

AssetWise Performance Management

APM Maintenance Task Analysis Guide



Trademark Notice

Bentley, the “B” Bentley logo, AssetWise, Ivara, and Ivara Work Smart are either registered or unregistered trademarks or service marks of Bentley Systems, Incorporated or one of its direct or indirect wholly owned subsidiaries. All other brands and product names are trademarks of their respective owners.

Copyright Notice

Copyright © 2016, [Bentley Systems, Incorporated](#). All Rights Reserved.

Including software, file formats, and audiovisual displays; may only be used pursuant to applicable software license agreement; contains confidential and proprietary information of Bentley Systems, Incorporated and/or third parties which is protected by copyright and trade secret law and may not be provided or otherwise made available without proper authorization.

For reference, a copy of the End User License Agreement named “EULA.pdf” is installed in the same folder as the product.

Corporate Headquarters	International Headquarters	Asia Headquarters
Bentley Systems, Incorporated 685 Stockton Drive Exton, PA 19341-0678 USA Phone: (1) 610 458-5000 Fax: (1) 610 458-1060 http://www.bentley.com	Bentley Systems International Limited Second Floor, Block 2, Park Place Upper Hatch Street Dublin 2 Ireland Phone: +353 1 436 4600 Fax: +353 1 416 1261 http://www.bentley.com	Bentley Engineering Software Systems Unit 1402-06, Tower 1 China Central Place, Beijing 100022 China Phone: (86) 10 5929 7000 Fax: (86) 10 5929 7001 http://www.bentley.com

APM Maintenance Task Analysis Guide

Published June 2016

APM Release 7.5



Contents

Preface	7
About This Guide	8
Related Documentation	9
1. Introduction to Maintenance Task Analysis	11
Overview of Maintenance Task Analysis	12
Creating the Components of the Analysis	12
Using Isograph Availability Workbench	14
MTA2 and Failure Tracking	14
Referencing SAP Plant Maintenance Objects in Analyses	14
Overview of Risk Analysis	17
Overview of Performing Analysis	24
Create the Analysis and Select Assets	24
Record the Primary Asset's Operating Context	25
Manage the Analysis	25
Add and Analyze Failure Modes	25
Using Isograph Availability Workbench	27
Develop and Implement Action Plans	27
Add Indicators to Action Plans	28
Add Tasks, Documents, and Work to Action Plans	28
Monitor the Status of Analyses	28
View Information About the Analysis	29
Link Action Plans to Projects	29
Create MTA2 Templates	29
Two Ways to Access Maintenance Task Analyses	31
Reusing Failure Modes	33
Setting up APM for Maintenance Task Analysis	34
Define Site Ownership of Analyses and Templates	34
Define Employee Roles	34
Estimate Failure Modes for Assets	34
Set up Analysis Types for MTA2	34
Define Operating Context Values	35
Define Modification Types	35
Define Checklist Items	35
Set Smart Mapping Options for Failure Mode Copies	36
Set up Document Numbering	36
Define Failure Mode Settings	36
Set up Risk Analysis	37
Set up Interoperability Options for SAP Plant Maintenance	38
Glossary of MTA2 Terms	39

2. Creating and Managing Analyses	47
Creating an Analysis from Scratch	48
Creating an Analysis From a Template	54
Setting Failure Mode Options for an Analysis	64
Setting Risk Analysis Options for an Analysis	77
Adding Assets to an MTA2	86
Excluding Assets from an Analysis	95
Working with Asset Scope on an MTA2	97
Recording the Primary Asset's Operating Context	100
Adding Team Members to an Analysis	101
Entering and Reviewing Comments on an Analysis	103
Recording Team Meetings on an Analysis	106
Working with the Analysis Checklist	107
3. Developing Failure Modes	111
Creating Failure Modes	112
Creating Analysis Requests for Failure Modes	118
Evaluating Susceptibility to Failure	124
Performing Failure Mode Risk Analysis	127
Performing Risk Analysis with Weighted Severities	144
Performing Demand Scenario Risk Analysis	147
Viewing Risk Analyses for Failure Modes	160
Recording Failure Data	164
Evaluating the Feasibility of Maintenance Tasks	171
Developing Primary Action Plans	178
Creating Secondary Action Plans	184
Calculating a Failure-Finding Interval	186
Adding Indicators, Tasks, and Work to Action Plans	192
Reviewing Indicator Collection Information	203
Adding Standard Documents to Action Plans	205
Recording and Reviewing Failure Mode Details	207
Adding Symptoms to a Failure Mode	210
4. Copying Failure Modes	211
Overview of the Copy Failure Modes Wizard	212
Setting Mapping Options for a Failure Mode Copy	221
Browsing for Failure Modes to Add to an MTA2 or Template	231
Copying Failure Modes to an Analysis or Template	244
Copying an Asset's Strategy Development Program	258
Revisiting Failure Mode Copy Requests	270
5. Working with Maintenance Task Analyses	275
Changing the Status of Failure Modes and Analyses	276
Sending an Analysis for Approval	280
Working with Action Plan Task Statuses	282
Viewing Information About an Analysis or Template	284
Reviewing Analysis Assets' Reliability Programs	289
Printing MTA2 Reports	296

Linking Action Plans to Projects	301
Working With a Project's Links to Action Plans.....	303
Changing the Primary Asset on an Analysis	305
Updating the Asset Hierarchy Snapshot	307
Viewing Failure Modes and Action Plans	308
Viewing Failure Modes for Standard Tasks and Jobs	310
Editing an Asset's Failure Modes	313
 6. MTA2 Templates.....	317
Creating an MTA2 Template	318
Setting up a Template Hierarchy	327
Viewing Template Hierarchies	332
Moving an Analysis Template to a Different Site.....	333
 Index	335



Preface

This preface contains information about the purpose and content of the *APM Maintenance Task Analysis Guide*. It also points out sections in other documents that provide information you might need.

Contents

About This Guide	8
Related Documentation	9

About This Guide

Maintenance task analysis (MTA2) is APM's strategy development methodology that delivers rapid results by enabling the analysis team to quickly create and implement basic, technically sound reliability programs. The *APM Maintenance Task Analysis Guide* is meant for analysis team members who intend to use APM's software tools to perform, record, and manage maintenance task analyses. This guide explains how to use APM to perform and record analyses, manage your analyses, and create MTA2 templates. Refer to:

- [“Introduction to Maintenance Task Analysis” on page 11](#) for definitions of MTA2 terms and concepts, a summary of the steps required to perform analyses, and ways to approach analyses.
- [“Creating and Managing Analyses” on page 47](#) for step-by-step instructions for creating analyses, working with assets, and using project management tools like meeting notes, checklists, and comment reviews.
- [“Developing Failure Modes” on page 111](#) for information about creating failure modes, performing risk and feasibility analysis, developing action plans, and adding indicators, standard tasks and jobs, and documents.
- [“Copying Failure Modes” on page 211](#) for information about copying failure modes between assets. The Copy Failure Mode wizard employs smart asset mapping to match assets, failure modes, and so on across branches of the asset hierarchy.
- [“Working with Maintenance Task Analyses” on page 275](#) when you have created analyses and wish to change their statuses, view information about them, or modify them in different ways.
- [“MTA2 Templates” on page 317](#) when you are ready to create and organize the templates on which you will base future analyses.

The *APM Maintenance Task Analysis Guide* is available in APM Help and as a stand-alone Portable Document Format (PDF) file. This PDF file is designed as a self-contained document that you can copy to different computers and use independently of the APM software. The guide is designed for two-sided printing on an office laser printer so that you can distribute, read, and annotate it as a printed book.

Related Documentation

In addition to this guide, you will find the following Help topics useful when developing maintenance task analyses. Cross-references to these topics are available throughout the guide, wherever they are pertinent to the current subject.

See this topic...	For information about...
"Setting up Site Types" in Help	Specifying the site types that support maintenance task analyses
"Strategy Development Settings", "Failure Mode Settings", and "Risk Analysis Settings" in Help	Setting default options for new analyses and templates, operating context values, modification types, and failure mode risk assessment values.
<i>APM Integration Guide for Iso-graph Availability Workbench</i>	Using the Availability Workbench to analyze and optimize failure modes. The guide is available in the APM\Docs\English\Integration_Guides folder.
"Changing an Asset's Primary Function" in Help	Changing the description of an asset's primary function, which is displayed in its analyses
"Setting up Asset Indicators" in Help	Creating indicators to assign to analyses
"Creating and Planning Projects" in Help	Creating projects to support modifications recommended for assets
"Standard Task and Standard Jobs" in Help	Creating standard tasks and standard jobs for performing corrective actions on assets



Chapter 1 **Introduction to Maintenance Task Analysis**

This chapter provides an overview of maintenance task analysis (MTA2), explaining the steps required to set up for MTA2 and perform analyses.

Contents

Overview of Maintenance Task Analysis	12
Overview of Risk Analysis	17
Overview of Performing Analysis	24
Two Ways to Access Maintenance Task Analyses	31
Reusing Failure Modes	33
Setting up APM for Maintenance Task Analysis	34
Glossary of MTA2 Terms	39

Overview of Maintenance Task Analysis

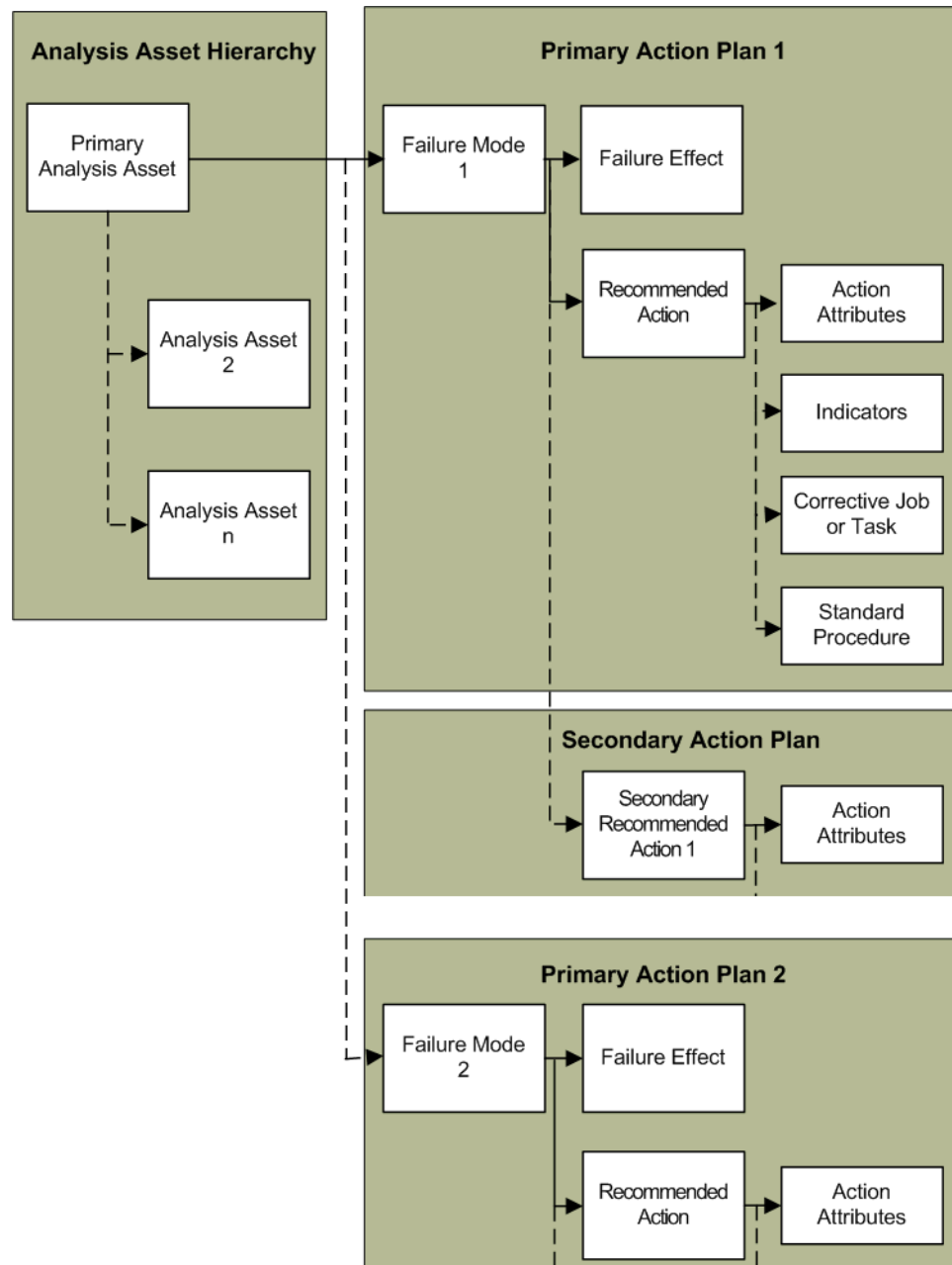
Maintenance task analysis (MTA2) is APM's unique strategy development methodology that enables the analysis team to quickly create and implement basic, technically-sound reliability programs. MTA2 is most effective when operational and maintenance knowledge about assets is well-documented and consistently used by employees. MTA2 provides an alternative to the resource-intensive RCM2 analysis, while still allowing you to identify the right work to improve performance across the plant.

MTA2 methodology and tools allow the analysis team to:

- Identify the assets to be analyzed
- Identify the causes of asset failure
- Recommend actions to prevent or mitigate failures

Creating the Components of the Analysis

The following diagram illustrates the components of an MTA2.



To perform maintenance task analysis, the analysis team:

- Selects the assets to be analyzed, which form the analysis asset hierarchy, a snapshot taken from the site's physical hierarchy.
- For each of the assets, identifies the causes of asset failure (failure modes) and the effects of the failure.

- Identifies failure consequences. For key assets, the team can perform failure mode risk assessments to determine which failure modes have the highest priority for implementation.
- Develops action plans to deal with each failure mode. A recommended action is selected for each failure mode, for example, condition-based maintenance or modification/redesign.
- Optionally evaluates the economic feasibility of implementing proposed maintenance tasks. With the help of the maintenance efficiency index (MEI), APM uses the avoidance savings and task costs to determine if the proposed tasks are justified or not.
- Depending on the type of action, adds indicators, corrective standard tasks or jobs, or procedures to the action plan. One or more secondary action plans can be recommended for a failure mode.

Using Isograph Availability Workbench

Using the integration functionality in APM, you can export failure modes from MTA2 and RCM2 analyses to the Isograph Availability Workbench (AWB), where you can analyze and optimize the data. You can then import optimization results into the APM analysis, review the recommendations in the **Optimization** view, and make appropriate changes to the action plans.

Before you can export failure modes, you must have installed the Availability Workbench with a valid license. Your APM license must include the Reliability Strategy Development and Implementation and Performance Management modules, and the modules must be active on the sites where you want to use the functionality.

For information about using this functionality, see *APM Integration Guide for Isograph Availability Workbench*.

