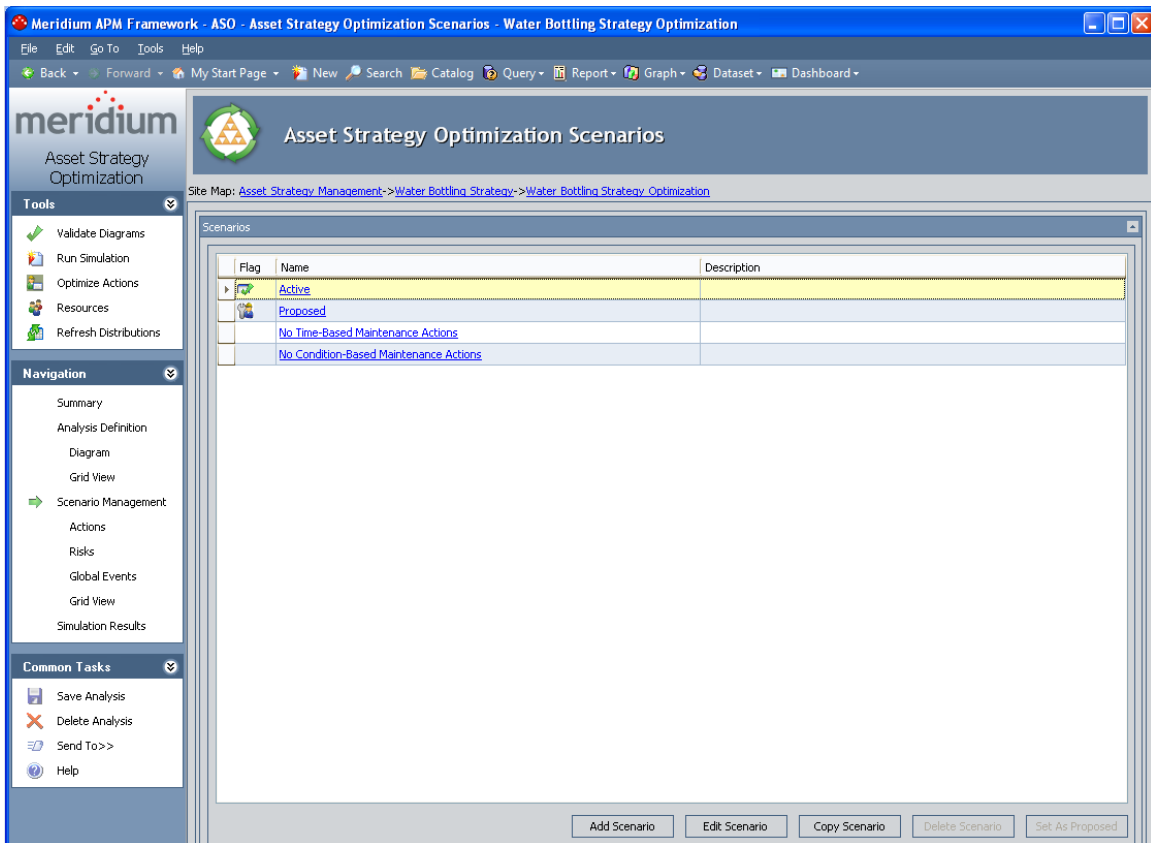
The Asset Strategy Optimization Analysis Definition - Grid page contains the following features:

- **Task menus:** Displays the task menus that are common to most pages in ASO: Tools menu, Navigation menu, and Common Tasks menu.

- **Asset Strategy Optimization Analysis Definition - Grid workspace:**
Serves as the main display area and contains the following features:
 - **Filter list:** Contains a list of Diagram elements. You can select any option in the list to view a specialized grid view of the Diagram that focuses on the selected element and detailed information related to the selected element. You can select any of the following elements:
 - Asset
 - Buffer
 - Link
 - Subsystem
 - Switch
 - **Grid:** Provides a grid view of the Diagram.

Aspects of the Asset Strategy Optimization Scenarios Page

The Asset Strategy Optimization Scenarios page contains a grid and buttons that you can use to manage the Scenarios associated with an ASO Analysis.




The grid displays the following columns of information, which display values from the corresponding fields in System Scenario records:

- Flag
- Name
- Description

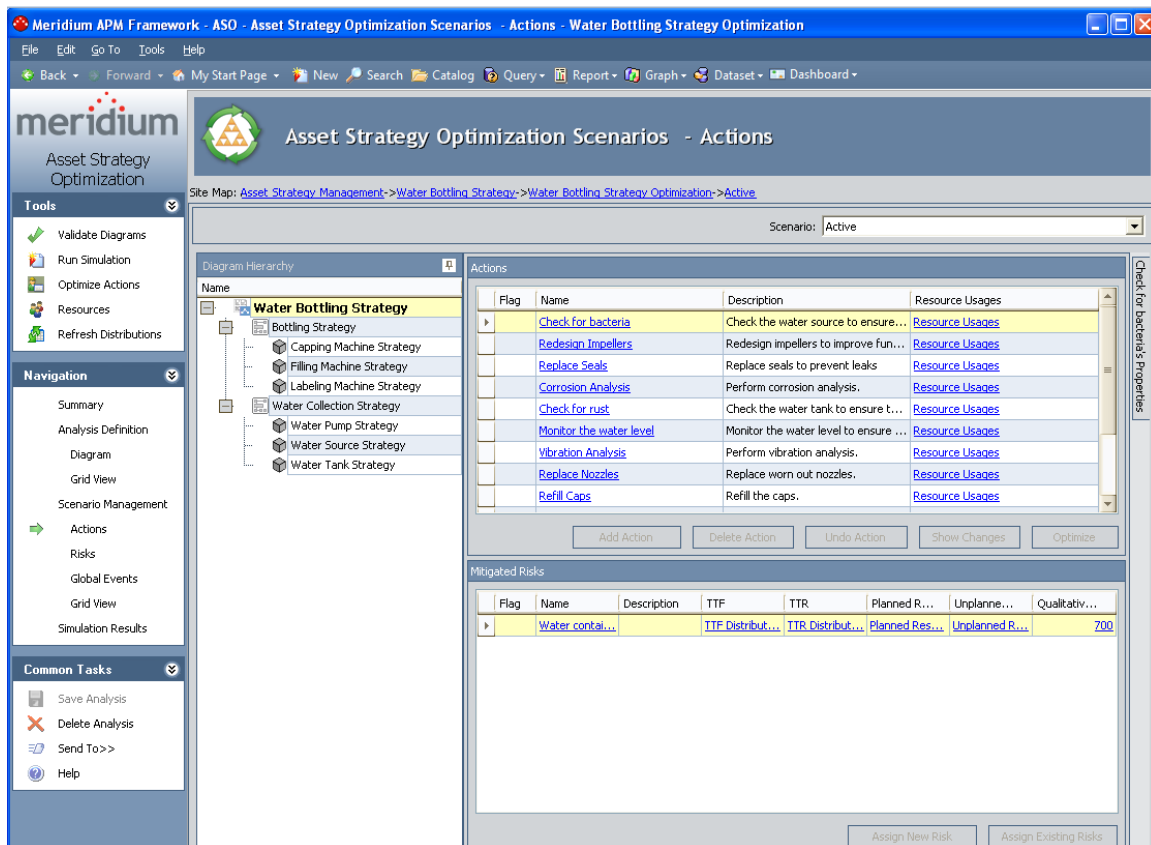
Below the Scenarios grid, the following buttons appear:

- **Add Scenario:** Displays the **Add New Scenario** dialog box, where you can create a new System Scenario record to link to the current System Analysis record. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Edit Scenario:** Displays a dialog box where you can modify the properties of the System Scenario record that is currently selected in the Scenarios grid. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.

- **Copy Scenario:** Creates a copy of the Scenario that is currently selected in the Scenarios grid. The copy includes the System Scenario record itself and the System Subsystem records that are linked to it. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Delete Scenario:** After asking for confirmation, deletes the Scenario that is currently selected in the **Scenarios** grid. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Set As Proposed:** Sets the currently selected Scenario to the Proposed Scenario, which causes the  icon to appear in the **Flag** column for that Scenario. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.

Aspects of the Asset Strategy Optimization Scenarios - Actions Page

The **Asset Strategy Optimization Scenarios - Actions** page lets you view and manage the Actions that exist for a given Scenario in an ASO Analysis.



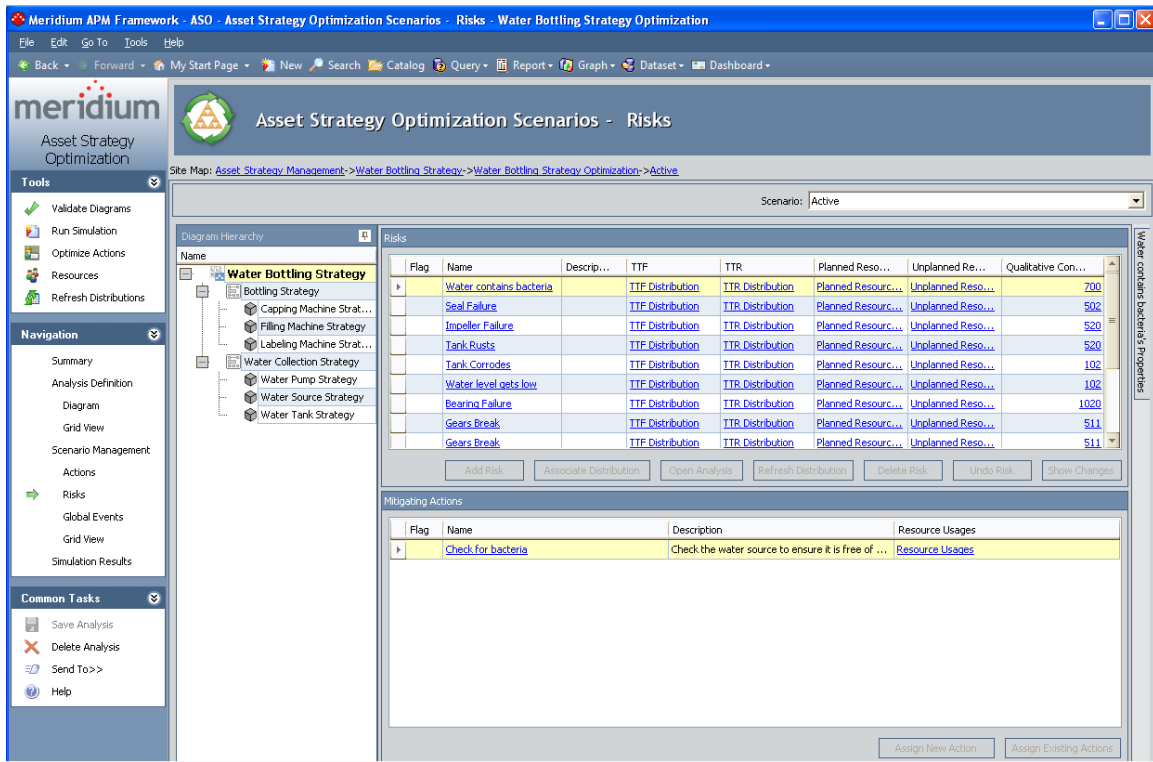
The Asset Strategy Optimization Scenarios - Actions page contains the following features:

- **Task menus:** Displays the task menus that are common to most pages in ASO: **Tools** menu, **Navigation** menu, and **Common Tasks** menu.
- **Asset Strategy Optimization Scenarios - Actions workspace:** Displays the following sections:
 - **Scenario list:** Contains the names of the System Scenario records that are associated with the current ASO Analysis. You can select any name in the list to view the Actions that are associated with that Scenario.
 - **Diagram Hierarchy pane:** Displays the Diagram elements that can have Actions associated with them.
 - **Actions pane:** Displays a grid that you can use to view Actions that are associated with the selected element in the **Diagram Hierarchy** pane and buttons that you can use to perform various operations against those Actions.

- **Mitigated Risks pane:** Displays a grid that you can use to view Risks that have been mitigated by the selected Action in the Actions pane and buttons that you can use to perform various operations against those Risks.

Aspects of the Asset Strategy Optimization Scenarios - Risks Page

The Asset Strategy Optimization Scenarios - Risks page lets you view and manage the Risks that exist for a given Scenario in an ASO Analysis.



The Asset Strategy Optimization Scenarios - Risks page contains the following features:

- **Task menus:** Displays the task menus that are common to most pages in ASO: Tools menu, Navigation menu, and Common Tasks menu.
- **Asset Strategy Optimization Scenarios - Risks workspace:** Displays the following sections:

- **Scenario list:** Contains the names of the System Scenario records that are associated with the current ASO Analysis. You can select any name in the list to view the Risks that are associated with that Scenario.
- **Diagram Hierarchy pane:** Displays the Diagram elements that can have Risks associated with them.
- **Risks pane:** Displays a grid that you can use to view Risks that are associated with the selected element in the **Diagram Hierarchy** pane and buttons that you can use to perform various operations against those Risks.
- **Mitigating Actions pane:** Displays a grid that you can use to view Actions that will mitigate the Risk selected in the **Risks** pane and buttons that you can use to perform various operations against those Actions.

Aspects of the Asset Strategy Optimization Scenarios - Global Events Page

The **Asset Strategy Optimization Scenarios - Global Events** page lets you view and manage the Global Events that exist for a given Scenario in an ASO Analysis.

The **Asset Strategy Optimization Scenarios - Global Events** page contains the following features:

- **Task menus:** Displays the task menus that are common to most pages in ASO: **Tools** menu, **Navigation** menu, and **Common Tasks** menu.
- **Asset Strategy Optimization Scenarios - Global Events workspace:** Displays the following sections:
 - **Scenario list:** Contains the names of the System Scenario records that are associated with the current ASO Analysis. You can select any name in the list to view the Global Events that are associated with that Scenario.
 - **Global Events pane:** Displays a grid that you can use to view Global Events that are associated with the selected Scenario and

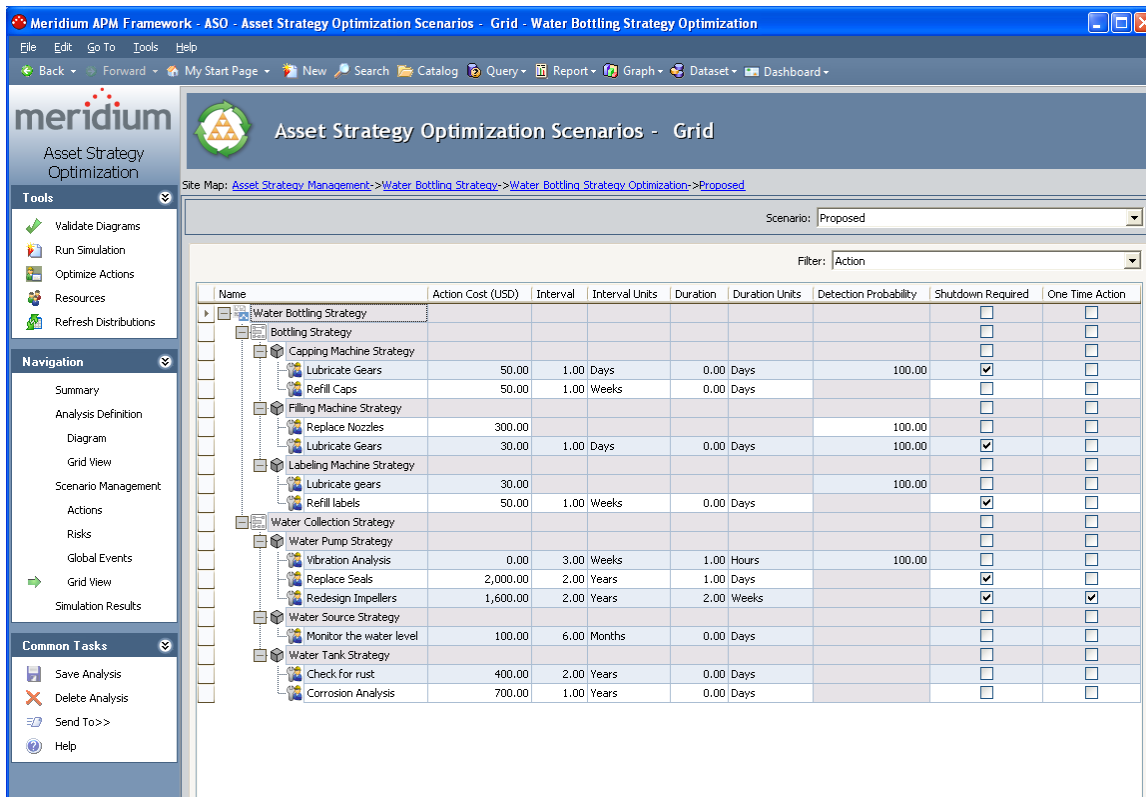
buttons that you can use to perform actions related to Global Events.

- **Actions to Align pane:** Displays a grid that you can use to view Actions to align with the Global Event and buttons that you can use to perform various operations against those Actions.

Aspects of the Asset Strategy Optimization Scenarios - Grid Page

The **Asset Strategy Optimization Scenarios - Grid** page displays an editable grid view of the Actions, Distributions, and Risks that belong to a given Scenario. The grid view facilitates a global view of the entire Scenario and the properties of its items. You can use the Scenario grid view to quickly type or select values for the Actions, Distributions, and Risks that belong to a Scenario.

If desired, you can alternatively enter values in Actions using the **Asset Strategy Optimization Scenarios - Actions** page. Likewise, you can enter values in Risks (including Distribution data) using the **Asset Strategy Optimization Scenarios - Risks** page. This documentation does not assume which approach you will use. It instead explains how to use both approaches so that you can decide which interface to use based upon your specific workflow.



The Asset Strategy Optimization Scenarios - Grid page contains the following features:

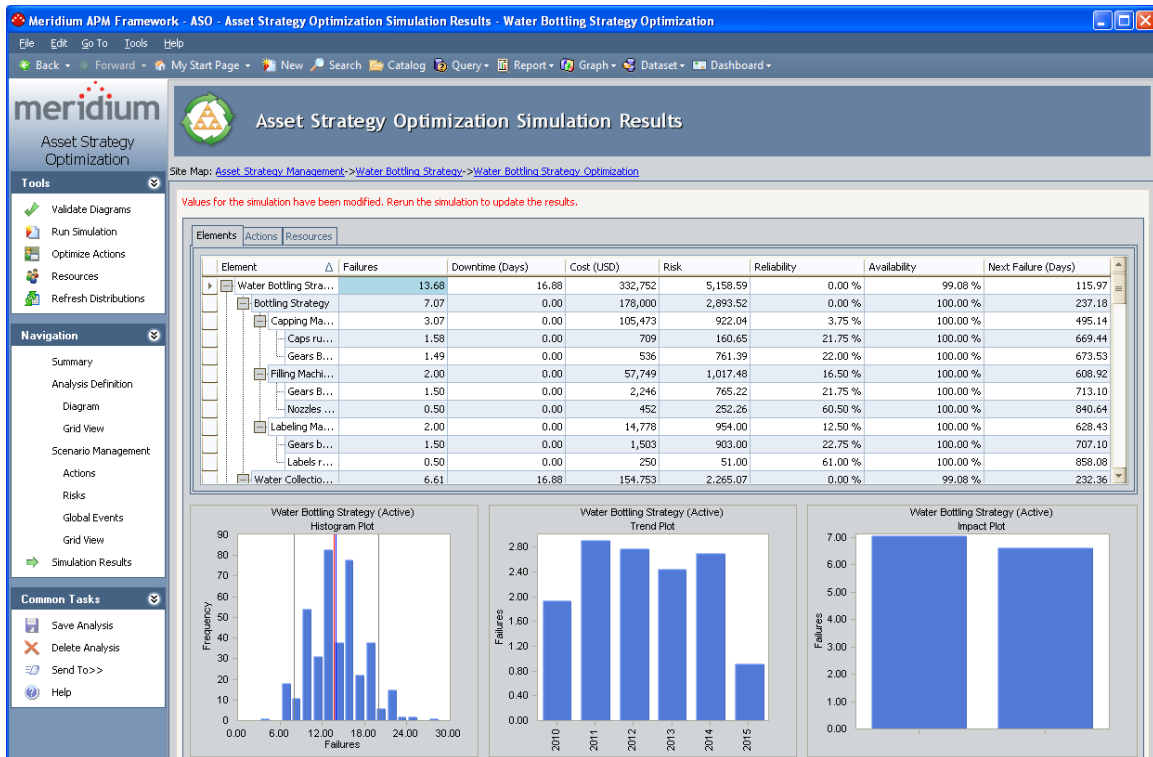
- **Task menus:** Displays the task menus that are common to most pages in ASO: Tools menu, Navigation menu, and Common Tasks menu.
- **Asset Strategy Optimization Scenarios - Grid workspace:** Serves as the main display area and contains the following features:
 - **Scenario list:** Contains a list of Scenarios that exist for the current ASO Analysis. You can select any Scenario in the list to view an editable grid view of the Actions, Distributions, and Risks that belong to that Scenario.
 - **Filter list:** Contains a list of *types* of Scenario elements. You can select any element type in the list to view an editable grid view of the elements of that type that belong to the Scenario that is selected in the Scenario list. You can select any of the following element types:

- Action

- Distribution
- Risk
- Grid: Provides a grid view of the Actions, Distributions, or Risks that belong to the Scenario that is selected in the Scenario list, based upon the element type that is selected in the Filter list.

Aspects of the Asset Strategy Optimization Simulation Results Page

The Asset Strategy Optimization Simulation Results page displays the simulation results that currently exist for an ASO Analysis.



The Asset Strategy Optimization Simulation Results page contains the following features:

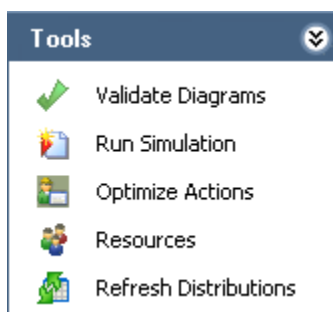
- Task menus: Displays the task menus that are common to most pages in ASO: Tools menu, Navigation menu, and Common Tasks menu.

- **Tabbed grid:** Appears at the top of the **Asset Strategy Optimization Simulation Results** workspace and contains detailed simulation results on three tabs:
 - **Elements tab:** Displays detailed simulation results for the components in the ASO Analysis.
 - **Actions tab:** Displays detailed simulation results for the Actions that are associated with the ASO Analysis.
 - **Resources tab:** Displays detailed simulation results for the Resources that are associated with the ASO Analysis.
- **Plots area:** Displays graphs that display data for the Scenario that is currently selected in the grid at the top of the workspace. As you select different cells in the grid, the graphs will be updated to display information that is specific to that element. The following graphs are displayed:
 - **Histogram Plot graph:** Provides a visual representation of the frequency distribution of the result that appear in the grid.
 - **Trend Plot graph:** Provides the average value for each analysis time interval, as defined by the value in the Time Analysis Type field in the root System Analysis record, of the result that appears in the grid.
 - **Impact Plot graph:** Provides the average values that are combined to make up the average value of the result that appears in the grid.

Note: If values that will affect the simulation results have been modified since the simulation was last run, a message will be displayed at the top of the page indicating that the simulation must be rerun. Whenever this message appears, we recommend that you rerun the simulation to ensure that valid results are displayed.

Task Menus

Tools Menu

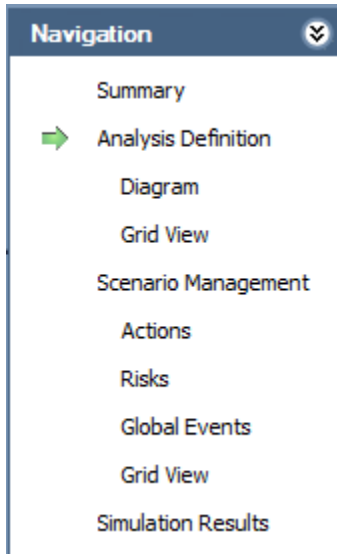


The Tools menu contains the following links:

- **Validate Diagrams:** Evaluates the Diagram in the ASO Analysis and provides feedback on whether or not the Diagram is valid. If the Diagram is invalid, detailed results will be displayed on the **Diagram Validation Results** dialog box. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Run Simulation:** Validates the Diagram in the ASO Analysis and, if the model is valid, shows the progress of the simulation and then displays the results on the **Asset Strategy Optimization Summary** page. If the Diagram is invalid, detailed results will be displayed on the **Diagram Validation Results** dialog box and the simulation cannot run. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Optimize Actions:** Displays the **Multiple Action Interval Optimization** window, where you can run a simulation to find the optimal interval to perform Actions that have been assigned to a Scenario.
- **Resources:** Displays the **Resources** window, where you can define Resources for the ASO Analysis.
- **Refresh Distributions:** After prompting you for confirmation, refreshes all the distribution data associated with the ASO Analysis by replacing the current TTF and TTR distributions with the most recently saved TTF and TTR distributions from the source distribution. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.

Navigation Menu

The **Navigation** menu contains links that allow you to navigate throughout the various views and elements of an ASO Analysis.



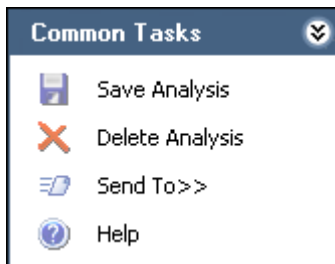
The Navigation menu contains the following links:

- **Summary:** Displays the Asset Strategy Optimization Summary page.
- **Analysis Definition:** Displays the Asset Strategy Optimization Analysis Definition page.
 - **Diagram:** Displays the Asset Strategy Optimization Analysis Definition - Diagram page.
 - **Grid View:** Displays the Asset Strategy Optimization Analysis Definition - Grid page.
- **Scenario Management:** Displays the Asset Strategy Optimization Scenarios page.
 - **Actions:** Displays the Asset Strategy Optimization Scenarios - Actions page.
 - **Risks:** Displays the Asset Strategy Optimization Scenarios - Risks page.

- **Global Events:** Displays the **Asset Strategy Optimization Scenarios - Global Events** page.
- **Grid View:** Displays the **Asset Strategy Optimization Scenarios - Grid** page.
- **Simulation Results:** Displays the **Asset Strategy Optimization Simulation Results** page.

Note: As you navigate through pages that are accessible from the **Navigation** menu, keep in mind that clicking the **Back** button will take you to the page you were on immediately before you accessed the current ASO Analysis. For example, if you open an ASO Analysis from an Asset Strategy, causing the **Asset Strategy Optimization Summary** page to be displayed, if you then navigate to the **Asset Strategy Optimization Analysis Definition** page and then click the **Back** button, the Asset Strategy will be displayed, not the **Asset Strategy Optimization Summary** page.

Common Tasks Menu



The **Common Tasks** menu contains the following links:

- **Save Analysis:** Saves all changes that you have made to the current ASO Analysis. This link is enabled only if the following conditions are met:
 - The analysis contains unsaved changes.
 - You are logged in as a Super User or a member of the MI ASM Analyst Security Group.
- **Delete Analysis:** After asking for confirmation, deletes the current analysis and then displays the **Overview** page for the strategy from which you created the ASO Analysis. This link is enabled only if you are

logged in as a Super User or member of the MI ASM Analyst Security Group.

- **Send To:** Displays a submenu with options that let you provide a link to the current page on your desktop (create shortcut), in an email message, or on a Home Page.
- **Help:** Displays the context-sensitive Help topic for the current page.

About Saving an ASO Analysis

An ASO Analysis consists of multiple records that are linked together to make up the entire analysis. As you navigate through the pages in ASO, you will add and modify records belonging to the analysis. Rather than saving these records individually, you will need to save the entire analysis in order to retain the changes that you have made to individual records.

You can save an ASO Analysis by clicking the **Save Analysis** link on the **Common Tasks** menu on any page in ASO. Clicking this link will save the root System Analysis record and *all* records that are linked to it, either directly or indirectly. In other words, when you save an ASO Analysis, the following analysis components will also be saved:

- Diagram
- Scenarios
- Resources
- Risks
- Actions
- Global Events
- Simulation results

If you make changes to any of the elements in this list and do not save the analysis, your changes will be discarded. You will know that the analysis contains unsaved changes if the **Save Analysis** link is enabled on the **Common**

Tasks menu. Additionally, when you navigate away from ASO, if the analysis contains unsaved changes, you will be prompted to save those changes.

Creating ASO Analyses

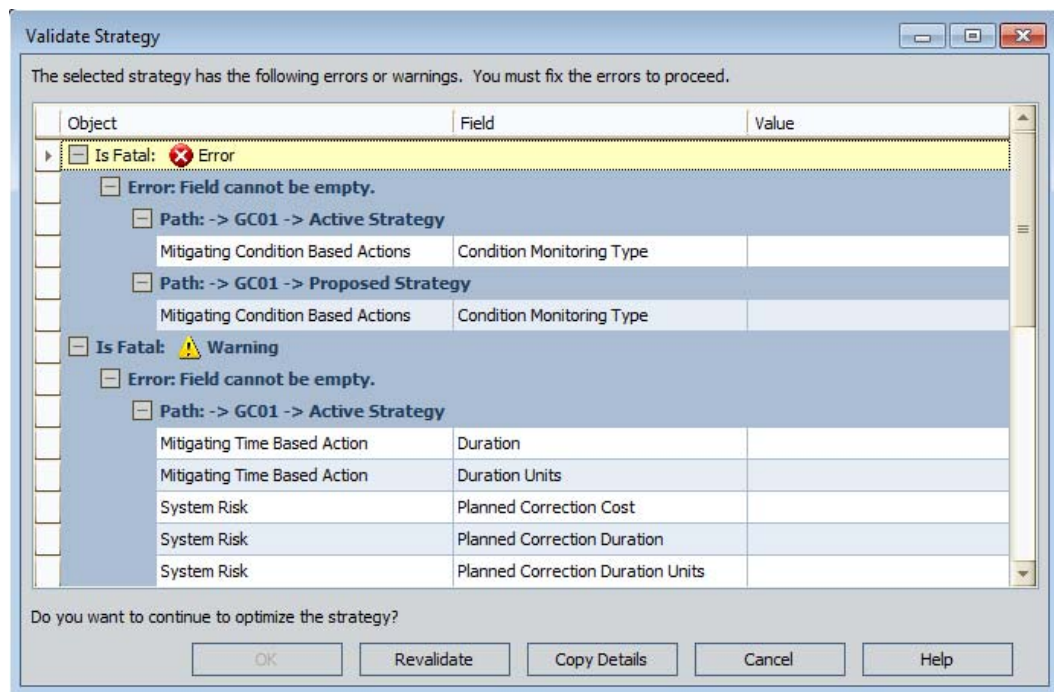
Creating an ASO Analysis

To create an ASO Analysis, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To create a new ASO Analysis:

1. Open the existing Asset Strategy, System Strategy, or Unit Strategy for which you want to create an ASO Analysis.
2. On the Tools menu, click the **Optimize Strategy** link.

The **Validate Strategy** window appears.



3. In the **Value** column, type or select values that are missing.

4. When you are finished providing the missing values, click the **Revalidate** button.

If any values are still missing, a row appears for each field that is missing a value.

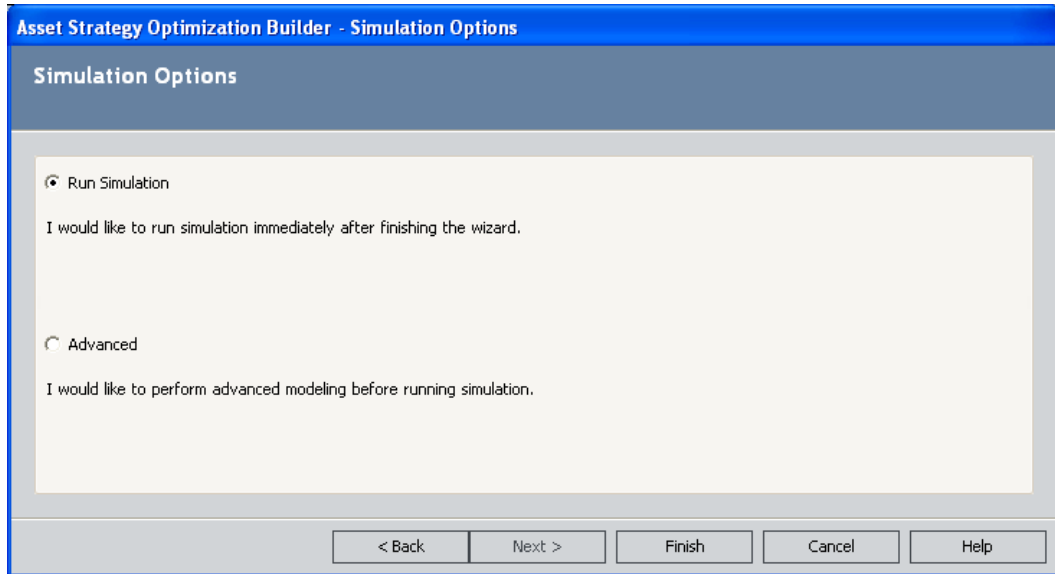
5. In the **Value** column, type or select values that are missing.
6. When you are finished providing the missing values, click **OK**.

The **Asset Strategy Optimization Builder** appears, displaying the Welcome screen.



7. Click the **Next** button.

The **Simulation Options** screen appears.



8. If you want to run the simulation before opening the ASO Analysis, accept the default selection **Run Simulation**.

-or-

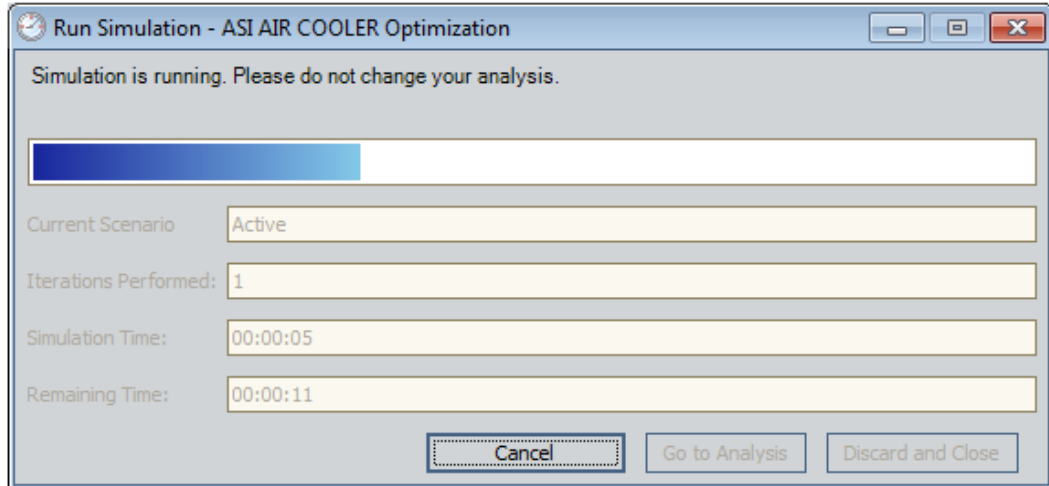
If you want to open the ASO Analysis without running the simulation so that you can define additional parameters before running the simulation manually, select the **Advanced** option.

9. Click the **Finish** button.

If you selected the **Advanced** option, the **ASO - Asset Strategy Optimization Analysis Definition - <Analysis Name>** page appears, where <Analysis Name> is the default name of the ASO Analysis.

-or-

If you accepted the default selection, the **Run Simulation** dialog box appears, indicating the progress of the simulation.



After the progress bar reaches the end, the **Go to Analysis** and **Discard and Close** buttons become enabled. If you do not want to view the results, you can click the **Discard and Close** button to close the **Run Simulation** dialog box. These instructions assume that you want to view the results.

10. Click the **Go to Analysis** button.

The **ASO - Asset Strategy Optimization Summary - <Analysis Name>** page appears, where **<Analysis Name>** is the default name of the ASO Analysis.

ASO Analysis Records That Are Created Automatically

When you create an ASO Analysis, the following items are created automatically:

- One System Analysis record. The System Analysis record is linked automatically to the Asset Strategy, System Strategy, or Unit Strategy record from which the ASO Analysis was created.
- Multiple System Scenario records:
 - **Active Scenario:** Represents the Active Strategy. Note that if you create an ASO Analysis from a System Strategy or Unit Strategy, the Active Scenario includes the Actions and Risks that belong to *all* Active Strategies that belong to that System Strategy or Unit Strategy. If you create an ASO Analysis from an Asset Strategy

that has never been activated (or from a System Strategy or Unit Strategy containing only Asset Strategies that have never been activated), the Active Scenario will still be created, but it will not contain any Actions or Risks.

- **Proposed Scenario:** Represents the Proposed Strategy. Note that if you create an ASO Analysis from a System Strategy or Unit Strategy, the Proposed Scenario includes the Actions and Risks that belong to *all* Proposed Strategies that belong to that System Strategy or Unit Strategy.
- Multiple System SubSystem records:
 - *Two* System SubSystem records will be created to represent the *one* Diagram. These System SubSystem records are identical to each other and will always share the same values.
 - One additional System SubSystem record will be created to represent each additional System Strategy that is included in the ASO Analysis. This means that if you create an ASO Analysis from an Asset Strategy that does not belong to a System Strategy, there will be only two System SubSystem records that represent the Diagram.

Likewise, if you create an ASO Analysis from a System Strategy or Unit Strategy, the Meridium APM system will evaluate the strategy collection and create System SubSystem records from any System Strategies that it finds in the collection.

- Multiple System Asset records, where each System Asset record represents an Equipment or Functional Location record that is linked to an Asset Strategy record that is included in the ASO Analysis. If you create an ASO Analysis from an Asset Strategy that does not belong to a System Strategy, only one System Asset record will be created to represent the Equipment or Functional Location record to which that Asset Strategy record is linked. If, however, you create an ASO Analysis from an Asset Strategy that belongs to a System Strategy containing *other* Asset Strategies, multiple System Asset records will be created to represent the Equipment or Functional Location records to which those Asset Strategy records are linked.

Likewise, if you create an ASO Analysis from a System Strategy or Unit Strategy, the Meridium APM system will evaluate the strategy collection

and create System Asset records from any Asset Strategies that it finds in the collection.

Note that the Meridium APM system creates *two* copies of each System Asset record. One of the System Asset records is linked to the Proposed Scenario record, and the other System Asset record is linked to the Active Scenario record.

- Multiple System Risk records:
 - For each Risk record that belongs to an Active Strategy that is included in the ASO Analysis, one System Risk record will be created and linked to the Active Scenario record.
 - For each Risk record that belongs to a Proposed Strategy that is included in the ASO Analysis, one System Risk record will be created and linked to the Proposed Scenario record.
- Multiple TTF Distribution records:
 - For each System Risk record that is included in the Active Scenario, one TTF Distribution record will be created and linked to the System Risk record.
 - For each System Risk record that is included in the Proposed Scenario, one TTF Distribution record will be created and linked to the System Risk record.
- Multiple TTR Distribution records:
 - For each System Risk record that is included in the Active Scenario, one TTR Distribution record will be created and linked to the System Risk record.
 - For each System Risk record that is included in the Proposed Scenario, one TTR Distribution record will be created and linked to the System Risk record.
- Multiple System Action records:
 - For each Action record that belongs to an Active Strategy that is included in the ASO Analysis, one System Action record will be created and included in the Active Scenario.

- For each Action record that belongs to a Proposed Strategy that is included in the ASO Analysis, one System Action record will be created and included in the Proposed Scenario.
- Multiple System Action Optimization records:
 - For each System Action record that is included in the Active Scenario, one System Action Optimization record will be created and linked to the System Action record.
 - For each System Action record that is included in the Proposed Scenario, one System Action Optimization record will be created and linked to the System Action record.
- Multiple System Risk Assessment records:
 - For each System Action record that is included in the Active Scenario, one System Risk Assessment record will be created and linked to the System Action record.
 - For each System Action record that is included in the Proposed Scenario, one System Risk Assessment record will be created and linked to the System Action record.

Opening Existing ASO Analyses

After an ASO Analysis exists for a strategy, you can access it by clicking the **Optimize Strategy** link on the **Tools** menu in ASM. When you click this link, the Meridium APM system runs the simulation and displays the results on the **ASO - Asset Strategy Optimization Summary - <Analysis Name>** page, where **<Analysis Name>** is the name of the ASO Analysis.

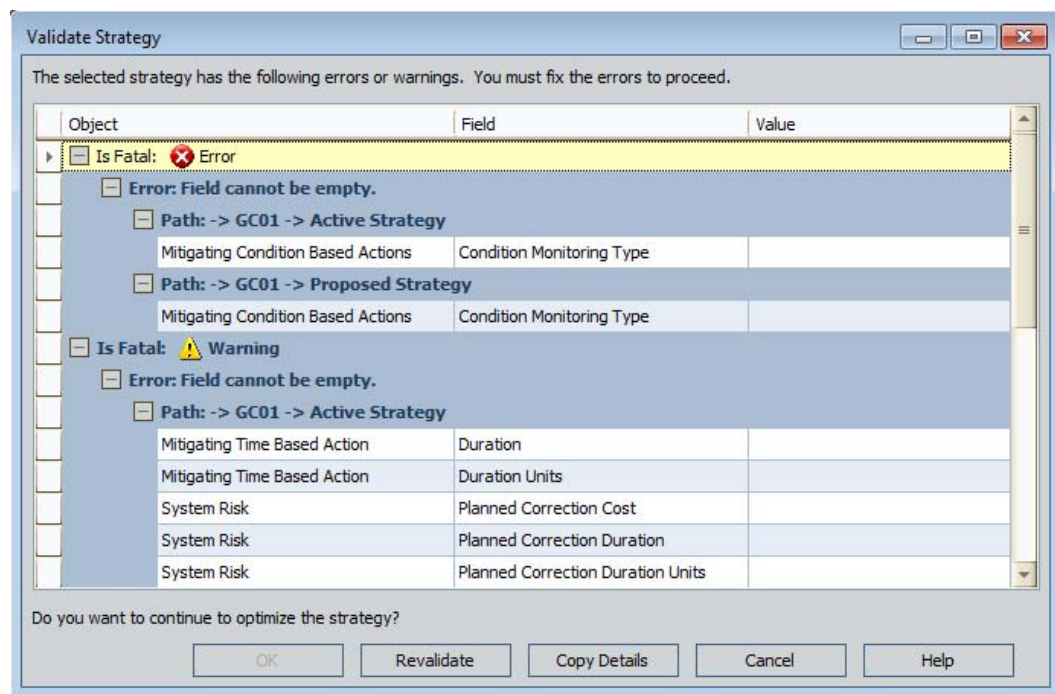
To open an existing ASO Analysis:

1. Open the existing Asset Strategy, System Strategy, or Unit Strategy whose ASO Analysis you want to open.
2. On the **Tools** menu, click the **Optimize Strategy** link.

If the Meridium system finds a value in all fields that are required in order to run the simulation, the **ASO - Asset Strategy Optimization Summary - <Analysis Name>** page appears, where <Analysis Name> is the name of the ASO Analysis. In this case, you can begin working with the existing ASO Analysis.

-OR-

If the Meridium system does not find a value in all fields that are required in order to run the simulation, the **Validate Strategy** window appears. In this case, proceed to step 3 of these instructions.



3. In the **Value** column, type or select values that are missing for each field in the list.
4. When you are finished providing the missing values, click the **Revalidate** button.

If any values are still missing, a row appears for each field that is missing a value.

5. In the **Value** column, type or select values that are missing.
6. When you are finished providing the missing values, click **OK**.

The ASO - Asset Strategy Optimization Summary - <Analysis Name> page appears, where <Analysis Name> is the name of the ASO Analysis.

Managing Analyses

Defining Analysis Parameters

The parameters of an ASO Analysis are defined in a System Analysis record, which is the root record in the analysis. The values that you define for the analysis parameters will serve as inputs to the simulation and will affect the simulation results. You can modify the analysis parameters and rerun the simulation to see the effect that they have on the results.

To define analysis properties, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To define the analysis properties:

- On the **Asset Strategy Optimization Analysis Definition** page, in the **Analysis Parameters** section, specify the desired values for the available fields.

After you have defined the desired parameters, you can save your changes or run the simulation to see the effect of the changes you made.

Managing Diagrams

About Building Diagrams






A Diagram represents the physical layout and construction of pieces of equipment and locations. A Diagram consists of a root System Subsystem record, which is linked to one or more System Subsystem, System Sensor, System Buffer, System Link, System Asset, and System Switch records that together make up the Diagram.







When you create an ASO Analysis, the Diagram is created automatically using the strategy (and any strategies it contains) from which you created the analysis. Therefore, after you have created an ASO Analysis, there is no manual step required for *creating* a Diagram. You simply can *build* out the Diagram further by adding the necessary elements and connections.

You can view and build a Diagram on the **Asset Strategy Optimization Analysis Definition- Diagram** page.

Elements of a Diagram

The following table lists the elements that are available in a Diagram and the associated records that are created automatically in the Meridium APM database when you add each element to the Diagram. Click the hyperlinked element in the table to view the properties associated with that element.

Icon	Element	Record	Description
	Start	None	Represents the starting point for all paths in the Diagram. This element is created by default when the Diagram is created. There is no record associated with this element, so any data that you enter for this element in the Properties grid will not be saved.
	End	None	Represents the ending point for all paths in the Diagram. This element is created by default when the Diagram is created. There is no record associated with this element, so any data that you enter for this element in the Properties grid will not be saved.
	Asset	System Asset	Represents a piece of equipment or location. An Asset element can either be imported from an Asset Strategy that exists within the Meridium APM database, or it can be created from scratch.
	Buffer	System Buffer	Represents an intermediate storage container between two other elements.
	Link	System Link	Connects other elements that work together to produce output.

Icon	Element	Record	Description
	Sensor	System Sensor	Detects the failure of a piece of equipment and location and notifies Switches of the failure. A Sensor cannot be connected to any other elements in the Diagram. Its purpose is to monitor other elements for failures. If an Asset element in the Diagram fails, the Sensor that is monitoring that element will activate designated Switches to start elements running and deactivate other Switches to put other elements in standby.
	Switch	System Switch	Represents a component that is activated or deactivated by a Sensor when a failure occurs. Switches allow you to connect or disconnect an entire branch of the Diagram when failures are detected.
 -and- 	Subsystem	System Subsystem	Represents a collection of equipment and locations. In the Diagram Hierarchy pane: <ul style="list-style-type: none"> The root Subsystem, like <i>Water Bottling Strategy</i> in our ASO Analysis Example, is represented by this icon:  Other Subsystem elements, like <i>Bottling Strategy</i> and <i>Water Collection Strategy</i> in our ASO Analysis Example, are represented by this icon:  After the Diagram is created automatically, additional System Subsystem elements can be created by importing System Strategies into the Diagram.

Accessing the Diagram

To access the Diagram:

- On the **Navigation** menu, under the **Analysis Definition** link, click the **Diagram** link.

The **Asset Strategy Optimization Analysis Definition - Diagram** page appears.

Basic Features of the Asset Strategy Optimization Analysis Definition - Diagram Page

Diagram Canvas

The Diagram Canvas on the **Asset Strategy Optimization Analysis Definition - Diagram** page is the main area that you will use for building a Diagram. When the Diagram is complete, the Diagram Canvas will contain a visual representation of equipment, locations, and the connections between them. The Diagram is interactive and can be modified using tools that are available on the Diagram Canvas itself, including the following features.

Note: The tasks that you can perform in the Diagram will vary, depending on your security privileges. Some options may be disabled based on these privileges. This documentation assumes that you are logged in as a Super User or member of the MI ASM Analyst Security Group.

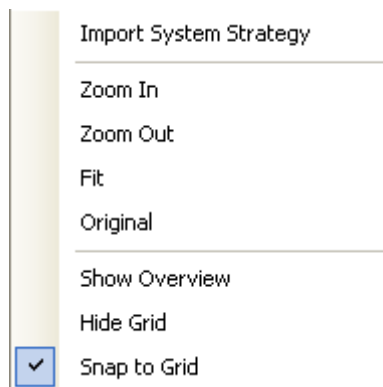
Drag-and-Drop

You can click any element on the Diagram Canvas to make a green box appear around it, then hold your mouse button down, and drag the element to the desired location.

Shortcut Menus

Diagram Canvas Shortcut Menu

You can right-click any blank area on the Diagram Canvas to see the menu shown in the following image.



The shortcut menu contains the following options:

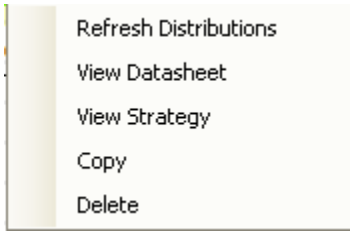
- **Import <Strategy>**: Displays the **Search Strategies** window, which you can use to search for a System Strategy or Asset Strategy to import into the Diagram. Note that if you right-click the Diagram from the level that represents a Unit Strategy, the label is **Import System Strategy**. Likewise, if you right-click the Diagram from the level that represents a System Strategy, the label is **Import Asset Strategy**.
- **Zoom In**: Zooms in on the Diagram by 10 percent of the current zoom level.
- **Zoom Out**: Zooms out from the Diagram by 10 percent of the current zoom level.
- **Fit**: Fits the entire Diagram within the space available on the Diagram Canvas.
- **Original**: Returns the Diagram to the original zoom level, which is the zoom level that is shown when you first access the **Asset Strategy Optimization Analysis Definition - Diagram** page.
- **Show Overview**: Opens the Overview window.
- **Hide Grid**: Removes the grid lines from the Diagram Canvas. This option appears on the menu only when the grid lines are displayed.

Note: When the grid lines are hidden, the **Hide Grid** option is replaced by the **Show Grid** option. This option will display the grid lines on the Diagram Canvas.

- **Snap to Grid**: Allows you to position elements only at intersections. In other words, you will not be able to position elements between lines. This option appears on the menu only when the grid lines are displayed.
- **Paste**: Pastes the element that was last copied. This option appears on the menu only when an element has been copied.

Element Shortcut Menu

You can also right-click any element on the Diagram Canvas to see options that are available for that element, which are shown in the following image.



The shortcut menu contains the following options:

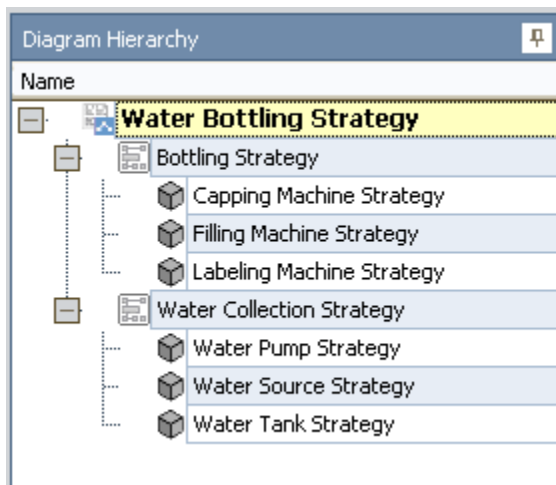
- **Refresh Distributions:** Refreshes the distribution data for the selected element by importing the most current information from the associated Asset Strategy. This menu option appears only when you right-click an Asset element.
- **View Datasheet:** Displays the datasheet associated with the currently selected record. This menu option appears only when you right-click an Asset element.
- **View Strategy:** Displays the **Overview** page for the strategy that was used to create that Diagram element.
- **Copy (CTRL+C):** Creates a copy of the selected element. This menu option does not appear if you select an Asset element that was created from an Asset Strategy that does not belong to a System Strategy.
- **Paste (CTRL+V):** Pastes the element that was last copied. This menu option does not appear if you select an Asset element that was created from an Asset Strategy that does not belong to a System Strategy.
- **Delete (DELETE):** Deletes the selected element from the Diagram. This menu option does not appear if you select an Asset element that was created from an Asset Strategy that does not belong to a System Strategy.

Note: When you select a connection, **Delete** is the only available option. When you select the Start or End element, **NO** options will appear on the shortcut menu.

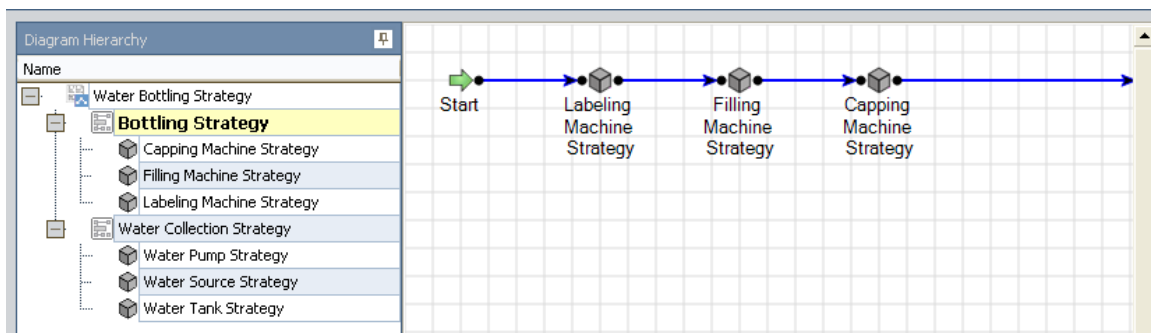
Diagram Hierarchy Pane

The **Diagram Hierarchy** pane on the **Asset Strategy Optimization Analysis Definition - Diagram** page provides a hierarchical view of the elements in a Diagram.

Consider our ASO Analysis Example. In this case, the **Diagram Hierarchy** pane would look like the following image.



You can click any element in the **Diagram Hierarchy** pane to display that element on the Diagram Canvas. For example, if you clicked **Bottling Strategy**, the element that represents the Bottling Strategy would be displayed on the Diagram Canvas as shown in the following image.








Because the Bottling Strategy element was created from a System Strategy that contains three Asset Strategies, the Diagram Canvas displays an Asset element for each Asset Strategy that belongs to the Bottling Strategy.

Note: The **Diagram Hierarchy** pane does not appear if you are viewing an ASO Analysis that was created from an Asset Strategy that does not belong to a System Strategy.

Diagram Palette Pane

On the **Asset Strategy Optimization Analysis Definition - Diagram** page, the **Diagram Palette** pane contains icons that represent the physical elements of

the Diagram. You can select an element from the palette and drag it onto the Diagram Canvas to define its properties and include it in the Diagram. The following icons are available:


-  Asset
-  Buffer
-  Link
-  Switch
-  Sensor

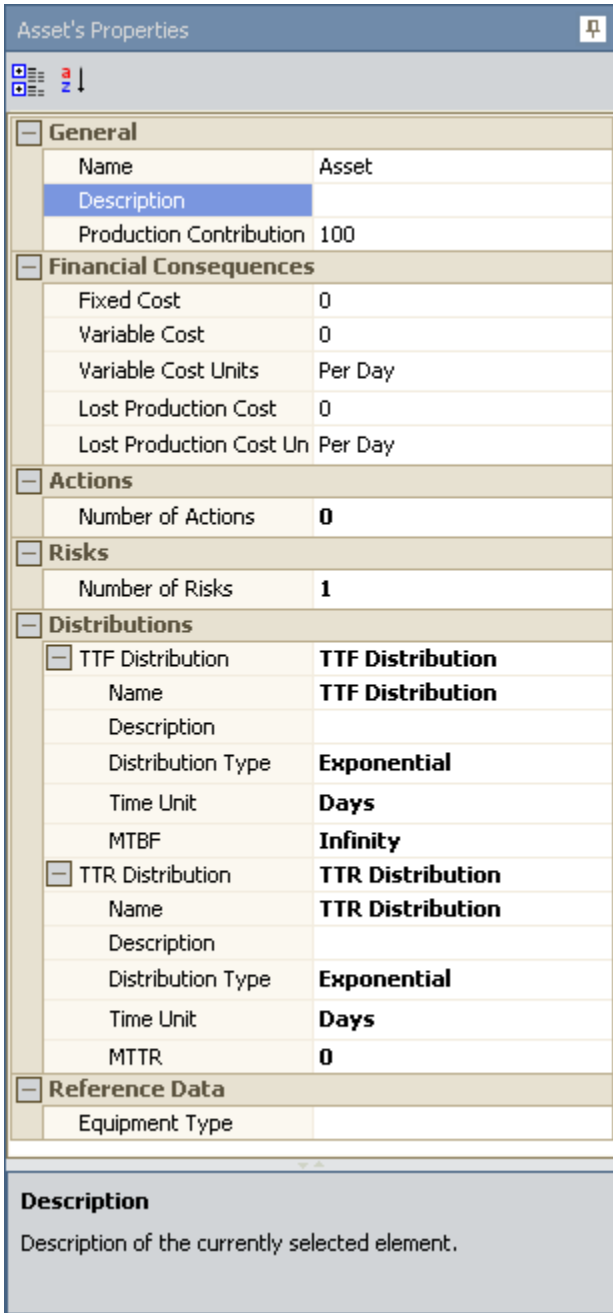
Note: The **Diagram Palette** pane does not appear if you are viewing an ASO Analysis that was created from an Asset Strategy that does not belong to a System Strategy.


Properties Pane

The **Properties** pane on the **Asset Strategy Optimization Analysis Definition - Diagram** page lets you view and modify the properties of the element that is currently selected in the Diagram. The header text of the **Properties** pane will indicate which element is selected by showing **<Name>'s Properties**, where **<Name>** is the value from the Name field of the selected element. For instance, in the following image, the value in the Name field is *Asset*, so the **Properties** pane is titled *Asset's Properties*. Throughout this documentation, we refer to this area of the screen generically as the **Properties** pane.

Note: The tasks that you can perform in the **Properties** pane will vary, depending on your security privileges. Some options may be disabled based on these privileges. The documentation assumes that you are logged in as a Super User or member of the MI ASM Analyst Security Group.

Most of the cells in the **Properties** pane represent fields in the record that corresponds to the selected element. You can click the  button to view fields in the **Properties** pane in the *categorized* view. The categorized view displays properties in sections that can be collapsed by clicking the minus sign (-) or expanded by clicking the plus sign (+).



You can also click the  button to view the **Properties** pane in the *alphabetical* view. The alphabetical view displays properties in alphabetical order according to the text box label, as shown in the following image.

Asset's Properties	
Description	
Equipment Type	
Fixed Cost	0
Lost Production Cost	0
Lost Production Cost Units	Per Day
Name	Asset
Number of Actions	0
Number of Risks	1
Production Contribution	100
<input type="checkbox"/> TTF Distribution	TTF Distribution
Name	TTF Distribution
Description	
Distribution Type	Exponential
Time Unit	Days
MTBF	Infinity
<input type="checkbox"/> TTR Distribution	TTR Distribution
Name	TTR Distribution
Description	
Distribution Type	Exponential
Time Unit	Days
MTTR	0
Variable Cost	0
Variable Cost Units	Per Day
Description	
Description of the currently selected element.	

The Properties pane works much like a standard datasheet, where you can place your cursor in a cell and then modify the value for the associated field. If a value already exists in a field, it will be displayed in the appropriate cell. At the bottom of the Properties pane, any help text defined for the selected field will be displayed. For example, in the preceding image, the help text defined for the Description field is *Description of the currently selected element*.

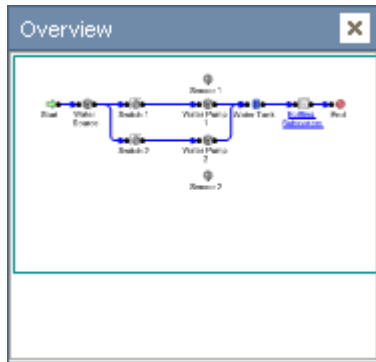
Displaying an Overview of the Diagram

If the Diagram you are currently viewing exceeds the size of the Diagram Canvas on the **Asset Strategy Optimization Analysis Definition - Diagram** page, you can use the overview feature to display a more compact view of the Diagram.

To display an overview of a Diagram:

1. Right-click any blank space on the Diagram Canvas.
2. Click **Show Overview**.

The **Overview** window appears, displaying a blue locator box that highlights the section of the Diagram that is currently shown on the Diagram Canvas.



You can click another location within the **Overview** window to move the locator box to that location. As you do so, the view on the Diagram Canvas will change to reflect your location within the Diagram on the **Overview** window.

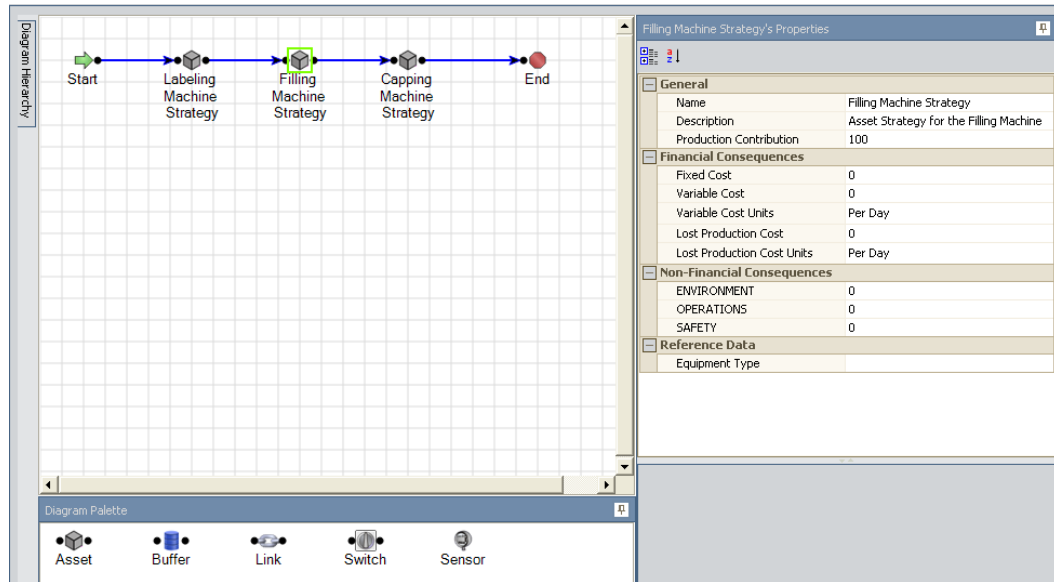
Hiding and Displaying Panes

If you are working with a large Diagram, you may want to increase the display area of the Diagram Canvas. You can do so by hiding the **Diagram Hierarchy**, **Diagram Palette**, and **Properties** panes.

To hide a pane:


- In the upper, right corner of the pane header, click the **☐** button.

The pane closes and is identified by a tab that appears in the pane's original position. For example, the following image shows the **Diagram Hierarchy** pane after it has been hidden. Note the **Diagram Hierarchy** tab that appears on the left side of the screen.



To display a hidden pane:

- Point to the tab that identifies the pane you want to display.

The pane reappears. If you move your pointer off the pane, the pane will disappear again. You can lock the pane back into the display position by clicking the  button again.

Adding Elements and Connections

About Adding Elements

When an ASO Analysis is created, the Diagram is built by default from the Unit Strategy, System Strategies, and Asset Strategies that are included in the analysis. If desired, you can build the Diagram further by adding elements and connections. You have two options for adding elements to the Diagram:

- You can create new elements from scratch by using the **Diagram Palette pane**. When you add an element in this way, the Meridium APM system will create a new record to store information for that element. The new record will be linked to the System Subsystem record that represents the Diagram.
- You can create new elements by importing records that already exist in the Meridium APM database. When you add an element in this way, the Meridium APM system will use the information in the existing record

to populate information in a new record to represent the appropriate Diagram element. The original record will continue to exist in the Meridium APM database. The new record will be linked to the System Subsystem that represents the Diagram.

After you add elements to the Diagram, you can create connections between them to indicate their relationship to one another and their physical arrangement.

Adding Elements from the Diagram Palette Pane

To add an element to the Diagram, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To add a new element to the Diagram from the Diagram Palette pane:

1. Click the desired element in the **Diagram Palette** pane.
2. Hold your mouse button down, drag the element to the Diagram Canvas, and then release your mouse button to drop it in the desired location.

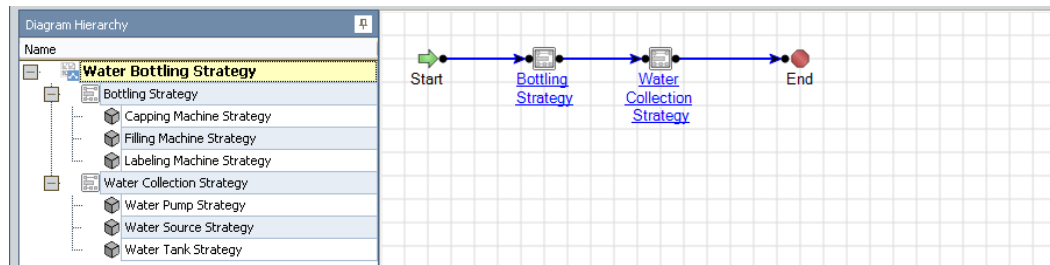
The element appears on the Diagram Canvas. It is selected automatically, so the **Properties** pane displays the properties of the new element. When you save the ASO Analysis, the appropriate record will be created in the Meridium APM database to store information for that element.

Importing Elements into the Diagram

About Importing Elements into the Diagram

In an ASO Analysis, you can import the following elements into the Diagram:

- **System Strategy:** If the Diagram contains at least one SubSystem element that was created from a System Strategy, you can import another System Strategy into the Diagram. The option to import a System Strategy is available only when the Diagram Canvas currently displays a SubSystem element. Consider the following image from our ASO Analysis Example, where the Diagram Canvas displays the elements that were created from the System Strategies *Bottling Strategy* and *Water Collection Strategy*.

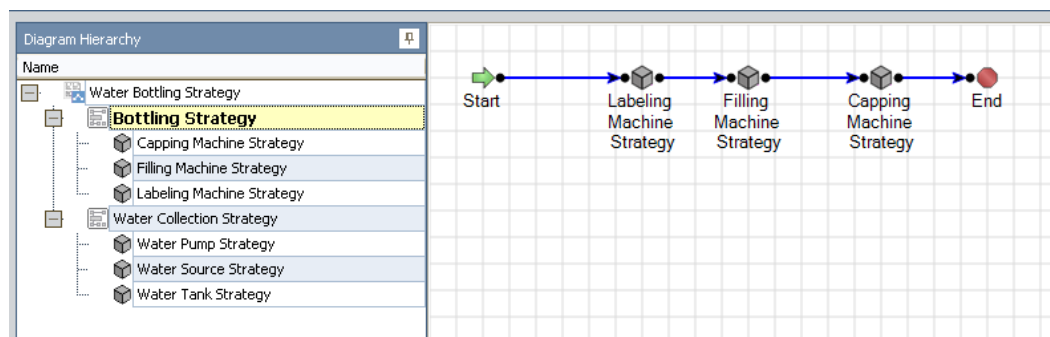


In this example, if you right-clicked the Diagram Canvas, the **Import System Strategy** option would appear on the shortcut menu.

When you import a System Strategy into the Diagram, the System Strategy is added to the Unit Strategy containing the System Strategy(s) that are represented by the currently displayed SubSystem element(s). This means that if you were to open the Unit Strategy in ASM, you would see the imported System Strategy in the list of System Strategies that it contains.

Note that when a System Strategy is imported, two copies of the same System Subsystem record are created, where each System Subsystem record represents the System Strategy record of the imported System Strategy. Note that one of the System Subsystem records is linked to the Proposed Scenario record, and the other System Subsystem record is linked to the Active Scenario record.

- **Asset Strategy:** Asset Strategies can be imported into any Diagram. The option to import an Asset Strategy is available, however, only when the Diagram Canvas currently displays an Asset element(s). Consider the following image from our ASO Analysis Example, where the Diagram Canvas displays the Asset elements that were created from the Asset Strategies *Labeling Machine Strategy*, *Filling Machine Strategy*, and *Capping Machine Strategy*.



In this example, if you right-clicked the Diagram Canvas, the **Import Asset Strategy** option would appear on the shortcut menu.

When you import an Asset Strategy into the Diagram, the Asset Strategy is added to the System Strategy containing the Asset Strategy(s) that are represented by the currently displayed Asset element(s). This means that if you were to open the System Strategy in ASM, you would see the imported Asset Strategy in the list of Asset Strategies that it contains.

Note that when an Asset Strategy is imported, two copies of the same System Asset record are created, where each System Asset record represents the Equipment or Functional Location record that is linked to the Asset Strategy record of the imported Asset Strategy. One of the System Asset records is linked to the Proposed Scenario record, and the other System Asset record is linked to the Active Scenario record.

When you import a System Strategy or Asset Strategy into the Diagram, the Meridium APM system validates the Asset Strategies to make sure they contain the necessary data to run a simulation. The **Validate Strategy** window appears, indicating which fields, if any, are missing values. You will need to provide the missing information before you can proceed with importing the strategy.

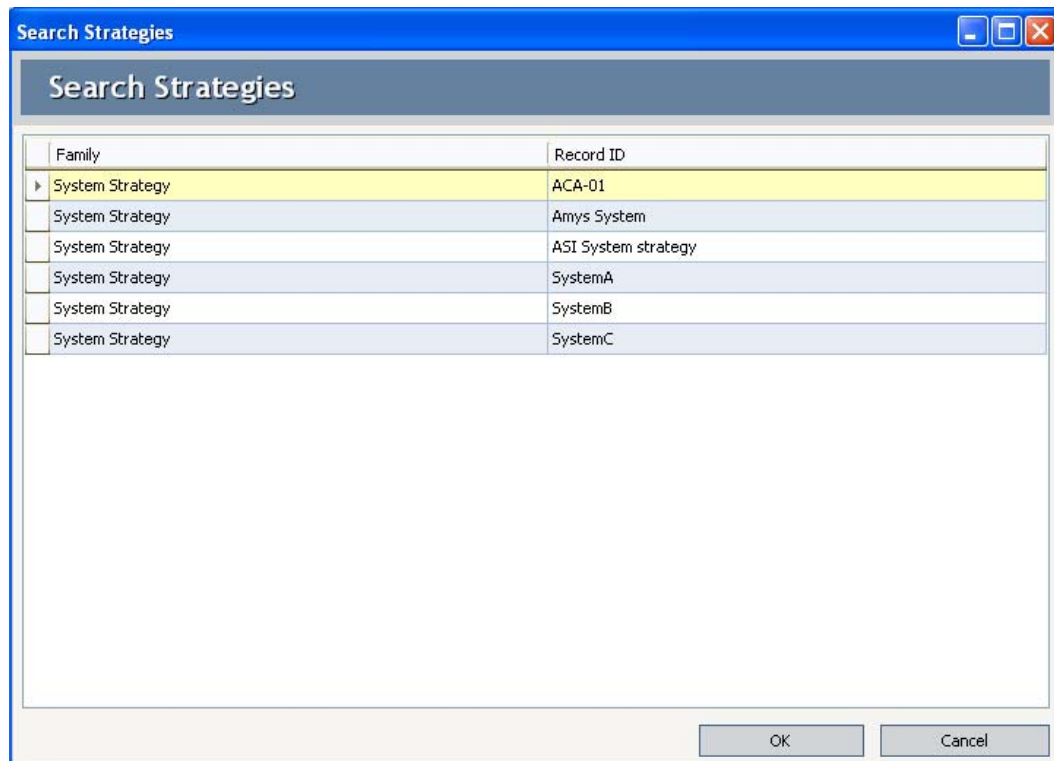
Importing System Strategies into the Diagram

To import a System Strategy into the Diagram, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To import a System Strategy into the Diagram:

1. Make sure that the Diagram Canvas currently displays a SubSystem element.
2. Right-click the Diagram Canvas, and click **Import System Strategy**.

The **Search Strategies** window appears.



The Search Strategies window contains a grid, where each row represents a System Strategy that is available for import.

Note: System Strategies that already belong to a Unit Strategy are not displayed in the grid.

3. In the grid, select the row containing the System Strategy that you want to import into the Diagram.
4. Click OK.

The Validate Strategy window appears, displaying a row for each field in an underlying Asset Strategy that is missing a value.

Note: If no fields are missing values, the window is blank.

5. If any fields are missing values, type or select the desired values.
6. Click OK.

The selected System Strategy is added to the Diagram and the Diagram Hierarchy pane as Subsystem elements. When you save the ASO

Analysis, the appropriate records will be created in the Meridium APM database to store information for the new elements.

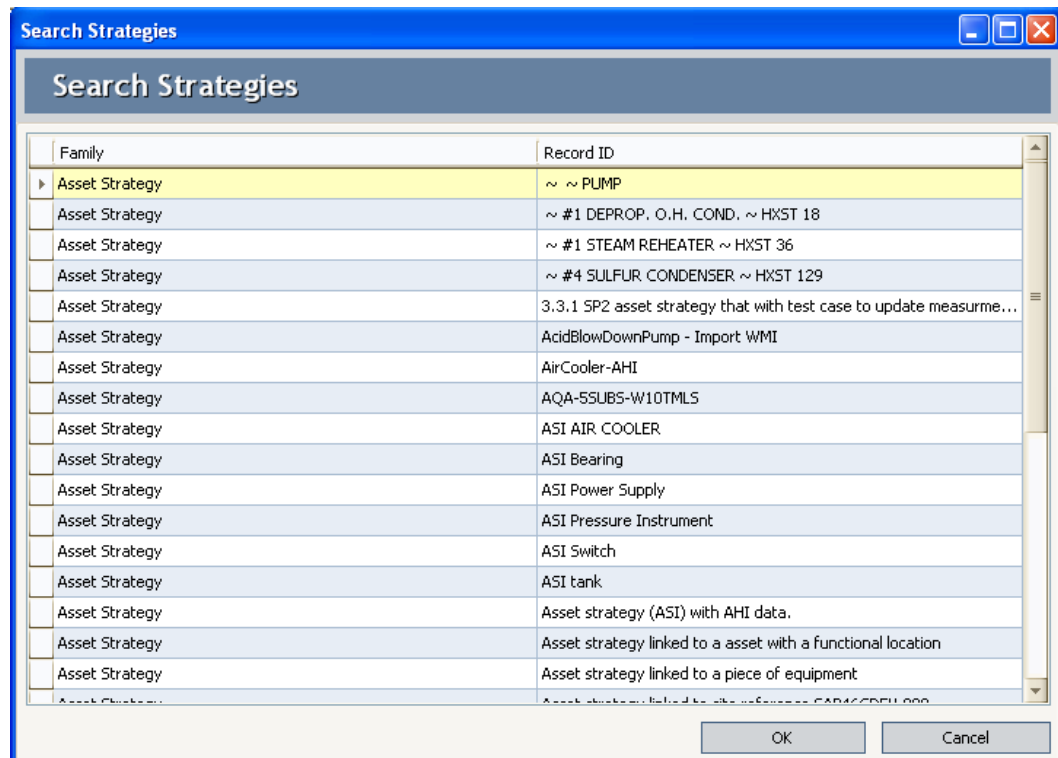
Importing Asset Strategies into the Diagram

To import an Asset Strategy into the Diagram, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To import an Asset Strategy into the Diagram:

1. Make sure that the Diagram Canvas currently displays an Asset element.
2. Right-click the Diagram Canvas, and click **Import Asset Strategy**.

The Search Strategies window appears.



The Search Strategies window contains a grid, where each row represents an Asset Strategy that is available for import.

Note: Asset Strategies that already belong to a System Strategy are not displayed in the grid.

3. In the grid, select the rows containing the Asset Strategies that you want to import into the Diagram.
4. Click OK.

The **Validate Strategy** window appears, displaying a row for each field in a selected Asset Strategy that is missing a value.

Note: If no fields are missing values, the window is blank.

5. If any fields are missing values, type or select the desired values.
6. Click OK.

The Asset Strategies are added to the Diagram and the **Diagram Hierarchy** pane as Asset elements. When you save the ASO Analysis, the appropriate records will be created in the Meridium APM database to store information for the new elements.

Connecting Elements in the Diagram

To connect Elements in the Diagram, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

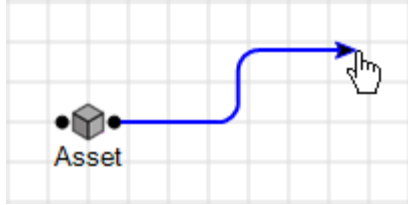
To connect two elements in the Diagram:

1. For the desired element, point to the black circle on the side from which you want to start the connection.

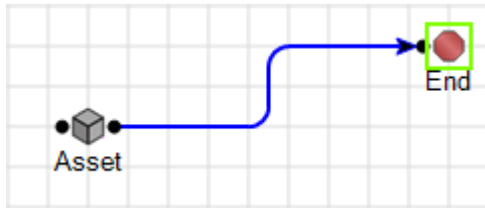


2. Click the port and drag the pointer in the direction that you want to create the connection.

An arrow will be drawn automatically in the direction that you drag your mouse.



3. Continue dragging your mouse until the arrow reaches the desired destination (i.e., the circle on the element that will serve as the end of the connection). The connection will be completed automatically.



4. Release your mouse button to set the connection.

Deleting Elements and Connections

Deleting Elements from the Diagram

If desired, you can delete any element from the Diagram. You cannot, however, delete the Start or the End node. To delete an Element from the Diagram, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To delete an element from the Diagram:

1. Right-click the element that you want to delete, and then click **Delete**.

-or-

Select the element that you want to delete, and press the Delete key on your keyboard.

A confirmation message appears, asking if you really want to delete the element.

2. Click the **Yes** button.

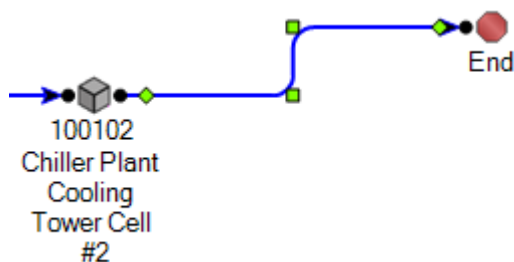
The element is deleted from the Diagram.

Deleting Connections Between Elements

To delete a connection between Elements in the Diagram, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To delete a connection between two elements in the Diagram:

1. Click the connector to select it.



Note: This image shows the Canvas Diagram with Hide Grid option selected.

2. Right-click the connection, and then click Delete.

-OR-

Press the Delete key on your keyboard.

A confirmation message appears, asking if you really want to delete the connection.

3. Click the Yes button.

The connection is deleted from the Diagram.

Validating Diagrams

Performing Validation

For the Meridium APM system to run simulations, the elements within the Diagram must be connected correctly. Isolated elements, broken connections, and circular connections will cause a Diagram to fail validation. When you perform a validation, the Meridium APM system will validate the Diagram in the ASO Analysis.

The validation process evaluates the Diagram in both directions:

- From the Start element to the End element.
- From the End element to the Start element.

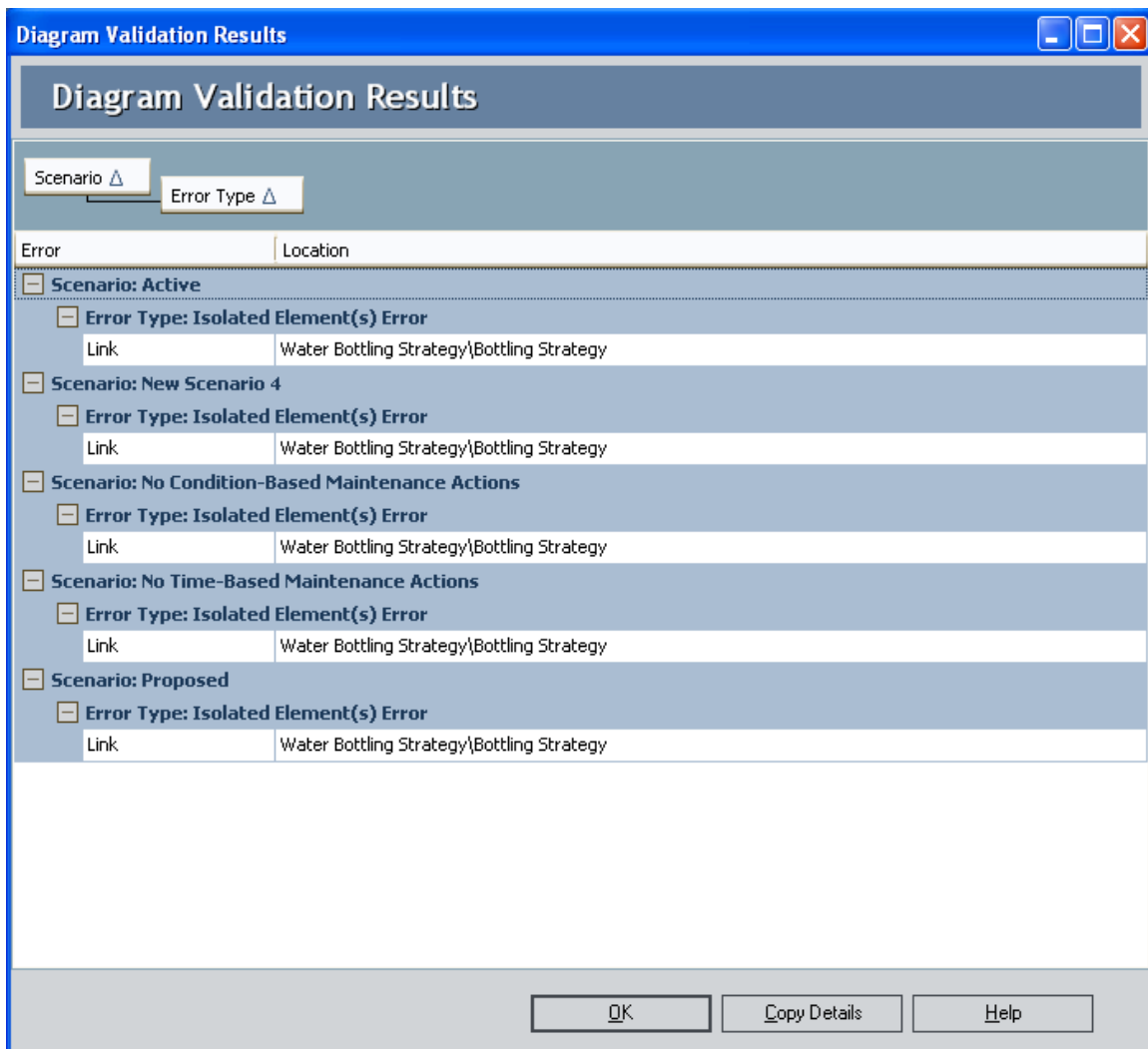
If an error is found along either path, it will be reported in the validation results. An error that is found along both paths will be reported twice.

To validate the Diagram:

- While viewing an ASO Analysis on any page, on the **Tools** menu, click the **Validate Diagrams** link.
 - If the Diagram is valid, the **Diagram Validation Results** dialog box will display a message stating that the Diagram is valid.
 - If the Diagram is invalid, the **Diagram Validation Results** dialog box will be displayed, where you can view the results of the validation.

About the Diagram Validation Results Dialog Box

The **Diagram Validation Results** dialog box displays all the errors that exist in the Diagram in an ASO Analysis.



The **Diagram Validation Results** dialog box displays the **Error** grid, which displays error information, organized first by **Scenario** and then by error type.

Below the **Error** grid, the following buttons appear:

- **OK**: Closes the **Diagram Validation Results** dialog box.
- **Copy Details**: Copies the content of the **Error** grid so that you can paste the error information into another application or file, such as a Microsoft Word or Microsoft Excel document. You can use this method to view the **Diagram Canvas** and error information simultaneously while you correct the errors.
- **Help**: Displays the context-sensitive **Help** topic for the **Diagram Validation Results** dialog box.

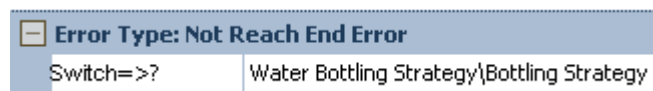
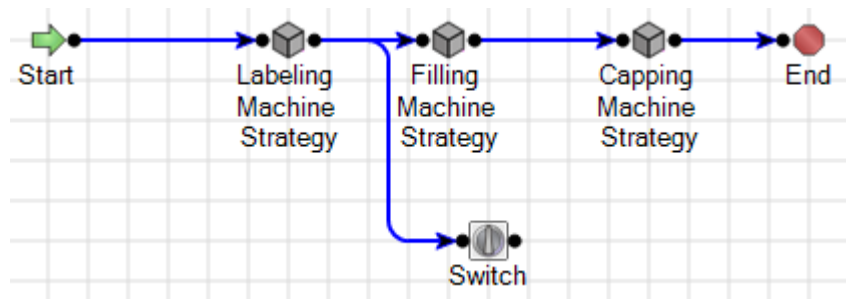
Interpreting Diagram Validation Results

If you validate an ASO Analysis Diagram and the Meridium APM system indicates that it is invalid, the **Diagram Validation Results** dialog box will be displayed, where you can view the results of the validation.

The **Diagram Validation Results** dialog box can display any of the following error messages, depending upon the conditions that are found within the Diagram:

- **Not Reach End Error:** The End element cannot be reached from the Start element by following connections in the Diagram. The Diagram must be connected such that a path exists from the Start element to the End element. If this path does not exist, the simulation will not run. You must correct this error before you can run the simulation.

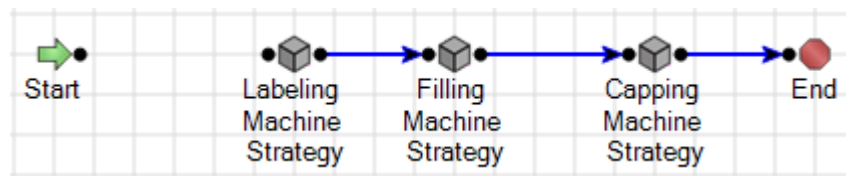
The following images show a broken connection error and the corresponding error message in the **Diagram Validation Results** dialog box.



Note: This broken connection did not produce a Not Reach Start error because there is a complete connection from the End element to the Start element.

- **Not Reach Start Error:** The Start element cannot be reached from the End element by following connections in the Diagram. The Diagram must be connected such that a path exists from the End element to the Start element. If this path does not exist, the simulation will not run. You must correct this error before you can run the simulation.

The following images show a broken connection error and the corresponding error message in the **Diagram Validation Results** dialog box.

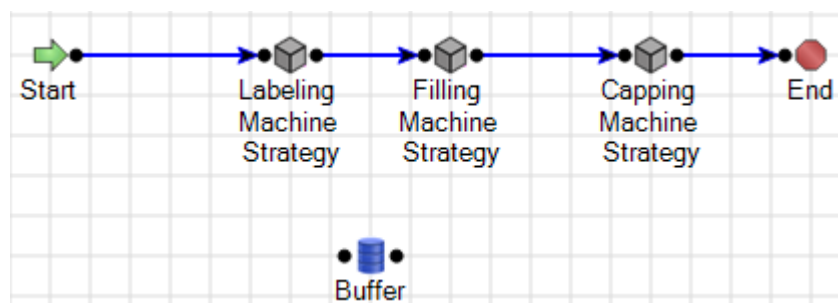


<input type="checkbox"/> Error Type: Not Reach End Error	Start=>?	Water Bottling Strategy\Bottling Strategy
<input type="checkbox"/> Error Type: Not Reach Start Error	?=>Labeling Machine Strategy	Water Bottling Strategy\Bottling Strategy

Note: This broken connection produced both a Not Reach End error and a Not Reach Start error because there is not a complete connection anywhere in the Diagram.

- **Isolated Element(s) Error:** An element is not connected to any other element on the Diagram Canvas. This type of error will not prevent the simulation from running, but the isolated element will be ignored by the simulation.

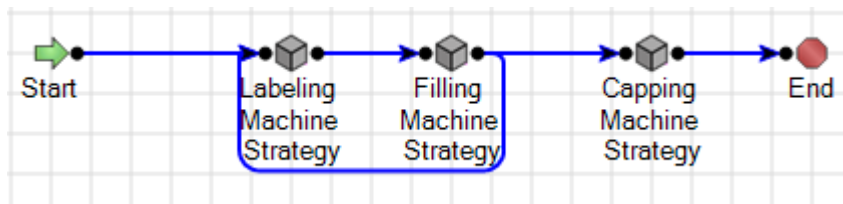
The following images show an isolated element error and the corresponding error message in the **Diagram Validation Results** dialog box.



<input type="checkbox"/> Error Type: Isolated Element(s) Error	Buffer	Water Bottling Strategy\Bottling Strategy
--	--------	---

- **Circular Error:** An element in the series has a connection to an earlier element in the series. This will prevent the Simulation from running and you must repair the connection so that it starts at the Start element and ends at the End element.

The following images show a circular error and its error message in the Diagram Validation Results dialog box.



Error Type: Circular Error	
Labeling Machine Strategy =>Labeling Machine Strategy	Water Bottling Strategy\Bottling Strategy
Filling Machine Strategy =>Filling Machine Strategy	Water Bottling Strategy\Bottling Strategy

Managing Scenarios

Workflow for Developing a Scenario

To develop a Scenario, you must complete the following steps:

1. Create a System Scenario record.
2. Add Risks, Actions, and Global Events to the Scenario, as desired.


Types of Scenarios

Each ASO Analysis will contain the following Scenarios:


- **Active Scenario:** Represents the current strategy for the equipment and locations that appear on the Diagram. When you create an ASO Analysis, the Active Scenario is created automatically. You cannot set another Scenario as the Active Scenario or delete the Active Scenario. Each analysis can contain only *one* Active Scenario. The Active Scenario always reflects data in the Active Strategies that are included in the ASO Analysis. In the Active Scenario, you *cannot*:
 - Create or delete Risks.
 - Create or delete Actions.

- Modify the association between Actions and Risks.
- Create new associations between Actions and Risks.

You can, however, define Resources, Global Events, and TTF and TTR Distributions.

In the grid on the **Asset Strategy Optimization Scenarios** page, the row representing the Active Scenario contains the  icon. By default, the Active Scenario is represented by the System Scenario record with the value *Active* in the Name field. If desired, you can change the value in the Name field.

- **Proposed Scenario:** Represents a proposed strategy for the equipment and locations that appear on the Diagram. When you create an ASO Analysis, the Proposed Scenario is created automatically. You can keep the default Proposed Scenario, or you can set another customer-defined Scenario as the Proposed Scenario. When you do so, the values in that customer-defined Scenario will be transferred to the Proposed Strategies that are included in the ASO Analysis. Each ASO Analysis must contain a Proposed Scenario at all times, and each analysis can contain only *one* Proposed Scenario. The Proposed Scenario always reflects data in the Proposed Strategies that are included in the ASO Analysis. In the Proposed Scenario, you can:
 - Create or delete Risks.
 - Create or delete Actions.
 - Modify the association between Actions and Risks.
 - Create new associations between Actions and Risks.
 - Define Resources, Global Events, and TTF and TTR Distributions.

In the grid on the **Asset Strategy Optimization Scenarios** page, the row representing the Proposed Scenario contains the  icon. By default, the Proposed Scenario is represented by the System Scenario record with the value *Proposed* in the Name field. If desired, you can change the value in the Name field.

- **Unmitigated Scenario:** Represents the unmitigated strategy, or the strategy as it exists with *only* Risks and *no* Actions, for the equipment and locations that are represented on the Diagram. The simulation results will include results for the Unmitigated Scenario, but you cannot modify the Unmitigated Scenario in ASO.

Each ASO Analysis contains only one Unmitigated Scenario. Because there is no System Scenario record to represent the Unmitigated Scenario, the Unmitigated Scenario does not appear in the grid on the **Asset Strategy Optimization Scenarios** page.

- **Customer-defined Scenario:** Represents a suggested strategy for the equipment and locations that appear on the Diagram. Customer-defined Scenarios do not reflect data in ASM. In a customer-defined Scenario, you can:
 - Create or delete Risks.
 - Create or delete Actions.
 - Modify the association between Actions and Risks.
 - Create new associations between Actions and Risks.
 - Define Resources, Global Events, and TTF and TTR Distributions.

Each ASO Analysis can contain multiple customer-defined Scenarios. Each customer-defined Scenario is represented by a System Scenario record without an icon. If desired, you can set a customer-defined Scenario as the Proposed Scenario. When you do so, the values in that customer-defined Scenario will be transferred to the Proposed Strategies that are included in the ASO Analysis.

Managing System Scenario Records

Creating System Scenario Records

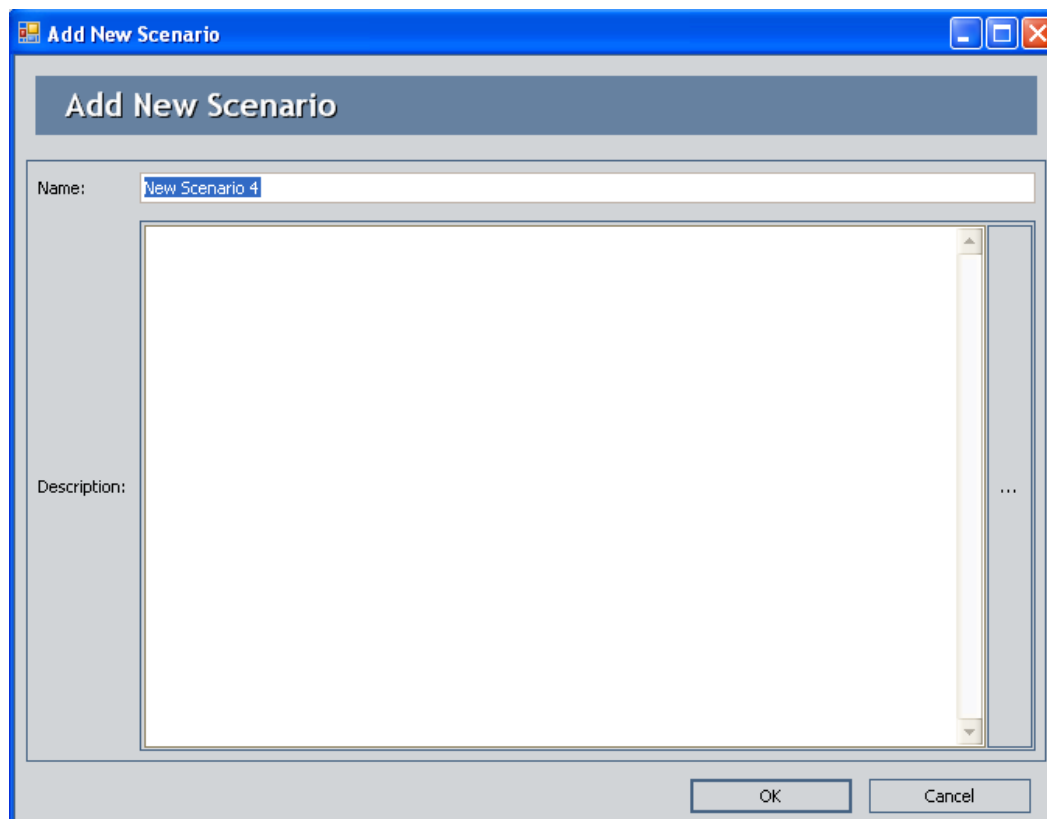
Creating a System Scenario record is the first step in the process of developing a Scenario. To create a System Scenario record, you must be logged in as a Super User or member of the MI ASM Analyst Security Group

Note: When you create a new ASO Analysis, two System Scenario records will be created automatically and identified by the values *Active* and *Proposed* in the Name field. You can modify either Scenario, or you can copy the Proposed Scenario to create a new Scenario, which you can then set as the Proposed Scenario. Each ASO Analysis must contain at least one Active Scenario and one Proposed Scenario.