MTA2 and Failure Tracking

If your organization tracks asset failures using APM, you can link each failure record that references a failure mode to an existing MTA2. You can also use a failure record as the starting point for a new MTA2. For more information, see “Failure Tracking” in Help.

Referencing SAP Plant Maintenance Objects in Analyses

If APM has been configured to access live, read-only information in an SAP Plant Maintenance system, you can view the following SAP objects and their properties in APM sites:

- Task lists – General, Equipment, Functional Locations, and Operations
- Maintenance items – Maintenance items, Equipment Object Lists and Functional Location Object Lists
- Maintenance plans

SAP objects can be referenced as corrective tasks in action plans and as proposed tasks in failure mode feasibility evaluations. SAP information is available in CPR, MTA2, RCM2, RBI, SIF, and HAZOP analyses.

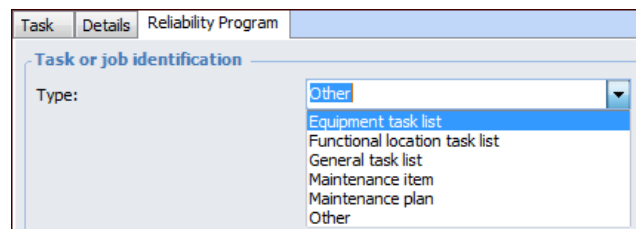
For example, a reliability engineer can reconcile the action plans developed in a strategy development analysis with actual maintenance items in SAP. When creating action plans, the engineer browses the SAP data, using filters to narrow the search for a maintenance item that matches the action plan. When the item is selected, its number is recorded in the action plan for later reference, and the engineer can then mark the action plan as “Implementation completed”. At any time, APM users can view details about the referenced maintenance item by double-clicking its icon to open a properties window. These interoperability features help users to quickly and accurately ensure that their action plans are properly implemented in SAP, without having to flip back and forth between systems.

Tip: Interoperability settings at the enterprise and site levels determine the SAP information available on sites. In the Enterprise window, **Integrations** view, APM administrators can create interoperability profiles to be assigned to individual sites. Profile settings determine if SAP objects, APM objects, or both are available in strategy development analysis and the **Reliability Program** view on site. Similarly, the profile controls whether SAP or APM information is displayed in action plan details.

Referencing SAP Objects in Analyses

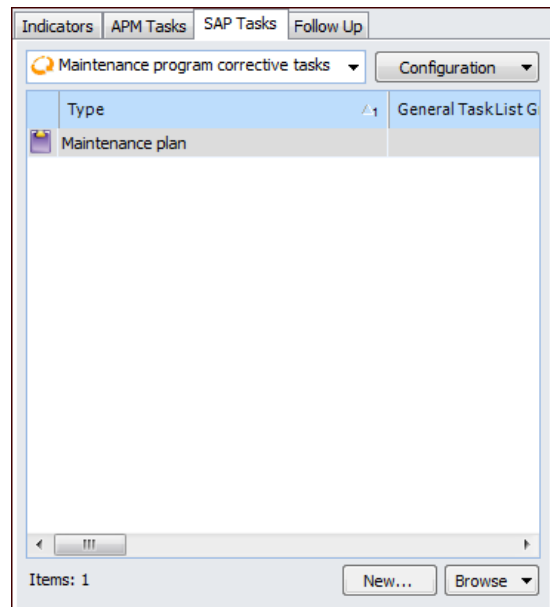
In a strategy development analysis SAP Plant Maintenance objects are available for selection in two locations:

- In Feasibility evaluations on failure modes, you can select an SAP item for the proposed task on the **Reliability Program** tab.



When action plans are updated from the Feasibility evaluation, the proposed task is referenced in the **SAP Tasks** tab.

- In primary and secondary action plans, you can select an SAP task list, maintenance item, or maintenance plan for corrective tasks. This example of the Maintenance Action Plan window shows both **APM Tasks** and **SAP Tasks** tabs because the site's profile makes information from both systems available.



In the action plan's **Details** area, SAP information (System condition and Work center) can replace APM information (Operating condition and Maintenance group).

For information about viewing, filtering, and browsing SAP objects, see [“Viewing SAP Plant Maintenance Information in APM”](#) in Help.

For information about setting up interoperability, see *APM Interoperability Guide for SAP Plant Maintenance*.

Overview of Risk Analysis

APM maintenance task analysis supports two types of risk analysis:

- Failure mode risk analysis is performed on the failure mode as a whole
- Demand scenario risk analysis is performed on each demand scenario identified for the failure mode

This topic explains each type and the concepts that are common to them.

Failure Mode Risk Analysis

In the process of evaluating a failure mode, you can quantify the relative risk (criticality) associated with the failure by evaluating the consequences (severity of the effect) and the probability of the failure occurring, assigning values for each factor. APM then calculates the relative risk by multiplying the severity by the probability values.

When the relative risk is established, APM calculates the failure mode's priority using a set of customer-defined rules. The consequence priority rules can be based on the failure mode's severity, relative risk, downtime costs, downtime duration, or a combination. For example, the Extreme priority could be assigned to failure modes whose total severity is equal to 5.0.

You can apply a confidence factor to the analysis to quantify your faith in current maintenance or inspection practices to contain the failure mode's risk. The confidence factor can adjust the inspection factor or the failure mode's position in the risk matrix.

After you have analyzed the failure modes, you can compare failure modes and identify the relative importance of addressing them. The **Risk Assessment** view in the Strategy Development Analysis window includes failure mode lists based on criticality, consequence priority, severity, and relative risk, as well as a risk plot, risk matrix, and lists of the evaluations. This view is also available for the asset.

APM provides two ways to perform failure mode risk analysis:

- Using a simple evaluation that allows you to enter weighted severity values, probability values, and confidence factors.
- Using evaluation forms for in-depth analysis of consequences and confidence factors.

With both methods, APM calculates the relative risk and displays it in the risk matrix chart. The method available in the Maintenance Action Plan window depends on the option selected in the analysis' risk analysis settings.

Before you can perform risk assessments, the severities, probabilities, failure mode consequence priorities, confidence factors, and risk matrix entries must be set up in the site's Strategy Development settings. For more information, see "Risk Analysis Settings" in Help.

Demand Scenario Risk Analysis

APM provides a method of performing risk analysis on safety devices that protect equipment, people, and environments from events such as pressure build-up, fire, or equipment failure. Risk analysis is performed on one or more demand scenarios identified on the failure mode.

A demand scenario is a situation that requires that an asset, such as a safety device, be put into operation. Examples of demand scenarios are fire, power failure, and blocked outlet.

Probability Based on Likelihood of Failure and Demand Rate

When demand scenario analysis is performed, probability of failure is based on the likelihood of failure and demand rate. The analysis team determines the probability by:

- Identifying the likelihood of the failure occurring based on past history or industry experience. This value describes how often the asset has been required to operate. An example of likelihood of failure is "Has happened at this location more than once in the last two years".
- Completing a confidence evaluation that quantifies the team's faith in the current maintenance or inspection practices to contain the demand scenario's risk. The confidence factor can adjust the likelihood of failure up or down.
- Identifying one or more demand scenarios. These are the situations that result in the safety device being required. For each scenario, a demand rate is also selected. The demand rate is the frequency with which the scenario is likely to occur. Demand rates are typically defined in terms of 0-0.5 year, 0.5-1.0 year, and so on.
- The demand rate with the highest criticality is used with the likelihood of failure to determine the probability of failure. APM uses the probability matrix to ascertain the result, and the selected probability of failure is added to the failure mode.

Demand Scenarios and the Failure Mode

The analysis team can then use questionnaires to evaluate the severity of consequences (health and safety, economic, environmental, reputation) to arrive at the demand scenario's relative risk (criticality). APM uses the demand scenario with the highest criticality to represent the failure mode.

For information about setting up probability questionnaires and matrices, as well as likelihood of failure values, demand rates, and scenarios, see "Failure Probability Settings" in Help.

The rest of this topic provides more detail about risk assessment concepts.

Risk (Criticality)

The risk number is calculated for the failure mode as the product of the Total failure mode severity and the probability of failure.

$$\text{Risk} = \text{Severity} * \text{Probability}$$

Severity

Failure severity measures the consequences when a failure occurs. Severity can be described in terms of health and safety, environmental, reputation, and economic categories and is usually described as:

- Severe
- High
- Medium
- Low
- Negligible

An impact statement and numerical value are associated with each severity value defined in APM. The higher the number, the more severe the effect. Economic impact can also be associated with each severity value to help determine avoidance savings and maintenance feasibility.

Probability of Failure

The probability of failure is the likelihood that the asset will fail due to the failure mode. There are three ways to evaluate probability:

- Using a probability evaluation questionnaire
- Based on the estimated time between failure
- Based on the likelihood of failure and demand rate

Probability is usually described as high, medium, low, or negligible.

Failure Mode Consequence Priority

APM calculates a consequence priority for the failure mode during risk analysis or for the failure during RCA evaluation. Consequence priorities allow you to rank and compare an asset's failure modes and failures. In failure analysis, the consequence priority is used in the calculation that determines whether the failure is suitable for RCA.

The rules defined for a priority can be based on any of these properties:

- **Downtime cost** – the total downtime cost of the failure mode or failure is used. The total downtime cost is the sum of the downtime occurrence cost and the downtime rate costs times the length of the downtime:

$$\text{Downtime Cost} = \text{Downtime Occurrence Costs} + (\text{Downtime Rate} * \text{Downtime Duration})$$

- **Downtime duration**
- **Failure cost**
- **Relative risk** (risk analysis only)
- **Severity**, which can include the sum, minimum, or maximum value for any or all of:
 - Health and safety consequences
 - Economic consequences
 - Environmental consequences
 - Reputation consequences
 - Failure mode consequences (risk analysis only)

The failure mode is assigned the highest ranking consequence priority for which it satisfies the priority's rules.

As an example, suppose a set of three consequence priorities. To simplify the example, the rules are based on a single property (total severity). In practice, the rules can be more complex and involve multiple properties and rule groups.

Priority	Rank	Rule
High	3	Total severity is at least 12

Priority	Rank	Rule
Medium	2	Total severity is at least 6
Low	1	Total severity is at least 0

A failure mode with a severity of 14 is assigned the consequence priority High. Although it satisfies the rules for each of the consequence priorities, it is assigned High because that is the highest ranking priority.

Risk Matrices

By combining probability and consequence priority, it is possible to group failure modes by risk in a two-dimensional matrix. Failure modes with a high consequence priority and a high probability are grouped together, followed by failure modes with lower consequences and lower probability, until at the opposite end of the matrix – the failure modes with negligible consequence and negligible probability. For example:

Probability	High	Low	High	Extreme	Extreme
	Medium	Low	Medium	High	Extreme
	Low	Negligible	Low	Medium	High
	Negligible	Negligible	Negligible	Low	Medium
		Negligible	Low	Medium	High
		Consequence Priority			

Confidence Factor

Confidence factor is used to adjust the location of a failure mode on the risk matrix based on your faith in the existing maintenance practices and equipment history. Factors considered can include things like:

- Is the equipment degradation mechanism stable and properly controlled?
- Have multiple reliable inspections been performed?
- Are the relevant process parameters reliably monitored?

A negative confidence factor represents low confidence and moves the failure mode to the right on the consequence priority axis and up on the probability axis.

A positive confidence factor represents a high confidence and moves the failure mode to the left on the consequence priority axis and down on the probability axis.

An adjustment value of 1 moves the failure mode one position on the matrix, a value of 2 moves it two positions, and so on.

For example, consider the results of the confidence factor on failure modes A and B:

- Failure mode A is originally positioned at the Low Probability and Low Consequence Priority entry on the risk matrix. It has a confidence factor of Low, which has an adjustment value of -2.

The failure mode is adjusted two positions to the right on the Consequence Priority axis and two positions up on the Probability axis, resulting in an adjusted risk matrix value of Extreme (represented by a^1 in the following diagram).

- Failure mode B is also positioned at Low/Low on the risk matrix. It has a confidence factor of High. High has an adjustment value of 1. The failure mode is adjusted one position to the left and down, resulting in an adjusted risk matrix value of Negligible (represented by b^1 in the following diagram).

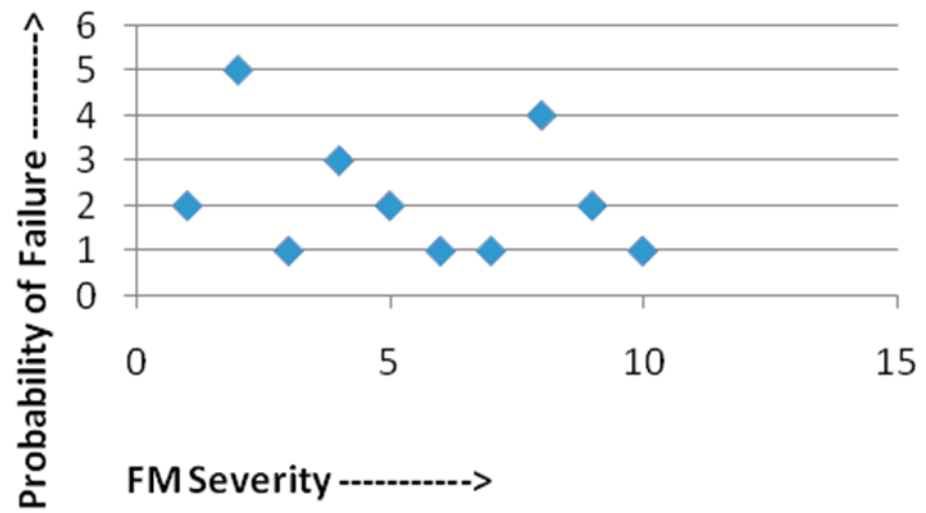
The following diagram shows how the confidence factor adjusts the positions of the two failure modes in the risk matrix:

Probability	High	Low	High	Extreme	Extreme (a^1)
	Medium	Low	Medium	High	Extreme
	Low	Negligible	Low ($a - [low]$) ($b - [high]$)	Medium	High
	Negligible	Negligible (b^1)	Negligible	Low	Medium
		Negligible	Low	Medium	High
		Consequence Priority			

Risk Plot

A risk plot is used to map the failure modes by severity and probability of failure. Failure modes with a high severity and high probability of failure appear in the upper right of the plot. Failure modes with low probability and low severity are plotted close to the bottom of the axis lines.

The risk plot provides a visual depiction of the relative risk of the failure modes, easily identifying the failure modes with high consequence and high probability: the failures modes that need to be addressed.



Overview of Performing Analysis

Performing maintenance task analysis involves defining the causes and effects of the assets' functional failures, performing risk analysis, if required, and developing action plans to prevent or mitigate failures. You can use APM's MTA2 tools to record analyses as they are performed by the team. Performing an analysis involves the following tasks. Links are provided to topics that explain each task in detail.