To create a new System Scenario record:

1. Access the **Asset Strategy Optimization Scenarios** page for the ASO Analysis for which you want to create a new Scenario.
2. In the **Scenarios** section, below the grid, click the **Add Scenario** button.

The **Add New Scenario** dialog box appears.



The content of the **Add New Scenario** dialog box is controlled by the default datasheet defined for the System Scenario family.

3. Define the properties of the System Scenario record as desired.

4. Click OK.

The System Scenario record is created, and the **Asset Strategy Optimization Scenarios - Actions** page appears so that you can begin adding Actions to the Scenario. Note that any Actions or Risks that exist in the Active Scenario are flagged as deleted by default so that you can see how the new Scenario differs from the Active Scenario.

Creating Copies of System Scenario Records

To create a copy of a System Scenario record, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To copy a Scenario:

1. Access the **Asset Strategy Optimization Scenarios** page for the ASO Analysis containing a Scenario that you want to copy.
2. In the grid within the **Scenarios** section, select the row containing the System Scenario record that you want to copy.
3. Below the grid, click the **Copy Scenario** button.

The Scenario is copied and appears in the grid in the **Scenarios** section with the value **Copy of <Scenario Name>** in the **Name** column, where **<Scenario Name>** is the name of the System Scenario record that you copied.

Modifying System Scenario Records

To modify a System Scenario record, you must be logged in as a Super User or member of the ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To modify a System Scenario record:

1. Access the **Asset Strategy Optimization Scenarios** page for the ASO Analysis containing a Scenario that you want to modify.

2. In the grid within the **Scenarios** section, select the row containing the System Scenario record that you want to modify.
3. Click the **Edit Scenario** button.

The <Scenario Name> dialog box appears, where <Scenario Name> is the value in the Name field of the System Scenario record that you selected. The content of this dialog box is controlled by the default datasheet defined for the System Scenario family.

4. Modify the properties of the System Scenario record as desired.
5. Click **OK**.

Your changes are applied.

Deleting System Scenario Records

To delete a Scenario, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To delete a Scenario from an ASO Analysis:

1. Access the **Asset Strategy Optimization Scenarios** page for the ASO Analysis containing a Scenario that you want to delete.
2. In the grid within the **Scenarios** section, select the row containing the scenario that you want to delete.
3. Below the grid, click the **Delete Scenario** button.

A confirmation message appears, asking if you really want to delete the Scenario.

4. Click the **Yes** button.

The Scenario is removed from the grid in the **Scenarios** section.

Managing Risks

About Risks

In ASO, a *Risk* identifies one way in which a piece of equipment or location can fail. If the risk occurs, then the piece of equipment or location will fail. In ASO Analyses, Risks are represented by *System Risk records*, which are linked to System Asset and System Switch records. When you create an ASO Analysis from a strategy, each Risk record in ASM is used to create a System Risk record in ASO. In addition, the System Risk record is linked automatically to the System Asset record that is created automatically from the Equipment or Functional Location record to which the Asset Strategy is linked.

A piece of equipment or location may have multiple Risks to represent multiple ways in which it can fail. As such, System Asset and System Switch records can be linked to multiple System Risk records.

Each risk has a characteristic pattern of causing a piece of equipment or location to fail as defined by its TTF distribution data or maximum operating time. Risks also have TTR distribution data, which characterizes the time required to correct the failure that occurs as the result of the Risk and get the system running again. This distribution data is stored in Distribution records, which are linked to Risk records.

Features of the Asset Strategy Optimization Scenarios - Risks Page

Diagram Hierarchy Pane

The **Diagram Hierarchy** pane on the **Asset Strategy Optimization Scenarios - Risks** page displays the elements that you have defined on the **Asset Strategy Optimization Analysis Definition - Diagram** page. In the following image, the **Diagram Hierarchy** pane is outlined in red.

Asset Strategy Optimization Scenarios - Risks

Site Map: [Asset Strategy Management](#) -> [DB-PMP-FEED](#) -> [DB-PMP-FEED Optimization](#) -> [Active](#)

Scenario: Active

Flag	Name	Desc...	TTF	TTR	Planned Resource U...	Unplanned Resource ...	Qualitative Consequ...	Risks to Reset
	Impeller Wear		TTF Distribution	TTR Distribution	Planned Resource Usa...	Unplanned Resource Usa...		102
	Lubricant Loss		TTF Distribution	TTR Distribution	Planned Resource Usa...	Unplanned Resource Usa...		102
	Lubricant Degrada...		TTF Distribution	TTR Distribution	Planned Resource Usa...	Unplanned Resource Usa...		102
	Misalignment		TTF Distribution	TTR Distribution	Planned Resource Usa...	Unplanned Resource Usa...		102
	Seal Leak		TTF Distribution	TTR Distribution	Planned Resource Usa...	Unplanned Resource Usa...		210
	Bearing Failure		TTF Distribution	TTR Distribution	Planned Resource Usa...	Unplanned Resource Usa...		102

Mitigating Actions

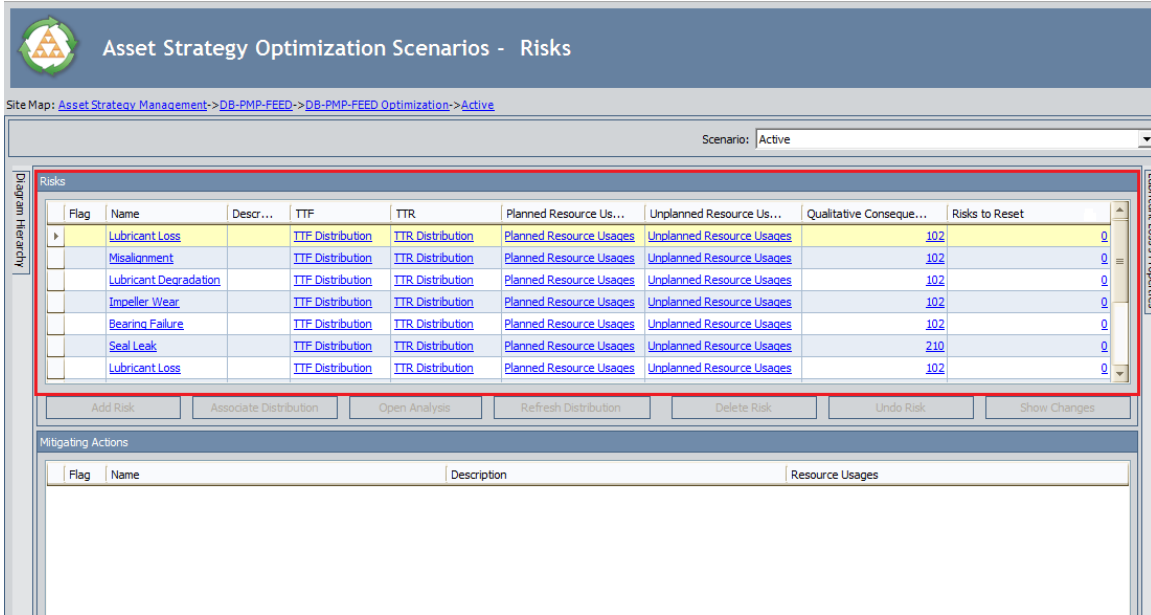
Flag	Name	Description	Resource Usages
	Internal Inspection	Disassemble and inspect internals for wear. Include inspec...	Resource Usages
	Vibration Analysis	Perform full spectrum vibration monitoring. Establish baseli...	Resource Usages
	Performance Test	Perform component performance test over full range of op...	Resource Usages

When you select an element in the **Diagram Hierarchy** pane, the associated Risks for that element are displayed in the **Risks** pane. For example, in this image, the selected *G0006A-071* Asset element has six associated Risks:

- Impeller Wear
- Lubricant Loss
- Lubricant Degradation
- Misalignment
- Seal Leak
- Bearing Failure


Risks Pane



The Risks pane is displayed on the **Asset Strategy Optimization Scenarios - Risks** page and on the Risks Editor window. It displays the Risks that are associated with the element that is selected in the **Diagram Hierarchy** pane. In the following image, the Risks pane is outlined in red.



Note: For the purposes of this image, the Diagram Hierarchy pane has been hidden.

The grid in the Risks pane displays the following columns of information:

- **Flag:** Contains an icon indicating the status of the System Risk record relative to the corresponding System Risk record that belongs to the Active Scenario.
 - If you are viewing System Risk records that belongs to the Active Scenario (i.e., the Scenario list above the grid contains the value *Active*), the Flag column will not contain an icon.
 - If you are viewing System Risk records that belongs to a non-Active Scenario (i.e., the Scenario list above the grid does not contain the value *Active*) and the System Risk record is *identical* to the corresponding System Risk record in the Active Scenario, the Flag column will not contain an icon.
 - If you are viewing System Risk records that belongs to a non-Active Scenario (i.e., the Scenario list above the grid does not contain the value *Active*) and the System Risk record does not have a corresponding System Risk record in the Active Scenario, the Flag column will contain the  icon.

- If you are viewing System Risk records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) and the System Risk record is *different* from the corresponding System Risk record in the Active Scenario, the **Flag** column will contain the  icon.
 - If you are viewing System Risk records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) whose System Scenario record was created from scratch (i.e., the System Scenario was not copied from another System Scenario record), the **Flag** column will contain the  icon.
- **Name:** Displays the value in the Name field in the System Risk record.
 - **Description:** Displays the value in the Description field in the System Risk record.
 - **TTF:** Displays the **TTF Distribution** link. You can click this link to open the **TTF Distribution** window, where you can view the Time to Failure (TTF) distribution data for the associated System Risk record.
 - **TTR:** Displays the **TTR Distribution** link. You can click this link to open the **TTR Distribution** window, where you can view the Time to Repair (TTR) distribution data for the associated System Risk record.
 - **Planned Resource Usages:** Displays the **Planned Resource Usages** link, which you can click to open the **Planned Resource Usages** window and view any *planned* Resources that have been assigned to the Risk.
 - **Unplanned Resource Usages:** Displays the **Unplanned Resource Usages** link, which you can click to open the **Unplanned Resource Usages** window and view any *unplanned* Resources that have been assigned to the Risk.
 - **Qualitative Consequence:** Displays a hyperlinked numeric value, which you can click to open the **Qualitative Consequence Editor** window.
 - **Risks to Reset:** Displays a number representing the number of additional Risks that will be reset following a planned or unplanned correction of the Risk in that row. This number appears as a hyperlink, which you can click to access the **Risks to Reset** dialog box, where you can manage the

additional Risks that will be reset in the simulation following a planned or unplanned correction of the source Risk.

When you right-click any cell in the grid in the **Risks** pane, a shortcut menu appears and contains options that you can use to manage the Risks that you want to reset following a planned or unplanned correction of the Risk in that row.

Below the grid in the **Risks** pane, the following buttons appear:

- **Add Risk:** Displays the **Add New Risk** window, where you create a new System Risk record to link to the currently selected System Asset or System Switch record. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Associate Distribution:** Displays the **Find Items** window, where you can search for a Reliability Distribution or Reliability Growth Analysis to associate with the selected Risk. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Open Analysis:** Displays the **Reliability Distribution Summary** page or the **Reliability Growth Analysis** page for the Reliability Distribution Analysis or Reliability Growth Analysis that is associated with the selected Risk. This button is enabled only when the selected Risk is associated with a Reliability Distribution Analysis or a Reliability Growth Analysis.
- **Refresh Distribution:** Refreshes the associated distributions by importing the TTF and TTR distribution information with the most current information from the associated Reliability Distribution Analysis or Reliability Growth Analysis. This link is enabled only when the selected Risk is associated with a Reliability Distribution Analysis or a Reliability Growth Analysis. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Delete Risk:** After asking for confirmation, deletes the System Risk record that is currently selected in the **Risks** pane. This button is always disabled if you are viewing Risks that belong to the Active Scenario. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Undo Risk:** Causes the System Risk record to be updated so that its values are identical to the values in the corresponding System Risk

record in the Active Scenario. Before you click the **Undo Risk** button, you might want to click the **Show Changes** button so that you can see how the System Risk record in this Scenario differs from the one in the Active Scenario. This button is always disabled if you are viewing Risks that belong to the Active Scenario. If you are viewing Risks that belong to any other Scenario, this button is enabled only if an Asset element is selected in the **Diagram Hierarchy** pane and the selected Risk is somehow different from the corresponding Risk in the Active Scenario. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.

- **Show Changes:** Displays the **Changes for <Risk>** window, where **<Risk>** is the value in the Name field in the selected System Risk record. You can use this window to see the differences that exist between values in this System Risk record and values in the corresponding System Risk record in the Active Scenario. This button is always disabled if you are viewing Risks that belong to the Active Scenario. If you are viewing Risks that belong to any other Scenario, this button is enabled only if an Asset element is selected in the **Diagram Hierarchy** pane and the Risk is somehow different from the corresponding Risk in the Active Scenario.

Mitigating Actions Pane

The **Mitigating Actions** pane is displayed on the **Asset Strategy Optimization Scenarios - Risks** page and on the Risks Editor window. It displays the Actions that are associated with the Risk that is selected in the Risks pane. In the following image, the **Mitigating Actions** pane is outlined in red.

Asset Strategy Optimization Scenarios - Risks

Site Map: [Asset Strategy Management](#) > [DB-PMP-FEED](#) > [DB-PMP-FEED Optimization](#) > [Active](#)

Scenario: Active

Flag	Name	Description	TTF	TTR	Planned Resource Usages	Unplanned Resource Usages	Qualitative Consistency	Risks to Reset
	Seal Leak		TTF Distribution	TTR Distribution	Planned Resource U...	Unplanned Resourc...	210	
	Bearing Failure		TTF Distribution	TTR Distribution	Planned Resource U...	Unplanned Resourc...	102	
	Impeller Wear		TTF Distribution	TTR Distribution	Planned Resource U...	Unplanned Resourc...	102	
	Lubricant Degradation		TTF Distribution	TTR Distribution	Planned Resource U...	Unplanned Resourc...	102	
	Misalignment		TTF Distribution	TTR Distribution	Planned Resource U...	Unplanned Resourc...	102	
	Lubricant Loss		TTF Distribution	TTR Distribution	Planned Resource U...	Unplanned Resourc...	102	




Mitigating Actions

Flag	Name	Description	Resource Usages
	Operator Check	Verify proper operation. Qualitative observation of condition and performance.	Resource Usages
	Internal Inspection	Disassemble and inspect internals for wear. Include inspection for erosion/corrosion.	Resource Usages

When you select a Risk in the Risks pane, the associated Actions for that Risk are displayed in the Mitigating Actions pane. For example, in this image, the *Seal Leak* Risk has two associated Actions: *Operator Check* and *Internal Inspection*.

The grid in the Mitigating Actions pane displays the following columns of information:

- **Flag:** Contains an icon indicating the status of the System Action record relative to the corresponding System Action record that belongs to the Active Scenario.
 - If you are viewing System Action records that belongs to the Active Scenario (i.e., the Scenario list above the grid contains the value *Active*), the Flag column will not contain an icon.
 - If you are viewing System Action records that belongs to a non-Active Scenario (i.e., the Scenario list above the grid does not contain the value *Active*) and the System Action record is *identical* to the corresponding System Action record in the Active Scenario, the Flag column will not contain an icon.

- If you are viewing System Action records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) and the System Action record does not have a corresponding System Action record in the Active Scenario, the **Flag** column will contain the  icon.
 - If you are viewing System Action records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) and the System Action record is *different* from the corresponding System Action record in the Active Scenario, the **Flag** column will contain the  icon.
 - If you are viewing System Action records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) whose System Scenario record was created from scratch (i.e., the System Scenario was not copied from another System Scenario record), the **Flag** column will contain the  icon.
- **Name:** Displays the value in the Name field in the System Action record.
 - **Description:** Displays the value in the Description field in the System Action record.
 - **Resource Usages:** Displays the **Resources Usages** link, which you can click to open the **Resource Usages** window to manage the Resources that have been assigned to the Action.

Below the grid in the **Actions** pane, the following buttons appear:

- **Assign New Action:** Displays the **Select Action Type** dialog box, where you can create a new System Action record to link to the currently selected System Asset or System Switch record. When you create a new Action by using the **Assign New Action** button, the Action will be assigned to mitigate the Risk currently selected in the **Risks** pane. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Assign Existing Actions:** Displays the **Assign Actions** window, where you can assign an existing Action to mitigate the Risk currently selected in the **Risks** pane or remove an existing Action from mitigating the Risk currently selected in the **Risks** pane. This link is enabled only if you are

logged in as a Super User or member of the MI ASM Analyst Security Group.

Creating Risks

Creating Risks on the Risks Page

To create a Risk, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

Note: You can add Risks only to non-Active Scenarios.


The following instructions provide details on creating Risk records and simultaneously assigning them to Actions via the **Asset Strategy Optimization Scenarios - Risks** page. You can also create Risk records and simultaneously assign them to Actions using the **Asset Strategy Optimization Scenarios - Actions** page.

To add a Risk to an Asset or Switch element in a Scenario:

1. While viewing the desired non-Active Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the element to which you want to add a Risk.
2. Below the grid in the **Risks** pane, click the **Add Risk** button.

The **Add New Risk** window appears, displaying the default datasheet for the System Risk family.

3. In the fields in the **Add New Risk** window, define the properties of the System Risk record as desired.
4. Click **OK**.

The new Risk appears in the Risks grid with the  icon in the Flag column.

Creating Risks on the Actions Page

To assign a new Risk to an Action, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

Note: You can create new Risks and assign them to Actions only in non-Active Scenarios.

The following instructions provide details on creating a Risk record and simultaneously assigning it to an Action using the **Asset Strategy Optimization Scenarios - Actions** page. You can also create Risk records and simultaneously

assign them to Actions using the **Asset Strategy Optimization Scenarios - Risks** page.

To assign a new Risk to an Action:

1. While viewing the desired non-Active Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the element that contains the Action to which you want to assign a Risk.
2. In the grid in the **Actions** pane, select the Action to which you want to assign a Risk.
3. Below the grid in the **Mitigated Risks** pane, click the **Assign New Risk** button.

The **New Risk** window appears, displaying the default datasheet for the System Risk family.

New Risk

Name:

Description:

Last Failure:

Fixed Unplanned Correction Cost:

Variable Unplanned Correction Cost:

Planned Correction Cost:

Planned Correction Duration:

Is Active: Is Latent:

Failure Without Replacement: Number of Subcomponents:

PF Interval:

Repair Immediately: Percentage of PF Interval to Wait (%):

4. In the fields on the **New Risk** window, define the properties of the System Risk record as desired.
5. Click **OK**.

The new Risk is created, linked to the selected element, and assigned to the Action, and it appears in the grid in the **Mitigated Risks** pane.

Assigning Existing Risks to Actions

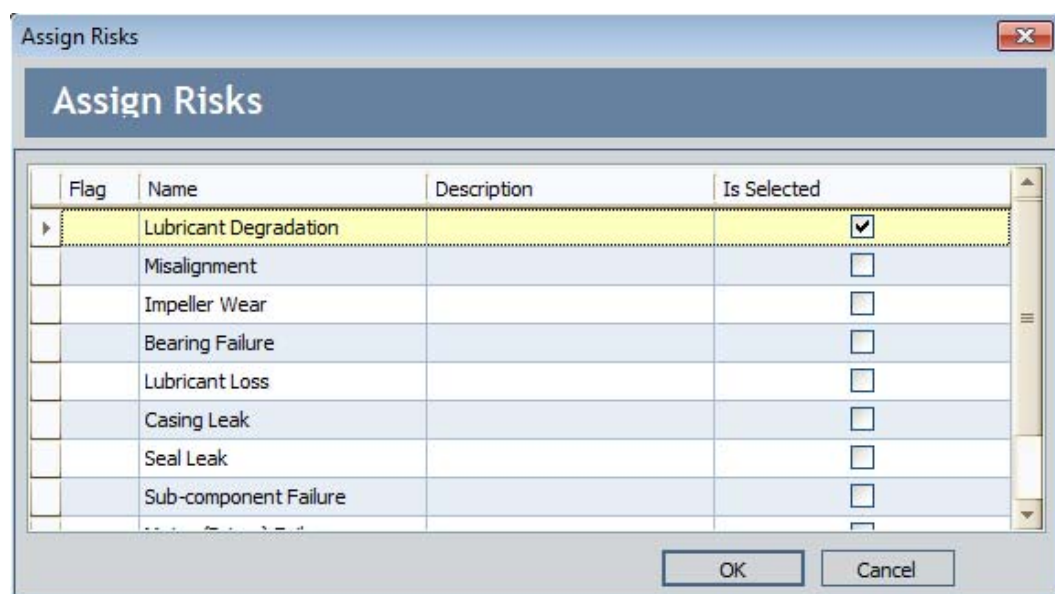
To assign existing Risks to an Action, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

Note: You can assign existing Risks to Actions only for Scenarios in a state other than *Active*.

To assign existing Risks to an Action:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, select the Action to which you want to assign a Risk.
2. In the grid in the **Actions** pane, select the Action to which you want to assign a Risk.
3. Below the grid in the **Mitigated Risks** pane, click the **Assign Existing Risks** button.

The **Assign Risk** window appears, which shows the Risks that exist in the Scenario to which the Action belongs.



4. In the **Assign Risks** window, in the **Is Selected** column of the grid, select the check box for the Risk(s) that you want to assign to the Action.

Hint: You can *clear* the **Is Selected** check box to remove from the Action any Risk that is currently assigned.

5. Click **OK**.

The Risk(s) are assigned to the selected Action in the **Actions** pane and appear in the grid in the **Mitigated Risks** pane.

Modifying Risks

Options for Modifying Risks

You can modify the values in a System Risk record using either of the following options:

- **Asset Strategy Optimization Scenarios - Risks** page.
- **Asset Strategy Optimization Scenarios - Grid** page.

Modifying Risks Using the Risks Page

To modify a Risk, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To modify a Risk using the **Asset Strategy Optimization Scenarios - Risks** page:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the row that contains the Risk that you want to modify.
2. In the **Risks** pane, in the **Name** column, click the hyperlinked name of the Risk that you want to modify.

The **<Risk Name>** dialog box appears, where **<Risk Name>** is the name of the System Risk record that you selected.

3. Modify the properties of the System Risk record as desired.

4. Click OK.

Your changes are saved.

Modifying Risks Using the Grid Page

To modify a Risk, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To modify a Risk using the Asset Strategy Optimization Scenarios - Grid page:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Grid** page, in the **Filter** list, select **Risk**.

The grid is updated to display only the Risks that belong to that Scenario.

Name	Fixed Unplanned Correct...	Variable Unplanned Correct...	Variable Unplanned Correct...	Planned Correct...	Planned Corre...	Planned Correction ...	PF...
Water Bottling Strategy			Per Day				
Bottling Strategy			Per Day				
Capping Machine St...			Per Day				
Caps run out.	450.00	0.00	Per Day	1	1	0.00	0.00 Days
Gears Break	360.00	0.00	Per Day	10	1	0.00	0.00 Days
Filling Machine Stra...			Per Day				
Gears Break	1,500.00	0.00	Per Day	10	1	0.00	0.00 Days
Nozzles wear out	900.00	0.00	Per Day	1	1	0.00	0.00 Days
Labeling Machine St...			Per Day				
Gears break	1,000.00	0.00	Per Day	...	1	0.00	0.00 Days
Labels run out	500.00	0.00	Per Day	1	1	0.00	0.00 Days
Water Collection Strategy			Per Day				
Water Pump Strategy			Per Hour				
Bearing Failure	2,000.00	600.00	Per Day	10	10	1,000.00	3.00 Hours
Impeller Failure	1,500.00	1,000.00	Per Day	10	10	800.00	2.00 Hours
Seal Failure	1,500.00	1,000.00	Per Day	1	1	1,000.00	8.00 Hours
Water Source Strat...			Per Day				
Water contains ...	8,000.00	0.00	Per Day	...	100	0.00	0.00 Days
Water level get...	5,300.00	0.00	Per Day	1	1	0.00	0.00 Days
Water Tank Strategy			Per Day				
Tank Corrodes	1,100.00	0.00	Per Day	1	1	0.00	0.00 Days
Tank Rusts	1,800.00	0.00	Per Day	10	10	0.00	0.00 Days

2. In the grid, in any cell containing a value that you want to modify, delete the current value, and type or select the desired value.
3. On the **Common Tasks** menu, click the **Save Analysis** link.

Your changes are saved.

Managing Resources for Risks

About Resources for Risks

After Resources exist for an ASO Analysis, you can assign them to Risks. When you do so, you associate the cost of that Resource with each failure that occurs as a result of that Risk. This allows you to assign a realistic, financial cost to the consequences of the Risk that can be included in the simulation results.

When you assign a Resource to a Risk, a System Resource Usage record will be created and will store information that specifies how the Resource will be used (e.g., the quantity and duration). There are two ways to assign Resources to Risks:

- **Planned Resource Usage:** Used for a planned correction, or when a potential failure is detected by a condition-based maintenance Action and triggers repairs that mitigate the failure before it can occur. This is a proactive approach that keeps the piece of equipment or location running.
- **Unplanned Resource Usage:** Used for an unplanned correction, or repairs for a piece of equipment or location that has failed unexpectedly due to a Risk. This is a reactive approach with focuses on getting the piece of equipment or location running again after it has failed.

Assigning Resources to Risks

To assign a Resource to a Risk, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

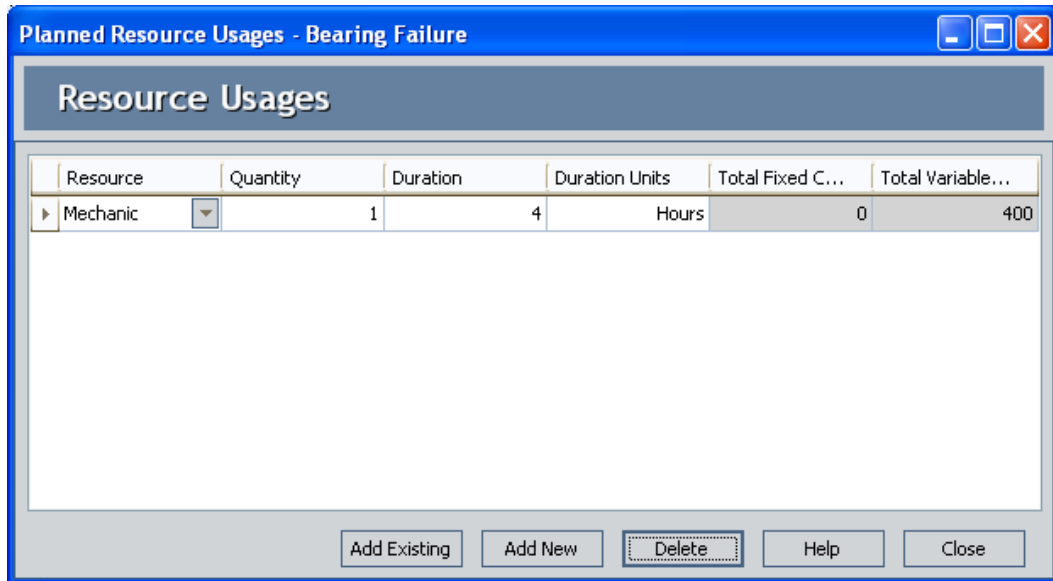
To assign a Resource to a Risk:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the element that contains the Risk to which you want to assign a Resource.
2. In the grid in the **Risks** pane, in the row containing the Risk to which you want to assign a Resource, click the **Planned Resource Usages** link.

-OR-

In the grid in the Risks pane, in the row containing the Risk to which you want to assign a Resource, click the **Unplanned Resource Usages** link.

The <Resource Usages> - <Risk> window appears, where <Resource Usages> is the type of Resource Usage that you selected and <Risk> is the name of the Risk that you selected.



In this image, the **Planned Resource Usages - Bearing Failure** window displays the Resources that are assigned to the current Risk.

3. Click the **Add Existing** button. This button will be enabled only if one or more Resources already exist for the analysis.

A new row appears in the grid.

Hint: Alternatively, you can click the **Add New** button to create a Resource from scratch and assign it to a Risk. After you have created the Resource, you can skip to step 5.

4. In the **Resource** cell of the first row, click the button, and select the Resource that you want to assign to the Risk.
5. Type the desired values in the **Quantity**, **Duration**, and **Duration Units** cells. These values will be used to populate the corresponding fields in the System Resource Usage record.

Note: The Total Fixed Cost and Total Variable Cost columns display the actual value that will be incurred when the System Resource Usage is added to the Simulation Results. Since this value is a product of the values you enter on the **Resource** dialog box and **Resource Usage** window, the cells are disabled and you cannot type values in these cells.

6. Click the Close button.

The <Resource Usages> - <Risk> window closes and your selections are applied.

Modifying Resources Assigned To Risks

When you modify a Resource that is assigned to a Risk, you modify the *System Resource Usage record*. The actual System Resource record is not changed.

To modify a Resource, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To modify a Resource that is assigned to a Risk:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the element whose Risk has Resources that you want to modify.
2. In the grid in the **Risks** pane, in the row containing the Risk whose Resources you want to modify, click the **Planned Resource Usages** link.

-OR-

In the grid in the **Risks** pane, in the row containing the Risk whose Resources you want to modify, click the **Unplanned Resource Usages** link.

The <Resource Usages> - <Risk> window appears, where <Resource Usages> is the type of Resource Usage that you selected and <Risk> is the name of the Risk that you selected.

3. In the **Resource Usages** grid, modify the properties of the Resource Usage record as desired.

4. Click the **Close** button.

Your changes are saved.

Removing Resources from Risks

When you remove a Resource from a Risk, you delete the System Resource Usage record so that the Resource is no longer used by the selected Risk. The actual System Resource record is still available for the ASO Analysis and can be used if needed.

To remove a Resource from a Risk, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To remove a Resource from a Risk:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the Risk whose Resource you want to remove.
2. In the grid in the **Risks** pane, in the row containing the Risk whose Resources you want to remove, click the **Planned Resource Usages** link.

-OR-

In the grid in the **Risks** pane, in the row containing the Risk whose Resources you want to remove, click the **Unplanned Resource Usages** link.

The **<Resource Usages> - <Risk>** window appears, where **<Resource Usages>** is the type of Resource Usage that you selected and **<Risk>** is the name of the Risk that you selected.

3. In the **Resource Usages** grid, select the Resource that you want to remove.
4. Click the **Delete** button.

A confirmation message appears, asking if you really want to delete the selected item(s).

5. Click the Yes button.

The Resource Usage is removed from the Risk.

Managing Distribution Data for Risks

About Defining Distribution Data for Risks

You have two options for defining distribution data for Risks. You can:

- Enter distribution data manually.
- Associate distribution data from existing Reliability Distribution Analyses and Reliability Growth Analyses.

Defining Distribution Data Manually

Options for Modifying Distribution Data Manually

You can modify the values in a Distribution record using either of the following options:

- Using the **Asset Strategy Optimization Scenarios - Risks** page.
- Using the **Asset Strategy Optimization Scenarios - Grid** page.

Defining Distribution Data Manually Using the Risks Page

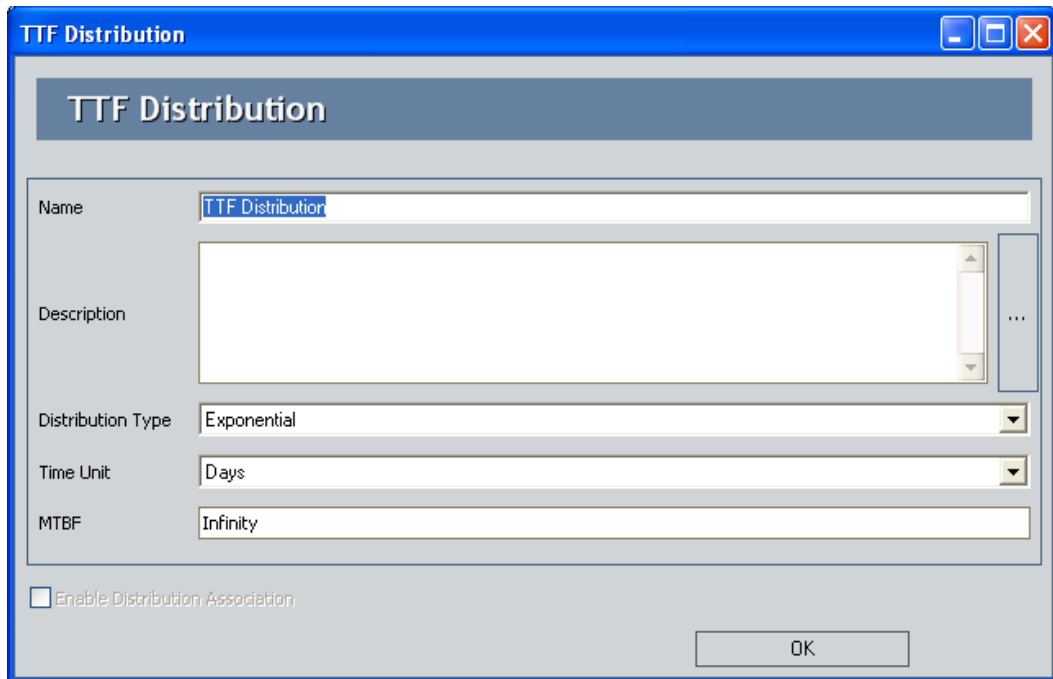
To define distribution data, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To define TTF or TTR distribution data manually using the **Asset Strategy Optimization Scenarios - Risks** page:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the element whose Risk distribution you want to define.
2. In the grid in the **Risks** pane, in the row containing the Risk whose distribution data you want to define...

- In the TTF column, click the TTF Distribution link.
- or-
- In the TTR column, click the TTR Distribution link.

The TTR Distribution or TTR Distribution window appears, depending on which link you clicked.



The screenshot shows a dialog box titled "TTF Distribution". The dialog has a header bar with the title "TTF Distribution". Below the header, there are several input fields and a checkbox. The "Name" field contains "TTF Distribution". The "Description" field is empty. The "Distribution Type" dropdown is set to "Exponential". The "Time Unit" dropdown is set to "Days". The "MTBF" field contains "Infinity". At the bottom left, there is a checkbox labeled "Enable Distribution Association" which is currently unchecked. At the bottom right, there is an "OK" button.

3. Define the properties of the Distribution record as desired.
4. Click OK.

Your new distribution data is saved.

Defining Distribution Data Manually Using the Grid Page

To define distribution data, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To define TTF or TTR distribution data manually using the Asset Strategy Optimization Scenarios - Grid page:

1. While viewing the desired Scenario on the Asset Strategy Optimization Scenarios - Grid page, in the Filter list, select Distribution.

The grid is updated to display only the Distributions that belong to the Risks in that Scenario.

Name	Distribution Type	Time Unit	Parameter 1	Parameter 2	Parameter 3
Water Bottling Strategy					
Bottling Strategy					
Capping Machine Strategy					
Caps run out.					
TTF Distribution	Exponential	Years	3.33 (MTBF)		
TTR Distribution	Exponential	Days	0.00 (MTTR)		
Gears Break					
TTF Distribution	Exponential	Years	3.33 (MTBF)		
TTR Distribution	Exponential	Days	0.00 (MTTR)		
Filling Machine Strategy					
Gears Break					
TTF Distribution	Exponential	Years	3.33 (MTBF)		
TTR Distribution	Exponential	Days	0.00 (MTTR)		
Nozzles wear out					
TTF Distribution	Exponential	Years	10.00 (MTBF)		
TTR Distribution	Exponential	Days	0.00 (MTTR)		
Labeling Machine Strategy					
Gears break					
TTF Distribution	Exponential	Years	3.33 (MTBF)		
TTR Distribution	Exponential	Days	0.00 (MTTR)		
Labels run out					
TTF Distribution	Exponential	Years	10.00 (MTBF)		
TTR Distribution	Exponential	Days	0.00 (MTTR)		
Water Collection Strategy					
Water Pump Strategy					
Bearing Failure					
TTF Distribution	Exponential	Months	60.00 (MTBF)		
TTR Distribution	Exponential	Hours	8.00 (MTTR)		
Impeller Failure					
TTF Distribution	Exponential	Months	24.00 (MTBF)		
TTR Distribution	SingleValue	Hours	12.00 (Value)		
Seal Failure					
TTF Distribution	Weibull	Years	4.00 (Beta)	3.00 (Eta)	0.00 (Gamma)
TTR Distribution	SingleValue	Hours	12.00 (Value)		

2. In the grid, in any cell containing a value that you want to modify, delete the current value, and type or select the desired value.
3. On the Common Tasks menu, click the Save Analysis link.

Your changes are saved.

Associating Existing Distribution Data with Risks

About Associating Existing Distribution Data with Risks

As an alternative to entering distribution data manually for Risks, you can associate Risks with distribution data from existing Reliability Growth Analyses and Reliability Distribution Analyses. When you enter data manually, you can choose any values that you desire for your distribution data, but when you associate existing distribution data with Risks, you use data stored in actual Reliability Growth or Reliability Distribution Analyses.

After existing distribution data has been associated with a Risk, you can update the information periodically. When you associate the distribution data, the Entity Key and Family Key of the Reliability Distribution and Reliability Growth Analysis are stored in the System Risk record, thereby establishing a connection between the two records that allows for future updates. This way your ASO Analysis uses the most current information available to calculate the simulation results.

Associating Existing Distribution Data with Risks

To associate existing distribution data with Risks, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To associate an existing Reliability Distribution Analysis or Reliability Growth Analysis with a Risk:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the element that contains the Risk with which you want to associate distribution data.
2. In the grid in the **Risks** pane, select the Risk with which you want to associate a distribution data.
3. Below the grid in the **Risks** pane, click the **Associate Distribution** button.

The **Find Items** window appears, where you can search for a Reliability Growth Analysis or Reliability Distribution Analysis whose distribution data you want to associate with a Risk.

4. In the **Find Items** window, perform a search to locate your desired analysis.

The search results appear at the bottom of the window.

5. In the search results, select the desired record.
6. Click the **Open** button.

The distribution data from the selected record is imported, and a connection is established between the Risk and the selected Reliability Growth Analysis or Reliability Distribution Analysis.

Refreshing Distribution Data

To refresh the distribution data associated with a Risk:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the element that contains the Risk whose distribution data you want to refresh.
2. In the grid in the **Risks** pane, select the Risk whose distribution data you want to refresh.
3. Below the grid in the **Risks** pane, click the **Refresh Distribution** button.

A confirmation message appears, asking if you really want to refresh all distribution data for this Risk.

4. Click **OK**.

The distribution data is refreshed.

Opening Associated Analyses

You can open the Reliability Growth or Reliability Distribution Analysis that is associated with the Risk selected in the **Diagram Hierarchy** pane. To open a Reliability Growth or Reliability Distribution Analysis, you must be logged in as a Super User or a member of the ASM Analyst Security Group.

To open an associated analysis:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the

element that contains the Risk whose associated Reliability Growth or Reliability Distribution Analysis you want to view.

2. In the grid in the **Risks** pane, select the Risk whose associated Reliability Growth or Reliability Distribution Analysis you want to view.
3. Below the grid in the **Risks** pane, click the **Open Analysis** button.

Note: If your ASO Analysis has any unsaved changes, you will be prompted to save them.

The ASO Analysis is closed, and the Reliability Growth or Reliability Distribution Analysis is opened.

Removing the Association Between a Risk and a Growth or Distribution Analysis

To remove the association between a Risk and a Reliability Growth or Reliability Distribution Analysis, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To remove the association between a Risk and a Reliability Growth or Reliability Distribution Analysis:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the element that contains the Risk for which you want to remove an analysis association.
2. In the grid in the **Risks** pane, select the hyperlink that represents the analysis association that you want to remove.

The **<Distribution>** window appears, where **<Distribution>** is the TTF or TTR distribution that you selected.

The screenshot shows a dialog box titled "TTF Distribution". It contains the following fields and controls:

- Name:** TTF
- Description:** (empty)
- Distribution Type:** Weibull
- Time Unit:** Days
- Beta:** 2.72438312043926
- Eta:** 152.983892628505
- Gamma:** 0
- Enable Distribution Association
- OK button

3. In the bottom of the <Distribution> window, clear the **Enable Distribution Association** check box.

The fields in the **TTF Distribution** window are enabled.

Note: You can keep the last values that have been imported from the associated analysis or you can enter new distribution data manually.

4. Click **OK**.

Your changes are saved.

Managing Risks to Reset

About Resetting Risks

When a simulation is run, the occurrence of the Risks that are defined for a piece of equipment, location, or switch are simulated, based upon the TTF Distribution associated with that Risk. When a Risk with a failure type of *Failure With Replacement* occurs or after actions are performed that mitigate the occurrence of that Risk in the simulation, that Risk will be reset automatically. This means that the time in service for the component associated with the Risk will be changed to zero (0), indicating that the component was replaced (or repaired to as good as new).

When a Risk will be reset automatically is determined by the failure type of that Risk. A Risk whose failure type is *Failure With Replacement* will be reset automatically when any of the following scenarios occur:

- An unplanned correction takes place following the occurrence of a Risk.
- A planned correction takes place to mitigate the occurrence of a Risk.
- Preventive Maintenance is performed against a piece of equipment or location to mitigate the occurrence of a Risk.
- A Special Action with a TTF replacement is performed against a piece of equipment or location to mitigate the occurrence of a Risk.

A Risk whose failure type is *Failure Without Replacement* will be reset automatically when any of the following scenarios occur:

- Preventive Maintenance is performed against a piece of equipment or location to mitigated the occurrence of a Risk.
- A Special Action with TTF replacement is performed against an asset to mitigate the occurrence of a Risk.

For example, suppose that the following Risks with a failure type of *Failure With Replacement* are defined in your simulation for a *Water Pump* asset:

- Bearing failure
- Impeller failure
- Seal failure

In the simulation, after unplanned correction is completed following the occurrence of the *Bearing failure* Risk, the time in-service for the Bearing will be reset automatically to zero (0) to indicate that you will replace the Bearing after it fails so that the *Bearing failure* Risk will not occur again until the defined TTF Distribution is reached.

In addition to Risks being reset automatically as described above, you can specify that *additional* Risks be reset following the planned or unplanned correction of a given Risk. In other words, you can specify a Risk as a *source* Risk, whose planned or unplanned correction triggers additional Risks to be

reset at that time. This means that the time in-service for the components associated with the additional Risks will be changed to zero (0), indicating that the additional components were also replaced (or repaired to as good as new) following the planned or unplanned correction of the source Risk.

Throughout the documentation we will use the term *source Risk* to refer to a Risk whose planned or unplanned correction triggers the resetting of additional Risks. We will use the term *additional Risk* to refer to Risks that are reset by the occurrence or mitigation of a source Risk.

You can specify that additional Risk should be reset *only* when:

- An unplanned correction takes place following the occurrence of a given Risk.
- or-
- A planned correction takes place to mitigate the occurrence of a given Risk.

It is important to note that source Risks that are mitigated as a result of Special Action with a TTF replacement or Preventive Maintenance will not trigger any additional Risks to be reset.

Continuing with our previous example, suppose that:

- You will replace the Seal *in addition to* the Bearing when the *Bearing failure* Risk occurs.
- or-
- The planned correction that you perform to mitigate the effect of the *Bearing failure* Risk will *also* mitigate the occurrence of the *Seal failure* Risk.

In this case, you want to indicate in your simulation that the *Bearing failure* Risk (i.e., the source Risk) should reset the *Seal failure* Risk (i.e., an additional Risk). In other words, the time that the Seal has been in-service will *also* be changed to zero (0) to reflect that the Seal was replaced (or repaired to as good as new) when the *Bearing failure* Risk occurs or is mitigated as a result of planned correction.

You can manage the additional Risks that you should be reset by a source Risk via the **Risk to Reset** dialog box or the shortcut menu in the **Risks** pane on the **Asset Strategy Optimization Scenarios- Risks** page. You can specify *any* Risk that is defined for an asset as a source Risk or an additional Risk, with a few exceptions.

Rules for Resetting Risks

When you set up a simulation to include source and additional Risks, it is important to keep in mind the following rules:

- You can specify a Risk as a source Risk if the failure type for that Risk is:
 - Failure With Replacement
 - or-
 - Failure Without Replacement
- You can specify a Risk as an additional Risk only if the failure type for that Risk is *Failure With Replacement*.

Keep in mind that in the simulation, only Risks whose failure type is *Failure With Replacement* are reset following a planned or unplanned correction. Risks whose failure type is *Failure Without Replacement* are not be reset following a planned or unplanned correction because the components associated with these Risks are not replaced (or repaired to as good as new). Specifically, this means that a Risk whose failure type is *Failure Without Replacement*:

- Can be specified as a *source* Risk. In other words, the planned or unplanned correction of these Risks can trigger additional Risks to be reset, if the failure type of the additional Risks is *Failure With Replacement*.
- *Cannot* be specified as *additional* Risks. In the **Risks to Reset** grid on the **Risks to Reset** dialog box, rows containing Risks whose failure type is *Failure Without Replacement* are disabled.

For example, suppose that the following Risks with the following failure types are defined for a *Shell and Tube Heat Exchanger* asset:

- A Tube Bundle Failure Risk whose failure type is *Failure Without Replacement*.

- A Shell Head Failure Risk whose failure type is *Failure With Replacement*.
- A Seals (gaskets) Failure Risk whose failure type is *Failure With Replacement*.

Now suppose that when you complete planned or unplanned correction for the *Tube Bundle Failure* Risk, though you will not replace (or repair to as good as new) the Tube Bundle, you *will* replace (or repair to as good as new) the Seals (gaskets). In this case, you want to indicate in your simulation that the *Tube Bundle Failure* Risk is a source Risk that should trigger the resetting of the *Seals (gaskets) Failure* Risk (i.e., an additional Risk). In other words, the time that the Seal (gasket) has been in service will be changed to zero (0) to reflect that the Seal (gasket) will be replaced (or repaired to as good as new) following the planned or unplanned correction of the *Tube Bundle Failure* Risk.

Interpreting Simulation Results That Include Source and Additional Risks

The results for a simulation will appear differently depending upon whether or not the simulation includes source and additional Risks. It is important that you understand how to interpret simulation results that include source and additional Risks. When you set up a simulation to include source and additional Risks, you should keep in mind the information listed in this topic. This documentation assumes that you are familiar with System Risk records and their role in an ASO Analysis.