Create the Analysis and Select Assets

Starting the maintenance task analysis involves selecting the primary asset to be analyzed, with or without its descendants. Analyses can be performed on all types of assets except components. You can create the MTA2 from scratch or from a template. You can select an analysis type (a set of predefined options), change the default analysis type, or select options manually.

For more information:

- [“Creating an Analysis from Scratch” on page 48](#)
- [“Creating an Analysis From a Template” on page 54](#)

An analysis can also be created from an analysis request. For example, when an inspector reviews an indicator reading and decides that a failure mode review is required, the inspector can create a request for a strategy development analysis. When the request is processed, the analysis is created or updated. Information from the request is copied to the analysis: the requested start and completion dates are copied to the planning information on the **General** tab's, **Details** tab. The **Analysis Requests** tab shows information about the original request.

It is a good idea to review a new analysis' settings to ensure that they are appropriate for the asset and process. For more information:

- [“Setting Failure Mode Options for an Analysis” on page 64](#)
- [“Setting Risk Analysis Options for an Analysis” on page 77](#)

As the analysis progresses, you might wish to add assets or exclude an asset from the analysis hierarchy that you identified when creating the analysis. You can also change the primary asset on an analysis and update the analysis hierarchy.

For more information:

- [“Adding Assets to an MTA2” on page 86](#)
- [“Excluding Assets from an Analysis” on page 95](#)

- [“Changing the Primary Asset on an Analysis” on page 305](#)
- [“Updating the Asset Hierarchy Snapshot” on page 307](#)

In some cases, assets are large enough to warrant separate analyses for different sections. For example, when the top portion of a large vessel contains gas and the bottom holds liquid, separate analyses or failure modes are needed to define and respond to different failure modes and effects. In this case, you can provide a description of the analysis scope. The same asset can be added to the analysis as many times as required, each with a difference scope description.

For more information, see [“Working with Asset Scope on an MTA2” on page 97](#).

Record the Primary Asset’s Operating Context

The analysis team will find it helpful to define the circumstances in which the assets operate before they develop failure modes and action plans. Recording the operating context in APM involves selecting a brief description from the list of supplied values and then entering the detailed operating context statement, including how and where the asset is used and the performance criteria that apply to output, throughput, safety, environmental integrity, and so on.

For more information:

- [“Recording the Primary Asset’s Operating Context” on page 100](#)

Manage the Analysis

APM provides tools to help you manage the analysis project, from recording team members, to documenting meetings, to recording comments. For more information:

- [“Adding Team Members to an Analysis” on page 101](#)
- [“Entering and Reviewing Comments on an Analysis” on page 103](#)
- [“Recording Team Meetings on an Analysis” on page 106](#)
- [“Working with the Analysis Checklist” on page 107](#)

Add and Analyze Failure Modes

Create or copy one or more failure modes and failure effects. A failure mode is an event that causes an asset to fail to perform its function. For example, if a pump’s impeller becomes worn, the pump cannot convey liquid at the required rate. A failure effect is the result of a failure mode.

For example, when a pump's impeller becomes worn (failure mode), the flow through the pump declines until it no longer delivers liquid at the required rate.

The next step in developing the failure modes is to select a recommended action from the list provided:

- **Scheduled Restoration/Discard:** Scheduled restoration entails restoring the initial capability of an existing asset at or before a specified age limit, regardless of its apparent condition at the time. Scheduled discard or replacement tasks entail discarding an asset at or before a specified age limit, regardless of its condition at the time.
- **Condition-Based Maintenance** entails checking for potential failures so that action can be taken to prevent the functional failure or to avoid the consequences of the functional failure. On-condition tasks are so called because the items that are inspected are left in service on the condition that they continue to meet specified performance standards.
- **Failure-Finding Maintenance** involves checking a hidden function at regular intervals to find out whether it has failed. The intervals are calculated based on the required availability of the asset and the reliability of the protected function.
- **Modification/Redesign** is any one-time change to the equipment, training, maintenance or operating procedures, etc.
- **No Scheduled Maintenance** means assets are left in service until a functional failure occurs, at which point they are repaired or replaced.

You can perform failure mode or demand scenario risk analysis, depending on the requirements of the asset. You can also record failure data, especially if you intend to use Isograph Availability Workbench to optimize reliability programs.

Tip: Susceptibility to failure evaluation can also be incorporated into risk analysis. Typically, a questionnaire is used to examine the asset's non-age related degradation patterns. It can provide an alternative to probability of failure analysis for these failure modes. For example, susceptibility evaluation can be used to determine the vulnerability of atmospheric storage tanks to corrosion under insulation or stress cracking. The evaluation can result in recommended actions, susceptibility ratings, or both.

For more information:

- [“Creating Failure Modes” on page 112](#)
- [“Creating Analysis Requests for Failure Modes” on page 118](#)

- [“Overview of Risk Analysis” on page 17](#)
- [“Evaluating Susceptibility to Failure” on page 124](#)
- [“Performing Failure Mode Risk Analysis” on page 127](#)
- [“Performing Risk Analysis with Weighted Severities” on page 144](#)
- [“Performing Demand Scenario Risk Analysis” on page 147](#)
- [“Viewing Risk Analyses for Failure Modes” on page 160](#)
- [“Recording Failure Data” on page 164](#)
- [“Recording and Reviewing Failure Mode Details” on page 207](#)
- [“Copying Failure Modes” on page 211](#)

Using Isograph Availability Workbench

Using the integration functionality in APM, you can export failure modes from MTA2 and RCM2 analyses to the Isograph Availability Workbench (AWB), where you can analyze and optimize the data. You can then import optimization results into the APM analysis, review the recommendations in the **Optimization** view, and make appropriate changes to the action plans.

Before you can export failure modes, you must have installed the Availability Workbench with a valid license. Your APM license must include the Reliability Strategy Development and Implementation and Performance Management modules, and the modules must be active on the sites where you want to use the functionality.

For information about using this functionality, see *APM Integration Guide for Isograph Availability Workbench*.

Develop and Implement Action Plans

You can evaluate the economic feasibility of implementing the proposed maintenance tasks. Then develop the action plans for the selected strategy by describing tasks, determining frequencies, and more.

In some cases, you might need to create secondary action plans for failure modes. For example, a failure mode might require a condition-based maintenance task to check for signs of wear, a secondary modification to procedures (for example, training for maintenance personnel), and scheduled restoration in the future. You can add secondary actions as you are developing the MTA2, or you can add them later.

For more information:

- [“Evaluating the Feasibility of Maintenance Tasks” on page 171](#)

- [“Developing Primary Action Plans” on page 178](#)
- [“Creating Secondary Action Plans” on page 184](#)
- [“Calculating a Failure-Finding Interval” on page 186](#)

Add Indicators to Action Plans

Depending on the type of action, you can create or select indicators to monitor assets for potential failure. When you have developed action plans, you can generate a report that shows how indicators are distributed on standard tasks.

For more information:

- [“Adding Indicators, Tasks, and Work to Action Plans” on page 192](#)
- [“Reviewing Indicator Collection Information” on page 203](#)

Add Tasks, Documents, and Work to Action Plans

Depending on the type of action, you can create or select a corrective task to support the recommended action. If the asset is to be modified or redesigned, you can assign a standard document to the action plan. You can also assign work requests and work order tasks for follow-up work.

For more information:

- [“Adding Indicators, Tasks, and Work to Action Plans” on page 192](#)
- [“Adding Standard Documents to Action Plans” on page 205](#)
- [“Viewing Failure Modes for Standard Tasks and Jobs” on page 310](#)

Monitor the Status of Analyses

Monitor the status of an analysis by reviewing failure modes and marking them “Facilitation Completed” and “Implementation Completed”. When implementation has been completed for all of its failure modes, the analysis’ status automatically changes to “Analysis Completed”.

If your organization uses the APM formal approval process, it is typically employed to vet the analysis when implementation has been completed for all failure modes. When the analysis has been approved, you can close the analysis.

You can define action plan task statuses for use with failure modes and action plans in addition to the statuses provided by APM (Facilitation Incomplete, Facilitation Completed, Implementation Completed, and Implementation Not Required). Facilitators and implementers can then use the additional statuses to co-ordinate their efforts, for example, marking an action plan for follow-up or review.

For more information:

- [“Changing the Status of Failure Modes and Analyses” on page 276](#)
- [“Sending an Analysis for Approval” on page 280](#)
- [“Working with Action Plan Task Statuses” on page 282](#)

View Information About the Analysis

At any time, you can review analysis summaries or detailed information about an analysis’ status and history. The **Analysis Summary** view provides information about the analysis’ assets, action plans, indicators, tasks, and jobs. The **Implementation** view provides a list of action plans, their failure modes, recommended actions, corrective tasks, and indicators. You can also review the reliability programs for the analysis assets.

You can also print several reports from the analysis, including lists of action plan details and failure modes.

For more information:

- [“Viewing Information About an Analysis or Template” on page 284](#)
- [“Reviewing Analysis Assets’ Reliability Programs” on page 289](#)
- [“Viewing Failure Modes and Action Plans” on page 308](#)
- [“Printing MTA2 Reports” on page 296](#)

Link Action Plans to Projects

When the recommended action is to modify or redesign the asset, you can link the action plan to a project to plan and track the modifications.

For more information:

- [“Linking Action Plans to Projects” on page 301](#)
- [“Working With a Project’s Links to Action Plans” on page 303](#)

Create MTA2 Templates

A maintenance task analysis template is a group of settings that can be used as the basis for an analysis. You can create MTA2 templates and organize them in a hierarchy.

For more information:

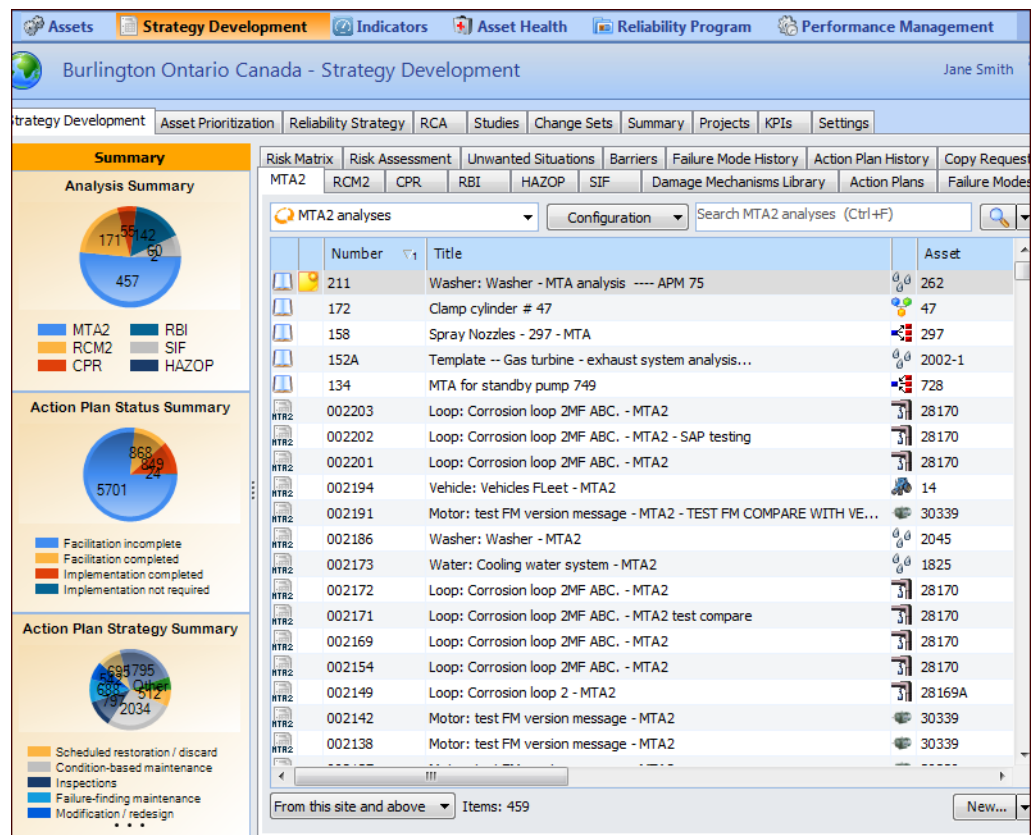
- [“Creating an MTA2 Template” on page 318](#)
- [“Setting up a Template Hierarchy” on page 327](#)

- “Viewing Template Hierarchies” on page 332
- “Moving an Analysis Template to a Different Site” on page 333

Two Ways to Access Maintenance Task Analyses

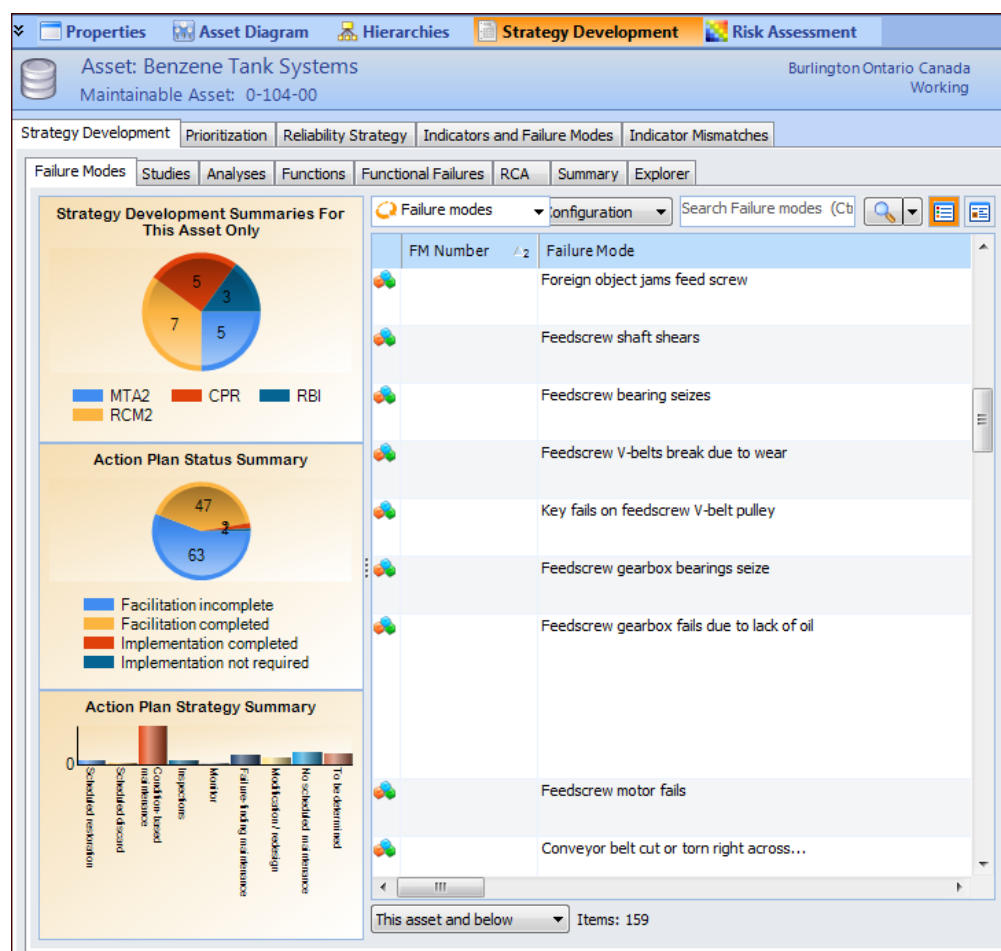
APM provides two ways to access analyses: from the site's or the asset's **Strategy Development** view. The views provide different types of information.

The Site window, **Strategy Development** view contains tabs that allow you to review all of the site's strategy development analyses and to view failure modes for all assets. For example:



Note: The summary charts shown in this example are set up as sidebar dashboards and assigned to employees. For more information, see “[Dashboards](#)” in Help.

On the Asset window, **Strategy Development** view, you can view the asset's failure modes, indicators, functions, functional failures, and the analyses where the asset is the primary asset. You can also view other maintenance task analyses that include the asset's failure modes.



Reusing Failure Modes

When you have performed a number of analyses, you might find that the same information is reused often. Then it becomes more efficient to copy analyses than to create them from scratch. You might also wish to ensure that information is consistent in different analyses. There are several ways that you can reuse information efficiently. You can:

- Create templates. A strategy development analysis template is a group of settings that can be used as the basis for a strategy development analysis (MTA2 or RCM2). A template identifies failure modes for a type of asset, rather than for a specific asset. Similarly, it refers to indicator templates and task templates, not to specific asset indicators and standard tasks. It includes an operating context for assets and a recommended action plan for each of its failure modes.
- Select an analysis or template and use the **Copy to** command to copy failure modes from the selected analysis to another maintenance task analysis, an MTA2 template, or even to the same analysis.
- Copy failure modes into an open analysis when you are creating it. You can copy the action plans from any maintenance task analysis or template.
- Copy an asset's strategy development program, including MTA2 and RCM2 failure modes.

Over time, failure modes can be reused in several analyses. Usually, the failure mode does not change. Instead, action plans change to reflect differences in the asset reliability program.

Setting up APM for Maintenance Task Analysis

Before you can begin analyzing assets, your APM environment must be set up to accommodate MTA2. This topic explains the types of options that are available to prepare for analysis and provides links to detailed information.

Define Site Ownership of Analyses and Templates

At the enterprise level, specify which site types can own analyses and templates. An MTA2 template can be used at the site where it was created and at any lower sites.

For more information, see “Setting up Site Types” in Help.

Define Employee Roles

When an employee record is added to APM, by default the person is allowed to create and update all types of strategy development analysis. If your organization requires that specific employees take these roles, employee records can be updated to prevent others from doing so.

For more information, see “Selecting Roles for an Employee” in Help.

Estimate Failure Modes for Assets

To make it easier for the analysis team to estimate the time required to complete analyses, you can enter the estimated number of failure modes per asset according to asset type.

Tip: To view the total estimated failure modes for assets according to type, on the Site window, select the **Assets** view, **Summaries** tab, and then the **Failure Modes Estimate** tab. This tab shows a chart of the estimate and count by asset type.

For more information, see “Setting up Asset Types” in Help.

Set up Analysis Types for MTA2

An analysis type is a collection of preferred settings for strategy development analysis. The settings range from specifying how analysis titles are defaulted, to how avoidance savings are recorded on failure modes, to how risk analysis is performed (if at all), to whether analyses must be sent for approval. Selecting an analysis type on an analysis quickly ensures that its settings are correct and consistent with your organization's standards.

When defining an analysis type, you can specify the varieties of analyses it can be used with: MTA2, RCM2, RBI, CPR, SIF, HAZOP, or a combination. For example, you could create two types of MTA2, one with risk analysis and one without. Or you could create a type that applies to both MTA2 and RBI analyses.

Default analysis types can be assigned to each of the varieties of analysis. When you create an MTA2, its default analysis type determines the pre-defined settings and options in the analysis. When a default type has not been designated, you can select an analysis type when you create the analysis to quickly set up the options. In the Strategy Development Analysis window, the **Properties** view, **General** tab, **Details** tab shows the analysis type. You can change the default selections as required.

For information about defining analysis types and assigning default types, see “Setting up Analysis Types” in Help.

Define Operating Context Values

In the Strategy Development settings for the site, you can define operating contexts. These are short values that describe the circumstances in which a physical asset or system is expected to operate. For example, Production and Standby are commonly used operating contexts.

When creating maintenance task analyses or templates, you can include the asset’s operating context by selecting a value and providing a description.

For more information, see “Setting up Operating Contexts” in Help.

Define Modification Types

In the Strategy Development settings for the site, you can define modification types for use in action plans that recommend modifications or redesign of the asset.

For more information, see “Setting up Modification Types” in Help.

Define Checklist Items

An analysis checklist is a list of “things to do” to remind the team of the steps they need to consider when performing the analysis. For each item that you add to APM settings, you can specify the varieties of analysis it applies to, identify it with an icon, and provide a description.

When recording an analysis, you can mark analysis checklist items as “Performed” and provide comments for them. APM records the employee who checked off the item, the date, and time. The analysis team can view the status of checklist items in the analysis window, **Properties** view, **Checklist** tab.

You can set up checklist items in the site’s Strategy Development settings. For more information, see “Setting up Checklist Items” in Help.

Set Smart Mapping Options for Failure Mode Copies

The copy function for failure modes includes smart asset mapping, which uses information about the source assets to identify matching assets in the target asset structure. Using the Copy Failure Modes wizard, you can select source and target asset structures, the failure modes to copy, and the criteria for identifying target assets. You can then confirm or change the matches that the system suggests. When you click **Process**, the wizard performs the copy and reports the results.

You can select smart mapping settings at the site-level to determine the default values shown in the Copy Failure Modes wizard. You can also save the mapping settings that you define for a particular copy request to the site level.

For more information, see [“Setting Smart Mapping Defaults for Failure Mode Copy Requests”](#) in Help.

Set up Document Numbering

You can define the formatting of failure mode and analysis numbers at the site level in Strategy Development settings.

Tip: The numbering settings also show the number that APM will automatically assign to the next failure mode and strategy development analysis that is created.

For more information, see [“Setting the Numbering Format for Analyses, Failure Modes, and Unwanted Situations”](#) in Help.

Define Failure Mode Settings

The site’s Strategy Development settings include several objects and settings that are specific to failure modes and apply to MTA2 failure modes:

- Action plan statuses
- Material types and classifications
- Barrier types and more

- Technologies
- Evaluation groups
- MEI override reasons for feasibility evaluations
- Symptoms
- Duty codes
- Severity of usage values
- Task effectiveness ratings
- Process flows

For more information about these options, see “Failure Mode Settings” in Help.

Set up Risk Analysis

Before the analysis team can perform risk analysis on failure modes or demand scenarios, several types of objects and tools need to be set up.

For failure mode risk analysis, you will need:

- One or more risk matrices, as well as failure mode criticalities, consequence priorities, and risk plot lines
- Failure probabilities and a probability questionnaire
- Susceptibility to failure questionnaires to evaluate non-age related degradation, if applicable to your assets
- Severities as well as questionnaires for Health and Safety, Environmental, and Reputation consequences
- Confidence questionnaires, as well as degradation types, inspection strategies, confidence factors, and inspection factors

For demand scenario risk analysis, you will need:

- One or more risk matrices, as well as failure mode criticalities, consequence priorities, and risk plot lines
- Failure probabilities, as well as likelihoods of failure, demand rates, demand scenarios, and a probability matrix
- Severities as well as questionnaires for Health and Safety, Environmental, and Reputation consequences
- Confidence questionnaires, as well as confidence factors

For more information about these settings, see:

- “Risk Analysis Settings” in Help
- “Failure Probability Settings” in Help

- “Consequence Severity Settings” in Help
- “Confidence Evaluation Settings” in Help

Set up Interoperability Options for SAP Plant Maintenance

APM provides plugin technology that allows users to view and reference live, read-only data from an SAP Plant Maintenance system. SAP data, such as maintenance plans, maintenance items, and task lists, can be viewed in APM sites and referenced as proposed and corrective tasks in RCM2 analysis.

For more information, see *APM Interoperability Guide for SAP Plant Maintenance*.

Glossary of MTA2 Terms

The following terms are used throughout the MTA2 topics. For a full glossary of APM terms, see “Glossary” in Help.

Term	Definition
Action Plan	An action plan in a strategy development analysis identifies an asset’s failure mode and recommends an action to prevent the failure or mitigate its consequences. For example, MTA2 and SIF action types are condition-based maintenance, failure-finding maintenance, scheduled restoration or discard, modification or redesign, and no scheduled maintenance (run to failure). RBI analyses support actions such as inspections, strategy, and modification or redesign.
Asset Reliability Program	An asset reliability program is a set of pre-planned work (standard tasks and standard jobs) for an asset. You can also include triggering rules that define when this work is to be done. Standard tasks and standard jobs that are not triggered may also be included in an asset reliability program.
Condition-based Maintenance	A task that entails checking for potential failures so that action can be taken to prevent the functional failure or to avoid consequences of the functional failure.
Demand Scenario	A demand scenario is a situation that requires that an asset, such as a safety device, be put into operation. Examples of demand scenarios are fire, power failure, and blocked outlet.
Environmental Consequences	A failure mode has environmental consequences if it could breach any corporate, municipal, regional, national, or international environmental standard or regulation which applies to the physical asset or system under consideration.

Term	Definition
Failure Consequence	The way in which the effects of a failure mode matter (evidence of failure, impact on safety, the environment, operational capability, direct and indirect repair costs).
Failure Effect	What happens when a failure mode occurs.
Failure-finding Interval	A failure-finding interval is the length of time that it is considered safe to wait before performing failure-finding maintenance. The interval is calculated or estimated based on the desired availability and the frequency of failure of the protective device or system.
Failure-finding Maintenance	A scheduled task used to determine whether a specific failure has occurred.
Failure Mode	<p>A failure mode is a single event that causes a functional failure. For example, if a pump's impeller becomes worn, the pump cannot convey liquid at the required rate. Failure modes are analyzed in maintenance task analysis (MTA2) and reliability-centered maintenance (RCM2) analysis, along with the action plans that prevent or mitigate failures.</p> <p>Safety instrumented function (SIF) analyses examine the risk of failure in safety devices, the effects and consequences of failure, and ways to reduce risk by putting safety provisions in place.</p> <p>For risk-based inspection (RBI) analyses, the failure of concern is loss of containment of pressurized equipment items. Examples of failure modes are small hole, crack, and rupture.</p>

Term	Definition
Failure Mode Consequence Priority	<p>A failure's or failure mode's consequence priority provides an indication of the relative importance of the asset failure. The larger the number, the greater the severity of the failure. The priority can be used to recommend root cause analysis for a failure or to determine the order of action plan implementations.</p> <p>Consequence priorities are assigned to failure modes during risk assessment. In failure evaluation, the consequence priority is used in the calculation that determines whether the failure is suitable for root cause analysis. APM assigns the consequence priority by comparing the information to a set of customer-defined rules. The consequence priority rules can be based on the failure severity, relative risk (risk analysis only), failure costs, downtime costs, downtime, or a combination. For example, the Extreme consequence priority could be assigned to failures or failure modes whose total severity is greater than 25 or failure costs are more than \$25,000.</p>
Function	<p>What the owner or user of a physical asset or system wants it to do.</p> <p>See also Primary Function and Secondary Function.</p>
Function Group	<p>A function group is a way of identifying assets that are responsible for performing a particular function. For example, the "Pump Assembly" function group could be used to indicate the relationship between a centrifugal pump, 20 HP motor, and valves.</p>

Term	Definition
Maintenance Task Analysis	<p>Maintenance task analysis (MTA2) is APM's unique strategy development methodology that enables the analysis team to quickly create and implement basic, technically-sound reliability programs. MTA2 is most effective when operational and maintenance knowledge about assets is well-documented and consistently used by employees. MTA2 provides an alternative to the resource-intensive RCM2 analysis, while still allowing you to identify the right work to improve performance across the plant.</p> <p>MTA2 methodology and tools allow the analysis team to:</p> <ul style="list-style-type: none"> • Identify the assets to be analyzed • Identify the causes of asset failure • Recommend actions to prevent or mitigate failures
No Scheduled Maintenance	A failure management policy that permits a specific failure mode to occur without any attempt to anticipate or prevent it. Also referred to as "Run-to-Failure".
Non-Operational Consequence	A category of failure consequences that do not adversely affect safety, the environment, or operations, but only require repair or replacement of any item(s) that may be affected by the failure.
Operating Context	The operating context is the circumstances in which a physical asset or system is expected to operate.
Operational Consequences	A category of failure consequences that adversely affect the operational capability of a physical asset or system (output, product quality, customer service, military capability, or operating costs in addition to the cost of repair).

Term	Definition
P-F Interval	The PF interval is the time between the point at which a potential failure becomes detectable and the point at which it degrades into a functional failure.
Primary Function	The function that constitutes the main reason why an asset or system is acquired by its owner or user.
Reliability Strategy Selection	Reliability strategy selection (RSS) analysis applies a set of criteria to an asset to determine the most appropriate plan for improving its reliability. The analysis team uses the Reliability Strategy Selection questionnaire to perform, document, and review analyses of system-level assets. Possible strategies are to implement (or continue) basic care, perform maintenance task analysis, perform RCM2 analysis, or escalate the asset risk to stakeholders for further consideration and action.
Run-To-Failure	A failure management policy that permits a specific failure mode to occur without any attempt to anticipate or prevent it. Referred to in APM as “No Scheduled Maintenance”.
Safety Consequences	A failure mode has safety consequences if it could injure or kill a human being.
Scheduled Restoration/ Discard	A scheduled task that entails restoring or discarding an item at or before a specified age limit, regardless of its condition at the time.
Secondary Function	Function that a physical asset or system has to fulfill apart from its primary function, such as those needed to fulfill regulatory requirements and those which concern issues such as protection, control, containment, comfort, appearance, energy efficiency and structural integrity.