- If an unplanned correction causes a source Risk and any additional Risk to be reset, in the simulation results, the Failure associated with the unplanned correction of the source Risk will be attributed *only* to the source Risk.
- If a planned correction of a source Risk triggers additional Risks to be reset, in the simulation results, the following values will be attributed to each individual Risk:
 - Planned correction cost
 - Planned resource usages
 - Downtime

Downtime for each Risk will be calculated based upon the planned correction duration for that Risk.

- If an unplanned correction of a source Risk, triggers additional Risk to be reset, in the simulation results, the following values will be attributed to each individual Risk:
 - Fixed unplanned correction cost
 - Variable unplanned correction cost
 - Unplanned resource usage
 - Downtime

Variable unplanned correction cost and downtime for each Risk will be calculated based upon the TTR distribution for that Risk.

- If planned or unplanned correction of a source Risk triggers additional Risks to be reset, in the simulation results, the System Asset record to which the System Risk records are linked will be populated with the *largest* downtime value of all the Risks (i.e., source and additional). For example, suppose the following Risks are defined for a *Water pump* asset:
 - A *Bearing failure* Risk that is a source Risk, and whose downtime value is *1 day*.
 - A *Seal Failure* Risk that is an additional Risk, and whose downtime value is *2 days*.

In this case, after the *Bearing failure* Risk resets the *Seal Failure* Risk will be reset, and in the simulation results, a downtime value of *2 days* will be attributed to the *Water pump* asset.

- If planned or unplanned correction has started for an additional Risk, and then planned or unplanned correction starts for the source Risk that resets that additional Risk, the additional Risk will be reset only once as a result of its own planned or unplanned correction. The additional Risk will not be reset two times as a result of its own planned or unplanned correction and the planned or unplanned correction of the source Risk. This will be reflected in the simulation results.

The Risks to Reset Dialog Box

Overview of the Risks to Reset Dialog Box

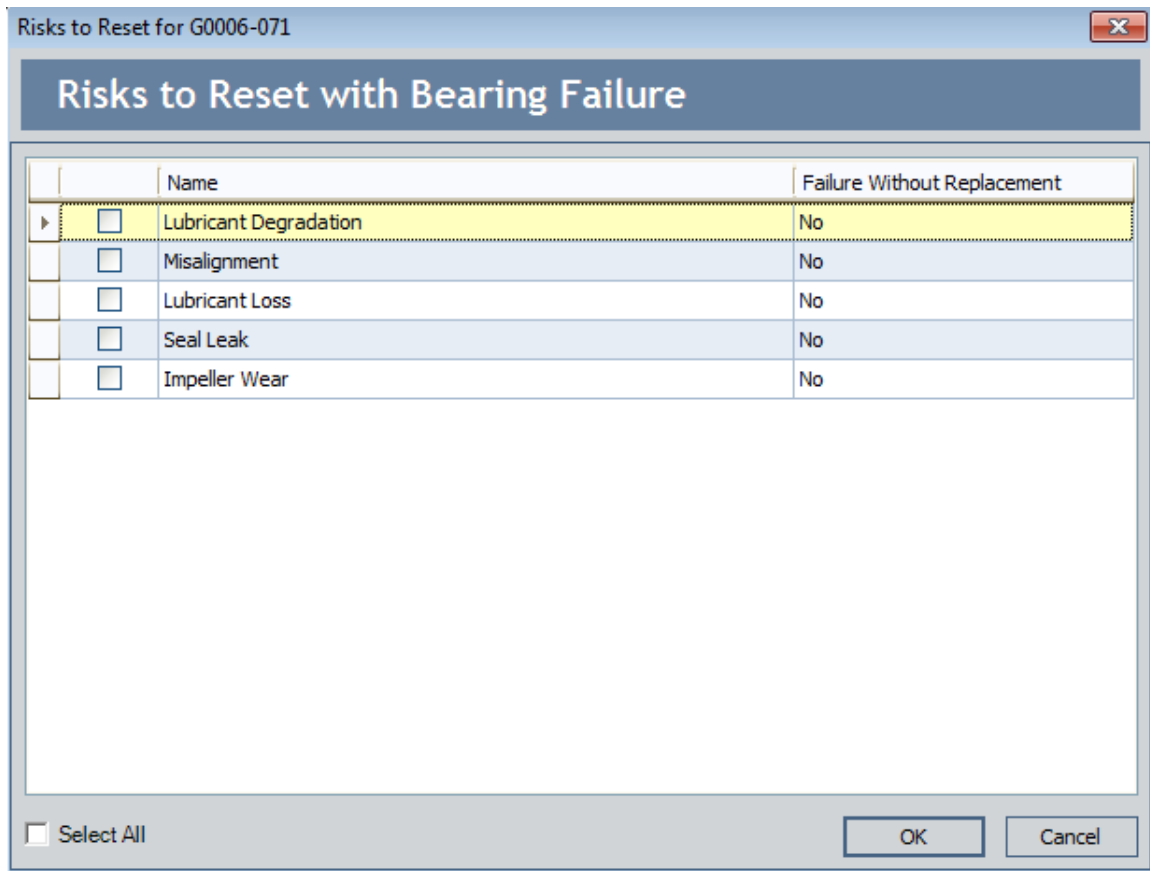
Using the **Risks to Reset** dialog box, you can specify per source Risk the additional Risks that should be reset following the planned or unplanned correction of that Risk.

The **Risks to Reset for <Asset ID>** dialog box contains the **Risks to Reset <Risk ID>** grid, where:

- **<Asset ID>** is the Entity ID of the System Asset record represented by the Asset element and to which the System Risk record is linked.
- **<Risk ID>** is the value stored in the Name field in the System Risk record of the source Risk for which you are specifying additional Risks to be reset.

Throughout this documentation, we refer to the **Risks to Reset for <Asset ID>** dialog box as the **Risks to Reset** dialog box, and we refer to the **Risks to Reset for <Risk ID>** grid as the **Risks to Reset** grid.

Consider the following image, which shows an example of what the **Risks to Reset** dialog box looks like when you access it from a *Bearing failure* Risk that is defined for the Asset element *G0006-071*.



In this image, you can see that the **Risks to Reset** grid displays the Risks that are defined for the Asset element *G0006-071*. You can select these Risks to specify that the *Bearing failure* Risk (i.e., the source Risk) should reset additional Risks in the simulation.

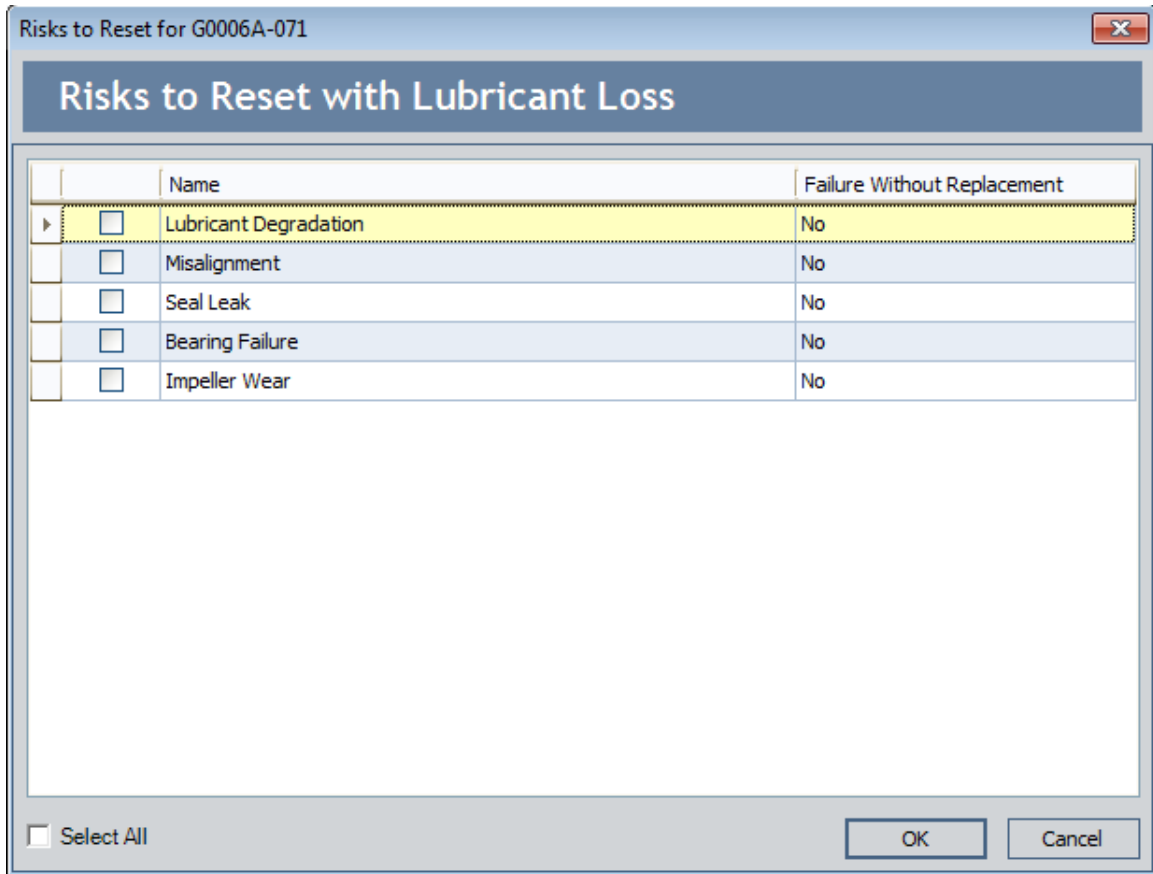
Using the Risks to Reset Dialog Box

You can use the **Risks to Reset** dialog box to select the additional Risks that a source Risk should reset. You can access the **Risks to Reset** dialog box by clicking the hyperlinked number in the **Risks to Reset** cells in the:

- Risks pane on the **Asset Strategy Optimization Scenarios - Risks** page.
- Mitigated Risks pane on the **Asset Strategy Optimization Scenarios - Actions** page.

You can modify selections on the **Risks to Reset** dialog box only when it is accessed via the **Asset Strategy Optimization Scenarios - Risk** page. If you access the **Risks to Reset** dialog box via the **Asset Strategy Optimization Scenarios - Actions** page, all the options will be disabled. The following image

shows the Risks to Reset dialog box as it appears when you access it from the Asset Strategy Optimization Scenarios - Risks page.



The Risks to Reset dialog box contains the Risks to Reset grid, which displays all the Risks that are defined for the selected Asset element, except for the currently selected Risk, whose ID appears in the title above the grid. This is the source Risk.

Each row in the grid represents one Risk. For each Risk that is displayed in the grid, the following columns appear and contain values from the underlying System Risk record:

- **Name:** Displays the value stored in the Name field in the System Risk record.
- **Failure Without Replacement:** Displays one of the following read-only selections that is stored in the Failure Without Replacement field in the System Risk record:

- **No:** Indicates that the failure type for the Risk in that row is *Failure With Replacement*. Risks with this failure type can be selected as an additional Risk to be reset.
- **Yes:** Indicates that the failure type for the Risk in that row is *Failure Without Replacement*. Risks with this failure type *cannot* be selected as an additional Risk to be reset, and rows in the grid for these Risks will be disabled.

An additional, unlabeled column containing a check box appears to the left of the **Name** column and lets you select the Risks that should be reset by the source Risk.

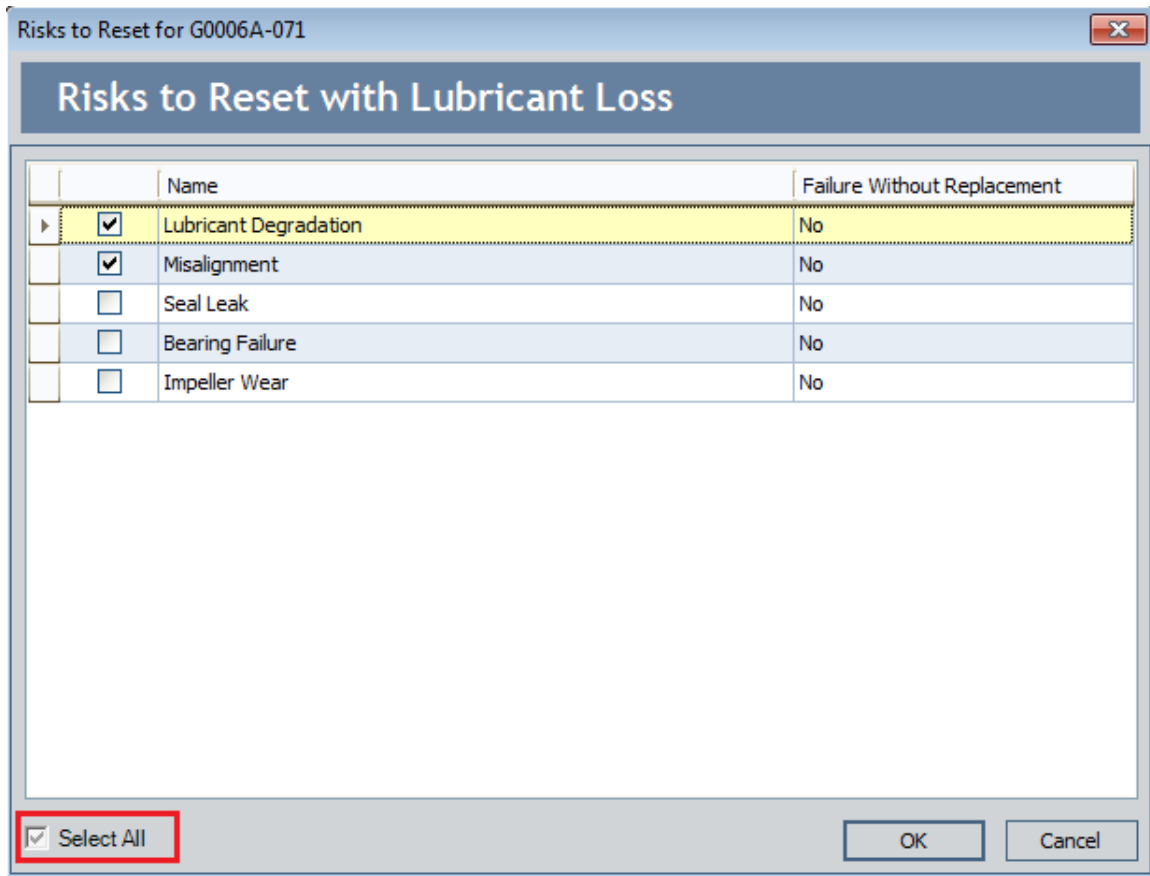
Below the grid, the **Select All** check box appears, which you can use to:

- Select *all* the Risks that are defined for the piece of equipment or location.

-or-

- Clear *all* the currently selected Risks.

If one or more check boxes are selected in the grid (but not all), the **Select All** check box will be selected and colored gray. For example, the following image shows how the **Select All** check box appears in this case. A red outline has been added to the image to highlight this check box. You can clear the gray **Select All** check box to clear all the currently selected check boxes.

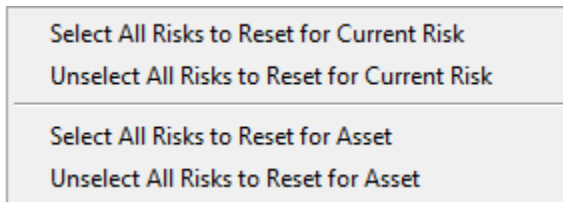


In addition, the following buttons are available on the **Risks to Reset** dialog box:

- **OK:** Saves your changes and closes the **Risks to Reset** dialog box.
- **Cancel:** Closes the **Risks to Reset** dialog box and discards your changes.

The Shortcut Menu in the Risk Pane

When you right-click any cell in the **Risks** pane on the **Asset Strategy Optimization Scenarios - Risks** page, a shortcut menu appears, as shown in the following image. This menu contains options that you can use to manage the **Risks** that you want to be reset by a source **Risk**. The source **Risk** is determined by the row from which you access the shortcut menu.



The shortcut menu in the Risks pane contains the following options:

- **Select All Risks to Reset for Current Risk:** Specifies that ALL the Risks defined for the equipment should be reset by the selected source Risk.
- **Unselect All Risks to Reset for Current Risk:** Specifies that *none* of the Risks defined for the equipment should be reset by the selected source Risk.
- **Select All Risks to Reset for Asset:** Specifies that ANY Risk defined for the equipment should reset ALL the remaining Risks defined for the equipment.
- **Unselect All Risks to Reset for Asset:** Specifies that *none* of the Risks defined for the equipment should be reset by any other Risk defined for the equipment.

Specifying Risks to Reset

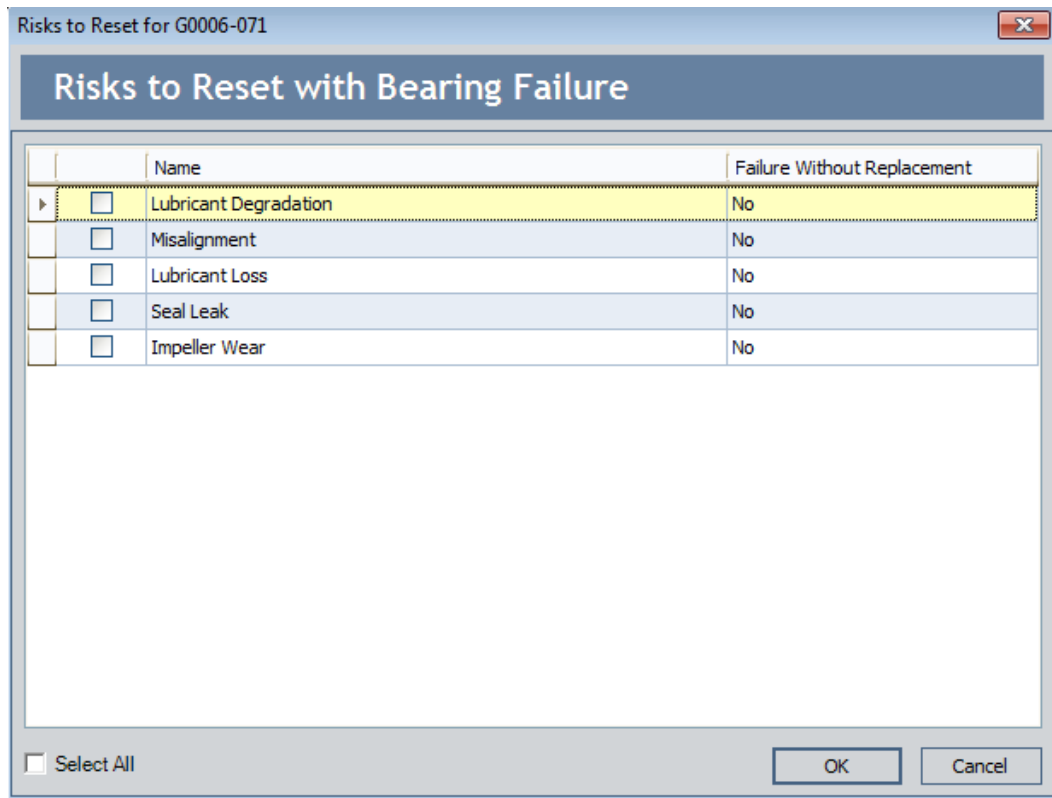
The following instructions provide details on specifying which additional Risks should be reset by a source Risk, using the **Risks to Reset** dialog box. When you specify that a Risk should be reset, the time in-service for the component associated with the Risk will be changed to zero (0) in the simulation, following the planned or unplanned correction of the source Risk.

These instructions assume that you are viewing the desired ASO Analysis on the **Asset Strategy Optimization Scenarios - Risks** page. Additionally, if you are viewing a System or Unit Strategy, these instructions assume that the desired Asset element is selected in the **Diagram Hierarchy** pane.

To specify Risks to reset:

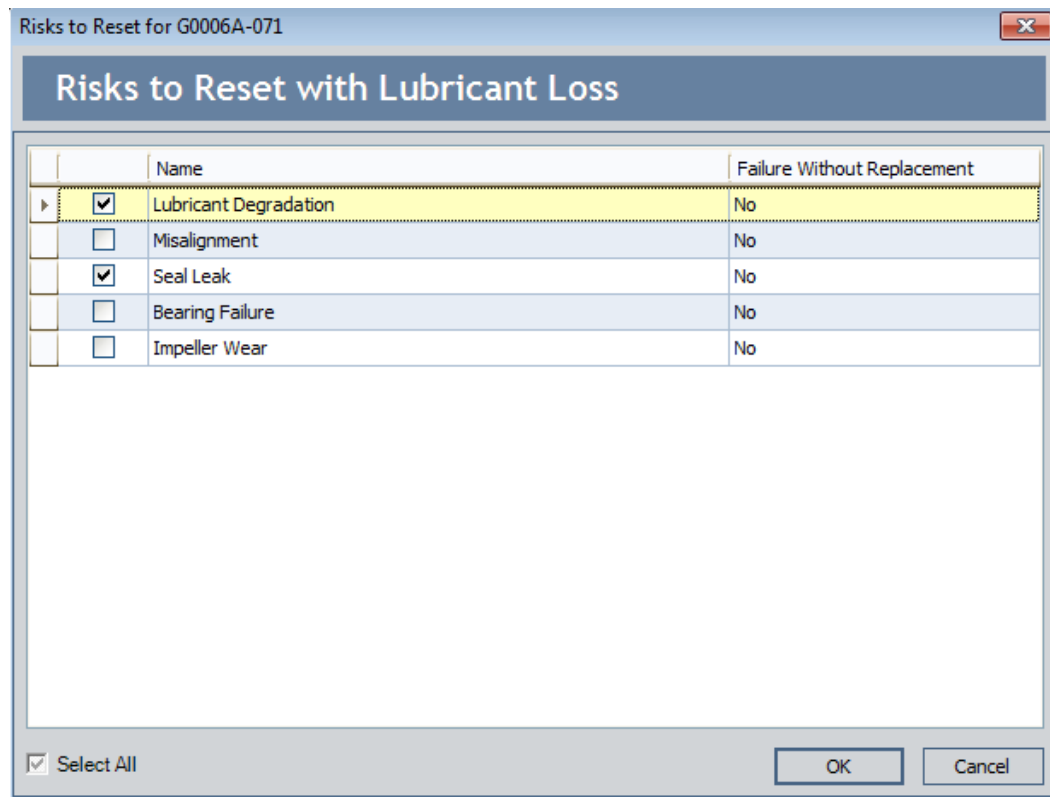
1. In the Risks pane, locate the row containing the desired source Risk.
2. In the Risks to Reset cell, click the hyperlinked number.

The Risks to Reset dialog box appears.



3. In the Risks to Reset grid, select the check box in the row containing each additional Risk that you want to be reset by the source Risk.

In the following image, you can see that the *Lubricant Degradation* and *Seal Leak* Risks are selected to be reset by the *Lubricant Loss* Risk.



Hint: You can use the **Select All** check box to select *all* the Risks defined for the piece of equipment or location.

4. Click OK.

The Risks to Reset dialog box closes, and the hyperlinked in the Risks to Reset cell for the source Risk changes to reflect the number of additional Risks you selected. When you run the simulation, the time in-service for the components associated with the additional Risks will be changed to zero (0), following the planned or unplanned correction of the source Risk.



In the following image, you can see that the hyperlinked number in the Risks to Reset cell for the *Lubricant Loss* Risk is 2, indicating that the *Lubricant Loss* Risk resets two additional Risks. The Risks to Reset cell has been outlined in red to highlight this value.

Flag	Name	Descr...	TTF	TTR	Planned Resource Usages	Unplanned Resource ...	Qualitative Consequ...	Risks to Reset
▶	Lubricant Loss		TTF Distribution	TTR Distribution	Planned Resource Usages	Unplanned Resource Us...	102	2
	Misalignment		TTF Distribution	TTR Distribution	Planned Resource Usages	Unplanned Resource Us...	102	0
	Lubricant Degradation		TTF Distribution	TTR Distribution	Planned Resource Usages	Unplanned Resource Us...	102	0
	Impeller Wear		TTF Distribution	TTR Distribution	Planned Resource Usages	Unplanned Resource Us...	102	0
	Bearing Failure		TTF Distribution	TTR Distribution	Planned Resource Usages	Unplanned Resource Us...	102	0
	Seal Leak		TTF Distribution	TTR Distribution	Planned Resource Usages	Unplanned Resource Us...	210	0

In the example used in these instructions, when you run the simulation, the time that the Lubricant and the Seal has been in service will be changed to zero (0), following the planned or unplanned correction of the *Lubricant Loss* Risk to reflect that the Seal and the Lubricant were replaced (or repaired to as good as new).

Updating Risks to Reflect the Active Scenario

If a Scenario contains a System Risk record whose values are different from the corresponding System Risk record in the Active Scenario, you can update the System Risk record in the non-Active Scenario so that its values are identical to the values in the corresponding System Risk record in the Active Scenario. You can update a System Risk record only if an Asset element is selected in the **Diagram Hierarchy** pane and the selected System Risk record is somehow different from the corresponding System Risk record.

You will know that a System Risk record is somehow different from the corresponding System Risk record in the Active Scenario if the row in which it appears contains the  icon or the  icon.

Note: Before you update a System Risk record, you might want to click the **Show Changes** button so that you can see how the System Risk record in this Scenario differs from the one in the Active Scenario.

To update a Risk record, you must be logged in as Super User or a member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.




To update a System Risk record so that its values match the values in the corresponding System Risk record in the Active Scenario:

1. While viewing the desired non-Active Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the Asset element whose System Risk record you want to update.
2. In the grid in the **Risks** pane, select the System Risk record that you want to update.
3. Below the grid in the **Risks** pane, click the **Undo Risk** button.

The System Risk record is updated so that its values are identical to the values in the corresponding System Risk record in the Active Scenario.

Viewing Differences Between Proposed Risks and Active Risks

About Viewing Differences Between Proposed Risks and Active Risks

If a non-Active Scenario contains a System Risk record whose values or values in related records are different from the corresponding records in the Active Scenario, you can view the differences between those records. You will know that a System Risk record or a related record is somehow different in the Active Scenario if the row in which it appears contains the  icon or the  icon. You can view the differences, however, only if the row contains the  icon.

You can view these differences on the **Changes for <Risk>** dialog box, where **<Risk>** is the value stored in the Name field in the corresponding System Risk record. You can access this dialog box from the **Show Changes** button in the **Risks** pane on the **Asset Strategy Optimization Scenarios - Risks** page, when a Risk is selected in the grid. The **Changes for <Risk>** dialog box contains a grid that contains the following information:

- **Field:** The field whose value differs from the value in the same field in the corresponding record in the Active Scenario.
- **Old Value:** The value in the Active Scenario, with the exception of the following fields:
 - Planned Resource Usages
 - Unplanned Resource Usages
 - Related Risks

Instead, these cells indicate that changes were made to the data in these areas for the Risk. To see the specific changes, you will need to open the corresponding records.

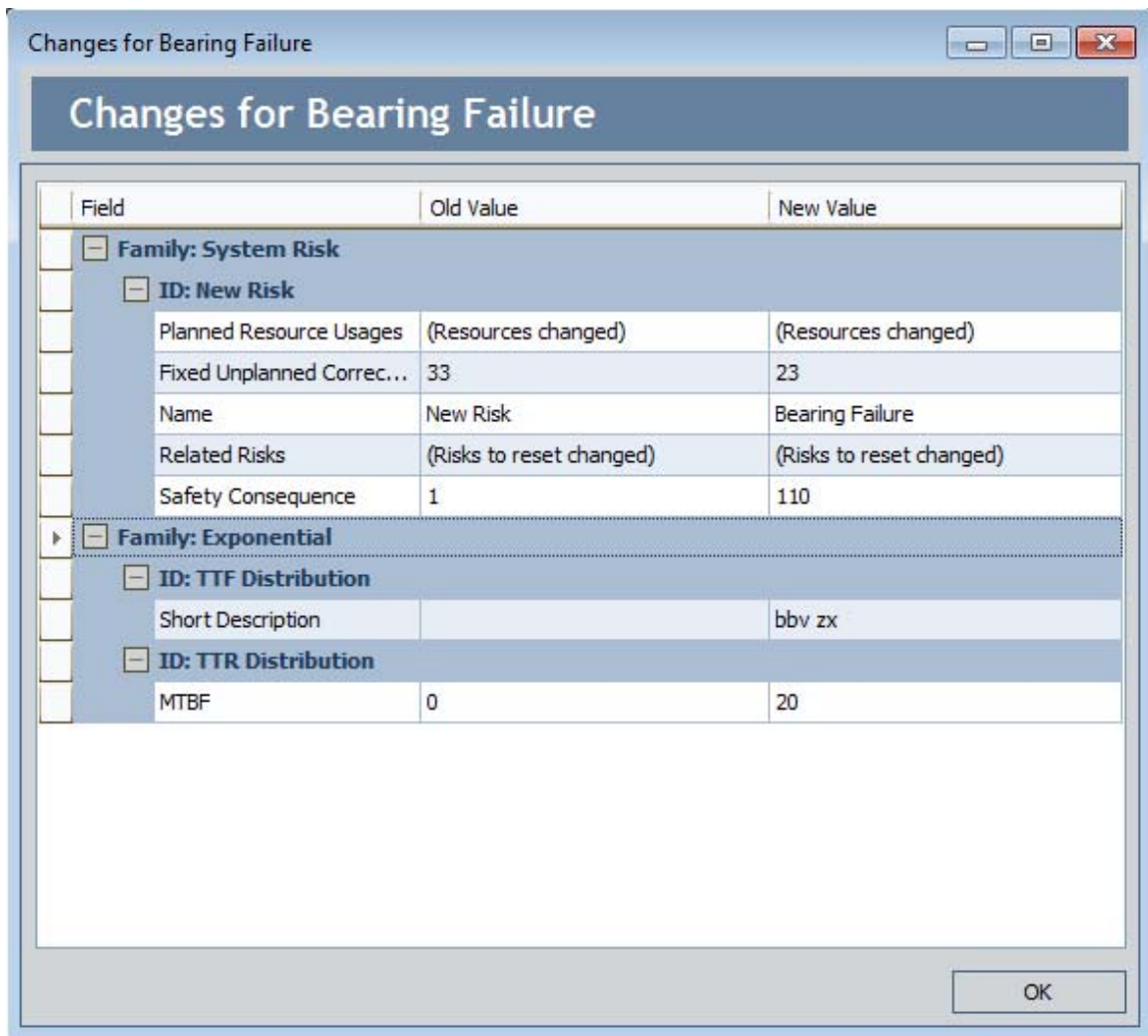
- **New Value:** The value in the non-Active Scenario, with the exception of the following fields:
 - Planned Resource Usages
 - Unplanned Resource Usages

- Related Risks

Instead, these cells indicate that changes were made to the data in these areas for the Risk. To see the specific changes, you will need to open the corresponding records.

The rows in the grid are grouped by family name, and then by record ID.

The following image shows what the **Changes for <Risk>** dialog box looks like when you are viewing changes for a *Bearing Failure* Risk.



Accessing the Changes for <Risk Name> Dialog Box

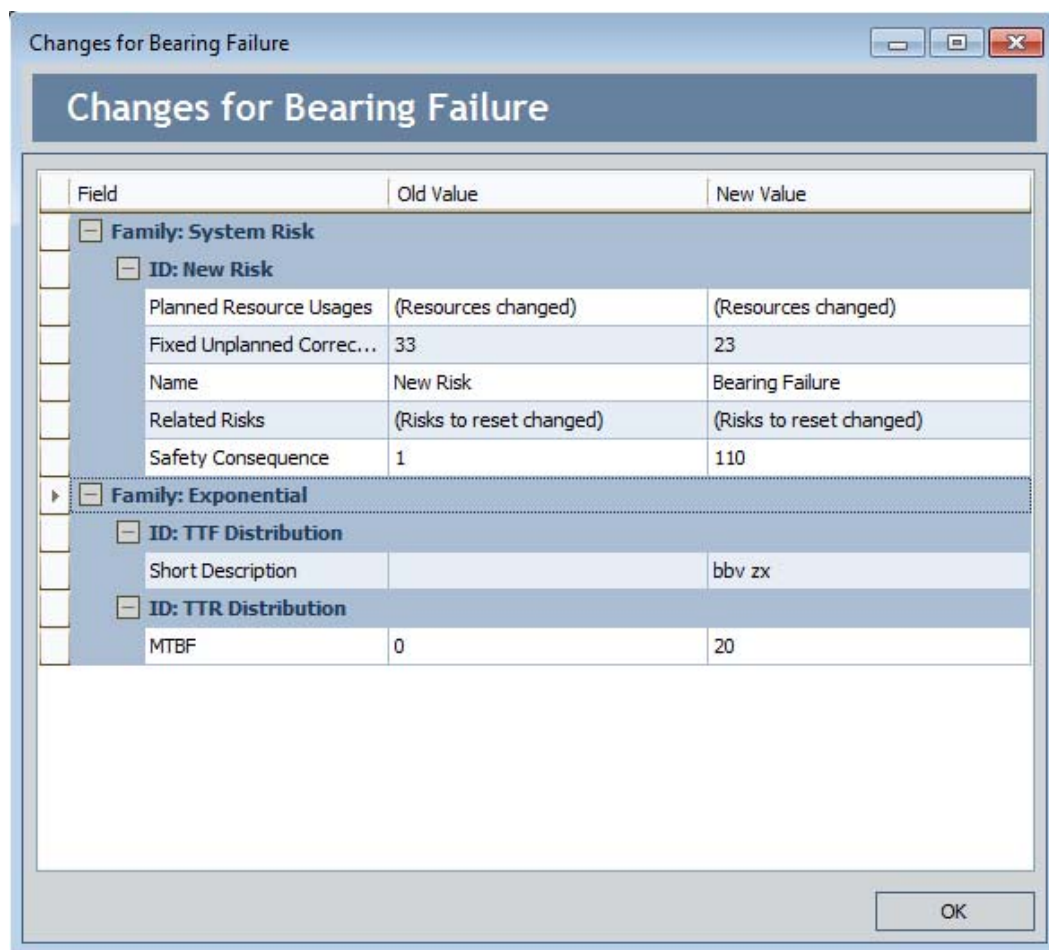
If a non-Active Scenario contains a System Risk record whose values or values in related records are different from the Active Scenario, you can view the

differences between those records using these instructions. After you review the differences, if desired, you can update the System Risk record in the current Scenario so that its values will match the values in the Active Scenario.

To access the Changes for <Risk name> window:

1. While viewing the desired non-Active Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the Asset element whose System Risk records you want to view.
2. In the **Risks** pane, select the row containing the Risk whose differences you want to view.
3. Below the grid, click the **Show Changes** button.

The Changes for <Risk> dialog box appears.



Deleting Risks

To delete a Risk, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

Note: You can delete a Risk only in a non-Active Scenario.

To delete a Risk:

1. While viewing the desired non-Active Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the element whose Risk you want to delete.
2. In the grid in the **Risks** pane, select the Risk that you want to delete.
3. Below the grid in the **Risks** pane, click the **Delete Risk** button.

A confirmation message appears, asking if you really want to delete the Risk.

4. Click the **Yes** button.

The Risk is removed from the grid on the **Asset Strategy Optimization Scenarios - Risks** page.

Managing Actions

About Actions

In an ASO Analysis, an *Action* represents an operation that can be performed against a piece of equipment or location. Actions can represent inspections, general maintenance, or specific events that mitigate Risks. Using an action to mitigate a risk can help to improve reliability and efficiency by minimizing downtime and lost production costs.

Actions can be unique events that happen only once during a simulation period, or they can be repeated at certain times during the simulation period. You can optionally assign resources to actions to associate a specific cost with the action. When you assign resources to actions, a System Resource Usage record will be created.

Actions in ASO Analyses are stored in the following records:

- **System Condition Monitor Records:** Store information about continuous, condition-based maintenance Actions.
- **System Inspection Records:** Store information about periodic, condition-based maintenance Actions.
- **System Preventive Maintenance Records:** Store information about time-based maintenance Actions.
- **System Special Action Records:** Store information about procedural, redesign, or training Actions.

Features of the Asset Strategy Optimization Scenarios - Actions Page

Diagram Hierarchy Pane

The **Diagram Hierarchy** pane on the **Asset Strategy Optimization Scenarios - Actions** page displays the elements in the Diagram that can have Actions associated with them. In the following image, the **Diagram Hierarchy** pane is outlined in red.

The screenshot shows the 'Asset Strategy Optimization Scenarios - Actions' interface. On the left, the 'Diagram Hierarchy' pane is outlined in red, showing a tree structure of assets under 'FCC-DB', with 'G0005-098' selected. The main area displays a table of actions for this asset, with columns for Flag, Name, Description, and Resource Usages. Below the actions table is a 'Mitigated Risks' table showing a risk for 'Lubricant De...' with a score of 502.

Flag	Name	Description	Resource Usages
▶	Change Lubricant	Perform changeout of lubricant	Resource Usages
	Check Lubrication	Perform check of lubricant, add or change oil w...	Resource Usages
	Internal Inspection	Disassemble and inspect internals for wear. Incl...	Resource Usages
	Vibration Analysis	Perform full spectrum vibration monitoring. Esta...	Resource Usages
	Lube Oil Analysis	Perform lube oil analysis. Establish action levels...	Resource Usages
	Motor Test	Inspect and test motor current	Resource Usages
	Operational Check	Verify proper operation. Qualitative observatio...	Resource Usages

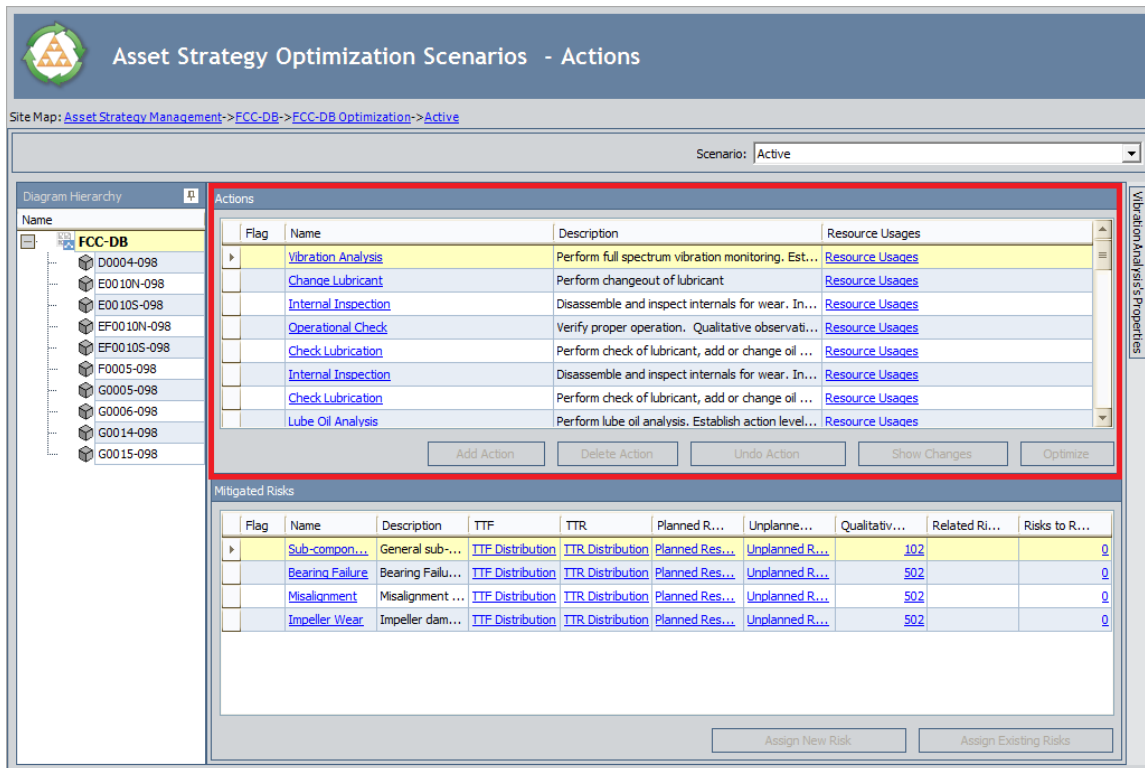
Flag	Name	Description	TTF	TTR	Planned R...	Unplanne...	Qualitativ...	Related RI...	Risks to R...
▶	Lubricant De...		TTF Distribution	TTR Distribution	Planned Res...	Unplanned R...	502		0

When you select an element in the **Diagram Hierarchy** pane, the Actions that are currently defined for that element are displayed in the **Actions** pane. For example, in this image, the selected *G0005-098* asset has seven associated Actions:


- Change Lubricant
- Check Lubrication
- Internal Inspection
- Vibration Inspection
- Lube Oil Analysis
- Motor Test
- Operational Check



Actions Pane

The **Actions** pane is displayed on the **Asset Strategy Optimization Scenarios - Actions** page and on the **Actions Editor** window. It displays the Actions that are associated with the element that is selected in the **Diagram Hierarchy** pane. In the following image, the **Actions** pane is outlined in red.



The grid in the Actions pane displays the following columns of information:

- **Flag:** Contains an icon indicating the status of the System Action record relative to the corresponding System Action record that belongs to the Active Scenario.
 - If you are viewing System Action records that belongs to the Active Scenario (i.e., the Scenario list above the grid contains the value *Active*), the Flag column will not contain an icon.
 - If you are viewing System Action records that belongs to a non-Active Scenario (i.e., the Scenario list above the grid does not contain the value *Active*) and the System Action record is identical to the corresponding System Action record in the Active Scenario, the Flag column will not contain an icon.
 - If you are viewing System Action records that belongs to a non-Active Scenario (i.e., the Scenario list above the grid does not contain the value *Active*) and the System Action record does not have a corresponding System Action record in the Active Scenario, the Flag column will contain the  icon.

- If you are viewing System Action records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) and the System Action record is different from the corresponding System Action record in the Active Scenario, the **Flag** column will contain the  icon.
- If you are viewing System Action records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) whose System Scenario record was created from scratch (i.e., the System Scenario was not copied from another System Scenario record), the **Flag** column will contain the  icon.
- **Name:** Displays the value that exists in the Name field in the System Action record.
- **Description:** Displays the value that exists in the Description field in the System Action record.
- **Resource Usages:** Displays the **Resource Usages** link, which provides access to any Resources that have been assigned to the Action.

Below the grid in the **Actions** pane, the following buttons appear:

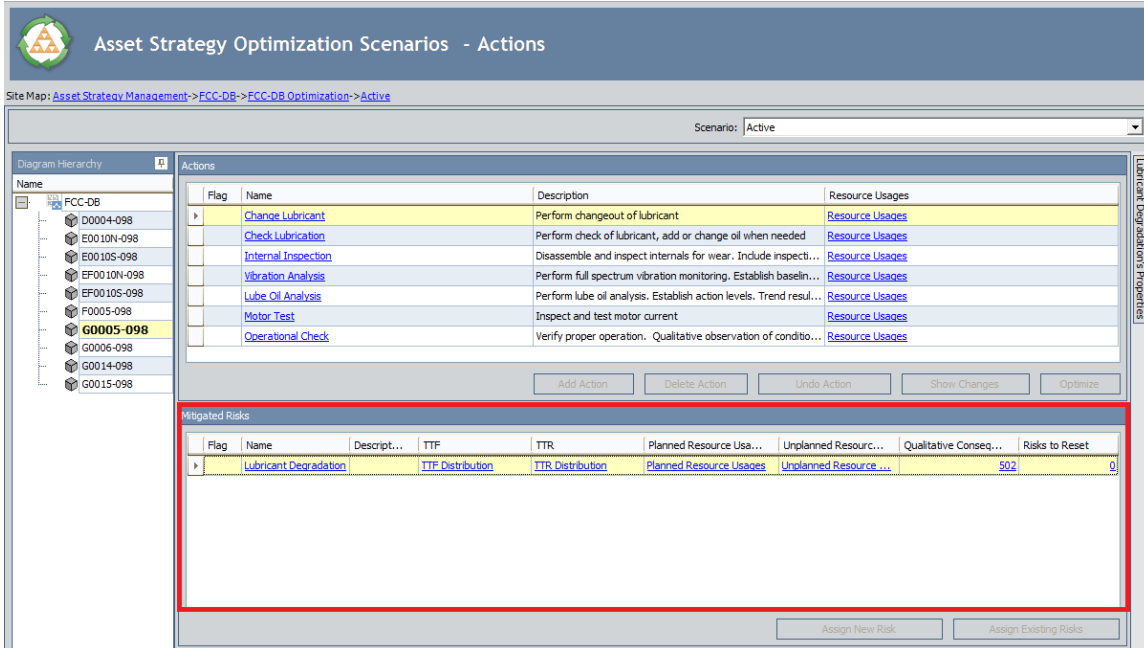
- **Add Action:** Displays the **Select Action Type** dialog box, where you can create a new System Action record to link to the current System Asset or System Switch record. This button is always disabled if you are viewing Actions that belong to the Active Scenario. To add Actions, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The documentation assumes that you have the privileges that are required to perform the task.
- **Delete Action:** After asking for confirmation, deletes the System Action record that is currently selected in the **Actions** pane. To delete Actions, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The documentation assumes that you have the privileges that are required to perform the task.
- **Undo Action:** Causes the System Action record to be updated so that its values are identical to the values in the corresponding System Action record in the Active Scenario. Before you click the **Undo Risk** button, you might want to click the **Show Changes** button so that you can see how the System Action record in this Scenario differs from the one in the

Active Scenario. This button is always disabled if you are viewing Actions that belong to the Active Scenario. If you are viewing Actions that belong to any other Scenario, this button is enabled only if an Asset element is selected in the **Diagram Hierarchy** pane and the Action is somehow different from the corresponding Action in the Active Scenario. This option is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.


- **Show Changes:** Displays the **Changes for <Action>** window, where <Action> is the value in the Name field in the selected System Action record. You can use this window to see the differences that exist between values in this System Action record and values in the corresponding System Action record in the Active Scenario. This button is always disabled if you are viewing Actions that belong to the Active Scenario. If you are viewing Actions that belong to any other Scenario, this button is enabled only if an Asset element is selected in the **Diagram Hierarchy** pane and the Action is somehow different from the corresponding Action in the Active Scenario.
- **Optimize:** Displays the **Action Interval Optimization** window, where you can find the optimal interval at which to implement an Action.


Mitigated Risks Pane


The **Mitigated Risks** pane is displayed on the **Asset Strategy Optimization Scenarios - Actions** page and on the **Actions Editor** window. It displays the Risks that are mitigated by the Action that is selected in the **Actions** pane. In the following image, the **Mitigated Risks** pane is outlined in red.



The Mitigated Risks pane displays the following columns of information:

- **Flag:** Contains an icon indicating the status of the System Risk record relative to the corresponding System Risk Assessment record that belongs to the Active Scenario.
 - If you are viewing System Risk records that belongs to the Active Scenario (i.e., the Scenario list above the grid contains the value *Active*), the Flag column will not contain an icon.
 - If you are viewing System Risk records that belongs to a non-Active Scenario (i.e., the Scenario list above the grid does not contain the value *Active*) and the System Risk record is identical to the corresponding System Risk Assessment record in the Active Scenario, the Flag column will not contain an icon.
 - If you are viewing System Risk records that belongs to a non-Active Scenario (i.e., the Scenario list above the grid does not contain the value *Active*) and the System Risk record does not have a corresponding System Risk Assessment record in the Active Scenario, the Flag column will contain the  icon.
 - If you are viewing System Risk records that belongs to a non-Active Scenario (i.e., the Scenario list above the grid does not contain the value *Active*) and the System Risk record is different

from the corresponding System Risk Assessment record in the Active Scenario, the **Flag** column will contain the  icon.

- If you are viewing System Risk records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) whose System Scenario record was created from scratch (i.e., the System Scenario was not copied from another System Scenario record), the **Flag** column will contain the  icon.
- **Name:** Displays the value that exists in the Name field in the System Risk record. This value appears as a hyperlink that you can click to open the datasheet for that System Risk record.
- **Description:** Displays the value that exists in the Description field in the System Risk record.
- **TTF:** Displays the **TTF Distribution** link. You can click this link to open the **TTF Distribution** window, where you can view and modify the Time to Failure (TTF) distribution data for the associated System Risk record.
- **TTR:** Displays the **TTR Distribution** link. You can click this link to open the **TTR Distribution** window, where you can view and modify the Time to Repair (TTR) distribution data for the associated System Risk record.
- **Planned Resource Usages:** Displays the **Planned Resource Usages** link, which you can click to open the **Planned Resource Usages** window and view any planned Resources that have been assigned to the Risk.
- **Unplanned Resource Usages:** Displays the **Unplanned Resource Usages** link, which you can click to open the **Unplanned Resource Usages** window and view any unplanned Resources that have been assigned to the Risk.
- **Qualitative Consequence:** Displays a hyperlinked numeric value, which you can click to open the **Qualitative Consequence Editor** window.
- **Risks to Reset:** Displays a number representing the number of additional Risks that will be reset in the simulation following the planned or unplanned correction of the Risk in that row. This number appears as a hyperlink, which you can click to access the **Risks to Reset** dialog box, where you can view the additional Risks that will be reset in the simulation following the planned or unplanned correction of the source

Risk. For details on managing Risks to reset, see the section of this documentation on managing Risks to reset.

Below the **Mitigated Risks** grid, the following buttons appear:

- **Assign New Risk:** Displays the **New Risk** window, where you can create a new Risk that will be mitigated by the Action that is currently selected in the **Actions** pane. This option is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Assign Existing Risks:** Displays the **Assign Risks** window, where you can assign an existing Risk to be mitigated by the Action that is currently selected in the **Actions** pane or remove an existing Risk from being mitigated by the Action that is currently selected in the **Actions** pane. This option is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.

Creating Actions

About Creating System Action Records

When you create an Action in an ASO Analysis, a record is created in a subfamily of the System Action family. The Meridium APM system determines the specific family in which to create the record based upon:

- Your selections in the **Action Type** and **Condition Monitoring Type** lists on the **Select Action Type** dialog box.
- AND-
- The values that exist in System Action Mapping records.

After you select values on the **Select Action Type** dialog box, the Meridium APM system searches all System Action Mapping records for a record with identical values in the Action Type and Condition Monitoring fields, respectively. When it finds a record with matching values, the Meridium APM system creates a System Action record in the family whose caption appears in the ASO Action Type field in that System Action Mapping record.

About the Select Action Type Dialog Box

The **Select Action Type** dialog box lets you specify the type of Action that you want to create using the combination of values that you select in the **Action Type** and **Condition Monitoring Type** lists.

Before you can create an Action, however, you will need to access the **Select Action Type** dialog box. You can do so via the following methods:

- If you want to create a new Action and assign it to an element without assigning it to a Risk, on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the element to which you want to add an Action, and then click the **Add Action** button, which appears below the grid on the **Actions** pane.

-OR-

- If you want to create a new Action and assign it to an element and a Risk, on the **Asset Strategy Optimization Scenarios - Risks** page, in the **Diagram Hierarchy** pane, select the element that contains the Risk to which you want to assign an Action, and then click the **Assign New Action** button, which appears below the grid in the **Mitigated Actions** pane.

The following table shows the values that you can select in the **Action Type** and **Condition Monitoring Type** lists and the record in the System Action subfamily that will be created, based up on the combination of values that you specify.

Note: The **Condition Monitoring Type** list appears only if you select *Condition-Based Maintenance (Predictive) (CM)* in the **Action Type** list.

Selecting this Action Type Value:	...and this Condition Monitoring Type Value:	...Creates this record:
Condition-Based Maintenance (Predictive) (CM)	Periodic	System Inspection
Condition-Based Maintenance (Predictive) (CM)	Continuous	System Condition Monitor
Procedure (PROC)	n/a*	System Special Action

Selecting this Action Type Value:	...and this Condition Monitoring Type Value:	...Creates this record:
Redesign (DSN)	n/a*	System Special Action
Time-Based Maintenance (Preventive) (PM)	n/a*	System Preventive Maintenance
Training (TRN)	n/a*	System Special Action

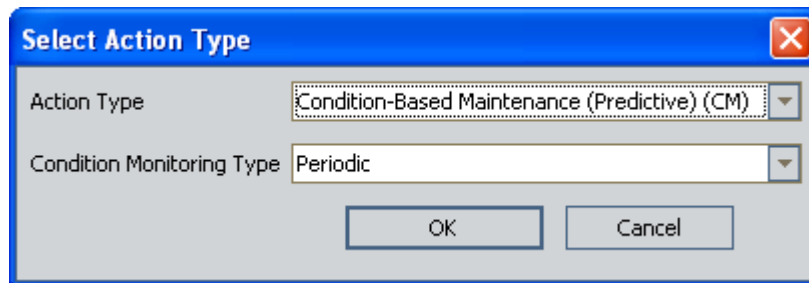
For example, if you create an Action by selecting *Condition-Based Maintenance (Predictive) (CM)* in the **Action Type** list and *Continuous* in the **Condition Monitoring Type** list, a System Condition Monitor record will be created.

Creating System Condition Monitor Records

To create a new System Condition Monitor record:

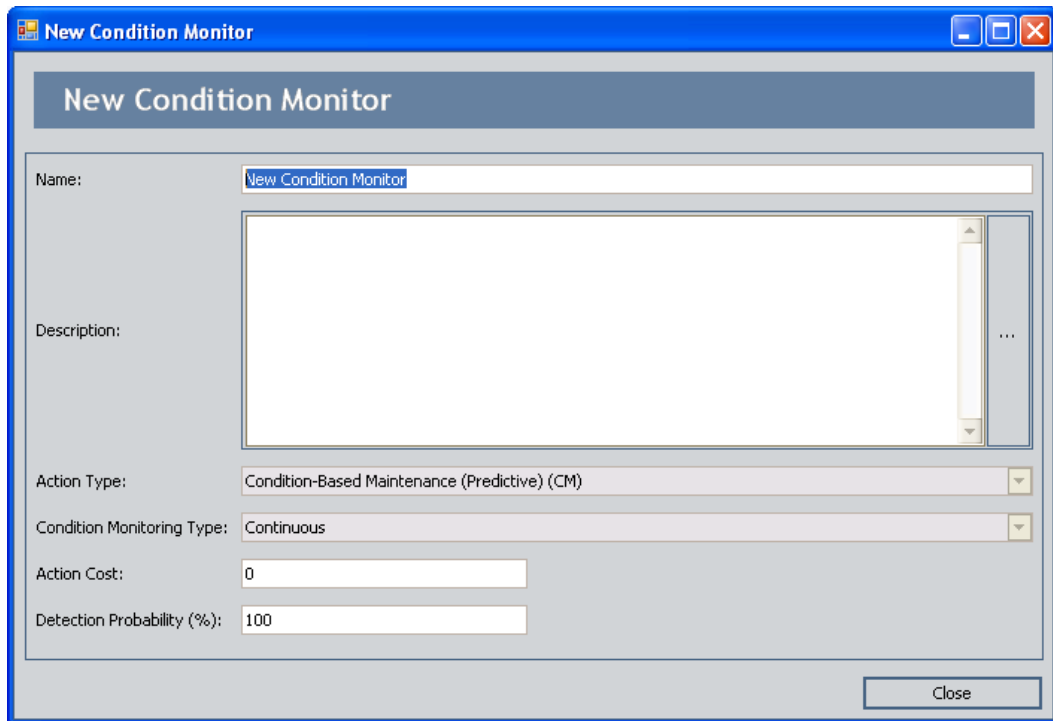
1. Using the desired method, access the **Select Action Type** dialog box.

The **Select Action Type** dialog box appears.



2. In the **Action Type** list, select **Condition-Based Maintenance (Predictive) (CM)**.
3. In the **Condition Monitoring Type** list, select **Continuous**.
4. Click **OK**.

The **New Condition Monitor** window appears.



5. In the fields on the **New Condition Monitor** window, define the values of the System Condition Monitor record as desired.
6. Click **OK**.

The System Condition Monitor record is saved, and the new Action appears in the **Actions** grid.

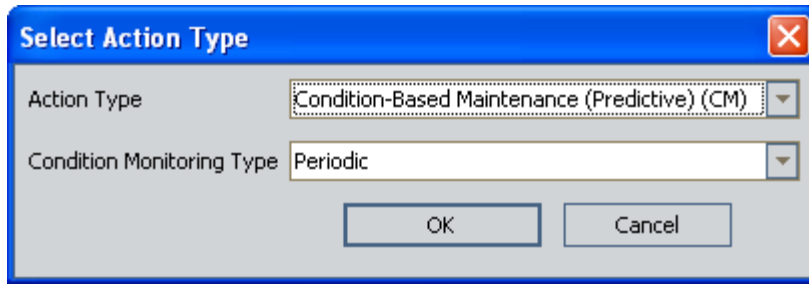
Hint: If desired, in the grid in the **Actions** pane, you can click the **Resource Usages** hyperlink to assign Resources to the Action.

Creating System Inspection Records

To create a new System Inspection record:

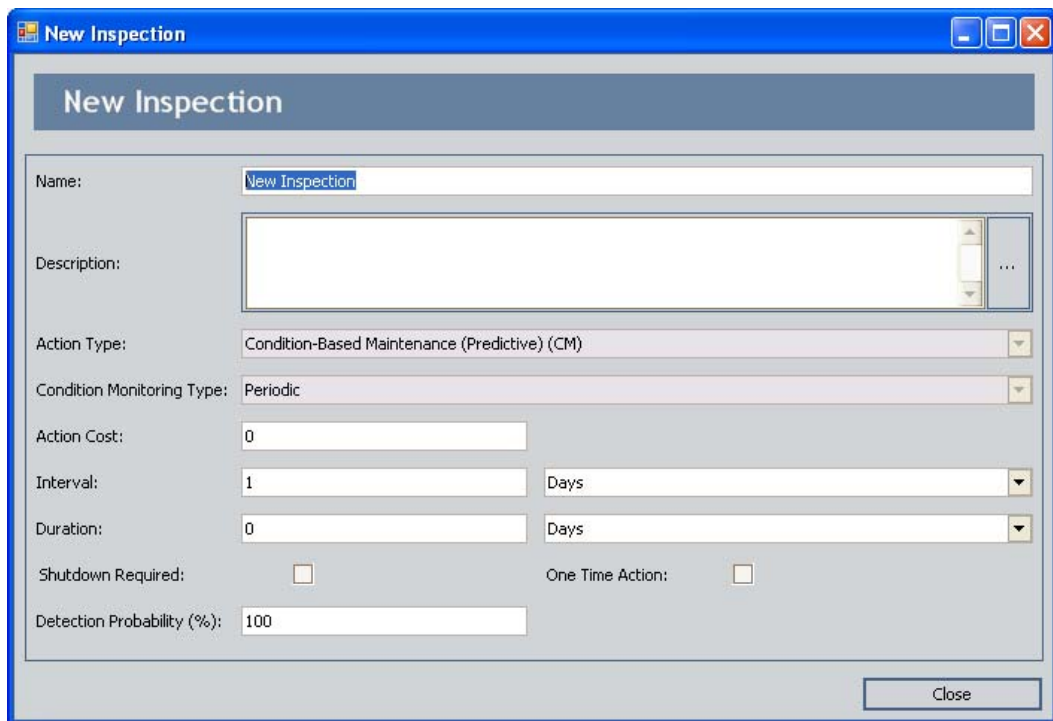
1. Using the desired method, access the **Select Action Type** dialog box.

The **Select Action Type** dialog box appears.



2. In the Action Type list, select Condition-Based Maintenance (Predictive) (CM).
3. In the Condition Monitoring Type list, select Periodic.
4. Click OK.

The New Inspection window appears.



5. In the fields on the New Inspection window, define the values of the System Inspection record as desired.
6. Click OK.

The System Inspection record is saved, and the new Action appears in the Actions grid.

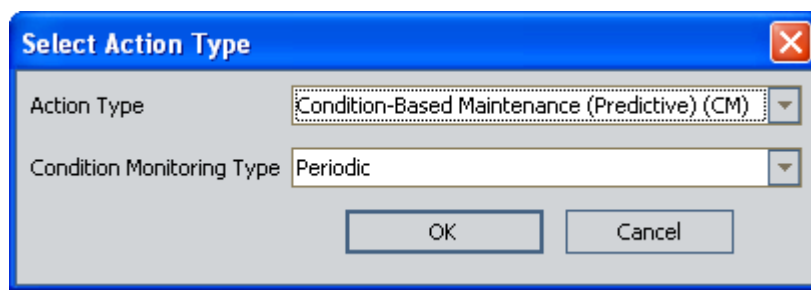
Hint: If desired, in the grid in the Actions pane, you can click the **Resource Usages** hyperlink to assign Resources to the Action.

Creating System Preventive Maintenance Records

To create a new System Preventive Maintenance record:

1. Using the desired method, access the **Select Action Type** dialog box.

The **Select Action Type** dialog box appears.



2. In the **Action Type** list, select **Time-Based Maintenance (Preventive)(PM)**.

The **Condition Monitoring Type** list is hidden.

3. Click **OK**.

The **New Preventive Maintenance** window appears.

The screenshot shows a dialog box titled "New Preventive Maintenance". It contains the following fields and controls:

- Name:** A text box containing "New Preventive Maintenance".
- Description:** A large empty text area.
- Action Type:** A dropdown menu currently showing "Time-Based Maintenance (Preventive) (PM)".
- Condition Monitoring Type:** An empty dropdown menu.
- Action Cost:** A text box containing "0".
- Interval:** A text box containing "1" and a dropdown menu set to "Days".
- Duration:** A text box containing "0" and a dropdown menu set to "Days".
- Shutdown Required:** A checked checkbox.
- One Time Action:** An unchecked checkbox.
- Close:** A button at the bottom right.

4. In the fields on the **New Preventative Maintenance** window, define the values of the System Preventative Maintenance records as desired.
5. Click **OK**.

The System Preventive Maintenance record is saved, and the new Action appears in the **Actions** grid.

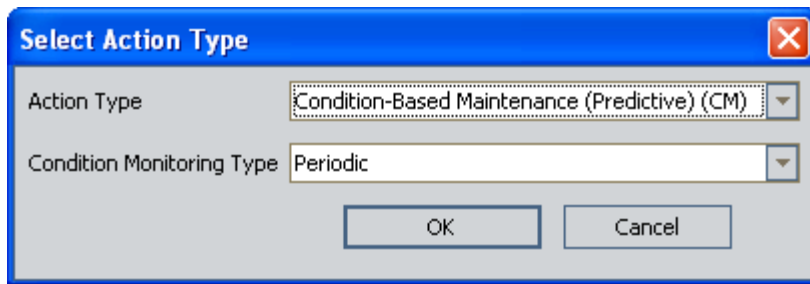
Hint: If desired, in the grid in the **Actions** pane, you can click the **Resource Usages** hyperlink to assign Resources to the Action.

Creating System Special Action Records

To create a new System Special Action record:

1. Using the desired method, access the **Select Action Type** dialog box.

The **Select Action Type** dialog box appears.



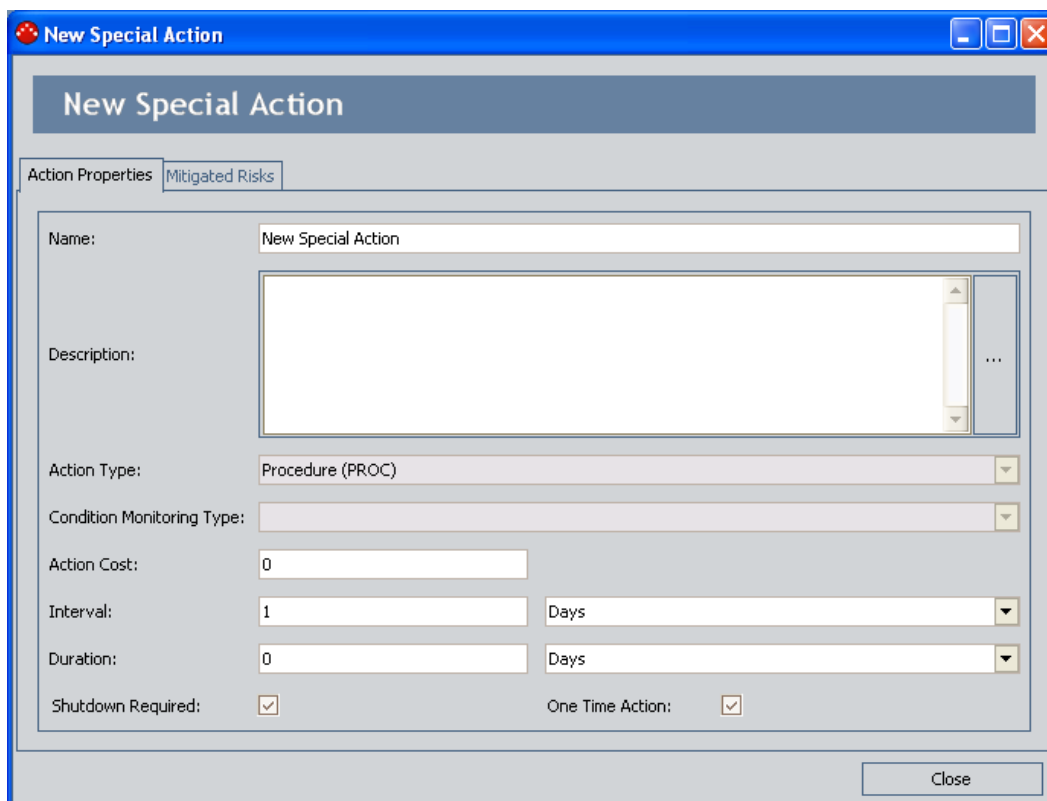
2. In the Action Type list, select one of the following values:

- Procedure (PROC)
- Redesign (DSN)
- Training (TRN)

The Condition Monitoring Type list is hidden.

3. Click OK.

The New Special Action window appears.



4. In the fields on the **Action Properties** tab, define the values of the New Special Action record as desired.
5. Click the **Close** button.

The System Special Action record is saved, and the new Action appears in the **Actions** grid.

Hint: If desired, in the grid in the **Actions** pane, you can click the **Resource Usages** hyperlink to assign Resources to the Action.

Assigning Existing Actions to Risks

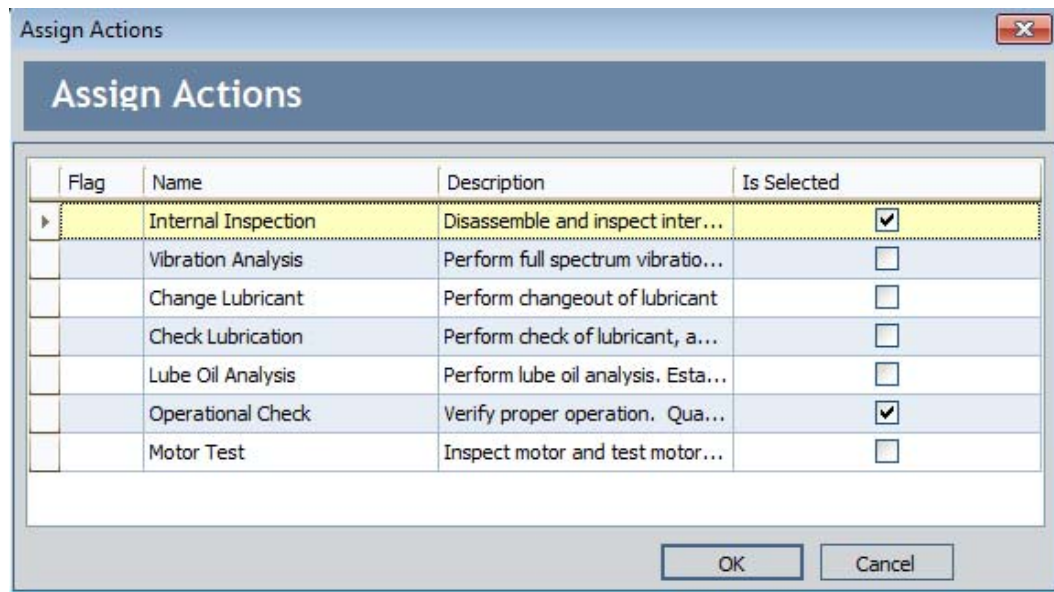
To assign Actions to a Risk, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

Note: You can assign existing Actions to Risks for Scenarios in a state other than *Active*.

To assign one or more existing Actions to a Risk:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Risks** page, select the Risk to which you want to assign an existing Action.
2. Below the grid in the **Mitigating Actions** pane, click the **Assign Existing Actions** button.

The **Assign Actions** window appears.



3. In the Is Selected column of the grid, select the check box for the Action(s) that you want to assign.

Note: You can remove any Action that is currently assigned to the Risk by clearing the Is Selected check box.

4. Click OK.

The Action(s) are assigned and appear in the grid in the Mitigating Actions pane.

Working with the <Special Action> Window

Overview of the <Special Action> Window

When you view an existing System Special Action record, it appears in the <Special Action> window, where <Special Action> is the name of the Action as it appears in the Name field in the System Special Action record.

Using the <Special Action> window, you can:

- View and modify the System Special Action record.
- View a list of System Risk Assessment records that are linked to the System Special Action record.

Additionally, for each System Risk Assessment record, you can specify the failure consequence and TTF Distribution values that you want to use in the simulation.

The <Special Action> window contains the following tabs:

- **Action Properties:** Displays the System Special Action datasheet.
- **Mitigated Risks:** Displays the list of System Risk Assessment records that are linked to the Action and provides options that you can use to specify the failure consequence and TTF Distribution values that you want to be used in the simulation when a Special Action is completed to mitigate the occurrence of a given Risk.

The Mitigated Risks Tab

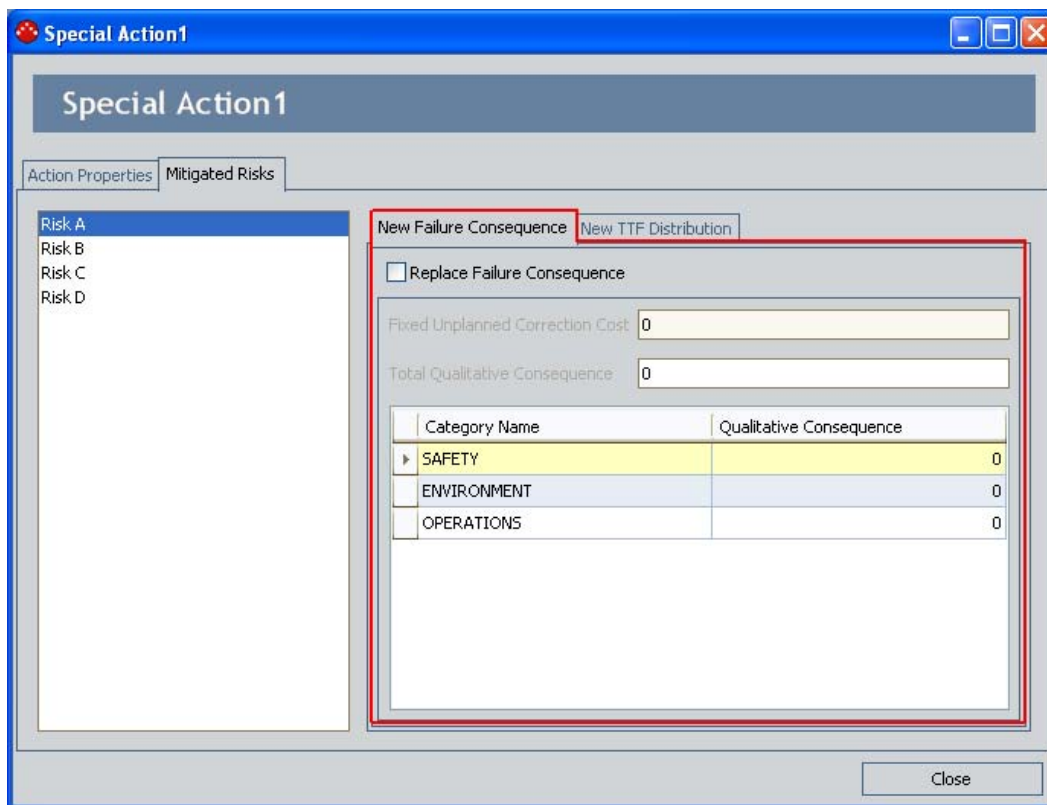
You can use the **Mitigated Risks** tab on the <Special Action> window to specify for each Mitigated Risk that is associated with the Special Action the Failure Consequence and TTF Distribution values that you want to be used in the simulation when the Special Action is completed to mitigate the occurrence of the given Risk.

To the left, the **Mitigated Risks** tab displays the list of Mitigated Risks that are associated with the Special Action. Each Mitigated Risk represents one System Risk Assessment record that is linked to the System Special Action record. For each Mitigated Risk that appears in the list to the left, the following items are displayed to the right:

- **New Failure Consequence tab:** Contains the following items:
 -
 - **Replace Failure Consequence check box:** Indicates that, for the selected Mitigated Risk, you want the simulation to use the Fixed Unplanned Correction Cost value and the Qualitative Consequence values that you specify below.
 - **Fixed Unplanned Correction Cost text box:** Stores the values that you want the simulation to use in place of the one that currently exists in the Fixed Unplanned Correction Cost field in the selected System Risk Assessment record. This text box is enabled only if the **Replace Failure Consequence** check box is selected.

- Total Qualitative Consequence:** Stores the value that you want the simulation to use in place of the Total Qualitative Consequence value that currently exists for the selected Mitigated Risk. This field is disabled and populated automatically with the sum of the individual values that appear in the table below the **Total Qualitative Consequence** text box. To modify this value, modify the individual values in the **Qualitative Consequence** cells in the table. The cells in the **Qualitative Consequence** column are enabled only when the **Replace Failure Consequence** check box is selected.

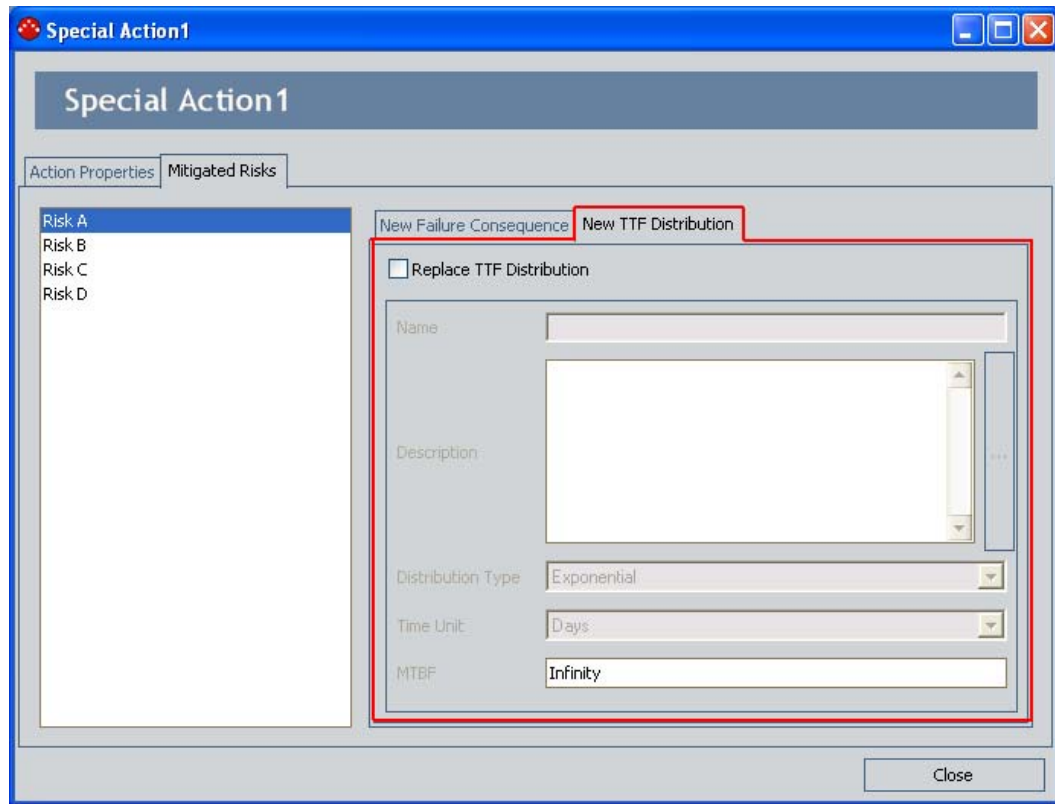
The following image shows an example of the **New Failure Consequence** tab. A red outline has been added to this image to highlight the tab.



- New TTF Distribution tab:** Contains the following items:
 - Replace TTF Distribution check box:** Indicates that, for the selected Mitigated Risk, you want the simulation to use the values that you specify in the Distribution fields below.

- **Distribution datasheet:** Contains the fields that appear in the Distribution record that is linked to the System Risk Assessment record. The fields on the datasheet are enabled only if the **Replace TTF Distribution** check box is selected. You can use these fields to store the values that you want to use when you run the simulation, in place of the values specified on the **TTF Distribution** dialog box for the System Risk record.

The following image shows an example of the **New TTF Distribution** tab. A red outline has been added to this image to highlight the tab.



Specifying Failure Consequence Values for the Simulation

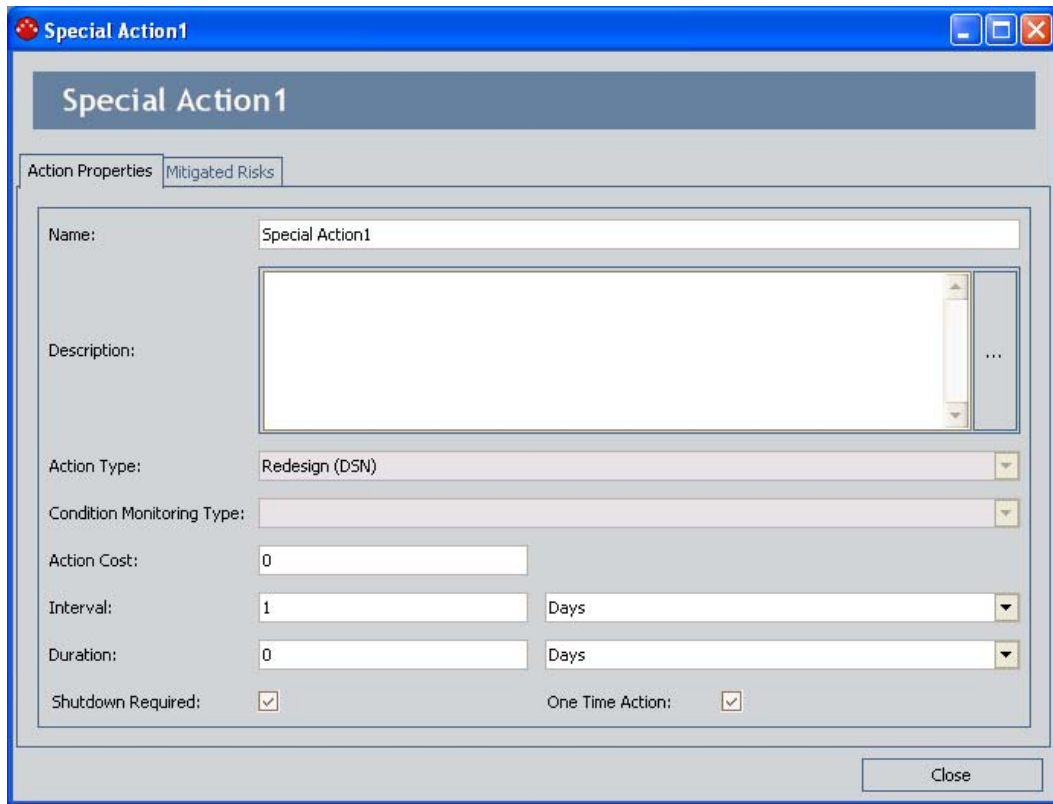
If desired, you can use the <Special Action> window to specify for each Mitigated Risk that is associated with the Special Action the Failure Consequence values that you want to be used in the simulation when the Special Action is completed to mitigate the occurrence of the given Risk.

To specify Failure Consequence values for the simulation:

1. On the **ASO - Asset Strategy Optimization Scenarios - Actions** page, in the **Actions** pane, locate the row containing the desired Special Action.

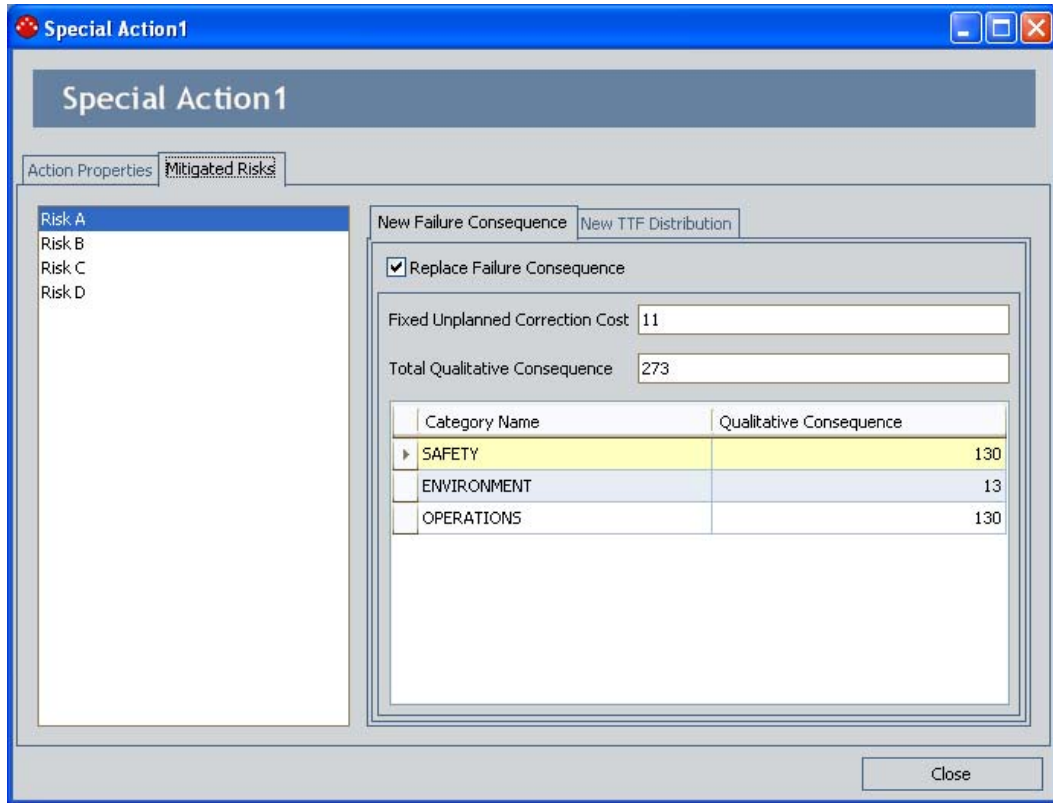
2. In the Name cell, click the hyperlinked name of the Special Action.

The <Special Action> window appears, where <Special Action> is the value that appears in the Name field in the System Special Action record.



3. Click the Mitigated Risks tab.

The Mitigated Risks tab appears.



4. In the list to the left, select the Mitigated Risk whose Failure Consequence values you want to specify for the simulation.
5. On the **New Failure Consequence** tab, select the **Replace Failure Consequence** check box.

The remaining fields are enabled.

6. In the remaining fields, modify the values as desired.
7. Repeat these steps for each Mitigated Risks whose failure consequence values you want to specify for the simulation, and then click the **Close** button.

Your changes are saved, and the values that you specified will be used the next time that the simulation is run.

Specifying TTF Distribution Values for the Simulation

If desired, you can use the <Special Action> window to specify for each Mitigated Risk that is associated with the Special Action the TTF Distribution

values that you want to be used in the simulation when the Special Action is completed to mitigate the occurrence of the given Risk.

To specify TTF Distribution values for the simulation:

1. On the **ASO - Asset Strategy Optimization Scenarios - Actions** page, in the **Actions** pane, locate the row containing the desired Special Action.
2. In the **Name** cell, click the hyperlinked name of the Special Action.

The **<Special Action>** window appears, where **<Special Action>** is the value that appears in the **Name** field in the System Special Action record.

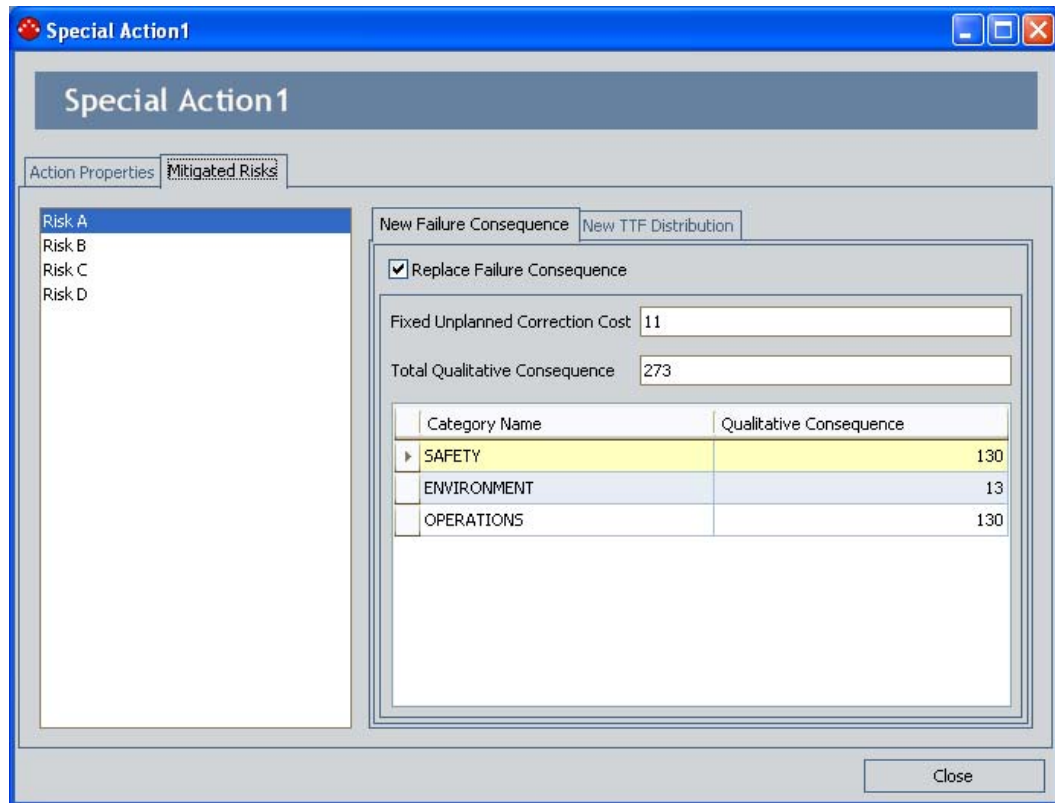
The screenshot shows a software window titled "Special Action1". It features a header bar with the text "Special Action1". Below the header, there are two tabs: "Action Properties" and "Mitigated Risks". The "Action Properties" tab is active and contains the following fields:

- Name:** Special Action1
- Description:** A large empty text area.
- Action Type:** Redesign (DSN)
- Condition Monitoring Type:** An empty dropdown menu.
- Action Cost:** 0
- Interval:** 1 Days
- Duration:** 0 Days
- Shutdown Required:**
- One Time Action:**

A "Close" button is located at the bottom right of the window.

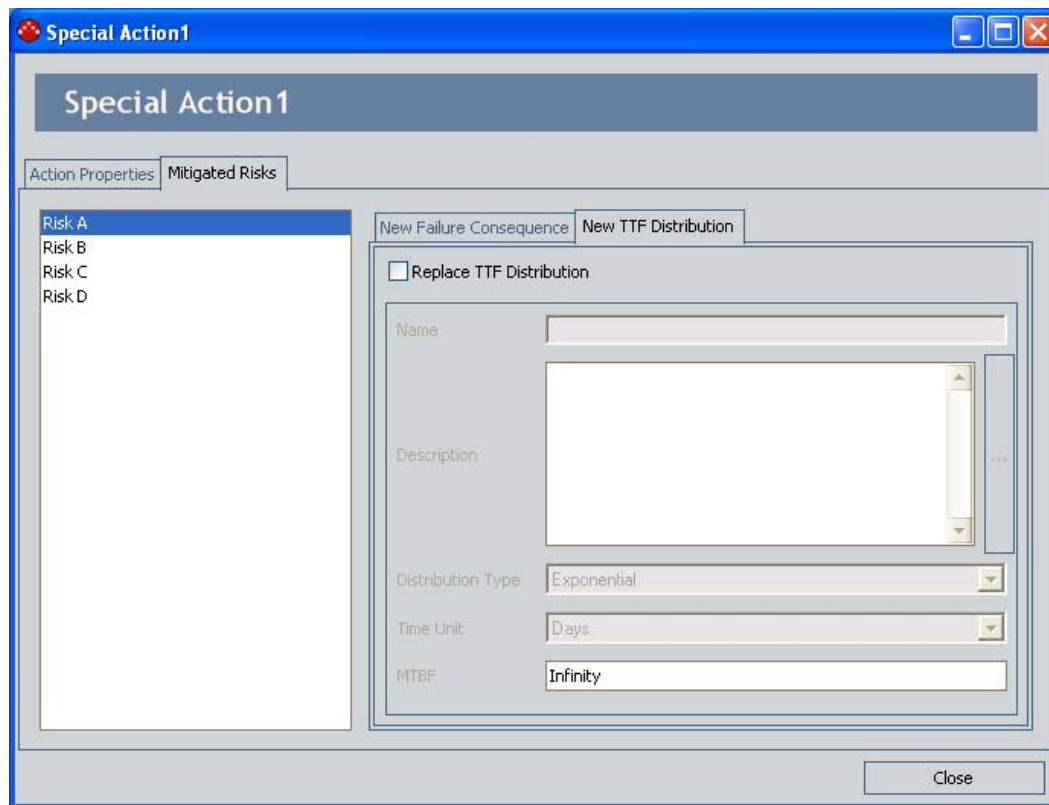
3. Click the **Mitigated Risks** tab.

The **Mitigated Risks** tab appears.



4. To the right, click the New TTF Distribution tab.

The New TTF Distribution tab appears.



5. In the list to the left, select the Mitigated Risk whose TTF Distribution values you want to specify for the simulation.
6. On the **New TTF Distribution** tab, select the **Replace TTF Distribution** check box.

The fields in the Distribution datasheet section are enabled.

7. In the remaining fields, modify the values as desired.
8. Repeat these steps for each Mitigated Risk whose TTF Distribution values you want to specify for the simulation, and then click the **Close** button.

Your changes are saved, and the values that you specified will be used the next time that the simulation is run.

Modifying Actions

Options for Modifying Actions

You can modify the values in a System Action record using either of the following pages:

- **Asset Strategy Optimization Scenarios - Actions** page.
- **Asset Strategy Optimization Scenarios - Grid** page.

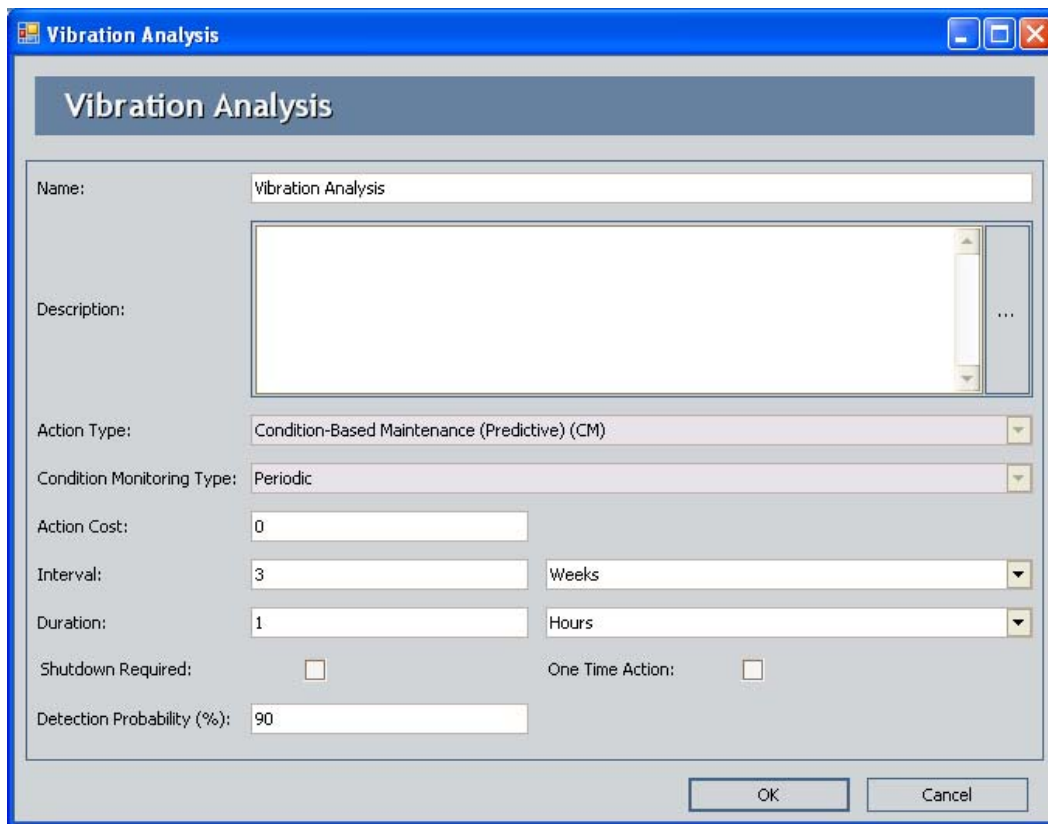
Modifying Actions Using the Actions Page

To modify Actions, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To modify an existing Action using the **Asset Strategy Optimization Scenarios - Actions** page:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the element that contains the Action that you want to modify.
2. In the grid in the **Actions** pane, click the hyperlinked name of the Action that you want to modify.

The <Action Name> window appears, where <Action Name> is the name of the Action that you selected.



The content of the **Vibration Analysis** window is controlled by the default datasheet for the System Inspection family.

3. Modify the fields in the System Action record as desired.
4. Click **OK**.

Your changes are saved.

Modifying Actions Using the Grid Page

To modify Actions, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To modify an Action using the Asset Strategy Optimization Scenarios - Grid page:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Grid** page, in the **Filter** list, select **Action**.

The grid is updated to display only the Actions that belong to that Scenario.