Term	Definition
Strategy Development Analysis	<p>Strategy development analyses are methodologies for evaluating asset priority, defining asset functions, determining how failures occur (failure modes), evaluating the risk of asset failure, and preventing or mitigating the effect of failures. The varieties of strategy development analysis include:</p> <ul style="list-style-type: none"> • Reliability Strategy Selection (RSS) • Asset Prioritization Analysis • Current Practice Review (CPR) • Maintenance Task Analysis (MTA2) • Reliability Centered Maintenance (RCM2) • Risk-based Inspection (RBI) • Safety Instrumented Function (SIF) Analysis • Hazard and Operability (HAZOP) Analysis
Strategy Development Analysis Template	<p>A strategy development analysis template is a group of settings that can be used as the basis for a strategy development analysis (MTA2, RCM2, SIF, or HAZOP). A template identifies failure modes for a type of asset, rather than for a specific asset. Similarly, it refers to indicator templates and task templates, not to specific asset indicators and standard tasks. It includes an operating context for assets and a maintenance strategy for each of its failure modes. In addition, an RCM2 template identifies functions and functional failures.</p>

Term	Definition
Susceptibility to Failure Evaluations	Susceptibility to failure evaluation examines the asset's non-age related degradation patterns. It can provide an alternative to probability of failure analysis for these failure modes. For example, susceptibility evaluation can be used to determine the vulnerability of atmospheric storage tanks to corrosion under insulation or stress cracking. The evaluation can result in recommended actions, susceptibility ratings, or both.
Time Between Failure	<p>The length of time between failures (TBF) is used in three ways in APM strategy development analyses:</p> <ul style="list-style-type: none">• The time between occurrences of the failure (TBF) when inspections and/or preventative maintenance are performed. This value is recorded in failure statistics.• The estimated length of time between failures (ETBF) when no preventive maintenance is performed on the asset. This value is sometimes used to determine probability of failure in risk analysis.• Estimated time between consequences (ETBC) – The time between unexpected consequences or failures when inspections and preventive maintenance are performed on the asset. APM calculates the residual risk using this value when maintenance feasibility is evaluated.



Chapter 2 **Creating and Managing Analyses**

Performing maintenance task analysis involves defining the causes and effects of the assets' functional failures and developing action plans to prevent or mitigate the failures. The following sections explain how to create an MTA2 from scratch or a template. They also explain how to adjust analysis options and to manage project tasks like recording team information, meeting minutes, and comments.

Contents

Creating an Analysis from Scratch	48
Creating an Analysis From a Template	54
Setting Failure Mode Options for an Analysis	64
Setting Risk Analysis Options for an Analysis	77
Adding Assets to an MTA2.	86
Excluding Assets from an Analysis	95
Working with Asset Scope on an MTA2	97
Recording the Primary Asset's Operating Context.	100
Adding Team Members to an Analysis	101
Entering and Reviewing Comments on an Analysis	103
Recording Team Meetings on an Analysis	106
Working with the Analysis Checklist	107

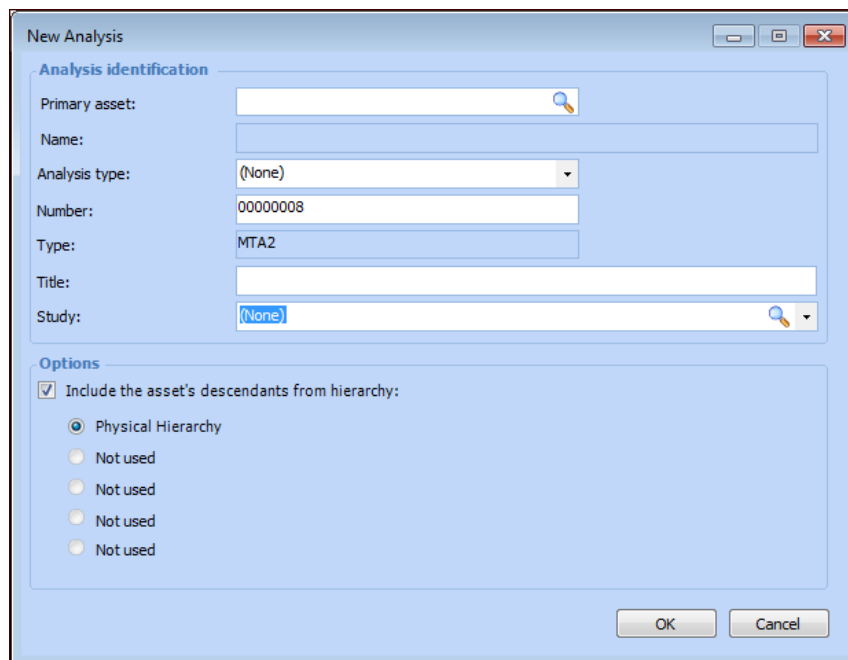
Creating an Analysis from Scratch

The first step in performing a maintenance task analysis is to create the analysis from scratch or from a template. In the process, you will select the assets to be analyzed.


This section explains how to create an MTA2 from scratch and includes links to more detailed explanations of some steps. For information about basing the MTA2 on a template, see [“Creating an Analysis From a Template” on page 54](#).

To Create an MTA2 from Scratch

1. Select the site’s **Strategy Development** view and tab, and then the **MTA2** tab.
2. From the **New** list, select **From Scratch**. The New Analysis dialog appears.



The image shows the 'New Analysis' dialog box. It has a title bar with standard window controls. The dialog is divided into two main sections: 'Analysis identification' and 'Options'. In the 'Analysis identification' section, there are fields for 'Primary asset:' (with a browse icon), 'Name:', 'Analysis type:' (a dropdown menu showing '(None)'), 'Number:' (containing '00000008'), 'Type:' (containing 'MTA2'), 'Title:', and 'Study:' (a dropdown menu showing '(None)' with a browse icon). The 'Options' section has a checked checkbox 'Include the asset's descendants from hierarchy:' and four radio button options: 'Physical Hierarchy' (selected), 'Not used', 'Not used', 'Not used', and 'Not used'. At the bottom right are 'OK' and 'Cancel' buttons.

3. Click the browse icon() to select the primary asset. The primary asset is usually the top asset in the hierarchy of the system to be analyzed.

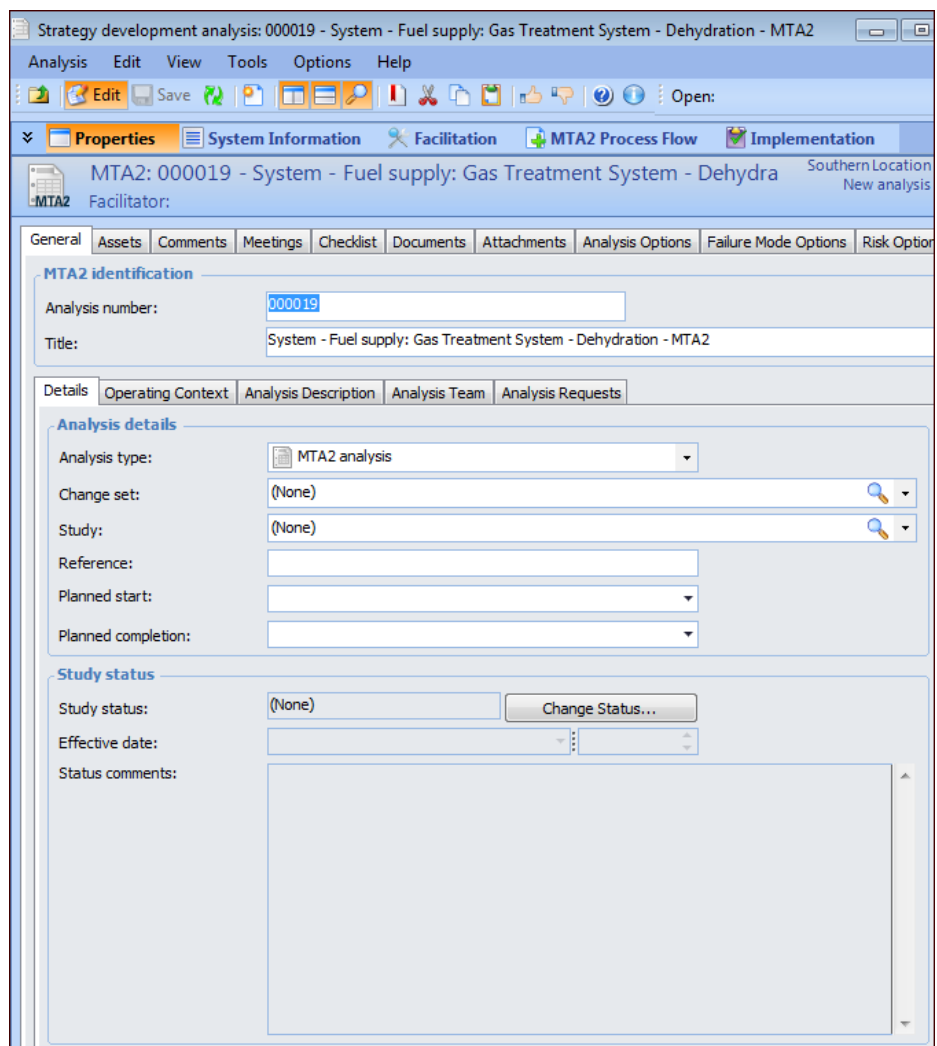
Tip: You can also create an MTA2 by opening an asset and selecting the **Strategy Development** view, **Strategy Development** tab. Then select the **Analyses** tab. From the **New** list, select **MTA2**. The New Analysis dialog appears, and the primary asset information is filled in.

4. The **Analysis type** box shows the default type for maintenance task analyses, if a default has been assigned. An analysis type is a collection of preferred options that can range from the default analysis title to how risk analysis is performed (if at all). You can change or select the analysis type to quickly set default options for the analysis.
5. Each analysis is assigned an analysis number by APM. You can change the number, but the new value must be unique for the site.
6. If analysis titles are created automatically when the asset is selected, the **Title** box displays the default name. The name follows this pattern:

Asset type: Primary asset - MTA2

You can change the title, if you wish.

7. Select an SDA study to associate with the analysis, if appropriate. Study references are used to group, filter, and order analyses.
 8. To include the primary asset's descendants in the analysis, select **Include the asset's descendants** and select the asset hierarchy.
- Note:** Component locations can be included in the analysis. However, component assets and their descendants cannot be included.
9. Click **OK**. If you are including the asset's descendants in the analysis, a progress dialog might appear as the analysis is created. The Strategy Development Analysis window appears. The **Facilitation** view, **Info Worksheet** tab is shown.
 10. To set the general properties of the analysis, select the **Properties** view. The **General** tab displays information about the analysis. For example:



The screenshot shows the MTA2 software interface. The title bar reads "Strategy development analysis: 000019 - System - Fuel supply: Gas Treatment System - Dehydration - MTA2". The menu bar includes Analysis, Edit, View, Tools, Options, and Help. The toolbar contains icons for Edit, Save, and other functions. The main window has tabs for Properties, System Information, Facilitation, MTA2 Process Flow, and Implementation. The "Properties" tab is active, showing "MTA2: 000019 - System - Fuel supply: Gas Treatment System - Dehydration - MTA2" and "Facilitator:". Below this is a "General" tab with sub-tabs: Assets, Comments, Meetings, Checklist, Documents, Attachments, Analysis Options, Failure Mode Options, and Risk Options. The "Analysis details" section includes fields for Analysis number (000019), Title (System - Fuel supply: Gas Treatment System - Dehydration - MTA2), Analysis type (MTA2 analysis), Change set ((None)), Study ((None)), Reference, Planned start, and Planned completion. The "Study status" section includes Study status ((None)), Effective date, and Status comments.

Tip: The **Optimization** view is available if you are using the Iso-graph Availability Workbench (AWB) to analyze and optimize the data in failure modes. You can then import optimization results into the analysis, review the recommendations in the **Optimization** view, and make appropriate changes to the action plans.

Before you can export failure modes, you must have installed the Availability Workbench with a valid license. Your APM license key must include the Reliability Strategy Development and Implementation and Performance Management modules, and the modules must be active on the sites where you want to use the functionality.

For information about using this functionality, see *APM Integration Guide for Isograph Availability Workbench*.

11. The **Details** tab displays the analysis type, if one has been assigned to the analysis. You can select an analysis type from the list to set default options.

12. If appropriate, select a change set from the list. This is usually a change authorization or change set number from a Management of Change (MOC) system.
13. Select an SDA study to associate with the analysis, if appropriate. Study references are used to group, filter, and order analyses.
14. If required, enter reference information, for example, the number for an external document.
15. Review the planned start and completion dates for the analysis and change them if necessary.

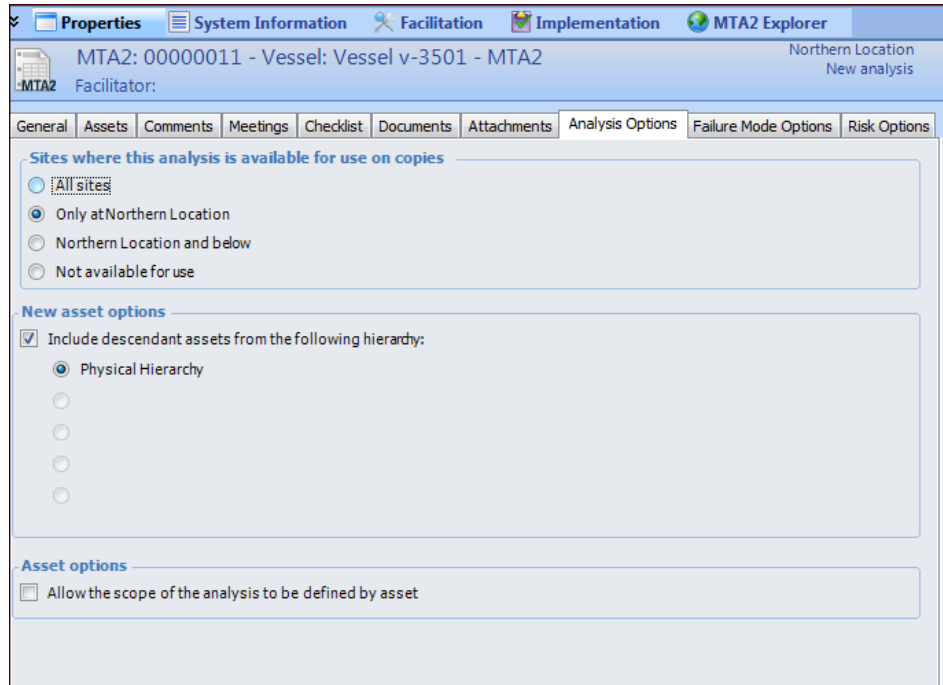
Tip: If the analysis was created when an analysis request was processed, the planned start and completion dates are copied from the request.

16. On the **Operating Context** tab, you can record the circumstances in which the asset operates. For more information, see [“Recording the Primary Asset’s Operating Context” on page 100](#).
17. Select the **Analysis Description** tab to record additional information about the analysis.
18. On the **Analysis Team** tab, you can add team members and identify the facilitator. For more information, see [“Adding Team Members to an Analysis” on page 101](#).

Tip: If the analysis was created when an analysis request was processed, the **Analysis Requests** tab displays the request.

19. On the **Assets** tab, you can change the primary asset by clicking **Change** and selecting another asset.
20. On the second **Assets** tab, you can view the assets in a list or select the **Hierarchy** tab to see the relationship between assets. You can add new or existing assets and exclude assets from the analysis. For more information, see [“Adding Assets to an MTA2” on page 86](#) and [“Excluding Assets from an Analysis” on page 95](#).
21. The **Comments** tab helps the analysis team keep track of their work in analyzing assets. For more information, see [“Entering and Reviewing Comments on an Analysis” on page 103](#).
22. Use the **Meetings** tab to record team meetings. For more information, see [“Recording Team Meetings on an Analysis” on page 106](#).
23. The **Checklist** tab displays standard tasks for your organization’s analysis projects. For more information, see [“Working with the Analysis Checklist” on page 107](#).