Name	Fixed Unplanned Correct...	Variable Unplanned Correct...	Variable Unplanned Corre...	...	Planned Correcti...	Planned Corre...	Planned Correction ...	PF...
Water Bottling Strategy			Per Day					
Bottling Strategy			Per Day					
Capping Machine St...			Per Day					
Caps run out.	450.00	0.00	Per Day	1 1 ...	0.00	0.00 Days	...	Days
Gears Break	360.00	0.00	Per Day	10 1 ...	0.00	0.00 Days	...	Days
Filling Machine Stra...			Per Day					
Gears Break	1,500.00	0.00	Per Day	10 1 ...	0.00	0.00 Days	...	Days
Nozzles wear out	900.00	0.00	Per Day	1 1 ...	0.00	0.00 Days	...	Days
Labeling Machine St...			Per Day					
Gears break	1,000.00	0.00	Per Day	... 1 ...	0.00	0.00 Days	...	Days
Labels run out	500.00	0.00	Per Day	1 1 ...	0.00	0.00 Days	...	Days
Water Collection Strategy			Per Day					
Water Pump Strategy			Per Hour					
Bearing Failure	2,000.00	600.00	Per Day	10 10 ...	1,000.00	3.00 Hours	...	We...
Impeller Failure	1,500.00	1,000.00	Per Day	10 10 ...	800.00	2.00 Hours	...	Days
Seal Failure	1,500.00	1,000.00	Per Day	1 1 ...	1,000.00	8.00 Hours	...	Days
Water Source Strat...			Per Day					
Water contains ...	8,000.00	0.00	Per Day	... 100 ...	0.00	0.00 Days	...	Days
Water level get...	5,300.00	0.00	Per Day	1 1 ...	0.00	0.00 Days	...	Days
Water Tank Strategy			Per Day					
Tank Corrodes	1,100.00	0.00	Per Day	1 1 ...	0.00	0.00 Days	...	Days
Tank Rusts	1,800.00	0.00	Per Day	10 10 ...	0.00	0.00 Days	...	Days

- 2. In the grid, in any cell containing a value that you want to modify, delete the current value, and type or select the desired value.
- 3. On the **Common Tasks** menu, click the **Save Analysis** link.

Your changes are saved.

Managing Resources for Actions

About Resources for Actions

After Resources exist for an ASO Analysis, you can assign them to Actions. When you do so, you associate the cost of that resource with each occurrence of the action. This allows you to assign a realistic cost to the action that can be included in the simulation results.

When you assign a Resource to an Action, a System Resource Usage record will be created and will store information that specifies how the Resource will be used (e.g., the quantity and duration).

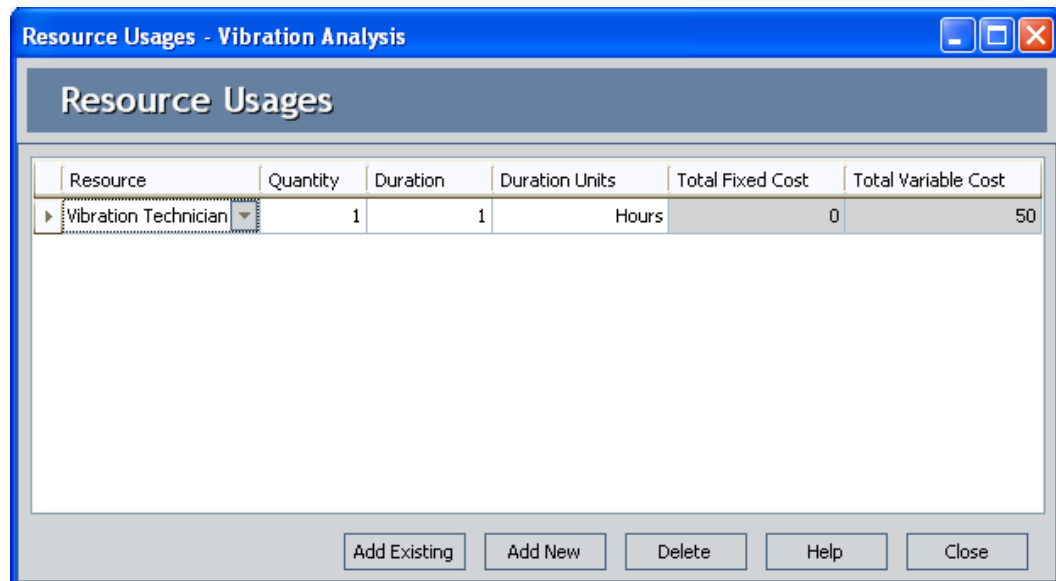
Assigning Resources to Actions

To assign Resources to Actions, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To assign a Resource to an Action:

1. While viewing the desired Active Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the element that contains the Action to which you want to assign a Resource.
2. In the grid in the **Actions** pane, in the row containing the Action to which you want to assign a Resource, click the **Resources Usages** link.

The **Resource Usages - <Action>** window appears, where **<Action>** is the name of the Action that you selected, displaying any Resources that are assigned to the Action.




In this image, the **Resource Usages - Vibration Analysis** window displays the Resources that are assigned to the Vibration Analysis Action.

3. Click the **Add Existing** button. This button will be enabled only if one or more Resources already exist for the analysis.

A new row appears in the grid.

Note: You can click the **Add New** button to create a Resource from scratch and assign it to an Action. After you have created the Resource, you can skip to step 5.

4. In the **Resource** cell of the first row, click the  button, and select the Resource you want to assign to the Action.
5. Type the desired values in the **Quantity**, **Duration**, and **Duration Units** cells. These values will be used to populate the corresponding fields in the System Resource Usage record.

Note: The **Total Fixed Cost** and **Total Variable Cost** columns display the actual value that will be incurred when the System Resource Usage is added to the Simulation Results. Since this value is a product of the values you enter on into the **Resource** dialog box and **Resource Usage** window, the cells are disabled and you cannot type values in these cells.

6. Click the **Close** button.

The **Resource Usages - <Action>** window closes, and the selected Resources are assigned to the Action.

Modifying Resource Assigned to Actions

When you modify a Resource assignment, you are modifying the *System Resource Usage record*. The actual System Resource record is not changed. To modify a Resource assignment, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To modify a Resource assigned to an Action:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the element whose Action has Resources that you want to modify.
2. In the grid in the **Actions** pane, in the row containing the Action whose Resources you want to modify, click the **Resource Usages** link.

The **Resource Usages - <Action>** window appears, where **<Action>** is the name of the Action that you selected.

3. In the **Resource Usages** grid, modify the properties of the Resource Usage record as desired.
4. Click the **Close** button.

Your changes are saved.

Removing Resources from Actions

When you remove a Resource from an Action, you delete the *System Resource Usage record* so that the Resource is not used by the selected Action. The actual System Resource record is still available for the ASO Analysis and can be used again if needed. To remove a Resources from an Action, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To remove a Resource from an Action:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the Action whose Resource assignment you want to remove.
2. In the grid in the **Actions** pane, in the row containing the Action whose Resource assignments you want to remove, click the **Resource Usages** link.

The **Resource Usages - <Action>** window appears, where <Action> is the name of the Action that you selected.

3. In the **Resource Usages** grid, select the Resource Usage record that you want to delete.
4. Click the **Delete** button.

A confirmation message appears, asking if you really want to delete the selected item(s).

5. Click the **Yes** button.

The Resource Usage is removed from the grid, and the System Resource Usage record is deleted from the database.

6. Click the **Close** button.

The **Resource Usages - <Action>** window closes.

About Optimizing Actions

About Optimizing Actions

In an ASO Analysis, you can *optimize Actions* to determine the most efficient interval at which to perform inspection or preventive maintenance Actions. The optimal interval balances the cost of the Actions and reliability.

You have two options for optimizing Actions:

- You can optimize a single Action.
- You can optimize multiple Actions across multiple Scenarios.

After an optimal interval has been calculated, you can apply it to your analysis by replacing the current interval value with the optimal interval value.

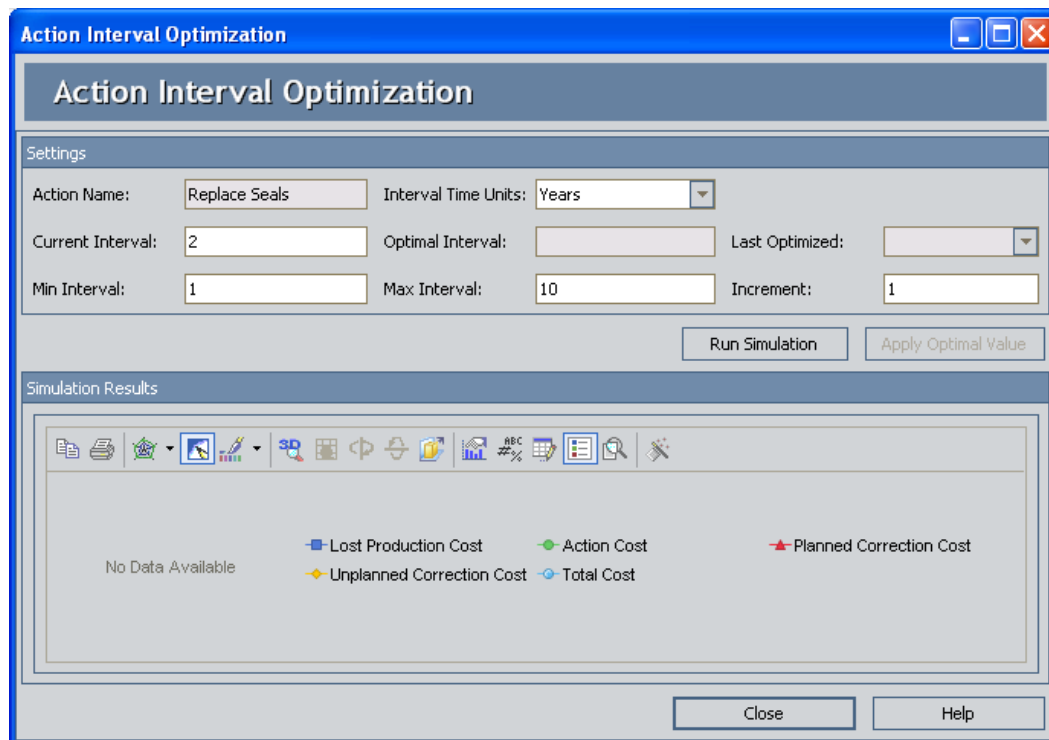
Optimizing a Single Action

To optimize an Action, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To optimize a single Action:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the element whose Action you want to optimize.
2. In the grid in the **Actions** pane, select the Action that you want to optimize.
3. Below the grid in the **Actions** pane, click the **Optimize** button.

The **Action Interval Optimization** window appears.



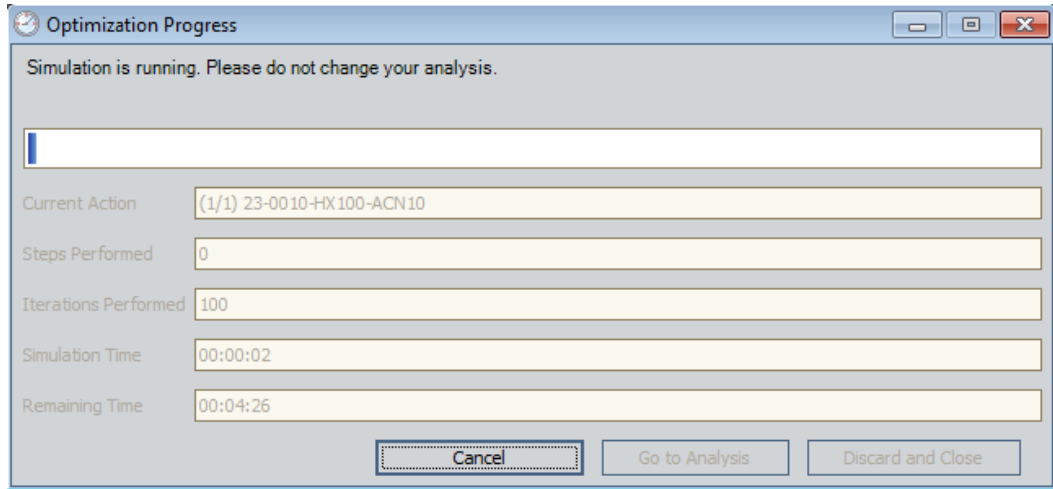
In this image, the **Action Interval Optimization** window displays the data necessary to optimize the Replace Seals Action.

4. In the **Min Interval** text box, type the desired minimum interval.
5. In the **Max Interval** text box, type the desired maximum interval.
6. In the **Increment** text box, type the desired increment.

Note: If desired, you can change the value in the **Current Interval** text box, which represents the current interval at which the current Action is performed. This text box is populated with the value in the Current Interval field in the System Action record. Modifying the value in the **Action Interval Optimization** window will cause the value in the System Action record to be updated with the same value.

7. Click the **Run Simulation** button.

The **Optimization Progress** window appears, displaying the progress of the optimization process.



After the progress bar reaches the end, the **Go to Analysis** and **Discard and Close** buttons become enabled. If you do not want to view the results, you can click the **Discard and Close** button to close the **Run Simulation** dialog box. These instructions assume that you want to view the results.

4. Click the **Go to Analysis** button.

The **Optimization Progress** window closes, and the **Action Interval Optimization** window displays the Cost chart and an updated value in **Optimal Interval** text box.

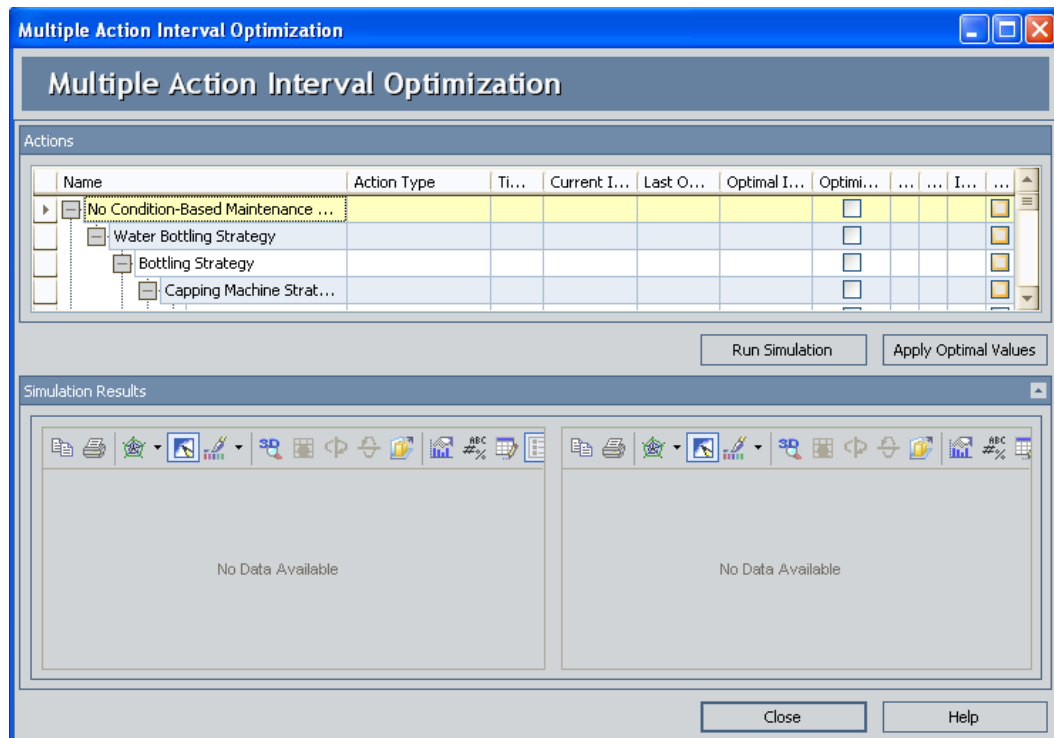
Optimizing Multiple Actions

To optimize Actions, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To optimize multiple Actions within an ASO Analysis:

1. While viewing the desired ASO Analysis on any page, on the **Tools** menu, click the **Optimize Actions** link.

The **Multiple Action Interval Optimization** window appears.



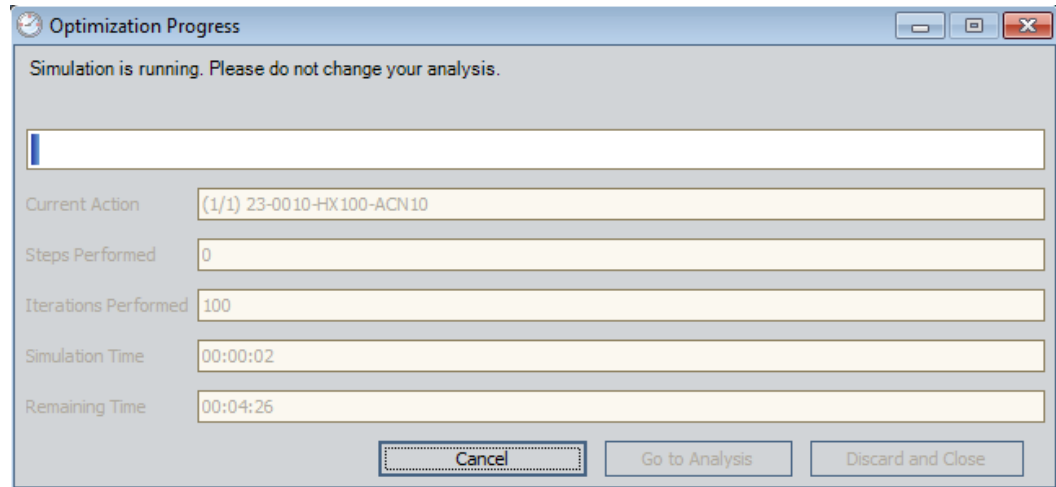
In this image, the **Multiple Action Interval Optimization** window displays Actions in an ASO Analysis that can be optimized.

2. In the grid in the **Actions** pane, select the **Optimize?** check box for the Actions that you want to optimize.
3. In the row containing the first Action you want to optimize, in the **Min Interval** text box, type the desired minimum interval.
4. In the row containing the first Action you want to optimize, in the **Max Interval** text box, type the desired maximum interval.
5. In the row containing the first Action you want to optimize, in the **Increment** text box, type the desired increment.
6. Repeat steps 3 through 5 for other Actions you want to optimize.

Note: If desired, you can change the data in the **Current Interval** text box, which represents the current interval at which the current Action is performed. This text box is populated with the value in the Current Interval field in the System Action record. Modifying the value in the **Multiple Action Interval Optimization** window will cause the value in the System Action record to be updated with the same value.

- Below the grid in the **Actions** pane, click the **Run Simulation** button.

The **Optimization Progress** window appears, displaying the progress of the optimization process.



After the progress bar reaches the end, the **Go to Analysis** and **Discard and Close** buttons become enabled. If you do not want to view the results, you can click the **Discard and Close** button to close the **Run Simulation** dialog box. These instructions assume that you want to view the results.

- Click the **Go to Analysis** button.

The **Optimization Progress** window closes, and the **Action Interval Optimization** window displays the Cost chart and an updated value in **Optimal Interval** text box.

Applying Optimal Values to Actions

About Applying Optimal Action Intervals

When you optimize Actions, you can determine the most efficient interval in which to perform inspection or preventive maintenance Actions. After you have found the optimal interval for an Action you can apply it to that Action. When you do so, the value in the **Current Interval** text box in the **Actions** pane and the value in the **Interval** field in the **System Action** record will be overwritten with the value that exists in the **Optimal Interval** text box.

After you apply the optimal interval, you will need to rerun the simulation for the ASO Analysis to update the result based upon the new action interval.

Applying Optimal Intervals to Actions

To apply optimal intervals to Actions, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

Applying the Optimal Value to a Single Action:

To apply the optimal interval to a Single Action:

1. Find the optimal Action interval value for the Action you want to optimize.
2. On the **Action Interval Optimization** window, in the **Settings** section, click the **Apply Optimal Value** button.

Note: The **Apply Optimal Value** button is enabled only after you have optimized an Action. If you close the **Action Interval Optimization** window, you will have to optimize the Action again for the **Apply Optimal Value** button to become enabled.

The value in the **Optimal Interval** text box replaces the value in the **Current Interval** text box in the **Settings** section and in the Interval field in the associated System Action record.

Applying Optimal Intervals to Multiple Actions:




To apply optimal intervals to multiple Actions:

1. Find the optimal Action intervals for the Actions you want to optimize.
2. In the grid in the **Actions** pane, in the **Apply?** column, select the check box for the Actions whose current interval you want to replace with the optimal interval.
3. Below the grid in the **Actions** pane, click the **Apply Optimal Values** button.

The values in the **Optimal Interval** text boxes replace the values in the respective **Current Interval** text boxes in the grid in the **Actions** pane and in the Interval field in the associated System Action records.

Viewing Differences Between Proposed Actions and Active Actions

About Viewing Differences Between Proposed Actions and Active Actions

If a non-Active Scenario contains a System Action record whose values or values in related records are different from the corresponding records in the Active Scenario, you can view the differences between those records. You will know that a System Action record or a related record is somehow different in the Active Scenario if the row in which it appears contains the  icon or the  icon. You can view the differences, however, only if the row contains the  icon.

You can view these differences on the **Changes for <Action>** dialog box, where **<Action>** is the value stored in the Name field in the corresponding System Action record. You can access this dialog box from the **Show Changes** button in the **Actions** pane on the **Asset Strategy Optimization Scenarios - Actions** page, when an Action is selected in the grid. The **Changes for <Action>** dialog box contains a grid that contains the following information:

- **Field:** The field whose value differs from the value in the same field in the corresponding record in the Active Scenario.
- **Old Value:** The value in the Active Scenario, with the exception of the following fields:
 - Planned Resource Usages
 - Unplanned Resource Usages

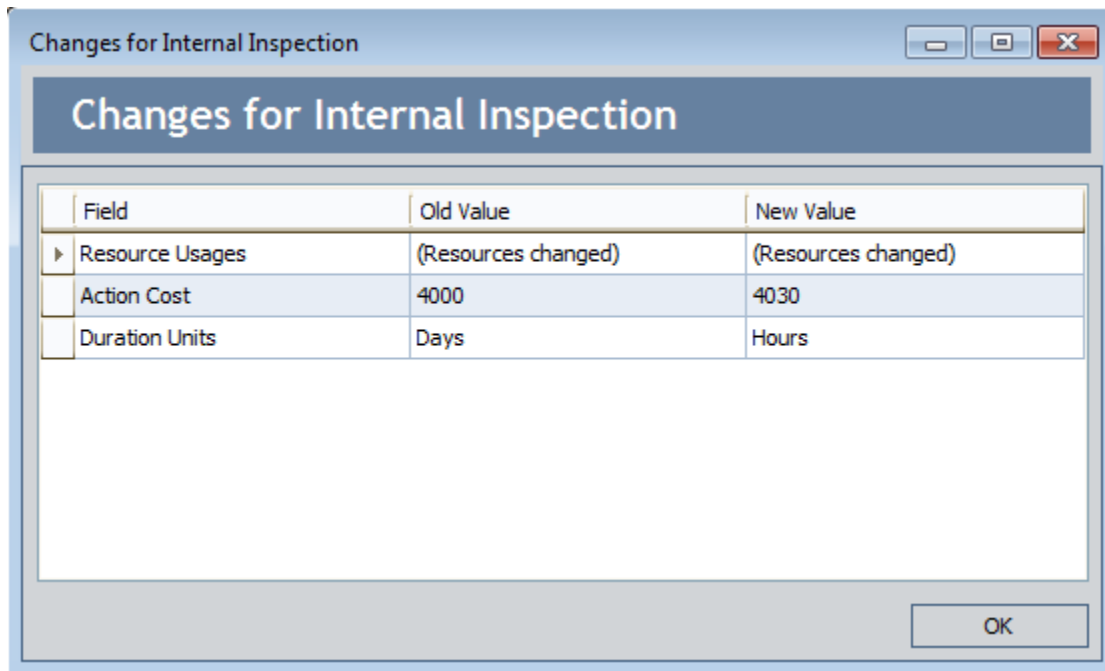
Instead, these cells indicate that changes were made to the data in these areas for the Action. To see the specific changes, you will need to open the corresponding records.

- **New Value:** The value in the non-Active Scenario, with the exception of the following fields:
 - Planned Resource Usages

- Unplanned Resource Usages

Instead, these cells indicate that changes were made to the data in these areas for the Action. To see the specific changes, you will need to open the corresponding records.

The following image shows what the **Changes for <Action>** dialog box looks like when you are viewing changes for an *Internal Inspection* Action.



Accessing the Changes for <Action> Dialog Box

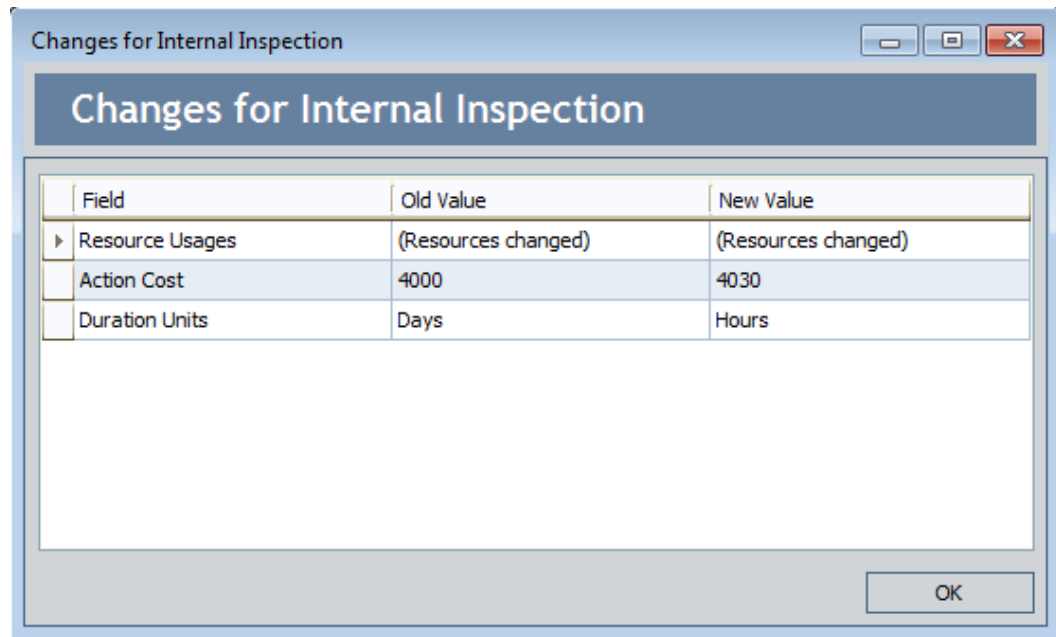
If a non-Active Scenario contains a System Action record whose values or values in related records are different from the corresponding records in the Active Scenario, you can view the differences between the records using the following instructions. After you review the differences, if desired, you can update the System Action record in the current Scenario so that its values will match the values in the Active Scenario.

To access the Changes for <Action> dialog box:

1. While viewing the desired non-Active Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the Asset element whose System Action record whose differences you want to view.

2. In the grid in the **Actions** pane, select the System Action record whose differences you want to view.
3. Below the grid in the **Actions** pane, click the **Show Changes** button.

The **Changes for <Action>** dialog box appears, where **<Action>** is the value in the Name field in the selected System Action record.



Updating Actions to Reflect the Active Scenario

If a Scenario contains a System Action record whose values are different from the corresponding System Action record in the Active Scenario, you can update the System Action record in the non-Active Scenario so that its values are identical to the values in the corresponding System Action record in the Active Scenario. You can update a System Action record only if an Asset element is selected in the **Diagram Hierarchy** pane and the selected System Action record is somehow different from the corresponding System Action record.

You will know that a System Action record is somehow different from the corresponding System Action record in the Active Scenario if the row in which it appears contains the  icon or the .

Note: Before you update a System Action record, you might want to click the **Show Changes** button so that you can see how the System Action record in this Scenario differs from the one in the Active Scenario.

To update Actions, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To update a System Action record so that its values match the values in the corresponding System Action record in the Active Scenario:

1. While viewing the desired non-Active Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the Asset element whose System Action record you want to update.
2. In the grid in the **Actions** pane, select the System Action record that you want to update.
3. Below the grid in the **Actions** pane, click the **Undo Action** button.

The System Action record is updated so that its values are identical to the values in the corresponding System Action record in the Active Scenario.

Deleting Actions

To delete an Action, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

Note: You can delete an Action only from a non-Active Scenario.

To delete an Action:

1. While viewing the desired non-Active Scenario on the **Asset Strategy Optimization Scenarios - Actions** page, in the **Diagram Hierarchy** pane, select the element whose Action you want to delete.
2. In the grid in the **Actions** pane, select the Action that you want to delete.
3. Under the grid in the **Actions** pane, click the **Delete Action** button.

A confirmation message appears, asking if you really want to delete the Action.

4. Click the Yes button.

The Action is removed from the grid in the **Asset Strategy Optimization Scenarios - Actions** page.

Managing Global Events

About Global Events

A *Global Event* is an optional component of a Scenario that groups together Actions requiring a shutdown so that they will be performed at the same time, thereby maximizing availability. The information for a Global Event is stored in a System Global Event record.

For instance, consider our ASO Analysis Example, where the Proposed Scenario contains two Actions that require a shutdown: *Redesign Impellers* and *Replace Seals*. The Redesign Impellers Action has a duration of one week, and the Replace Seals Action has a duration of one day. Performed independently of one another, they would result in a shutdown lasting eight days total.

Now, assume that you group the two Actions together using a Global Event, which specifies that the two Actions would be performed together during the same shutdown. Managing the Actions in this way would result in a shutdown lasting the longest of the two durations, or seven days. This approach is preferable, as it would save one day of cost associated with the shutdown.

ASO Analyses support the use of two types of Global Events:

- **Date-driven:** A Global Event that starts on a certain date.
- **Action-driven:** A Global Event that starts based upon a driving Action.

When you create a Global Event, any Actions that are selected to be assigned and that fall into a certain time period are performed simultaneously. The execution of the group of Actions together is the Global Event. The qualifying time period is defined by the values in the Max Delay and Max Advance Durations fields in the System Global Event record.

Note: While Global Events help limit downtime, the effects of Global Events are not presented explicitly anywhere in the simulation results. The effects of the Global Events are exhibited as less downtime, which means lower lost production costs.

Features of the Global Events Page

Global Events Pane

The Global Events pane appears on the **Asset Strategy Optimization Scenarios - Global Events** page and displays the Global Events that are associated with the Scenario that you are currently viewing. In the following image, the Global Events pane is outlined in red.

Asset Strategy Optimization Scenarios - Global Events

Site Map: [Asset Strategy Management](#)->[Water Bottling Strategy](#)->[Water Bottling Strategy Optimization](#)->[Proposed](#)

Scenario: Proposed

Flag	Name	Description	Driver Type
	ASO Example Global Event	ASO Example Global Event	ActionDriven

Buttons: Add Global Event, Delete Global Event, Undo Global Event, Show Changes

Actions to Align

Name	Is Driver
Water Bottling Strategy	
Water Collection Strategy	
Water Pump Strategy	
Replace Seals	<input checked="" type="checkbox"/>
Redesign Impellers	<input type="checkbox"/>

Assign Actions

The grid in the Global Events pane contains the following columns:

- **Flag:** Contains an icon indicating the status of the System Global Event record relative to the corresponding System Global Event record that belongs to the Active Scenario.
 - If you are viewing System Global Event records that belongs to the Active Scenario (i.e., the Scenario list above the grid contains the value *Active*), the Flag column will not contain an icon.

- If you are viewing System Global Event records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) and the System Global Event record is *identical* to the corresponding System Global Event record in the Active Scenario, the **Flag** column will not contain an icon.
 - If you are viewing System Global Event records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) and the System Global Event record does not have a corresponding System Global Event record in the Active Scenario, the **Flag** column will contain the 🌍 icon.
 - If you are viewing System Global Event records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) and the System Global Event record is *different* from the corresponding System Global Event record in the Active Scenario, the **Flag** column will contain the 🏠 icon.
 - If you are viewing System Global Event records that belongs to a non-Active Scenario (i.e., the **Scenario** list above the grid does not contain the value *Active*) whose System Scenario record was created from scratch (i.e., the System Scenario was not copied from another System Scenario record), the **Flag** column will contain the 🚫 icon.
- **Name:** Displays the value stored in the Name field of the System Global Event record.
 - **Description:** Displays the value stored in the Description field of the System Global Event record.
 - **Driver Type:** Displays the value stored in the Driver Type field of the System Global Event record.

Below the grid in the **Global Events** pane, the following buttons appear:

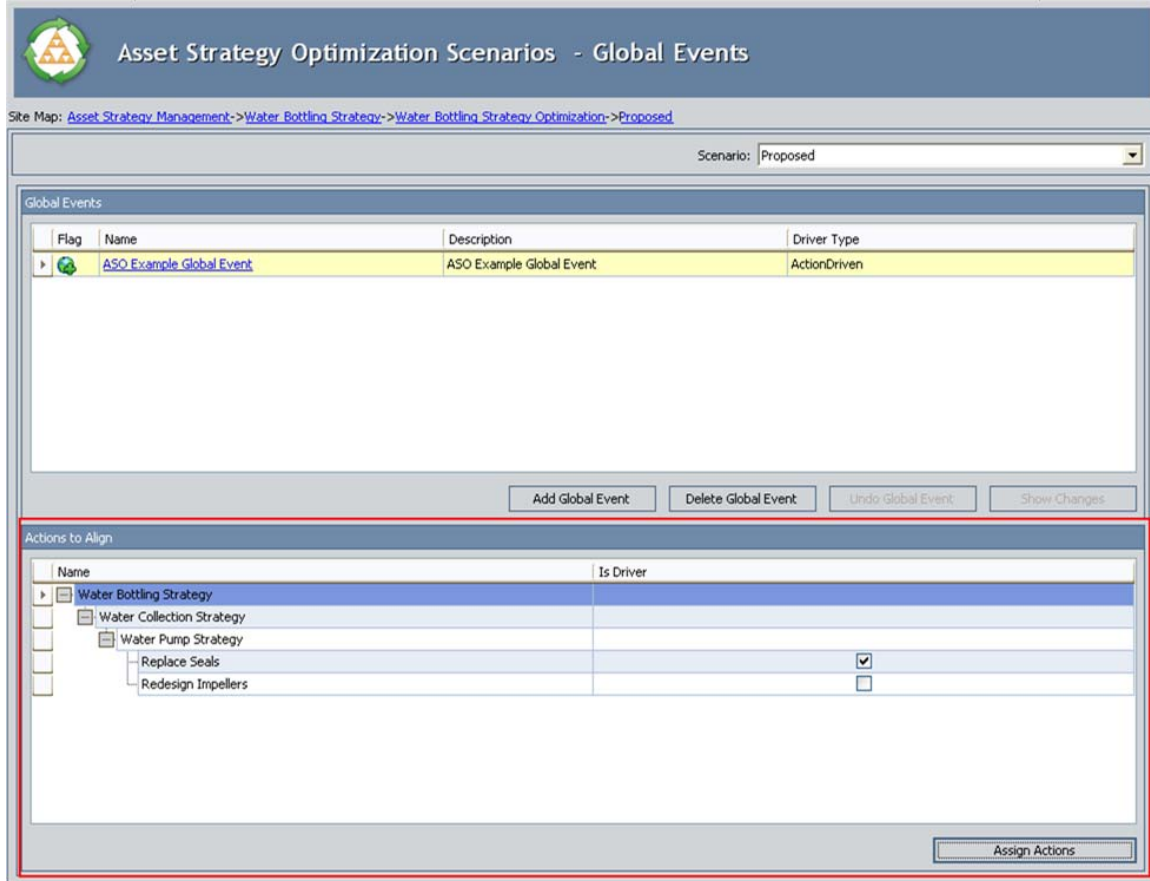
- **Add Global Event:** Displays the **New Global Event** window, where you can create a new System Global Event record. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Delete Global Event:** After asking for confirmation, deletes the System Global Event record that is currently selected in the grid in the **Global**

Event pane. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.

- **Undo Global Event:** Causes the System Global Event record to be updated so that its values are identical to the values in the corresponding System Global Event record in the Active Scenario. Before you click the **Undo Global Event** button, you might want to click the **Show Changes** button so that you can see how the System Global Event record in this Scenario differs from the one in the Active Scenario. This button is always disabled if you are viewing Global Events that belong to the Active Scenario. If you are viewing Global Events that belong to any other Scenario, this button is enabled only if the Global Event is somehow different from the corresponding Global Event in the Active Scenario. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Show Changes:** Displays the **Changes for <Global Event>** window, where **<Global Event>** is the value in the Name field in the selected System Global Event record. You can use this window to see the differences that exist between values in this System Global Event record and values in the corresponding System Global Event record in the Active Scenario. This button is always disabled if you are viewing Global Events that belong to the Active Scenario. If you are viewing Global Events that belong to any other Scenario, this button is enabled only if the Global Event is somehow different from the corresponding Global Event in the Active Scenario.

Actions to Align Pane

The **Actions to Align** pane appears on the **Asset Strategy Optimization Scenarios - Global Events** page and displays the Actions that are currently assigned to the Global Event that is selected in the **Global Events** pane. In the following image, the **Actions to Align** pane is outlined in red.



The grid in the **Actions to Align** pane displays the following columns:

- **Name:** Displays a hierarchy that displays the Actions, organized by Diagram element, that can be aligned by a Global Event. For example, the preceding image displays the *Replace Seals* and *Redesign Impellers* Actions, which are assigned to the *Water Pump Strategy* element. In addition, you can see that the *Water Pump Strategy* element belongs to the *Water Collection Strategy* element, which belongs to the *Water Bottling Strategy* element.
- **Is Driver:** Displays check boxes that allow you to identify driving Action(s) for Action-driven Global Events.

Below the grid in the **Actions to Align** pane, the following button appears:

- **Assign Action:** Displays the **Assign Actions** window, where you can select Actions to assign to the current Global Event. This link is enabled only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.

Creating Global Events

About Creating Global Events

To create a Global Event, you must complete two steps:

1. Create a System Global Event record.
2. Assign Actions to the Global Event.

Creating System Global Event Records

To create a System Global Event record, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To create a System Global Event record:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Global Events** page, below the grid in the **Global Events** pane, click the **Add Global Event** button.

The **New Global Event** window appears, where you can create a new Global Event.

The screenshot shows a dialog box titled "New Global Event". The "Name" field contains "New Global Event". The "Description" field is empty. The "Driver Type" dropdown is set to "Action Driven (ActionDriven)". The "First Date" dropdown is empty. The "One Time Event" checkbox is checked. The "Interval" field is set to "1" and the unit dropdown is set to "Years". The "Max Delay Duration" field is set to "0" and the unit dropdown is set to "Days". The "Max Advance Duration" field is set to "0" and the unit dropdown is set to "Days". The "OK" and "Cancel" buttons are at the bottom right.

The content of the **New Global Event** window is controlled by the default datasheet that is defined for the System Global Event family.

2. Define the properties of the System Global Event record as desired.
3. Click **OK**.

The System Global Event record is created and appears in the grid in the **Global Events** pane.

Managing Actions Related to Global Events

About Assigning Actions to Global Events

When you assign Actions to a Global Event, you select the Actions that will be executed at the same time, as defined by the Global Event. Any Actions that should be performed during the qualifying time period, as defined by the values in the Max Delay Duration and Max Advance Duration fields, will be executed together.

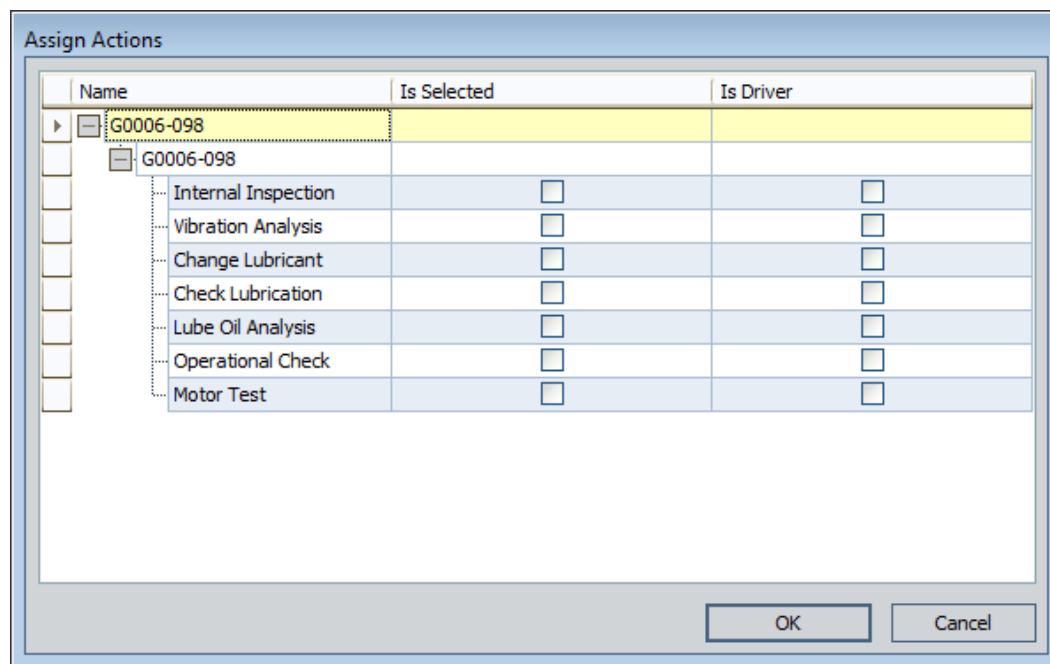
Assigning Actions to Global Events

To assign Actions to Global Events, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To assign an Action to a Global Event:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Global Events** page, in the grid in the **Global Events** pane, in the **Name** column, select the Global Event to which you want to assign Actions.
2. Below the grid in the **Actions to Align** pane, click the **Assign Actions** button.

The **Assign Actions** window appears, showing all of the Actions that exist for the Scenario.



3. In the **Is Selected** column, select the check box for the Actions that you want to assign to the selected Global Event.
4. If the Global Event is driven by Actions, in the **Is Driver** column, select the check box for the Actions that you want to drive the selected Global Event.

Note: This column is disabled for date-driven Global Events.

5. Click OK.

Your selections are saved and appear in the **Actions to Align** pane.

Hint: If you want to select the **Is Driver** check box for an Action, you must first select the **Is Selected** check box.

Removing Actions from Global Events

When you remove an Action from a Global Event, it will no longer be delayed or advanced in time to be executed with the other grouped Actions in the Global Event.

To remove Actions from Global Events, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To remove an Action from a Global Event:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Global Events** page, in the grid in the **Global Events** pane, in the **Name** column, select the Global Event that contains the Actions that you want to remove.
2. Below the grid in the **Actions to Align** pane, click the **Assign Actions** button.

The **Assign Actions** window appears.

3. In the **Is Selected** column, clear the check box for any Actions that you want to remove from the Global Event.
4. Click OK.

Your changes are saved, and the **Actions to Align** pane is updated to reflect those changes.

Modifying System Global Event Records

To modify a System Global Event record, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To modify a System Global Event record:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Global Events** page, in the grid in the **Global Events** pane, click the hyperlinked name of the System Global Event record that you want to modify.

The **<Global Event>** window appears, where **<Global Event>** is the name of the Global Event that you selected.

The screenshot shows a dialog box titled "ASO Example Global Event". The dialog contains the following fields and controls:

- Name:** ASO Example Global Event
- Description:** ASO Example Global Event
- Driver Type:** Action Driven (ActionDriven)
- First Date:** (empty)
- One Time Event:**
- Interval:** 1 (unit: Years)
- Max Delay Duration:** 0 (unit: Days)
- Max Advance Duration:** 0 (unit: Days)




Buttons: OK, Cancel

2. Modify the properties of the System Global Event record as desired.
3. Click OK.

Your changes are saved.

Viewing Differences Between the Current Scenario's Global Events and the Active Scenario's Global Events

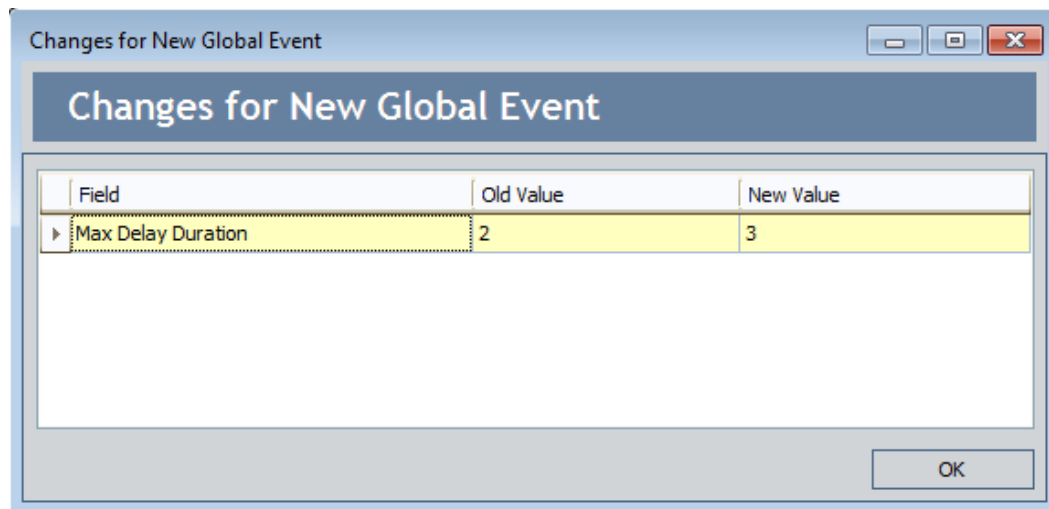
If a non-Active Scenario contains a System Global Event record whose values are different from the corresponding System Global Event record in the Active Scenario, you can view the differences between the System Global Event records using the following instructions. After you review the differences, if desired, you can update the System Global Event record in the current Scenario so that its values will match the values in the Active Scenario.

You will know that a System Global Event record is somehow different from the corresponding System Global Event record in the Active Scenario if the row in which it appears contains the  icon or the  icon. You can view the differences, however, only if the row contains the  icon.

To view differences between a System Global Event record in the current Scenario and the corresponding System Global Event record in the Active Scenario:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Global Events** page, in the grid in the **Global Events** pane, click the hyperlinked name of the System Global Event record whose differences you want to view.
2. Below the grid in the **Global Events** pane, click the **Show Changes** button.

The **Changes for <Global Event>** dialog box appears, where **<Global Event>** is the value in the Name field in the selected System Global Event record.





The Changes for <Global Event> dialog box contains a grid that displays the following columns:

- **Field:** The field whose value differs from the value in the same field in the corresponding System Global Event record in the Active Scenario. For example, in the preceding image, you can see that the value in the Max Advance Duration field is different between the System Global Event record in the current Scenario and the Active Scenario.
- **Old Value:** The value in the System Global Event record in the Active Scenario
- **New Value:** The value in the System Global Event record in the current Scenario.

Updating Global Events to Reflect the Active Scenario

If a Scenario contains a System Global Event record whose values are different from the corresponding System Global Event record in the Active Scenario, you can update the System Global Event record in the non-Active Scenario so that its values are identical to the values in the corresponding System Global Event record in the Active Scenario. You can update a System Global Event record only if the selected System Global Event record is somehow different from the corresponding System Global Event record.