24. Select the **Documents** tab to browse for standard documents that are relevant to the analysis.
25. While the analysis progresses, you can attach documents to it using the **Attachments** tab. For information about attaching a file, folder, note, or URL to an analysis, see “Adding Attachments to Objects” in Help.
26. Select the **Analysis Options** tab.



The screenshot shows the 'Analysis Options' tab in the MTA2 Facilitator application. The title bar indicates the current analysis is for 'MTA2: 00000011 - Vessel: Vessel v-3501 - MTA2' at the 'Northern Location'. The 'Analysis Options' tab is selected, showing settings for where the analysis is available and new asset options.

Sites where this analysis is available for use on copies

- ☐ All sites
- ☒ Only at Northern Location
- ☐ Northern Location and below
- ☐ Not available for use

New asset options

☒ Include descendant assets from the following hierarchy:

- ☒ Physical Hierarchy
- ☐
- ☐
- ☐
- ☐

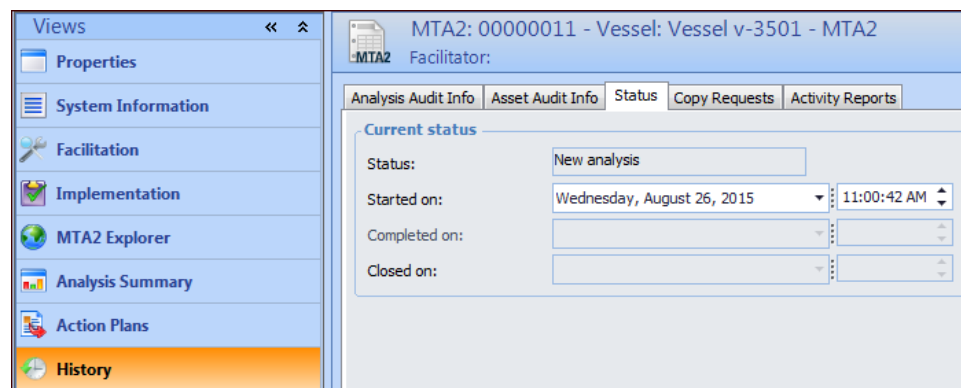
Asset options

☐ Allow the scope of the analysis to be defined by asset

27. Specify the sites where the analysis will be available for copies. You can choose:
 - All sites
 - This site only
 - This site and its descendants only
 - Not available for use
28. The **New asset options** area shows the settings you selected on the New Analysis dialog when creating the analysis. If you intend to add assets, you can select a different hierarchy.
29. In some cases, assets are large enough to warrant separate analyses for different sections. For example, when the top portion of a large vessel contains gas and the bottom holds liquid, separate analyses are needed to define and respond to different failure modes and effects. In this case, select **Allow the scope of the analysis to be defined by asset**.

On the **Assets** tab, you can provide a description of the scope covered by the analysis. The same asset can be added to the analysis as many times as required. For more information, see [“Working with Asset Scope on an MTA2”](#) on page 97.

30. Select the **Failure Mode Options** and **Risk Options** tabs to change the default settings for the analysis. For more information, see:
 - [“Setting Failure Mode Options for an Analysis”](#) on page 64
 - [“Setting Risk Analysis Options for an Analysis”](#) on page 77
31. On the **History** view, **Status** tab you can change the **Started on** date for the analysis.



Tip: As the analysis progresses, you can select the **Analysis Audit Info** tab or the **Asset Audit Info** tab to monitor the status of the analysis and its assets.

32. Select the **Copy Requests** tab when you wish to view failure mode copies for which the analysis was the source or target. For more information, see [“Copying Failure Modes”](#) on page 211.
33. Select the **Activity Reports** tab to view asset activity reports for this analysis and asset activity reports in which this analysis is included.

When you have completed these steps, you are ready to develop the analysis by creating failure modes and more. Refer to the following topics for more information:

- [“Creating Failure Modes”](#) on page 112
- [“Performing Failure Mode Risk Analysis”](#) on page 127
- [“Developing Primary Action Plans”](#) on page 178
- [“Creating Secondary Action Plans”](#) on page 184
- [“Adding Indicators, Tasks, and Work to Action Plans”](#) on page 192
- [“Adding Standard Documents to Action Plans”](#) on page 205

Creating an Analysis From a Template

A maintenance task analysis template (MTA2 template) is a group of settings that can be used as the basis for an analysis. An MTA2 template identifies failure modes for a type of asset, rather than for a specific asset. Similarly, it refers to indicator templates, task templates, and job templates, not to specific asset indicators, standard tasks, and standard jobs. It includes a maintenance strategy for each of its failure modes.

Creating an MTA2 using a template typically involves these tasks:

- Use the Copy Failure Modes wizard to select a template, the assets to analyze, and the failure modes
- Define additional failure modes as needed
- Check the team members copied from the template and make corrections as needed
- Fine-tune action plans
- Document the project with a description, notes, and attachments, as required

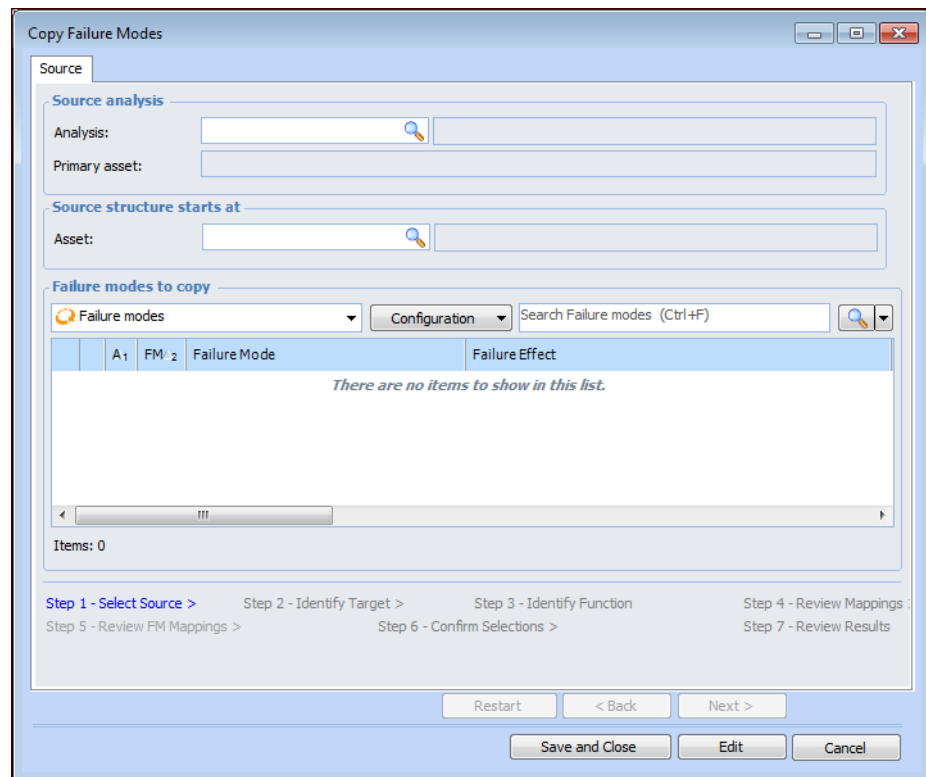
Note: If you base the new MTA2 on an RCM2 template, the functions and functional failures are not copied from the template.

Tip: To view information about an MTA2's source template, open the analysis, select the **Action Plans** view and the **Source Templates** tab.

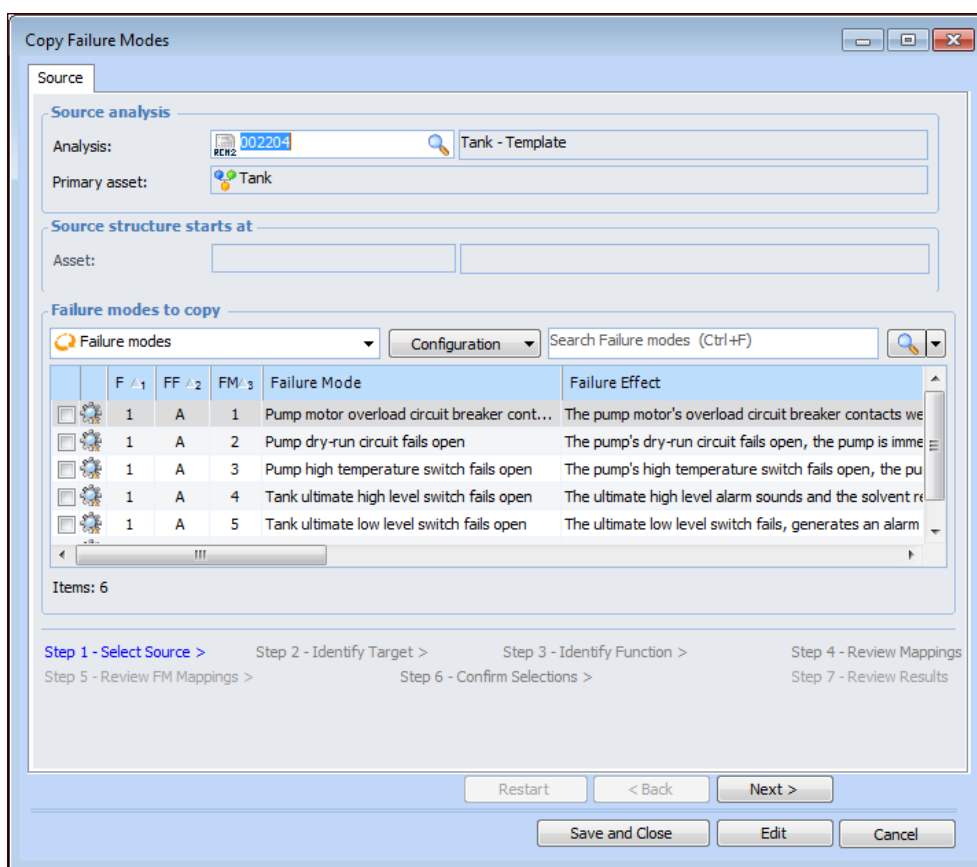
This topic explains how to start an MTA2 from a template. For information about creating an MTA2 from scratch, see [“Creating an Analysis from Scratch” on page 48](#).

To Create an MTA2 From a Template

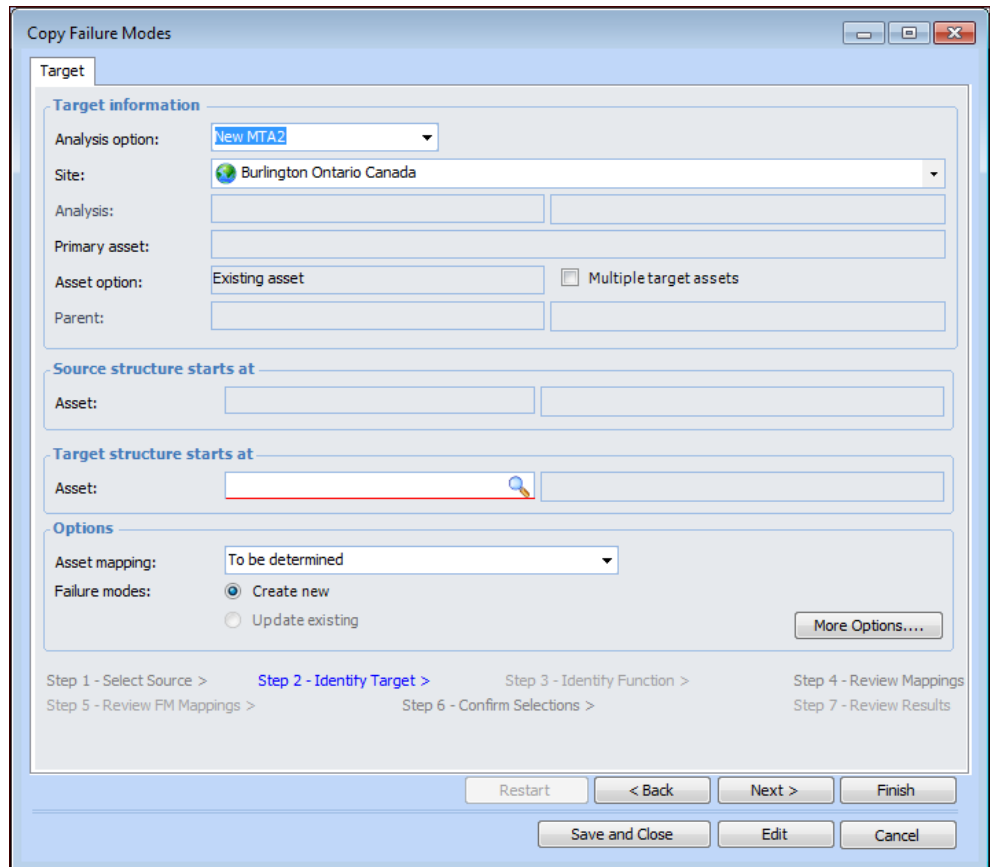
1. Select the site's **Strategy Development** view, **Strategy Development** tab, and then the **MTA2** tab.
2. From the **New** list, select **From a Template**. The Copy Failure Modes wizard appears.



3. Click the browse icon in the **Analysis** box to select the source template. The Strategy Development Analysis selector dialog appears, displaying analyses. Select an option from the **Configuration** list to view templates.
4. Select a template and click **OK**. The **Failure modes to copy** table displays the source's failure modes. The asset type is displayed. For example:



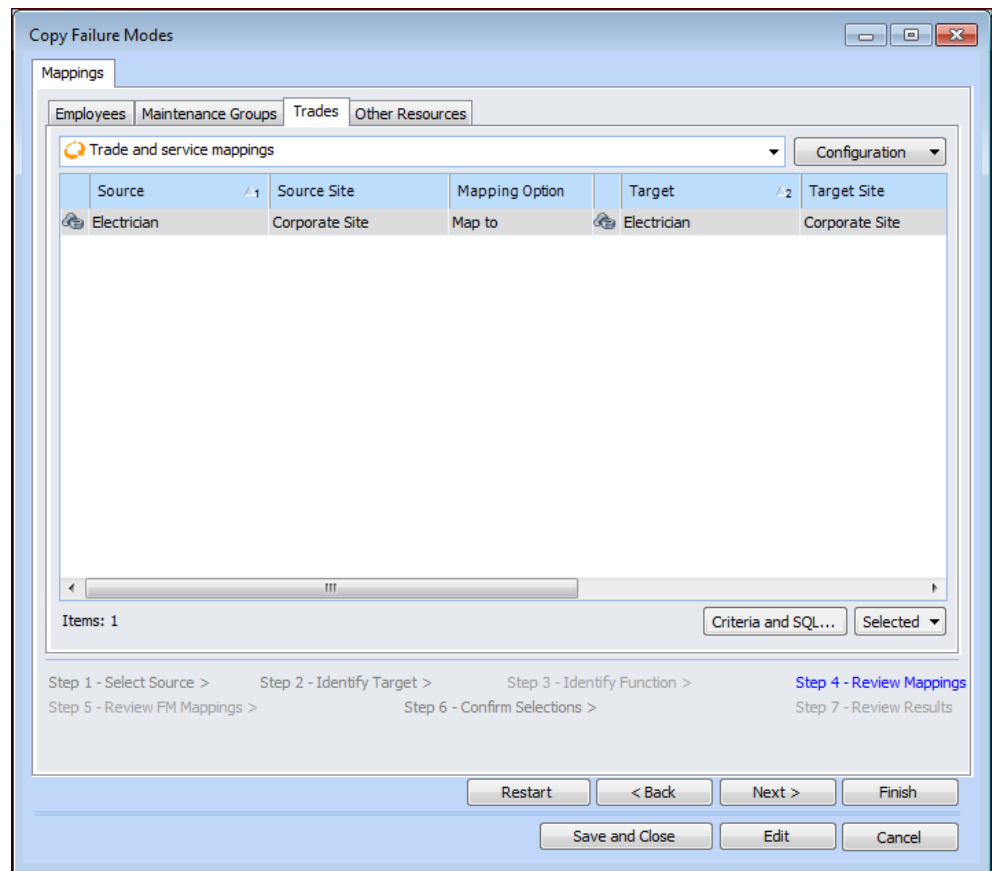
5. Select the failure modes to copy to the analysis.
6. Click **Next**. The Identify Target step appears.



7. Change the target site, if appropriate. If the source template is allowed to be used at other sites, those sites are available in the **Site** list.
8. In the **Target structure starts at** area, click the browse icon to select the target asset. This asset will be the primary asset in the analysis.
9. To set mapping options for finding employees, maintenance groups, and trades that match those on the template's failure modes, for example, if the target asset is on another site, click **More Options**. The Options dialog appears. For information about using this dialog, see [“Setting Mapping Options for a Failure Mode Copy”](#) on page 221.

Tip: For quick copies (when you do not need to adjust the mapping options or create a function), click **Finish** when you have selected the asset. The wizard performs the matching process and skips to the Confirm Selections step. Skip to step 14.

10. Click **Next**. The wizard matches objects as needed and presents the mappings for your review. The **Employees**, **Trades**, and **Maintenance Groups** tables display the mappings. For example:



Tip: To view information about a source object on any of the mapping tabs, right-click it and click **Source**. The Source dialog that appears contains tabs for the asset’s failure modes, indicators, tasks, jobs, job tasks, as well as the corrective tasks, jobs, and job tasks for the indicators. You can also view information about any secondary action plans included in the failure modes.

11. Scroll to the right to review the mappings.

The **Suggestion Origin** column displays the method used for matching. The options are:

- Previous match – the “Use results of previous copy” option is in effect
- Suggested – the mapping is based on another criterion, for example, hierarchy level or attribute matching
- Default – the source object is used as the target, provided that it is valid at the target site
- Manual – the user selected the mapping

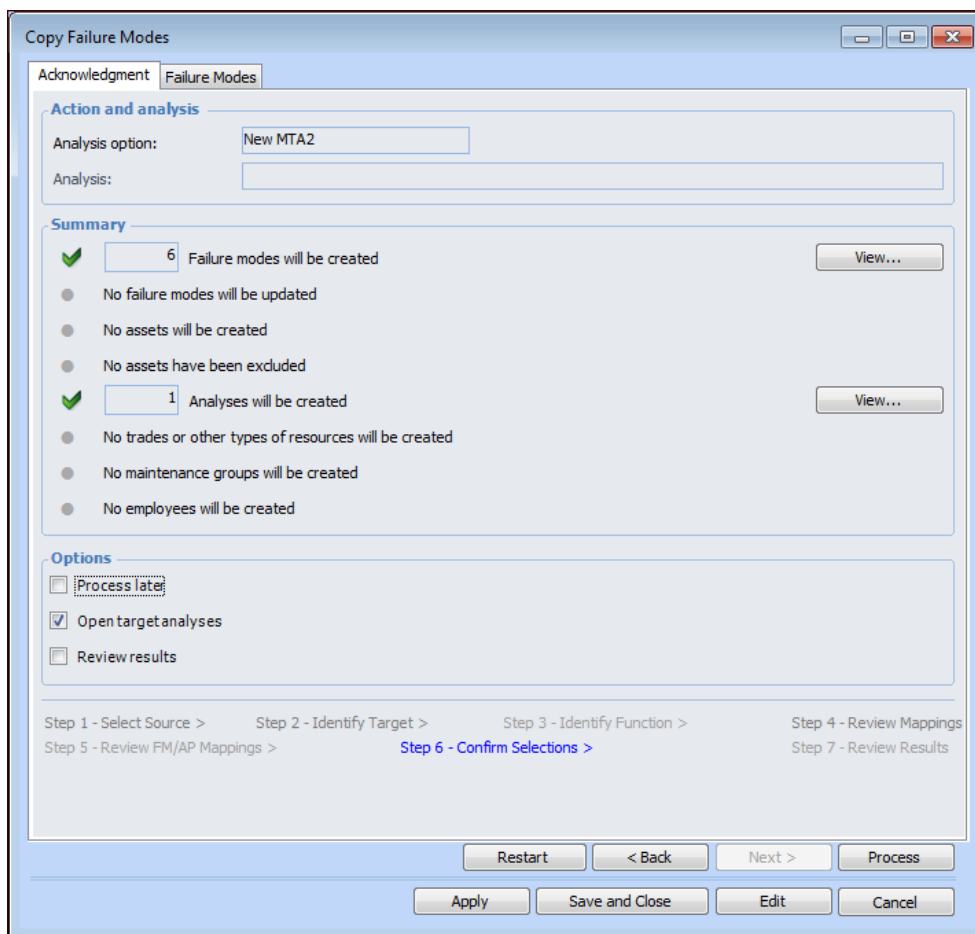
The **Suggested Match Quality**, **Closeness**, and **Single Or Multiple Candidates** columns show you the results of the smart mapping process.

12. To view more information about the matching process, click **Criteria and SQL**. The Mapping Criteria and SQL window appears. Click **Close** when you are finished.
13. To remove an employee, trade, or maintenance group from the copy request, select it in the table, click **Selected**, **Mark Target As**, and **Excluded**.

Tip: You can also double-click a mapping to review the Mapping dialog.

Note: If a mapping is marked as **To be determined**, the copy request cannot be processed. However, you can save and close it until you decide what to do with it. You can then re-open the request from a **Copy Requests** tab and finish defining and processing it. For more information, see [“Revisiting Failure Mode Copy Requests” on page 270](#).

14. Click **Next** or **Finish**. The Confirm Selections step appears. For example:



15. Check the items that will be created or updated. If an incorrect copy request is processed, you will have to make the corrections manually. Click **View** to see more details about the items. The **Failure Modes** tab displays information about the failure modes. If you wish to remove a failure mode from the list, right-click it and click **Remove**. Click **Back** to make adjustments on previous pages.
16. In the Confirm Selections step, **Acknowledgment** tab, select the processing options:

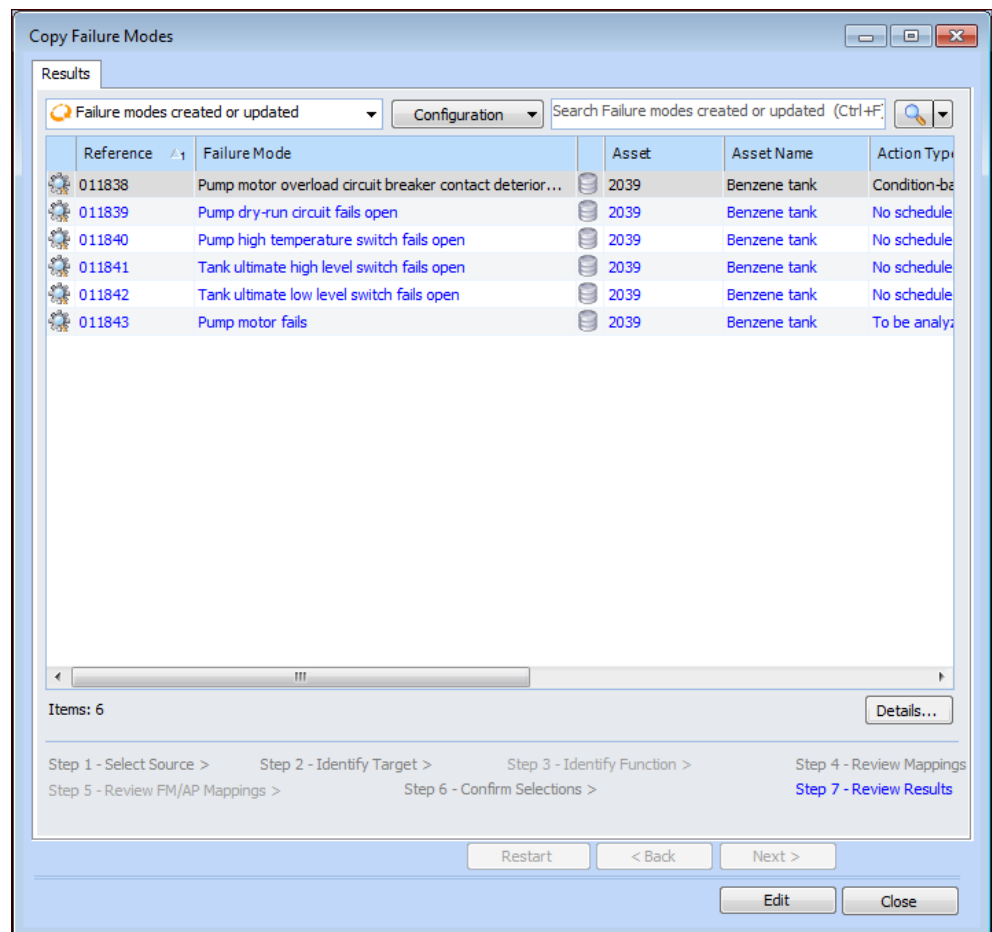
Setting Name	Description
Process Later	If this option is selected at the site level, failure mode copy requests are set to process later by default. The copy request is saved with the status “Process pending”. The user can later open the request to resume defining it or create a scheduled action (Process Failure Mode Copies) to perform the copies for all pending requests.

Open target analyses Target analyses are opened after the copy request is processed.

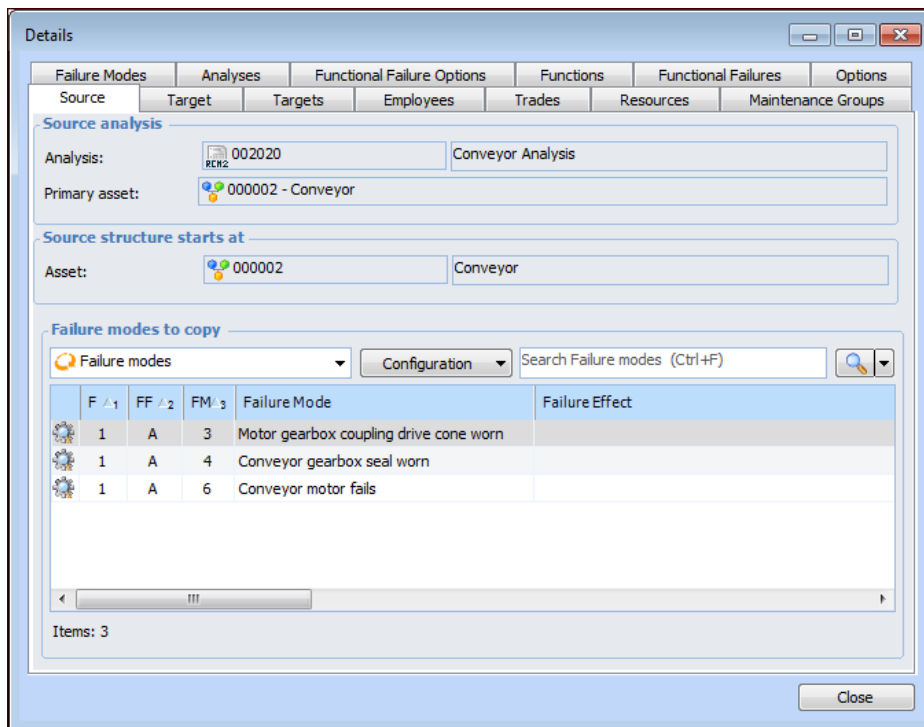
Review results The Results page is displayed after processing (if processing has not been deferred).

17. Click **Process** or **Finish** if **Process later** is selected. One of the following occurs:

- If **Process later** is selected, a confirmation message appears. Click **Yes** to save the copy request to be completed later.
- If processing has not been deferred, the copy is completed. If **Review results** is selected, the Review Results step appears. For example:



To view more information, click **Details**. The Details window displays information about the source and target asset structures, asset mappings, employees, trades, maintenance groups, failure modes, and so on. For example:



Details

Failure Modes | Analyses | Functional Failure Options | Functions | Functional Failures | Options

Source | Target | Targets | Employees | Trades | Resources | Maintenance Groups

Source analysis

Analysis: 002020 Conveyor Analysis

Primary asset: 000002 - Conveyor

Source structure starts at

Asset: 000002 Conveyor

Failure modes to copy

Failure modes Configuration Search Failure modes (Ctrl+F)


F #	FF #	FM #	Failure Mode	Failure Effect
1	A	3	Motor gearbox coupling drive cone worn	
1	A	4	Conveyor gearbox seal worn	
1	A	6	Conveyor motor fails	

Items: 3

Close

Click **Close** to return to the wizard.

When you are finished reviewing results, click **Close**. You can view the information again on the **Copy Requests** tab for the site or the analysis.

- If **Open target analyses** is selected in the Confirm Selections step, the Strategy Development Analysis window appears.
18. If you selected **Open target analyses** in the processing options, the analysis opens. Otherwise, open the analysis.
 19. Make sure that editing  is enabled.
 20. Review and modify the analysis as needed. For related information, see [“Creating an Analysis from Scratch” on page 48](#).

When you have completed these steps, you are ready to develop the analysis by creating action plans and more. Refer to the following topics for more information:

- [“Creating Failure Modes” on page 112](#)
- [“Performing Failure Mode Risk Analysis” on page 127](#)
- [“Developing Primary Action Plans” on page 178](#)
- [“Creating Secondary Action Plans” on page 184](#)
- [“Adding Indicators, Tasks, and Work to Action Plans” on page 192](#)

- “Adding Standard Documents to Action Plans” on page 205

Setting Failure Mode Options for an Analysis

This topic explains how to set the failure mode options for an analysis.