You will know that a System Global Event record is somehow different from the corresponding System Global Event record in the Active Scenario if the row in which it appears contains the  icon or the .

Note: Before you update a System Global Event record, you might want to click the **Show Changes** button so that you can see how the System Global Event record in this Scenario differs from the one in the Active Scenario.

To update a Global Event, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To update a System Global Event record so that its values match the values in the corresponding System Global Event record in the Active Scenario:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Global Events** page, in the grid in the **Global Events** pane, click the hyperlinked name of the System Global Event record that you want to update.
2. Below the grid in the **Global Events** pane, click the **Undo Global Event** button.

The System Global Event record is updated so that its values are identical to the values in the corresponding System Global Event record in the Active Scenario.

Deleting Global Events

To delete a Global Event, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To delete a Global Event:

1. While viewing the desired Scenario on the **Asset Strategy Optimization Scenarios - Global Events** page, in the grid in the **Global Events** pane, select the Global Event that you want to delete.
2. Below the grid in the **Global Events** pane, click the **Delete Global Event** button.

A confirmation message appears, asking if you really want to delete the selected Global Event.

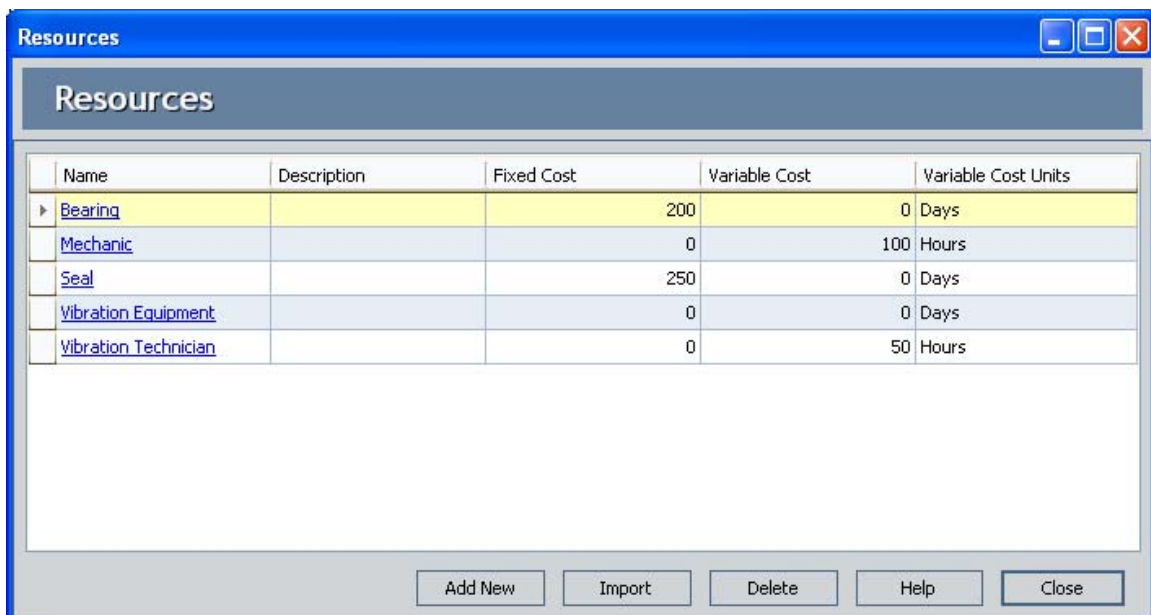
3. Click the **Yes** button.

The Global Event is removed from the grid in the **Global Events** pane and the System Global Event record is deleted from the database.

Managing Resources

About Resources

Resources are optional components in an ASO Analysis that represent physical parts or materials, such as spare bearings or seals, or human resources, such as mechanics or technicians, that you may want to use within the analysis. You can create a Resource by defining its properties via the **Resources** window, which is shown in the following image.



The properties of a Resource are stored in a System Resource record, which is created when you save a new Resource.

After Resources exist for an ASO Analysis, you can assign them to Actions and Risks to tie the resource and its cost with an occurrence of the associated event. For example, if you planned to create an Action that would perform certain maintenance actions, you might create a *Mechanic* Resource and assign the Mechanic to the Action.

Associating a Resource with an Action or a Risk will create a System Resource Usage Record, which is linked to the appropriate System Action or System Risk

record, which will store information that specifies how the resource will be used (e.g., the quantity and duration).

Creating Resources

About Adding Resources to Analyses

You have two options for adding Resources to an ASO Analysis. You can:

- Create new Resources from scratch.
- Import Resources that already exist in other ASO Analyses.

Note: Resources can also be created within the context of Actions and Risks. Doing so will cause those Resources to be available at the analysis level so that they can be assigned to other Actions and Risks.

Accessing the Resources Window

To access the Resources window:

- While viewing the desired ASO Analysis on any page, on the **Tools** menu, click the **Resources** link.

The Resources window appears.

Aspects of the Resources Window

The Resources window appears when you click the **Resources** link on the **Tools** menu in ASO.

Name	Description	Fixed Cost	Variable Cost	Variable Cost Units
Bearing		200	0	Days
Mechanic		0	100	Hours
Seal		250	0	Days
Vibration Equipment		0	0	Days
Vibration Technician		0	50	Hours

Buttons: Add New, Import, Delete, Help, Close

The **Resources** window contains a grid, where each row displays a separate System Resource record. The following columns of information are displayed in the grid by default:

- Name
- Description
- Fixed Cost
- Variable Cost
- Variable Cost Units

You can click the hyperlinked value in the **Name** cell to view the Resource datasheet for that resource.

Below the grid, the following buttons appear:

- **Add New:** Displays the **Add New Resource** window, where you can create a new System Resource record from scratch. This link is *enabled* only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Import:** Displays the **Resource Finder** window, where you can select the System Resource record that you want to import. This link is *enabled*

only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.

- **Delete:** After asking for confirmation, removes the selected row from the grid. The System Resource record will be deleted from the database when you save your changes to the ASO Analysis. This link is *enabled* only if you are logged in as a Super User or member of the MI ASM Analyst Security Group.
- **Help:** Displays the context-sensitive Help topic for the **Resources** window.
- **Close:** Closes the **Resources** window.

Creating Resources from Scratch

To create a Resource for ASO, you must be logged in as a Super User or member of the ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

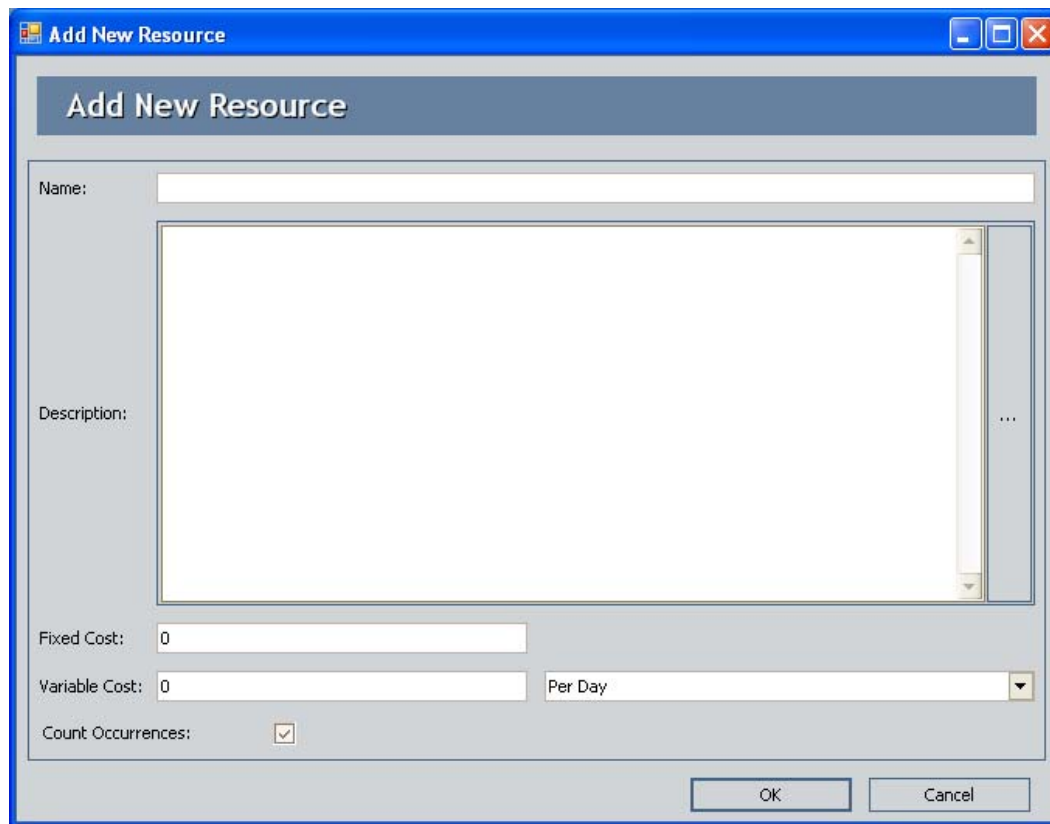
To create a new Resource for an ASO Analysis:

1. Access the **Resources** window.

The **Resource** window appears.

2. On the **Resources** window, click the **Add New** button.

The **Add New Resource** window appears.



The Add New Resources window displays the default datasheet that has been defined for the System Resource family.

3. Define the properties of the System Resource record as desired.
4. Click OK.

The Resource is created and appears in the grid on the Resources window.

Importing Existing Resources

When you import a Resource from one ASO Analysis into another ASO Analysis, the Meridium APM system creates a copy of the existing System Resource and links the new record to the root System Analysis record of the target analysis.

To import an existing Resource, you must be logged in as a Super User or member of the ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

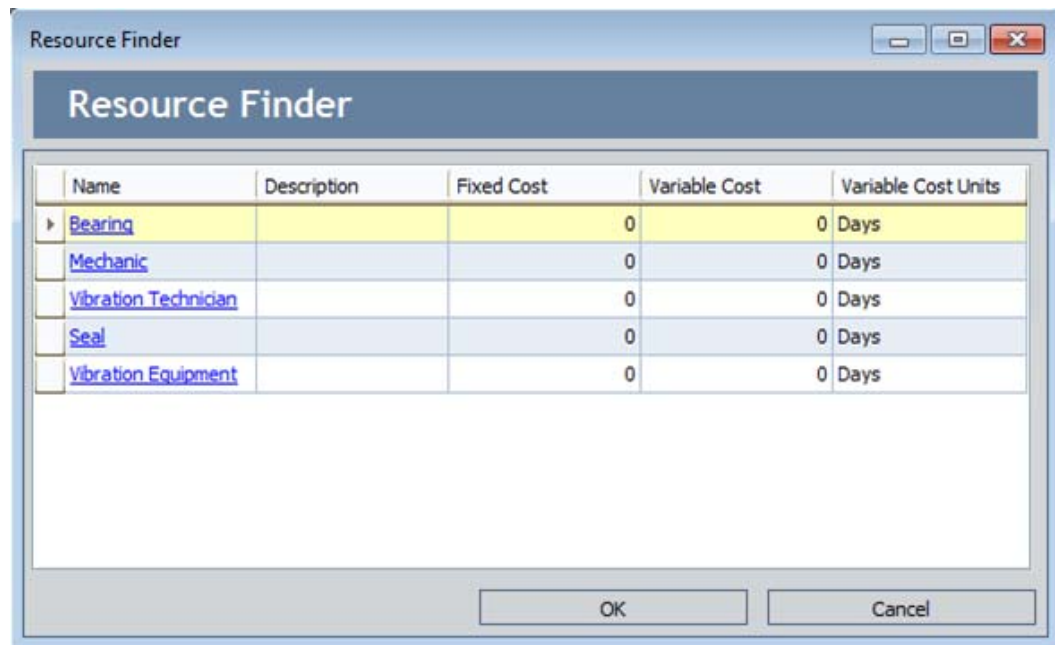
To import a Resource from one analysis into another:

1. Open the ASO Analysis into which you want to import the Resource.
2. Access the Resources window.

The Resource window appears.

3. Click the Import button.

The Resource Finder window appears, which displays the Resources that are available to be imported.



4. Select the row containing the Resource that you want to import.
5. Click OK.

A copy of the System Resource record is created, and the imported Resource appears on the Resources window.

Modifying Resources

To modify a Resource, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To modify an existing Resource:

1. While viewing the desired ASO Analysis on any page, on the Tools menu, click the Resources link.

The Resources window appears.

2. Click the hyperlinked name of the Resource that you want to modify.

The <Resource Name> dialog box appears, where <Resource Name> is the name of the System Resource record that you selected.

The screenshot shows a dialog box titled "Vibration Technician". The "Name" field contains "Vibration Technician". The "Description" field is empty. The "Fixed Cost" field contains "0". The "Variable Cost" field contains "50". The "Per Hour" dropdown menu is set to "Per Hour". The "Count Occurrences" checkbox is checked. The "OK" and "Cancel" buttons are at the bottom right.

The <Resource Name> window displays the default datasheet that has been defined for the System Resource family. This image displays the

Vibration Technician window, which defines the properties for the *Vibration Technician* System Resource record.

3. Modify the fields in the System Resource record as desired.
4. Click OK.

Your changes are saved.

Deleting Resources

To delete a Resource, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To delete a Resource:

1. While viewing the desired ASO Analysis on any page, on the **Tools** menu, click the **Resources** link.

The **Resource** window appears.

2. Select the row containing the System Resource record that you want to delete.
3. Click the **Delete** button.

A confirmation message appears, asking if you really want to delete the Resource.

4. Click the **Yes** button.

The Resource is removed from the grid in the **Resources** window. The System Resource record will be deleted from the database when you save your changes to the ASO Analysis.

Working with Simulations

About Running Simulations

When you run a simulation, you start the process of running Monte Carlo iterations for each Scenario in an ASO Analysis and viewing the results calculated from those simulations.

You will want to run the simulation after the ASO Analysis is created for the first time and if you make changes to the ASO Analysis that would affect the simulation results, such as changing the simulation parameters or modifying a Scenario. When you run the simulation, the Diagram is validated. If the Diagram is valid or contains only Isolated Element errors, then:

- If changes have been made to the analysis parameters, *all* Scenarios will be included in the simulation run.
- If *no* changes have been made to any of the analysis parameters, only the Scenarios that have been *modified* since the last simulation was run will be included in the new simulation run.
- If *no* changes have been made to the analysis parameters or any of the Scenarios, a message appears, indicating that no changes have been made.

Note: If no changes have been made to the analysis parameters or any of the Scenarios, but the **Random Seed** or **Event Log** check box is selected, then the simulation will include every Scenario in the new simulation run.

Keep in mind that it will take time to run simulations. Various factors influence the speed of the simulation process, including:

- The number of iterations defined.
- The complexity of the Scenarios (i.e., the number of pieces of equipment or locations, Risks, Actions, and Subsystems).
- The frequency at which actions occur.
- The frequency at which failures occur.

To shorten the run time of your simulation, you can reduce the number of iterations or the complexity of the analysis.

You can run only one simulation at a time. While a simulation is running, however, you can continue working in other areas of the Meridium APM Framework by:

- Clicking anywhere on the Meridium APM Framework main window outside the **Run Simulation** dialog box. When you do so, the simulation will continue to run in the background, and the dialog box will be hidden behind the Meridium APM Framework window. When the simulation finishes, the dialog box will be returned to focus automatically.

-or-

- Clicking either the minimize or the close button on the **Run Simulation** dialog box. When you do so, the simulation will continue to run in the background, and the minimized dialog box will appear on your Windows taskbar. When the simulation finishes, the dialog box will be maximized and returned to focus automatically.

Note: While a simulation is running, you cannot access or modify the associated Asset Strategy. If you try to do so, an error message will appear, indicating the action cannot be completed until the simulation is complete.

Options for Running Simulations

You have two options for running simulations:

- Run the simulation from ASO.

-or-

- Run the simulation from ASM.

The simulation results will be the same regardless of the starting point.

Running Simulations from ASO

To run a simulation, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To run a simulation from ASO:

1. On any page in ASO, on the Tools menu, click the Run Simulation link.

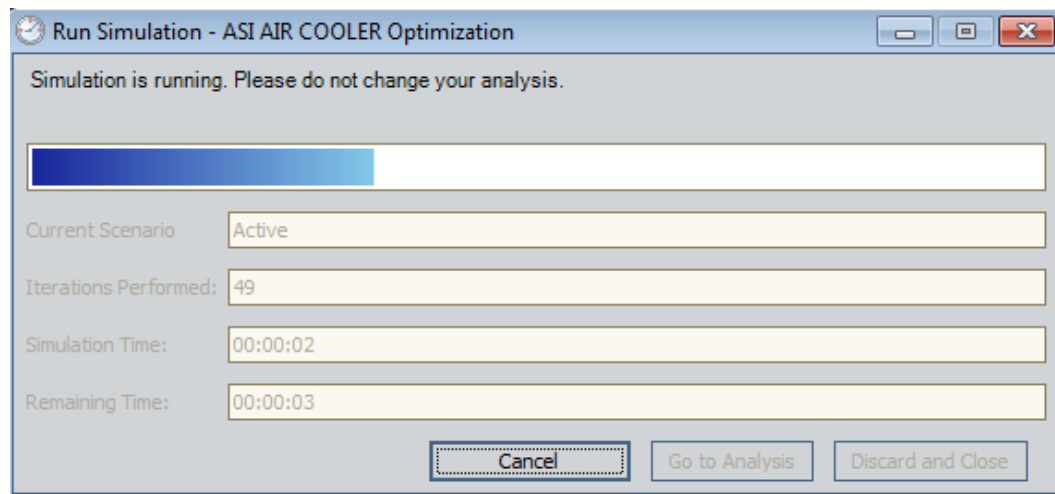
The **Browse For Folder** window appears, where you can select or create a folder in which to store the Event Logs.

Note: If the **Enable Event Log** check box is cleared on the **Asset Strategy Optimization Analysis Definition** page, the **Browse For Folder** dialog box will not appear.

2. Navigate to the location where you want to save the Event Logs.
3. Click OK.

Note: If there are already Event Logs files in the folder that you select, a warning message will appear, stating that any existing Event Log files may be overwritten.

The **Simulation Progress** dialog box appears and displays the progress of the simulation.



After the progress bar reaches the end, the **Go to Analysis** and **Discard and Close** buttons become enabled. If you do not want to view the results, you can click the **Discard and Close** button to close the **Run Simulation** dialog box. These instructions assume that you want to view the results.

4. Click the **Go to Analysis** button.

The **Asset Strategy Optimization Summary** page appears.

Working with the Event Log

About Event Logs

The Event Log is a diagnostic tool that lets you see what happens when you run simulations for an ASO Analysis. When the value in the Enable Event Log field in the root System Analysis record is set to *True*, when you run the simulation, one text file will be produced for every iteration of every Scenario in the ASO Analysis that records every event that happens in the iteration. Each file is named `<Scenario Name>-<Iteration Number>.txt` where:

- `<Scenario Name>` is the name of the Scenario in the ASO Analysis.
- `<Iteration number>` is the number of the iteration that is detailed in the file.

The Event Log files can be saved to any desired location when you run a simulation. The Event Log files are produced as text files, but can be opened in Microsoft Excel, where you will see the following columns of information:

- **Time:** The start time, in days, of the event.
- **Name:** The name of the Action, Risk, or element, as defined in its record, that is detailed in the row.
- **Event:** The event that is detailed in the row. The possible events that can be listed are:
 - **Alert:** A condition monitoring Action identifies a potential failure.
 - **Complete:** An Action is complete.

- **Complete Unplanned Correction:** A planned correction has finished repairs to an element that has failed.
 - **Failed:** An element has failed. It will have to be replaced or repaired before it can run again.
 - **Running:** The element is running.
 - **Schedule next <Action> in <Number> Days:** A Global Event has changed the schedule of an Action, where <Action> is the name of the Action that has been rescheduled and <Number> is the number of days until the next occurrence of the Action.
 - **Shutdown:** An element is stopped because an Action has turned it off.
 - **Simulation Ends:** The simulation is complete.
 - **Standby:** A Switch element is turned off.
 - **Start:** An Action starts.
 - **Start Unplanned Correction:** An unplanned correction has started repairs to an element that has failed.
 - **Stopped:** The element is stopped.
- **Path:** The location in the Diagram of the item associated with the event.

Understanding the Content of the Event Log

The Event Log in ASO works exactly like the Event Log in System Reliability.

Refreshing Multiple Distributions

Using the **Refresh Distributions** link on the **Tools** menu refreshes all the distribution data that was associated with Risks in the ASO Analysis. To refresh Distributions, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To refresh multiple Distributions:

1. While viewing the desired ASO Analysis on any page, on the **Tools** menu, click the **Refresh Distributions** link.

A confirmation message appears, asking if you really want to refresh all distributions having associated distributions.

2. Click **OK**.

The distribution data is refreshed.


Setting a Scenario as the Proposed Scenario

When you create an ASO Analysis, the Proposed Scenario is created by default. You can keep this Scenario as the Proposed Scenario, or you can set another customer-defined Scenario as the Proposed Scenario. When you do so, the values in that customer-defined Scenario will be transferred to the Proposed Strategies that are included in the ASO Analysis.

To set a Scenario as the Proposed Scenario, you must be logged in as a Super User or member of the MI ASM Analyst Security Group. The following instructions assume that you have the privileges that are required to perform the task.

To set a Scenario as the Proposed Scenario:

1. Access the **Asset Strategy Optimization Scenarios** page for the ASO Analysis containing a Scenario that you want to set as the Proposed Scenario.
2. In the grid within the **Scenarios** section, select the row containing the Scenario that you want to set as the Proposed Scenario.
3. Below the grid, click the **Set As Proposed** button.

The selected Scenario is set as the Proposed Scenario and flagged with the  icon in the grid. In addition, the values in that Scenario are transferred to the Proposed Strategies that are included in the ASO Analysis.

Managing Strategies for an ASO Analysis

Managing Strategies that are Included in an ASO Analysis

After a strategy has been included in an ASO Analysis, you can manage the strategy using ASM. You will know that a strategy has been included in an ASO Analysis if the value in the **Risk Analysis Type** list on the **Strategy Definition** page is *Simulation*. When an ASO Analysis includes a strategy, each time you navigate to the strategy (assuming that you have not changed the value in the **Risk Analysis Type** field manually to *Qualitative*), the results will reflect the information in ASO.

Some restrictions will apply to how you can manage strategies that are included in an ASO Analysis. The following subsections indicate which actions are always allowed, which are always restricted, and which are restricted depending upon certain conditions.

Always Allowed

The following actions are always allowed for strategies that are included in ASO Analysis:

- Creating new Actions or Risks.
- Modifying values in Actions or Risks.
- Copying Risks.
- Undoing Actions or Risks.
- Removing Actions or Risks.
- Assigning new or existing Actions to Risks.
- Assigning new or existing Risks to Actions.
- Defining the unmitigated risk rank (non-financial and financial) for any *new* Risks that are created after the analysis was last accessed.
- Applying an Asset Strategy Template as a non-master template to the Asset Strategy.

Always Restricted

The following actions are always restricted for Asset Strategies that are included in ASO Analysis:

- Modifying the unmitigated risk rank (non-financial or financial) for any Risk that existed when the analysis was last accessed.

Note: The unmitigated risk rank and unmitigated financial risk rank are still displayed in the Risks pane on the Asset Strategy Risks page, but the values are not hyperlinks. This means that you cannot access the Risk Matrix to view the risk ranks.

- Modifying the mitigated risk rank (non-financial or financial) for any Action that existed when the analysis was last accessed or defining the mitigated risk rank for any *new* Actions that are created after the analysis was last accessed.

Note: By default, the mitigated risk rank and mitigated financial risk ranks are not displayed in the Mitigating Actions pane on the Asset Strategy Risks page. This means that you cannot access the Risk Matrix to view the mitigated risk ranks.

- In the Risk Analysis, viewing the Actions pane.
- Applying an Asset Strategy Template as a master template to the Asset Strategy.

Conditionally Restricted

- Managing Asset Strategy states. Note the conditions:
 - If an ASO Analysis includes a System Strategy or Unit Strategy, you cannot transition the state of individual Asset Strategies that belong to the System or Unit Strategy.
 - If an Asset Strategy is included in an ASO Analysis and you change a value that causes the simulation results to become invalid (i.e., the simulation needs to be rerun), you cannot change the state of the Asset Strategy.

Additional ASM Graphs

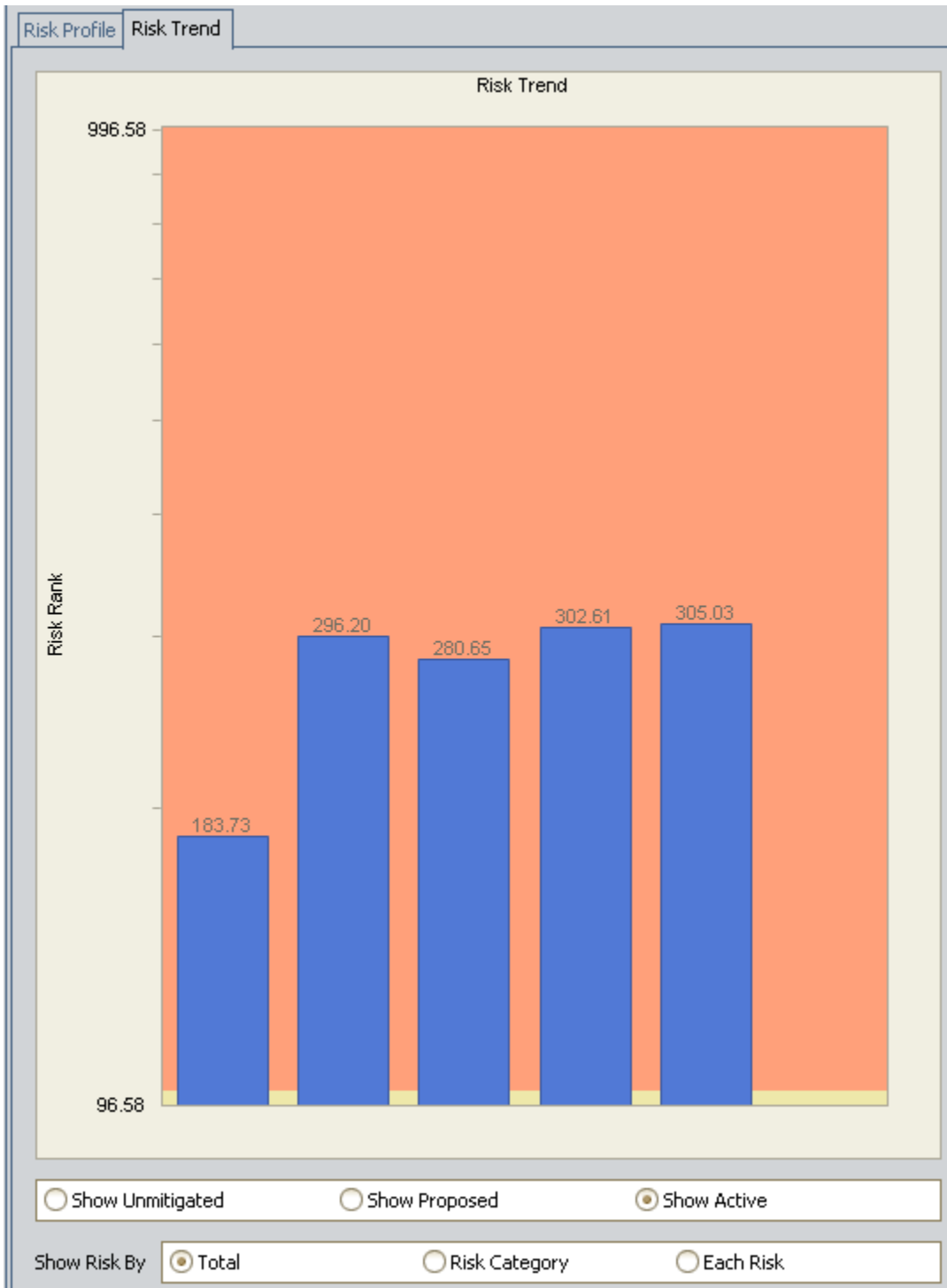
About Additional ASM Graphs

After a strategy is included in an ASO Analysis, when you open that strategy, you will see the following additional graphs in the Risk Analysis and on the Review Strategy page:

- Risk Trend
- Total Cost
- Total Cost Trend

Risk Trend Graph

After a strategy is included in an ASO Analysis, when you view the Risk Analysis or the Strategy Review page for that strategy, you will see the Risk Trend graph. The following image shows an example of the Risk Trend graph in ASM.



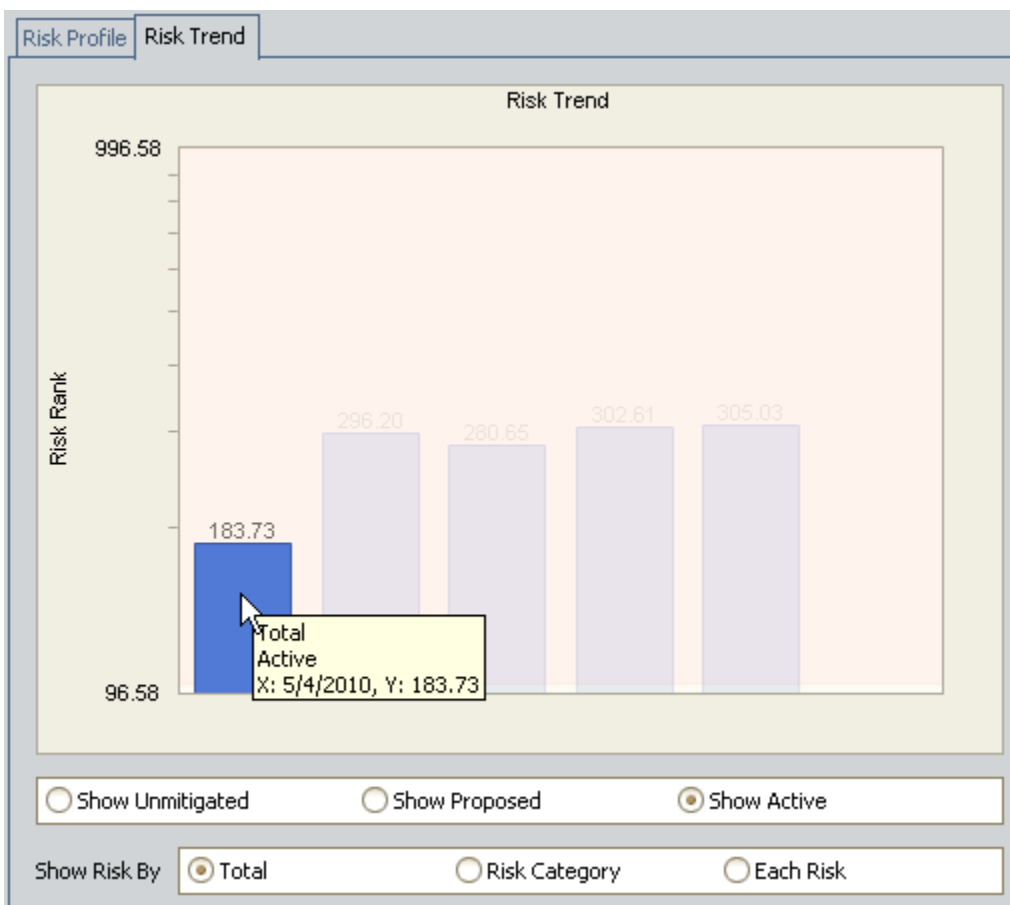
Note: The labels have been added to the graph in the image. In the baseline graph, the labels do not appear.

The Risk Trend graph in ASM displays the average (across all iterations) total risk of each Scenario for each analysis year or month, as defined by the value

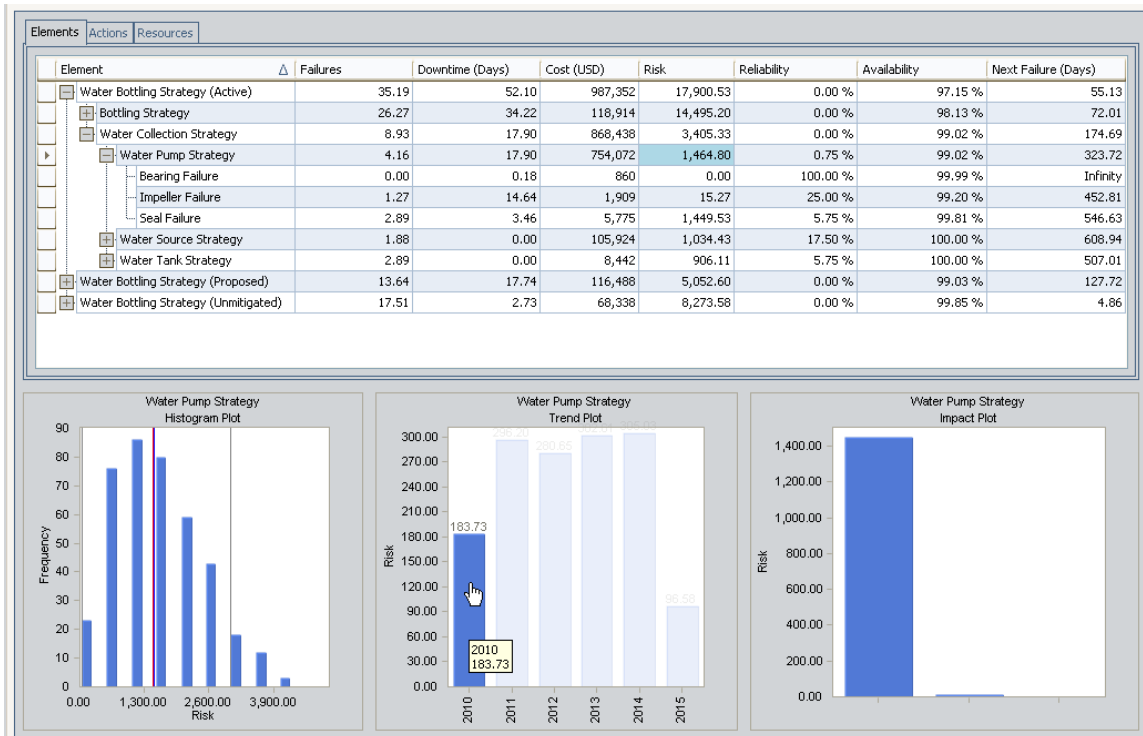
in the Time Analysis Type field in the root System Analysis record. If the Time Analysis Type field is set to:

- *Yearly*, the Risk Trend graph will display the risk for each year included in the simulation period.
- *Monthly*, the Risk Trend graph will display the risk for each month included in the simulation period.

The numbers that you see on the Risk Trend graph in ASM can also be seen in the simulation results in the ASO Analysis. Consider the following example, where the Risk Trend graph in ASM shows that for this Asset Strategy (Water Pump Strategy), the *active* risk for the first year is *183.73*:



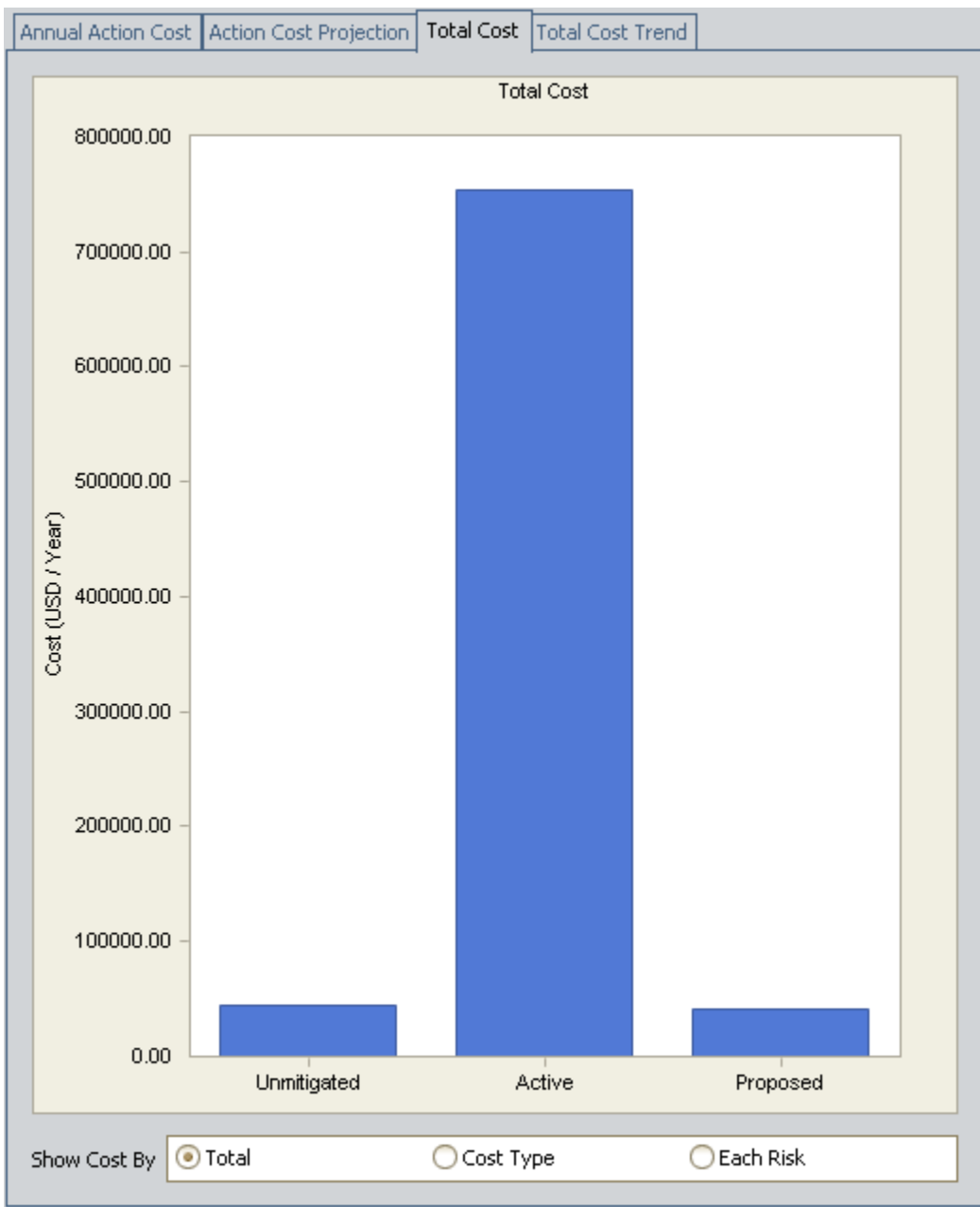
If you were to view the simulation results in the ASO Analysis that includes the Water Pump Strategy, you would see this same information. Specifically, you could view the Risk Trend Plot for the Active Scenario and the Water Pump Strategy element. The risk for the first year would be the same: *183.73*.



If desired, while viewing the Risk Trend graph, you can modify the graph to display the risk for each risk category that is included in the selected Scenario (i.e., Unmitigated, Proposed, or Active). To do so, below the x-axis, select the Risk Category option. Additionally, you can modify the graph to display the risk for each Risk that is included in the selected Scenario. To do so, below the x-axis, select the Each Risk option.

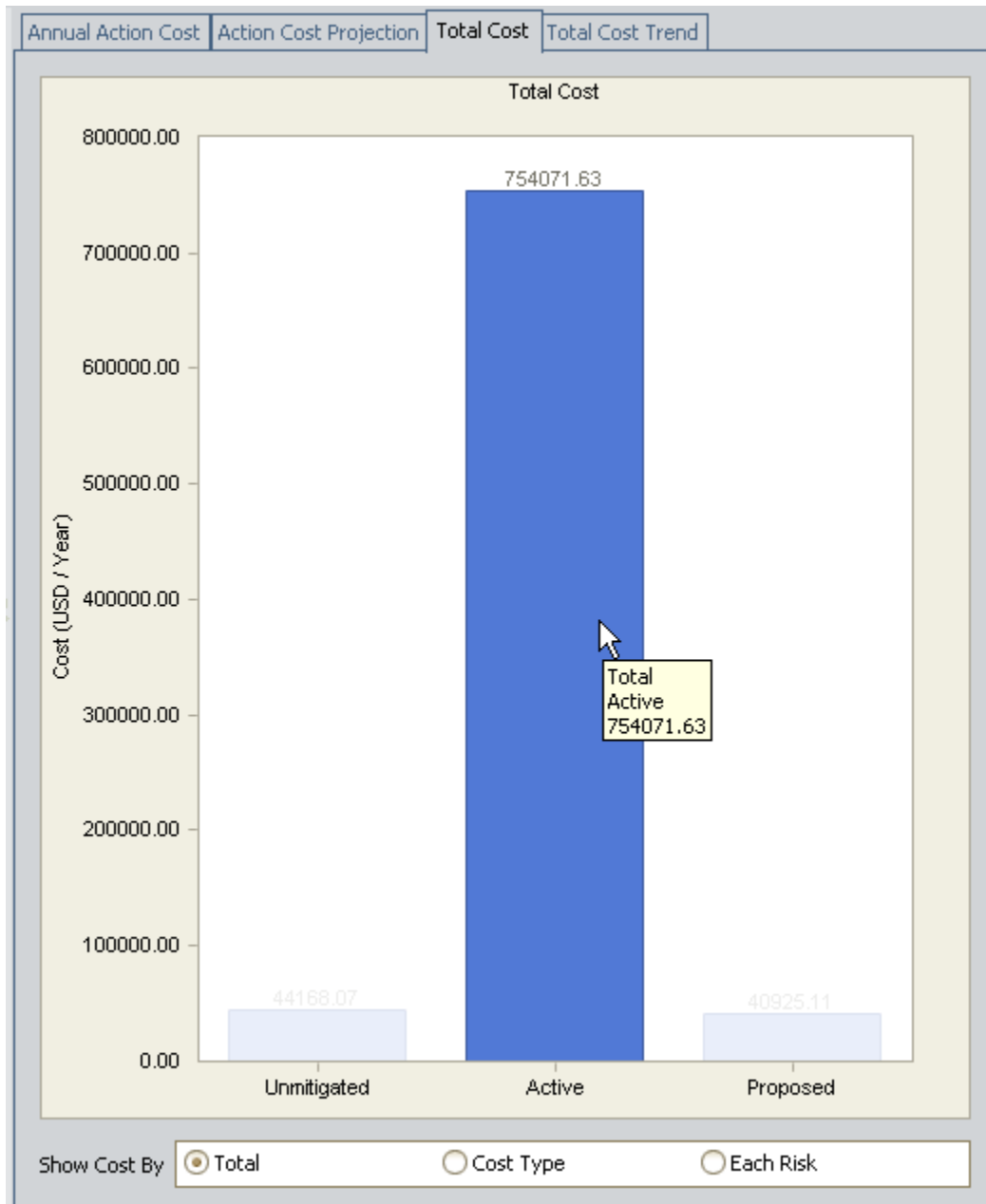
Total Cost Graph

After a strategy is included in an ASO Analysis, when you view the Risk Analysis or the Strategy Review page for that strategy, you will see the Total Cost graph. The following image shows an example of the Total Cost graph in ASM.



The Total Cost graph in ASM displays the average (across all iterations) total cost of each Scenario for the entire simulation period.

The numbers that you see on the Total Cost graph in ASM can also be seen in the simulation results in the ASO Analysis. Consider the following example, where the Total Cost graph in ASM shows that for this Asset Strategy (Water Pump Strategy), the *active* cost for the simulation period is \$754,071.63.



If you were to view the simulation results in the ASO Analysis that includes the Water Pump Strategy, you would see this same information. Specifically, in the Elements grid, you could view the value in the Cost (USD) column for the Active Scenario and the Water Pump Strategy element. The cost would be the same: \$754,072. You can see this value highlighted in blue in the following image.

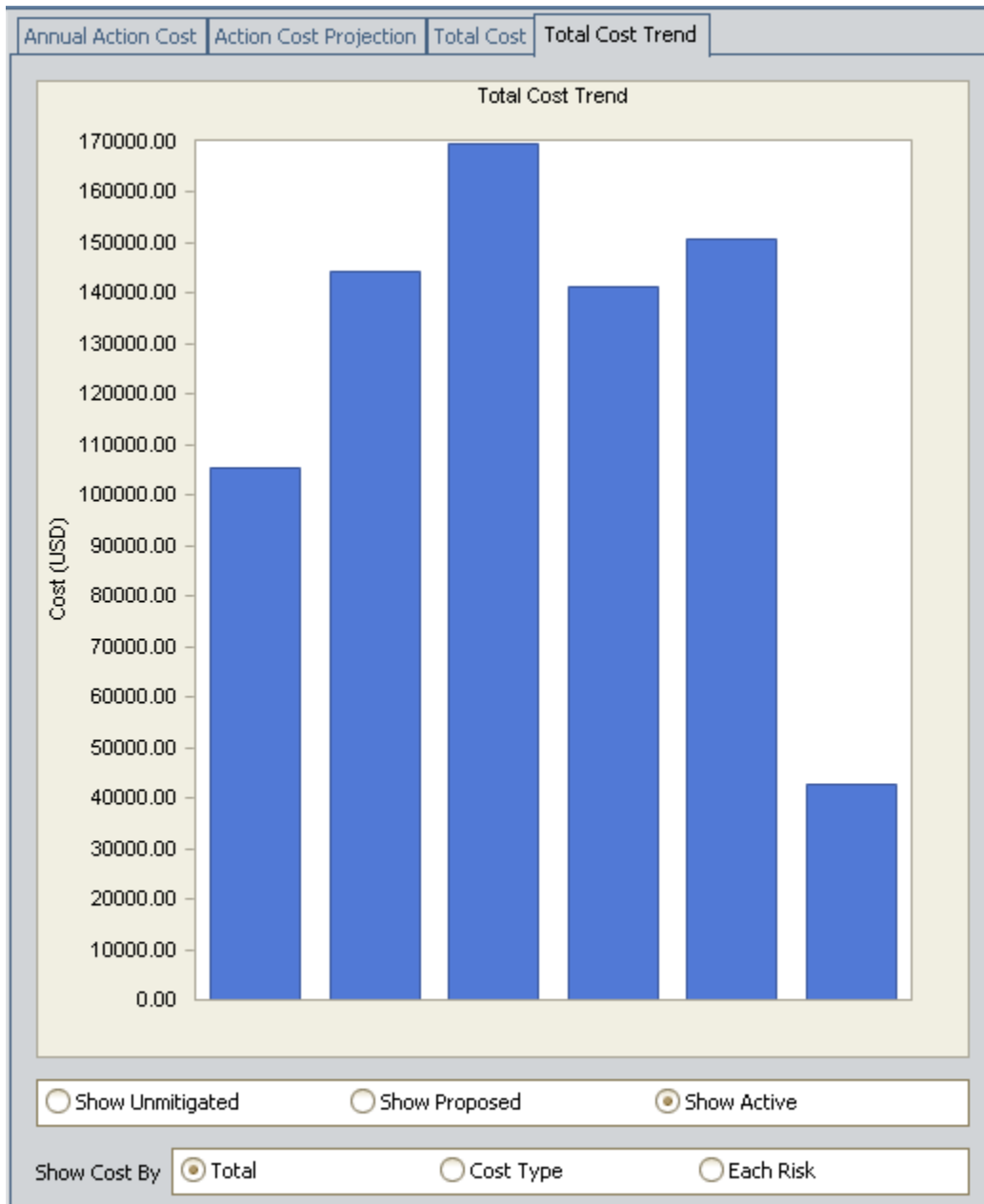
Note: The cost is rounded to the nearest dollar in the Elements grid.

Element	Failures	Downtime (Days)	Cost (USD)	Risk	Reliability	Availability	Next Failure (Days)
Water Bottling Strategy (Active)	35.19	52.10	987,352	17,900.53	0.00 %	97.15 %	55.13
Bottling Strategy	26.27	34.22	118,914	14,495.20	0.00 %	98.13 %	72.01
Water Collection Strategy	8.93	17.90	868,438	3,405.33	0.00 %	99.02 %	174.69
Water Pump Strategy	4.16	17.90	754,072	1,464.80	0.75 %	99.02 %	323.72
Bearing Failure	0.00	0.18	860	0.00	100.00 %	99.99 %	Infinity
Impeller Failure	1.27	14.64	1,909	15.27	25.00 %	99.20 %	452.81
Seal Failure	2.89	3.46	5,775	1,449.53	5.75 %	99.81 %	546.63
Water Source Strategy	1.88	0.00	105,924	1,034.43	17.50 %	100.00 %	608.94
Water Tank Strategy	2.89	0.00	8,442	906.11	5.75 %	100.00 %	507.01
Water Bottling Strategy (Proposed)	13.64	17.74	116,488	5,052.60	0.00 %	99.03 %	127.72
Water Bottling Strategy (Unmitigated)	17.51	2.73	68,338	8,273.58	0.00 %	99.85 %	4.86

If desired, while viewing the Total Cost graph, you can modify the graph to display the cost for each cost type that is included in the selected Scenario (i.e., Unmitigated, Proposed, or Active). To do so, below the x-axis, select the **Cost Type** option. Additionally, you can modify the graph to display the cost for each Risk that is included in the selected Scenario. To do so, below the x-axis, select the **Each Risk** option.

Total Cost Trend Graph

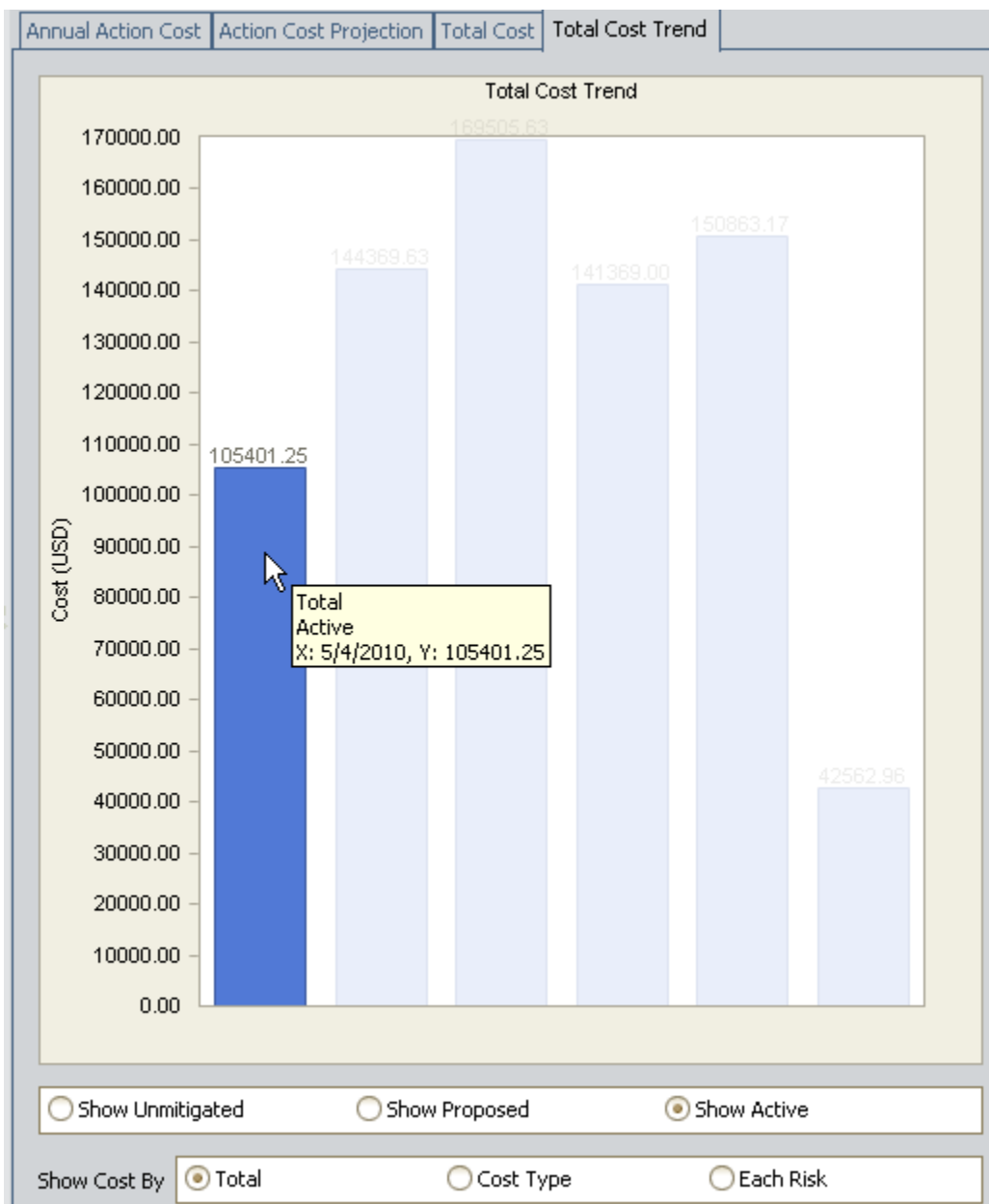
After a strategy is included in an ASO Analysis, when you view the Risk Analysis or the Strategy Review page for that strategy, you will see the Total Cost Trend graph. The following image shows an example of the Total Cost Trend graph in ASM.



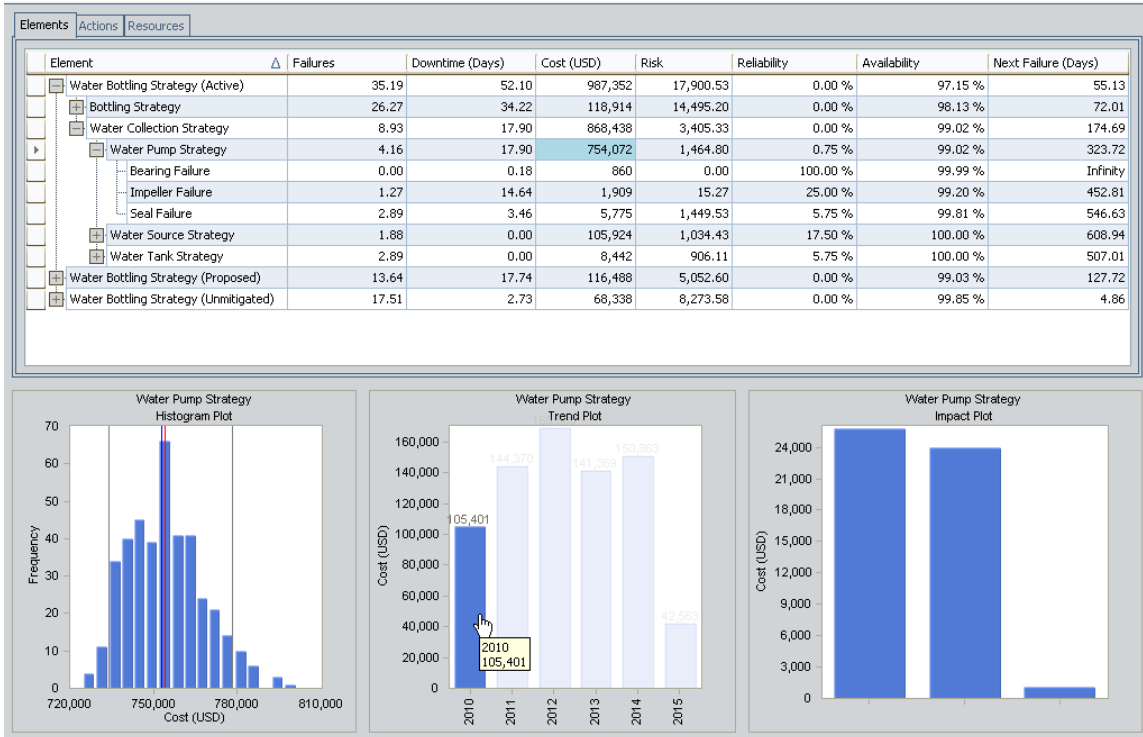
The Total Cost Trend graph in ASM displays the average (across all iterations) total cost of each Scenario for each analysis year or month, as defined by the value in the Time Analysis Type field in the root System Analysis record. If the Time Analysis Type field is set to:

- *Yearly*, the Total Cost Trend graph will display the cost trend for each year included in the simulation period.
- *Monthly*, the Total Cost Trend graph will display the cost trend for each month included in the simulation period.

The numbers that you see on the Total Cost Trend graph in ASM can also be seen in the simulation results in the ASO Analysis. Consider the following example, where the Total Cost Trend graph in ASM shows that for this Asset Strategy (Water Pump Strategy), the *active* cost for the first year is \$105,401.25.



If you were to view the simulation results in the ASO Analysis that includes the Water Pump Strategy, you would see this same information. Specifically, you could view the Cost Trend Plot for the Active Scenario and the Water Pump Strategy element. The cost for the first year would be the same: \$105,401.



If desired, while viewing the Total Cost Trend graph, you can modify the graph to display the cost trend for each cost type that is included in the selected Scenario (i.e., Unmitigated, Proposed, or Active). To do so, below the x-axis, select the **Cost Type** option. Additionally, you can modify the graph to display the cost trend for each Risk that is included in the selected Scenario. To do so, below the x-axis, select the **Each Risk** option.

Interpreting Analysis Results

Understanding the Analysis Results

When you run a Monte Carlo simulation, the Meridium APM system analyzes statistics about cost, performance, and reliability from the iterations of the Scenarios to calculate the simulation results. The data is presented in the **Asset Strategy Optimization Summary** page and the **Asset Strategy Optimization Simulation Results** page.

The **Asset Strategy Optimization Summary** page provides an overview of the costs and Resource statistics for the simulation using the following graphs:

- Annual Action Cost

- Action Cost Trend
- Total Cost
- Total Cost Trend
- Risk
- Risk Trend
- Resource Occurrence
- Resource Time
- Resource Cost

The simulation results are also presented in more detail on the **Asset Strategy Optimization Simulation Results** page. The following tabs are used to organize the data on the **System Reliability Simulation Results** page:

- **Elements**
- **Actions**
- **Resources**

By clicking a cell in any of these three grids, you can view more detailed information in the following plots:

- Histogram Plot graph
- Trend Plot graph
- Impact Plot graph

Details of the Analysis Summary

Total Cost Graph

The Total Cost graph on the **Asset Strategy Optimization Simulation Results** page works exactly like the Cost graph in System Reliability.

Note: In ASO, the Total Cost graph contains information for the Unmitigated, Active, and Proposed Scenario and information for any customer-defined Scenario. In System Reliability, there is no Unmitigated, Active, or Proposed Scenario, so the Cost graph contains only information for customer-defined Scenarios. Keep this distinction in mind when viewing the System Reliability Analysis example of the Cost graph.

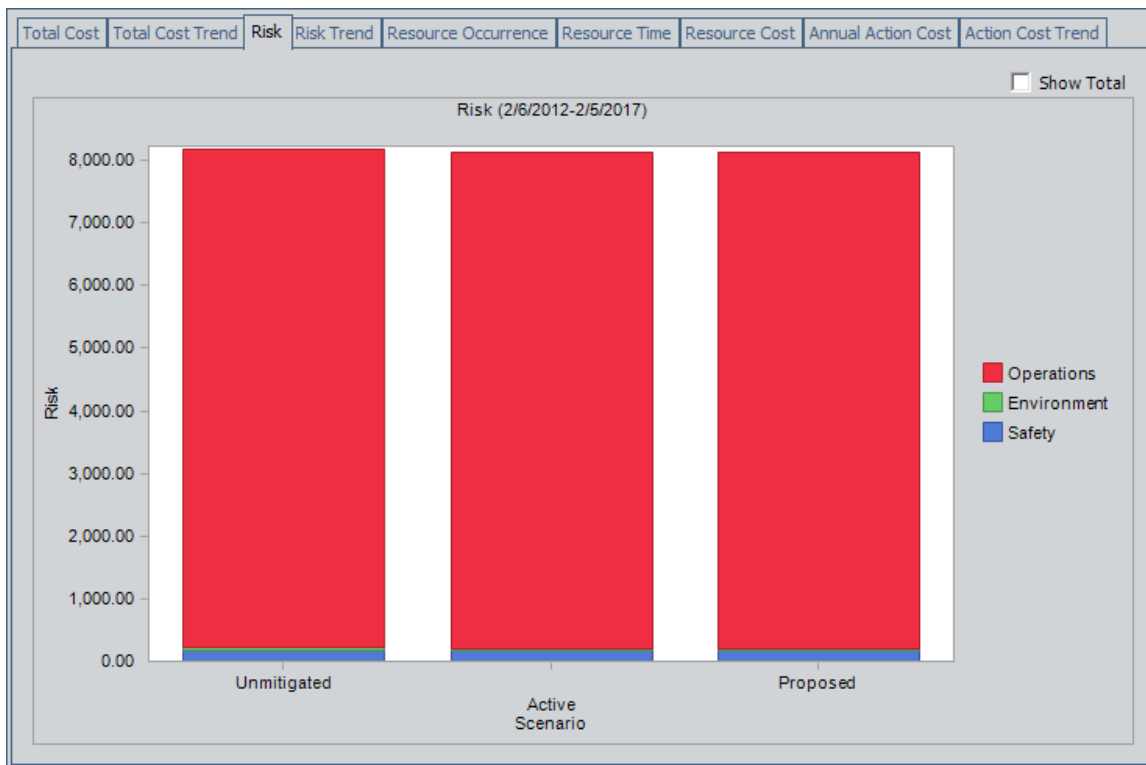
Total Cost Trend Graph

The Total Cost Trend graph on the **Asset Strategy Optimization Simulation Results** page works exactly like the Cost Trend graph in System Reliability.

Note: In ASO, the Total Cost Trend graph contains information for the Unmitigated, Active, and Proposed Scenario and information for any customer-defined Scenario. In System Reliability, there is no Unmitigated, Active, or Proposed Scenario, so the Cost Trend graph contains only information for customer-defined Scenarios. Keep this distinction in mind when viewing the System Reliability Analysis example of the Cost Trend graph.

Risk Graph

The Risk graph on the **Asset Strategy Optimization Summary** page displays the *average* total risk of each Scenario across all iterations, broken down into Operations, Environment, and Safety risk categories.



Each Risk has *three* separate risk ranks that fall into the following risk categories: Operations, Environment, and Safety. In other words, each Risk has an Operations risk rank, an Environment risk rank, and a Safety risk rank. In this section of the documentation, these risk ranks are referred to as *risk category risk ranks*.

Each bar on the graph represents a separate Scenario, and each bar is divided into sections that represent the three separate risk categories for the Risks in that Scenario. Per Scenario, the value for each risk category is calculated as the *sum* of the *calculated risk ranks* (not the risk category risk ranks) for ALL Risks in the Scenario that fall into that category.

The *calculated risk rank* for a Risk is determined using the following equation:

$$\text{Calculated Risk Rank} = \# \text{ Failures} \times \text{Risk Category Risk Rank}$$

...where:

- **# Failures** is the calculated number of failures for that Risk. This value is calculated automatically when you run the simulation and is displayed on the **Element** tab on the **Asset Strategy Optimization Simulation Results** page. Consider the following image, where the number of failures for the *Lubricant Loss* Risk is highlighted in blue.

Elements		
Element	Failures	
+ G0006-098 (Active)	17.02	
- G0006-098 (Proposed)	17.02	
- G0006-098	17.02	
Misalignment	1.48	
Motor (Driver) Failure	1.49	
Seal Leak	1.49	
Impeller Wear	1.51	
Bearing Failure	1.51	
Lubricant Loss	1.51	
Sub-component Failure	1.51	
Casing Leak	1.52	
Lubricant Degradation	5.01	

- Risk Category Risk Rank is the Operation, Environment, or Safety risk rank for that Risk (which can be accessed by clicking the hyperlinked Qualitative Consequence value on the **Asset Strategy Optimization Scenarios - Risks** page). Consider the following image, where the Safety risk rank is *100*.

Qualitative Consequence Editor

Qualitative Consequence

Total Qualitative Consequence

Category Name	Qualitative Consequence
▶ Safety	100
Environment	10
Operations	500

This explanation is best understood through an example. Consider the following table, which shows for a Proposed Scenario the Risks, number of failures per Risk, Safety risk ranks per Risk, and calculated risk ranks per Risk.

Risk	Number of Failures	Safety Risk Rank	Calculated Risk Rank (# Failures x Safety Risk Rank)
Seal Leak	1.49	100	149
Casing Leak	1.52	1	1.52
Motor (Driver) Failure	1.49	1	1.49
Sub-component Failure	1.51	1	1.51
Lubricant Loss	1.51	10	15.1
Misalignment	1.48	1	1.48
Lubricant Degradation	5.01	1	5.01
Bearing Failure	1.51	1	1.51
Impeller Wear	1.51	1	1.51

You can see that the calculated safety risk rank for each Risk is the number of failures multiplied by the safety risk rank for that Risk. If you were to add all of the calculated risk ranks together, the result would be *178.13*. The graph, therefore, would display a value *close to 178.13* as the Safety risk rank for the Proposed Scenario, as shown in the following image, where the value is *178.28*

Note: The value on the graph will not be the *exact* sum of the calculated risk ranks due to rounding. The number of failures that appears in the simulation results is rounded, but the values used to generate the graph are not rounded.

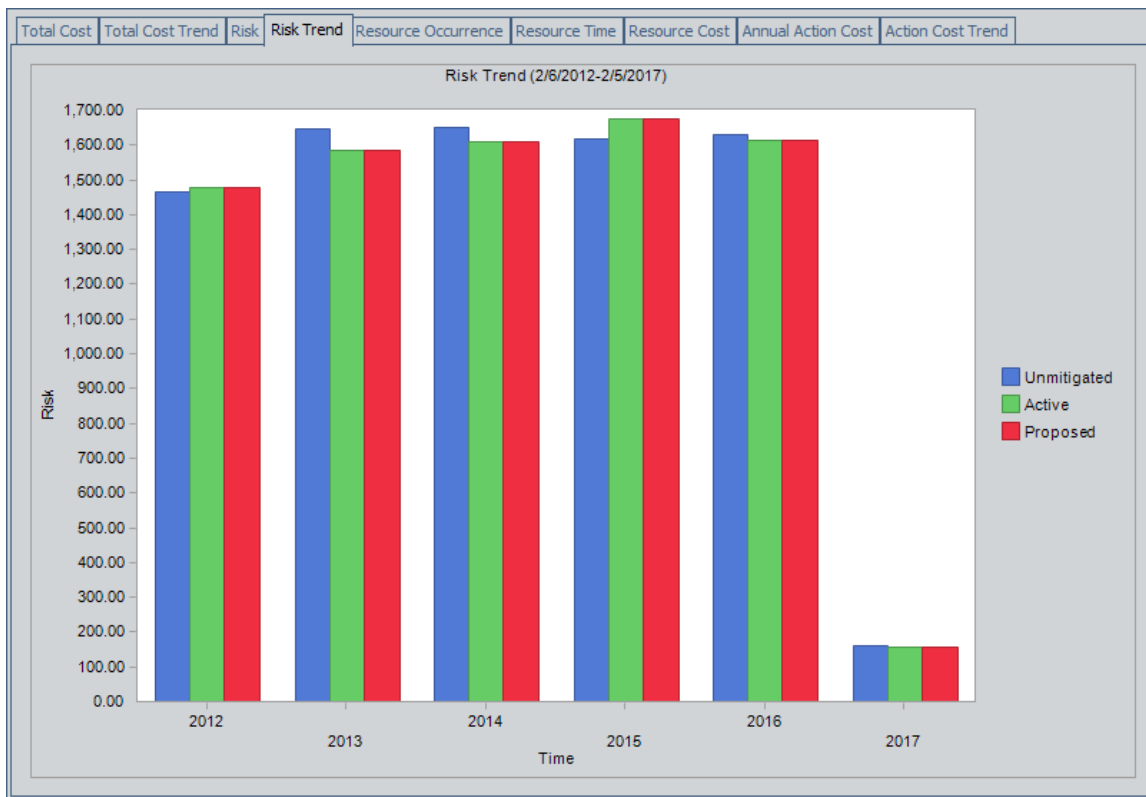


Note: If you prefer to see the various risk rank values for ALL risk categories added together and presented in a single column for each Scenario, select the **Show Total** check box in the upper right corner of the plot.

Risk Trend Graph

The Risk Trend graph on the **Asset Strategy Optimization Summary** page displays the average (across all iterations) total risk of each Scenario for each analysis year or month, as defined by the value in the Time Analysis Type field in the root System Analysis record. If the Time Analysis Type field is set to:

- *Yearly*, the Risk Trend graph will display the risk for each year included in the simulation period.
- *Monthly*, the Risk Trend graph will display the risk for each month included in the simulation period.



This image shows an example of the Risk Trend graph and presents the average total risk for all categories for each year in the analysis period. Note the following details about this example:

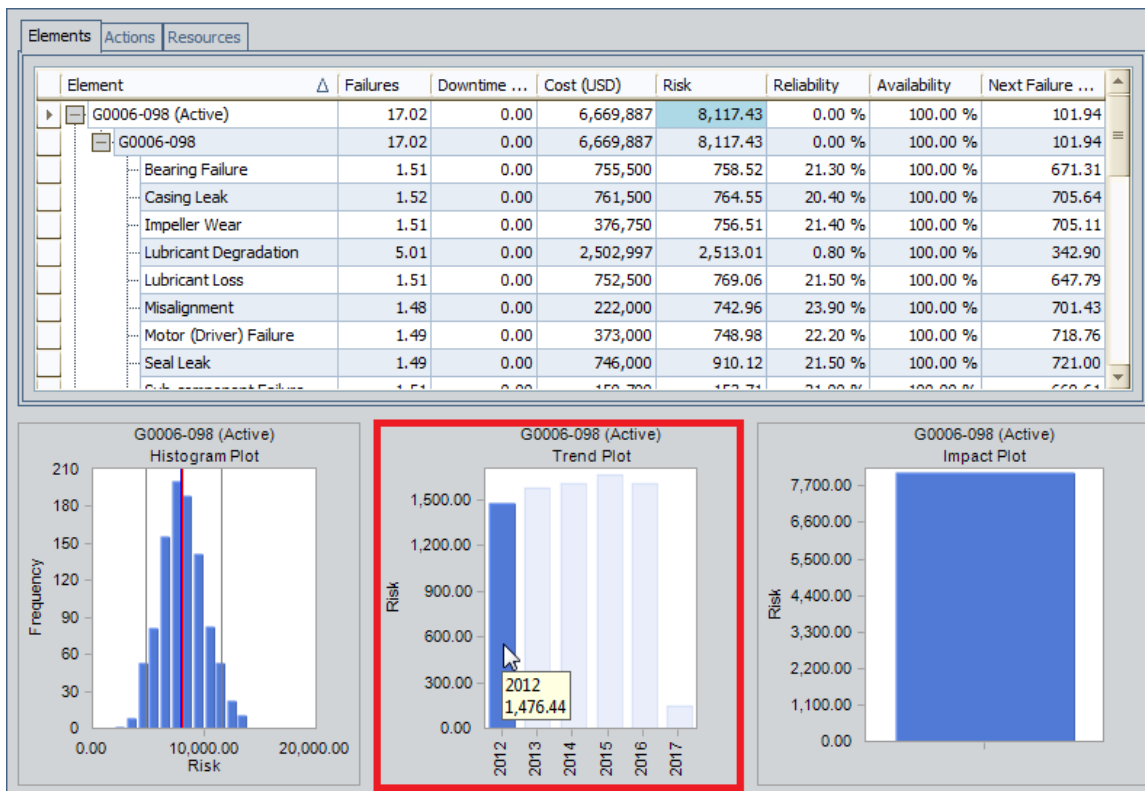
- The years 2012 and 2017 represent partial years, so the results from those two years do not represent a full 12 months.
 - 2012 represents almost 10 months, from 2/6/2012 (the date the simulation was run) to 12/31/2012 (the last day of the year in which the simulation was run).
 - 2017 represents a little over 1 month, from 1/1/2017 (the first day of the year in which the simulation period ends) to 2/5/2017 (the current day, n years from the day the simulation was run, where n is the simulation period).
- The risk for the Unmitigated Scenario is the highest in 2014 and the lowest in 2017.
- The risk for the Active Scenario is the highest in 2015 and the lowest in 2017.

- The risk for the Proposed Scenario is the highest in 2015 and the lowest in 2017.

The numbers that appear on the Risk Trend graph in the analysis summary also appear on the Trend Plot graph in the simulation results. For example, consider the following Risk Trend graph, which appears in the analysis summary. You can see that for the Active Scenario, the Risk in 2012 is *1,476.44*.



If you were to view the Trend Plot graph for the Active Scenario in the simulation results, you would see a screen like this, where the Trend Plot graph shows that the Risk in 2012 for the Active Scenario is *1,476.44*. A red outline has been added to the following image to highlight the Trend Plot graph.



Resource Occurrence Graph

The Resource Occurrence graph on the **Asset Strategy Optimization Simulation Results** page works exactly like the Resource Occurrence graph in System Reliability.

Note: In ASO, the Resource Occurrence graph contains information for the Unmitigated, Active, and Proposed Scenario and information for any customer-defined Scenario. In System Reliability, there is no Unmitigated, Active, or Proposed Scenario, so the Resource Occurrence graph contains only information for customer-defined Scenarios. Keep this distinction in mind when viewing the System Reliability Analysis example of the Resource Occurrence graph.

Resource Time Graph

The Resource Time graph on the **Asset Strategy Optimization Simulation Results** page works exactly like the Resource Time graph in System Reliability.

Note: In ASO, the Resource Time graph contains information for the Unmitigated, Active, and Proposed Scenario and information for any customer-defined Scenario. In System Reliability, there is no Unmitigated, Active, or Proposed Scenario, so the Resource Time graph contains only information for customer-defined Scenarios. Keep this distinction in mind when viewing the System Reliability Analysis example of the Resource Time graph.

Resource Cost Graph

The Resource Cost graph on the **Asset Strategy Optimization Simulation Results** page works exactly like the Resource Cost graph in System Reliability.

Note: In ASO, the Resource Cost graph contains information for the Unmitigated, Active, and Proposed Scenario and information for any customer-defined Scenario. In System Reliability, there is no Unmitigated, Active, or Proposed Scenario, so the Resource Cost graph contains only information for customer-defined Scenarios. Keep this distinction in mind when viewing the System Reliability Analysis example of the Resource Cost graph.

Annual Action Cost Graph

The Annual Action Cost graph on the **Asset Strategy Optimization Simulation Results** page works exactly like the Cost of Actions graph in Asset Strategy Management (ASM). with one exception. The Cost of Actions graph in ASM includes an additional option, **Show Cost By**, that does *not* appear on the Annual Action Cost graph in ASO.

Action Cost Trend Graph

The Action Cost Trend graph on the **Asset Strategy Optimization Simulation Results** page works exactly like the Cost Projection graph in Asset Strategy Management (ASM). with one exception. The Cost Projection graph in ASM includes an additional option, **Show Cost By**, that does *not* appear on the Action Cost Trend graph in ASO.

Details of the Simulation Results

Elements Tab

The Elements tab on the Asset Strategy Optimization Simulation Results page works exactly like the Elements tab in System Reliability.

Actions Tab

The Actions tab on the Asset Strategy Optimization Simulation Results page works exactly like the Actions tab in System Reliability.

Resources Tab

The Resources tab on the Asset Strategy Optimization Simulation Results page works exactly like the Resources tab in System Reliability.

Histogram Plot Graph

The Histogram Plot graph on the Asset Strategy Optimization Simulation Results page works exactly like the Histogram Plot graph in System Reliability.

Trend Plot Graph

The Trend Plot graph on the Asset Strategy Optimization Simulation Results page works exactly like the Trend Plot graph in System Reliability.

Impact Plot Graph

The Impact Plot graph on the Asset Strategy Optimization Simulation Results page works exactly like the Impact Plot graph in System Reliability.



Reference Information

Family Field Descriptions

System Condition Monitor

System Condition Monitor records store details about continuous, condition-based maintenance Actions. The following table provides an alphabetical list and description of the fields that exist for the System Condition Monitor family. The information in the table reflects the baseline state and behavior of these fields.

Field	Data Type	Description	Behavior and Usage
Action Cost	Number	A number that specifies the cost associated with any materials or personnel needed to complete the Action. For System Condition Monitor records, this value represents a one-time expense that is incurred when the Action is started. This field contains the value 0 by default.	On the System Condition Monitor datasheet, this field appears as a text box. You can remove the default value and type a number directly in the Action Cost cell.
Action Type	Character	The category into which the Action can be classified. By default, this field contains the value <i>Condition-Based Maintenance (Predictive) (CM)</i> .	This field is disabled on the System Condition Monitor datasheet.

Field	Data Type	Description	Behavior and Usage
Condition Monitoring Type	Character	Indicates whether the Action occurs continuously or periodically, at regular intervals. By default, this field contains the value <i>Continuous</i> .	This field is disabled on the System Condition Monitor datasheet.
Description	Text	Additional information about the action.	On the System Condition Monitor datasheet, this field appears as a text box with a  button. You can enter your own value directly in the Description cell or click the  button to view the Text Editor.
Detection Probability	Number	A number representing the probability that the action will identify a potential failure resulting from any Risk assigned to that Action and correct the potential failure.	On the datasheet, this field appears as a text box labeled Detection Probability (%) . You remove the default value and type a number directly in the cell. For an Action with no assigned Risks, any value stored in this field will be ignored. For example, a System Condition Monitor record with the Detection Probability value <i>50</i> has a 50% chance of identifying a potential failure resulting from a Risk. In other words, the action will detect one out of two potential failures resulting from any Risks assigned to the Action. By default, this field contains the value <i>100</i> .

Field	Data Type	Description	Behavior and Usage
GUID	Character	A value that uniquely identifies the record within an ASO Analysis. The value that exists in this field is generated automatically by the Meridium APM system and should not be modified as it is required for the proper functioning of ASO.	This field is disabled and not included on the datasheet by default.
Mandatory	Logical	This field is not used in ASO.	N/A
Name	Character	The name of the action.	On the datasheet, this field appears as a text box. You can enter your own value directly in the Name cell. This value is used to identify Actions in ASO Analyses. For instance, the Name column appears by default in the grid in the Actions pane on the Asset Strategy Optimization Scenarios - Actions page and displays values that exist in the Name field to identify the System Action records that are displayed in the grid.

System Inspection

System Inspection records store details about periodic, condition-based maintenance Actions. The following table provides an alphabetical list and description of the fields that exist for the System Inspection family. The information in the table reflects the baseline state and behavior of these fields. This list is not comprehensive.

Field	Data Type	Description	Behavior and Usage
Action Cost	Number	A number that specifies the cost associated with any materials or personnel needed to complete the action. For System Inspection records, this value represents an expense that is incurred every time the action occurs. This field contains the value 0 by default.	On the System Inspection datasheet, this field appears as a text box. You can remove the default value and type a number directly in the Action Cost cell.
Action Type	Character	The category into which the action can be classified. By default, this field contains the value <i>Condition-Based Maintenance (Predictive) (CM)</i> .	This field is disabled on the System Inspection datasheet.
Condition Monitoring Type	Character	Indicates whether the action occurs continuously or periodically, at regular intervals. By default, this field contains the value <i>Periodic</i> .	This field is disabled on the System Inspection datasheet.
Description	Text	Additional information about the action.	On the System Inspection datasheet, this field appears as a text box with a <input type="text"/> button. You can enter you own value directly in the Description cell or click the <input type="text"/> button to view the Text Editor.

Field	Data Type	Description	Behavior and Usage
Detection Probability	Number	A number representing the probability that the action will identify a potential failure resulting from any Risk and correct that failure before it occurs. For an Action with no assigned Risks, any value stored in this field will be ignored.	<p>On the System Inspection datasheet, this field appears as a text box labeled Detection Probability (%). You remove the default value and type a number directly in the cell.</p> <p>An action can detect a potential failure only when the action occurs during a Risk's PF Interval, as defined by the value in the PF Interval and PF Interval Units fields in the System Risk record. If the action does not occur during the PF Interval, the action cannot identify the potential failure, and the value in the Detection Probability field will be ignored. To make the action occur during the PF Interval of a Risk, you can manually modify the values in the PF Interval and PF Interval Units fields of the System Risk record, or you can optimize the Action.</p> <p>For example, setting the Detection Probability to 50 would indicate that the Action has a 50% chance of identifying a potential failure resulting from any risk if the action occurs during the PF Interval of the Risks. In other words, the action will detect one out of two potential failures resulting from any Risks assigned to the Action when the action occurs during the PF Interval of the Risks.</p>

Field	Data Type	Description	Behavior and Usage
Duration	Number	A number that, combined with the value in the Duration Units field, identifies the total time required to complete the action. For example, if the value in the Duration field is <i>4</i> and the value in the Duration Units field is <i>Hours</i> , then the action will take four hours to complete. This field contains the value <i>0</i> by default.	On the System Inspection datasheet, this field appears as a text box. You can remove the default value and enter your own value directly in the Duration cell.
Duration Units	Character	The time units associated with the value in the Duration field. By default, this field contains the value <i>Days</i> .	On the System Inspection datasheet, this field appears as a list with a blank caption and contains the following units: <i>Minutes, Hours, Days, Weeks, Months, or Years</i> . You can select a value from this list.
GUID	Character	A value that uniquely identifies the record within an ASO Analysis. The value that exists in this field is generated automatically by the Meridium APM system and should not be modified as it is required for the proper functioning of ASO.	This field is disabled and not included on the datasheet by default.



Field	Data Type	Description	Behavior and Usage
Interval	Number	A number that, combined with the value in the Interval Units field, indicates how often the action will occur. For example, if the value in the Interval field is <i>4</i> and the value in the Interval Units field is <i>Months</i> , then the action will occur every four months during the simulation period. This field contains the value <i>1</i> by default.	On the System Inspection datasheet, this field appears as a text box. You can remove the default value and enter your own value directly in the Interval cell.
Interval Units	Character	The time units associated with the value in the Interval field. By default, this field contains the value <i>Days</i> .	On the System Inspection datasheet, this field appears as list with a blank caption and contains the following units: <i>Minutes, Hours, Days, Weeks, Months, or Years</i> .
Mandatory	Logical	This field is not used in ASO.	N/A
Name	Character	The name of the action.	On the System Inspection datasheet, this field appears as a text box. You can enter your own value directly in the Name cell. This value is used to identify Actions in the ASO Analyses. For instance, the Name column appears by default in the grid in the Actions pane on the Asset Strategy Optimization Scenarios - Actions page and displays values that exist in the Name field to identify the System Action records that are displayed in the grid.

Field	Data Type	Description	Behavior and Usage
One Time Action	Logical	Indicates whether the action will occur one time or will be repeated more than once.	<p>On the System Inspection datasheet, this field appears as a check box labeled One Time Action. This check box is clear by default, indicating that the action will occur more than once. You can select this check box to indicate that an action will occur one time.</p> <p>For example, an action to inspect the vibration level of a pump might occur several times a year. In this case, the One Time Action check box in the corresponding System Inspection record would be <i>clear</i>. An action to inspect a newly installed pump for any installation errors might occur only once, however, in which case the One Time Action check box in the corresponding System Inspection record would be <i>selected</i>.</p>

Field	Data Type	Description	Behavior and Usage
Shutdown Required	Logical	Indicates whether the action requires the piece of equipment or location to be shut down in order for the action to be completed or can be completed while the piece of equipment or location is running.	<p>On the System Inspection datasheet, this field appears as a check box labeled Shutdown Required. This check box is clear by default, indicating that the piece of equipment or location does not need to be shut down for the action to be completed. You select this check box to indicate that the piece of equipment or location must be shut down for the action to be completed.</p> <p>For example, an action to inspect the vibration level of a pump could be completed while the pump is running, so the Shutdown Required check box would be <i>clear</i>. An action to inspect the internal components of a pump would be completed while the pump is not running, so the Shutdown Required check box would be <i>selected</i>.</p>

System Preventive Maintenance

System Preventive Maintenance records store information about time-based maintenance Actions. The following table provides an alphabetical list and description of the fields that exist for the System Preventive Maintenance family. The information in the table reflects the baseline state and behavior of these fields.

Field	Data Type	Description	Behavior and Usage
Action Cost	Number	A number that specifies the cost associated with any materials or personnel needed to complete the action. For System Preventive Maintenance records, this value represents an expense that is incurred every time the action occurs.	On the System Preventive Maintenance datasheet, this field appears as a text box. You can remove the default value and type a number directly in the Action Cost cell.
Action Type	Character	The category into which the action can be classified. By default, this field contains the value <i>Time-Based Maintenance (Preventive) (PM)</i> .	This field is disabled on the System Preventive Maintenance datasheet.
Condition Monitoring Type	Character	This field is not used for System Preventive Maintenance records.	This field is disabled on the System Preventive Maintenance datasheet.
Description	Text	Additional information about the action.	On the System Preventive Maintenance datasheet, this field appears as a text box with a  button. You can enter your own value directly in the Description cell or click the  button to view the Text Editor.

Field	Data Type	Description	Behavior and Usage
Duration	Number	A number that, combined with the value in the Duration Units field, identifies the total time required to complete the action. For example, if the value in the Duration field is <i>4</i> and the value in the Duration Units field is <i>Hours</i> , then the action will take four hours to complete. By default, this field contains the value <i>0</i> .	On the System Preventive Maintenance datasheet, this field appears as a text box. You can remove the default value and enter your own value directly in the Duration cell.
Duration Units	Character	The time units associated with the value in the Duration field.	On the System Preventive Maintenance datasheet, this field appears as a list with a blank caption and contains the following units: <i>Minutes, Hours, Days, Weeks, Months, or Years</i> .
GUID	Character	A value that uniquely identifies the record within an ASO Analysis. The value that exists in this field is generated automatically by the Meridium APM system and should not be modified as it is required for the proper functioning of ASO.	This field is disabled and not included on the datasheet by default.



Field	Data Type	Description	Behavior and Usage
Interval	Number	A number that, combined with the value in the Interval Units field, indicates how often the action will occur. For example, if the value in the Interval field is <i>4</i> and the value in the Interval Units field is <i>Months</i> , then the action will occur every four months during the simulation period. By default, this field contains the value <i>1</i> .	On the System Preventive Maintenance datasheet, this field appears as a text box. You can remove the default value and enter your own value directly in the Interval cell.
Interval Units	Character	The time units associated with the value in the Interval field.	On the System Preventive Maintenance datasheet, this field appears as list with a blank caption and contains the following units: <i>Minutes, Hours, Days, Weeks, Months, or Years.</i>
Mandatory	Logical	This field is not used in ASO.	N/A
Name	Character	The name of the action.	On the System Preventive Maintenance datasheet, this field appears as a text box. You can enter your own value directly in the Name cell. This value is used to identify Actions in the ASO Analyses. For instance, the Name column appears by default in the grid in the Actions pane on the Asset Strategy Optimization Scenarios - Actions page and displays values that exist in the Name field to identify the System Action records that are displayed in the grid.

Field	Data Type	Description	Behavior and Usage
One Time Action	Logical	Indicates whether the action will occur one time or will be repeated more than once.	<p>On the System Preventive Maintenance datasheet, this field appears as a check box labeled One Time Action. This check box is clear by default, indicating that the action will occur more than once. You can select this check box to indicate that an action will occur one time.</p> <p>For example, an action to inspect the vibration level of a pump might occur several times a year. In this case, the One Time Action check box in the corresponding System Inspection record would be <i>clear</i>. An action to inspect a newly installed pump for any installation errors might occur only once, however, in which case the One Time Action check box in the corresponding System Inspection record would be <i>selected</i>.</p>

Field	Data Type	Description	Behavior and Usage
Shutdown Required	Logical	Indicates whether the action requires the piece of equipment or location to be shut down in order for the action to be completed or can be completed while the piece of equipment or location is running.	<p>On the System Preventive Maintenance datasheet, this field appears as a check box labeled Shutdown Required. This check box is clear by default, indicating that the piece of equipment or location does not need to be shut down for the action to be completed. You select this check box to indicate that the piece of equipment or location must be shut down for the action to be completed.</p> <p>For example, an action to inspect the vibration level of a pump could be completed while the pump is running, so the Shutdown Required check box would be <i>clear</i>. An action to inspect the internal components of a pump would be completed while the pump is not running, so the Shutdown Required check box would be <i>selected</i>.</p>

System Special Action

System Special Action records store information about procedural, redesign, or training Actions. The following table provides an alphabetical list and description of the fields that exist for the System Special Action records. The information in the table reflects the baseline state and behavior of these fields.

Field	Data Type	Description	Behavior and Usage
Action Cost	Number	A number that specifies the cost associated with any materials or personnel needed to complete the action. For System Special Action records, this value represents an expense that is incurred every time the action occurs.	On the System Special Action datasheet, this field appears as a text box. You can remove the default value and type a number directly in the Action Cost cell.
Action Type	Character	The category into which the action can be classified.	On the System Special Action datasheet, this field appears a list labeled Action Type and contains the following values: <ul style="list-style-type: none"> • Procedures (PROC) • Redesign (DSN) • Training (TRN) You can select the desired value in this field when you create the System Special Action record. After you make your selection, this field will be disabled so that the value cannot be modified.
Condition Monitoring Type	Character	This field is not used for System Special Action records.	This field is disabled on the System Special Action datasheet.
Description	Text	Additional information about the action.	On the System Special Action datasheet, this field appears as a text box with a  button. You can enter your own value directly in the Description cell or click the  button to view the Text Editor.

Field	Data Type	Description	Behavior and Usage
Duration	Number	A number that, combined with the value in the Duration Units field, identifies the total time required to complete the action. For example, if the value in the Duration field is <i>4</i> and the value in the Duration Units field is <i>Hours</i> , then the action will take four hours to complete. By default, this field contains the value <i>0</i> .	On the System Special Action datasheet, this field appears as a text box. You can remove the default value and enter your own value directly in the Duration cell.
Duration Units	Character	The time units associated with the value in the Duration field.	On the System Special Action datasheet, this field appears as a list with a blank caption and contains the following units: <i>Minutes, Hours, Days, Weeks, Months, or Years</i> .
GUID	Character	A value that uniquely identifies the record within an ASO Analysis. The value that exists in this field is generated automatically by the Meridium APM system and should not be modified as it is required for the proper functioning of ASO.	This field is disabled and not included on the datasheet by default.

Field	Data Type	Description	Behavior and Usage
Interval	Number	A number that, combined with the value in the Interval Units field, indicates how often the action will occur. For example, if the value in the Interval field is <i>4</i> and the value in the Interval Units field is <i>Months</i> , then the action will occur every four months during the simulation period. By default, this field contains the value <i>1</i> .	On the System Special action datasheet, this field appears as a text box. You can remove the default value and enter your own value directly in the Interval cell.
Interval Units	Character	The time units associated with the value in the Interval field.	On the System Special Action datasheet, this field appears as list with a blank caption and contains the following units: <i>Minutes, Hours, Days, Weeks, Months, or Years</i> .
Mandatory	Logical	This field is not used in ASO.	N/A
Name	Character	The name of the action.	On the System Special Action datasheet, this field appears as a text box. You can enter your own value directly in the Name cell. This value is used to identify Actions in ASO Analyses. For instance, the Name column appears by default in the grid in the Actions pane on the Asset Strategy Optimization Scenarios - Actions page and displays values that exist in the Name field to identify the System Action records that are displayed in the grid.

Field	Data Type	Description	Behavior and Usage
One Time Action	Logical	Indicates whether the action will occur one time or will be repeated more than once.	<p>On the System Special Action datasheet, this field appears as a check box labeled One Time Action. This check box is selected by default, indicating that the action will occur once. You can clear this check box to indicate that an action will occur more than once.</p> <p>For example, an action to inspect the vibration level of a pump might occur several times a year. In this case, the One Time Action check box in the corresponding System Inspection record would be <i>clear</i>. An action to inspect a newly installed pump for any installation errors might occur only once, however, in which case the One Time Action check box in the corresponding System Inspection record would be <i>selected</i>.</p>

Field	Data Type	Description	Behavior and Usage
Shutdown Required	Logical	Indicates whether the action requires the piece of equipment or location to be shut down in order for the action to be completed or can be completed while the piece of equipment or location is running.	<p>On the System Special Action datasheet, this field appears as a check box labeled Shutdown Required. This check box is selected by default, indicating that the piece of equipment or location must be shut down for the action to be completed. You clear this check box to indicate that the piece of equipment or location does not need to be shut down for the action to be completed.</p> <p>For example, an action to inspect the vibration level of a pump could be completed while the pump is running, so the Shutdown Required check box would be <i>clear</i>. An action to inspect the internal components of a pump would be completed while the pump is not running, so the Shutdown Required check box would be <i>selected</i>.</p>

URLs

Parameters for the Asset Strategy Optimization URL

The URL for displaying ASO Analyses, `meridium://ASM/Optimization`, *requires* both parameters described in the following table. For examples of these parameters, click [here](#).

Parameter Name	Description	Accepted Value(s)	Notes
AnalysisKey	Specifies which ASO Analysis that you want to view.	The Entity Key of the desired System Analysis record.	None
Page	Identifies the page that you want to display.	Analysis	When the analysis appears, the Asset Strategy Optimization Summary page is displayed by default.

Examples of ASO URLs

- `meridium://ASM/Optimization?Page=Analysis&AnalysisKey=1234567`

Opens the ASO Analysis containing the System Analysis record with the Entity Key 1234567.

Glossary

Action

An operation that can be performed against a piece of equipment or location. Actions can represent inspections, general maintenance, or specific events that mitigate Risks.

Diagram

A representation of the physical layout and construction of pieces of equipment and locations. A Diagram consists of a root System Subsystem record, which is linked to one or more System Subsystem, System Sensor, System Buffer, System Link, System Asset, and System Switch records that together make up the Diagram.

Global Event

An optional component of a Scenario that groups together Actions requiring a shutdown so that they will be performed at the same time, thereby maximizing availability.

Resource

An optional component in an ASO Analysis that represents physical parts or materials, such as spare bearings or seals, or human resources, such as mechanics or technicians, that you may want to use within the analysis.

Risk

One way in which a piece of equipment or location can fail. If the risk occurs, then the piece of equipment or location will fail. In ASO Analyses, Risks are represented by System Risk records, which are linked to System Asset and System Switch records.

Scenario

A representation of a strategy in an ASO Analysis. Each ASO Analysis will contain an Active Scenario, a Proposed Scenario, an Unmitigated Scenario, and a Customer-defined Scenario.

Simulation

The process of running Monte Carlo iterations for each Scenario in a System Reliability Analysis and viewing the results calculated from those simulations.