These options include:

- Activate failure mode versioning, if appropriate
- Limit units of measure to the time category for PF intervals, failure-finding intervals, and Useful Life values
- Define default text for failure effects and tasks
- Select the process flow that specifies the panels users will see when developing an analysis. When a process flow is available, the user selects the **Process Flow** view in the analysis window and then “steps” through the panels. Hide or show step instructions in the flow.
- Show facilitation and implementation information separately, or combine the information in the Maintenance Action Plan window
- Set failure cost options to specify how avoidance savings values are used
- Set options for maintenance cost feasibility and the maintenance efficiency index
- Specify whether indicators are automatically added to the failure mode’s inspection task
- Set options for indicator collection information. You can specify how default values are assigned to indicators that are added to action plans. These values make it easier for users to find indicators based on trade, maintenance group, PdM technology, operating condition, and expected collection frequency. An indicator created using a template can receive its values either from the indicator template or the action plan to which it is added. Existing indicators can have their values updated from the action plan.
- Specify failure-tracking values for indicator alarm states. Indicator alarm states can specify that failure records are automatically created when users acknowledge alarms with work orders, work requests, or by marking the alarms as being fixed during inspection. The alarm state can also specify the failure mode reference and P-F interval to be copied to the failure record. You can specify that the indicator be updated with the failure mode reference and P-F interval from the action plan to which it is added.
- Define behavior when indicators, standard tasks, or standard jobs are deleted from action plans

- Using the integration functionality in APM, you can export failure modes from MTA2 and RCM2 analyses to the Isograph® Availability Workbench (AWB), where you can analyze and optimize the data. You can then import optimization results into the APM analysis, review the recommendations in the **Optimization** view, and make appropriate changes to the action plans.


Note: Before you can export failure modes, you must have installed the Availability Workbench. The Reliability Strategy Development and Implementation and Performance Management modules must be active on the sites where you want to use the functionality.

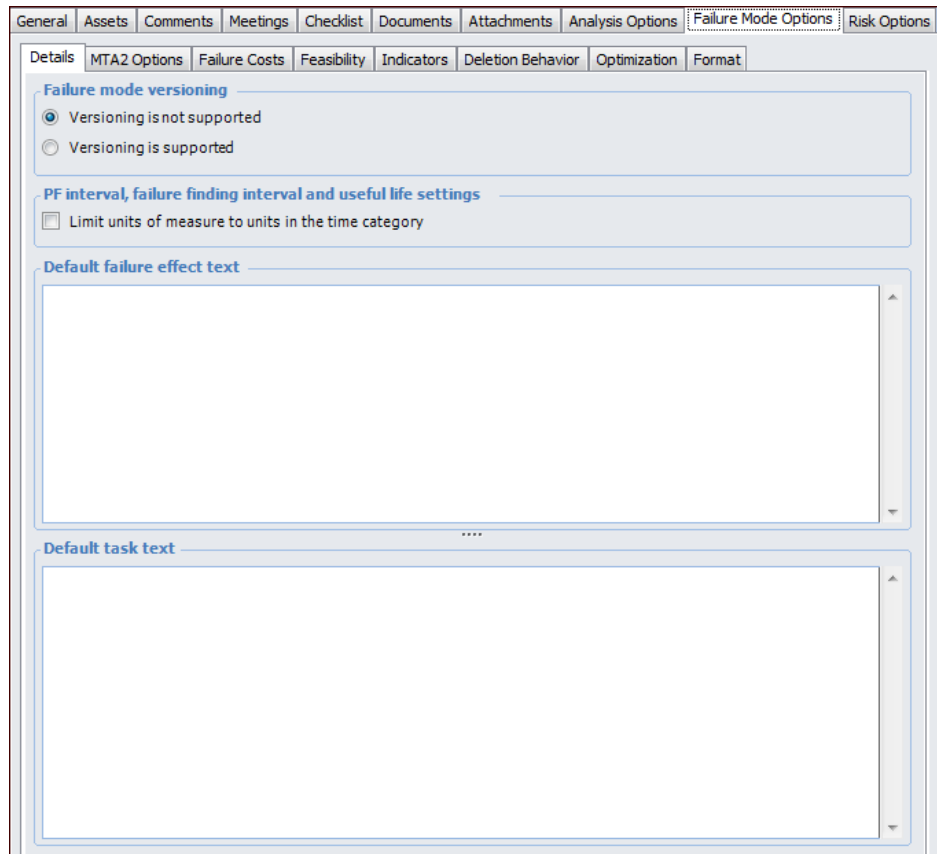
- Hide or show the **Failure mode note** sidebar in Maintenance Action Plan windows
- Specify the information that will be shown or hidden in the Maintenance Action Plan window

This topic explains how:

- [To Set Failure Mode Details](#)
- [To Set MTA2 Options](#)
- [To Set Failure Cost Options](#)
- [To Set Feasibility Options](#)
- [To Set Indicator Options](#)
- [To Set Deletion Behavior Options](#)
- [To Enable Optimization](#)
- [To Set Format Options](#)

To Set Failure Mode Details

1. Open the Strategy Development Analysis window.
2. Make sure that editing  is enabled.
3. On the **Properties** view, select the **Failure Mode Options** tab.



The screenshot shows the 'Failure Mode Options' dialog box with the 'Details' tab selected. The 'Failure mode versioning' section has two radio buttons: 'Versioning is not supported' (selected) and 'Versioning is supported'. The 'PF interval, failure finding interval and useful life settings' section has a checkbox 'Limit units of measure to units in the time category' which is unchecked. Below these are two large text input areas: 'Default failure effect text' and 'Default task text', both currently empty.

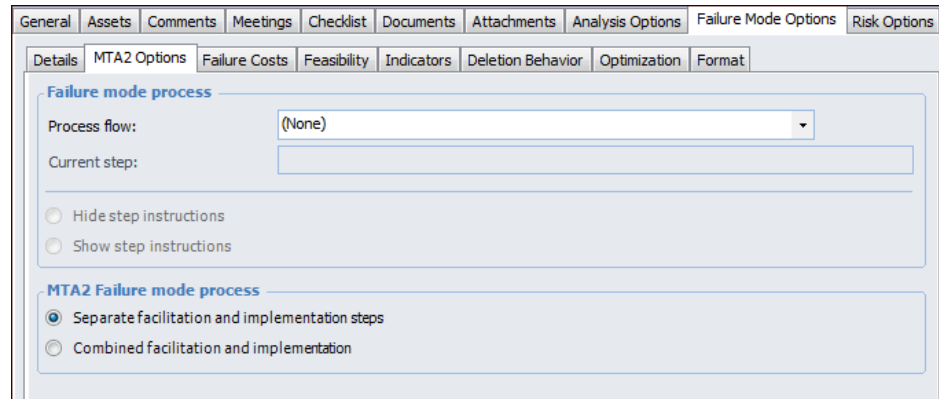
4. On the **Details** tab, set the following options:

Setting Name	Description
Failure mode versioning	When versioning is supported, the analysis team can create a new version of the failure mode.
Limit units of measure to units in the time category	Select this option to restrict PF intervals, failure-finding intervals, and Useful Life values to measures of time (hours, days, weeks, and so on). Otherwise, these values can use other units of measure, for example, cycles, operating hours, or kilometers.

5. In the **Default failure effects text** box, you can enter text that will automatically appear in the **Failure Effect** box of new failure modes.
6. In the **Default task text** box, you can enter text that will automatically appear in the **Task** boxes for new failure modes.

To Set MTA2 Options

1. Select the **MTA2 Options** tab.



2. Select the following options:

Setting Name	Description
Process flow	The process flow definition specifies the panels for the analysis. Users can select the Process Flow view in the analysis window and then “step” through the panels.
Current step	Step in the process flow shown by default in the Process Flow view.
Hide or show step instructions	Hide or show the instructions for completing the steps in the process flow.

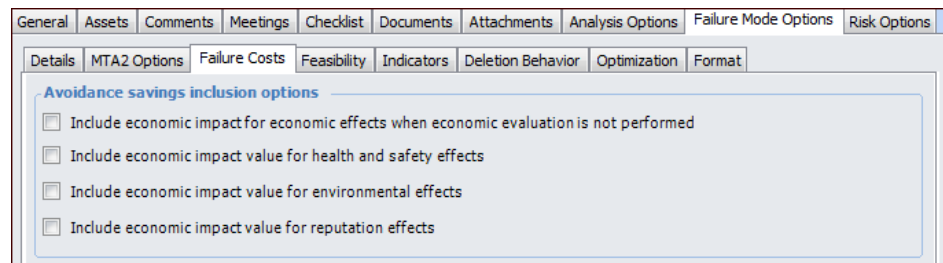
MTA2 failure mode process

When the facilitation and implementation steps are combined in the MTA2 Maintenance Action Plan window, the **General** tab displays the following:

- **Failure mode** box
- **Failure effects** box
- **Evident** list
- **Strategy** list
- **Analyzed separately** option
- **Task** box
- **Details** tab for the strategy
- **Mark as Implementation Complete** button

To Set Failure Cost Options

1. Select the **Failure Costs** tab.



2. Select the avoidance savings options:

Setting Name

Description

Include economic impact for economic effects when economic evaluation is not performed

When the analyst clicks one of the economic impact buttons on the risk matrix, that severity's economic impact amount is used in the avoidance savings calculation. The amount is shown on the failure mode's **Failure Data** tab.

However, if the analyst uses the Economic Evaluation Questionnaire, the results of the evaluation is used.

Include economic impact value for health and safety effects

When the analysis team performs a criticality analysis, the selected Health and Safety severity's economic impact amount is included when the failure mode's avoidance savings is calculated. The amount is shown on the failure mode's **Failure Data** tab.

Include economic impact value for environmental effects

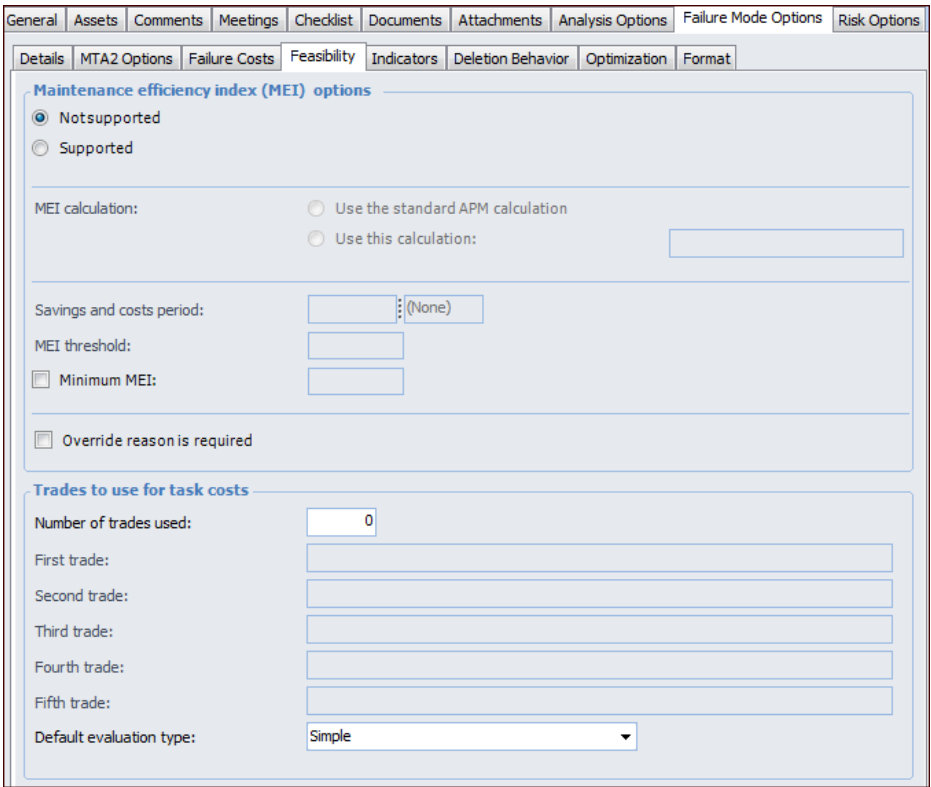
When the analysis team performs a criticality analysis, the selected Environmental severity's economic impact amount is included when the failure mode's avoidance savings is calculated. The amount is shown on the failure mode's **Failure Data** tab.

Include economic impact value for reputation effects

When the analysis team performs a criticality analysis, the selected Reputation severity's economic impact amount is included when the failure mode's avoidance savings is calculated. The amount is shown on the failure mode's **Failure Data** tab.

To Set Feasibility Options

1. Select the **Feasibility** tab.



The screenshot shows the 'Feasibility' tab in a software application. The interface includes a top navigation bar with tabs: General, Assets, Comments, Meetings, Checklist, Documents, Attachments, Analysis Options, Failure Mode Options, and Risk Options. Below this is a sub-navigation bar with tabs: Details, MTA2 Options, Failure Costs, Feasibility (selected), Indicators, Deletion Behavior, Optimization, and Format. The main content area is divided into two sections. The first section, 'Maintenance efficiency index (MEI) options', contains radio buttons for 'Notsupported' (selected) and 'Supported'. Below these are options for 'MEI calculation': 'Use the standard APM calculation' (selected) and 'Use this calculation:' with an adjacent text input field. Further down are input fields for 'Savings and costs period:' (with a dropdown set to '(None)'), 'MEI threshold:', and a checkbox for 'Minimum MEI:'. At the bottom of this section is a checkbox for 'Override reason is required'. The second section, 'Trades to use for task costs', contains an input field for 'Number of trades used:' (set to 0), followed by five input fields for 'First trade:', 'Second trade:', 'Third trade:', 'Fourth trade:', and 'Fifth trade:'. At the bottom of this section is a dropdown menu for 'Default evaluation type:' set to 'Simple'.

2. Set the options for maintenance feasibility:

Setting Name	Description
Maintenance efficiency index (MEI) options	If the maintenance efficiency index is used, select Supported .
MEI calculation	Select the source of the calculation: <ul style="list-style-type: none">• Use the standard APM calculation – The calculation supplied by APM• Use this calculation – Select the custom calculation from the list.
MEI calculation	Custom calculation used to determine the maintenance efficiency index.

Savings and costs period	The period (for example, 1,000 year) to use when calculating costs, including avoidance savings.
MEI threshold	If the feasibility analysis results in a maintenance efficiency index (MEI) that is equal to or greater than the threshold, the task is justified. If the MEI is less than the threshold, the task is not justified.
Minimum MEI	Minimum MEI values are supported.
Minimum MEI	Minimum MEI value. If the calculation results in a value lower than the minimum, the minimum value is used. For example, set this option to 0.00 if negative values are not supported.
Override reason is required	If selected, this option requires that users select a reason when they override a feasibility assessment.
Number of trades	The number of trades used in economic consequence and feasibility evaluations to estimate labor costs for a failure. The maximum number is 5.

3. For each trade, select a description.
4. Select the default evaluation type:
 - **Simple** – The evaluator can select one statement for each category on the form.
 - **Detailed** – The evaluator can select two statements for each category on the form.

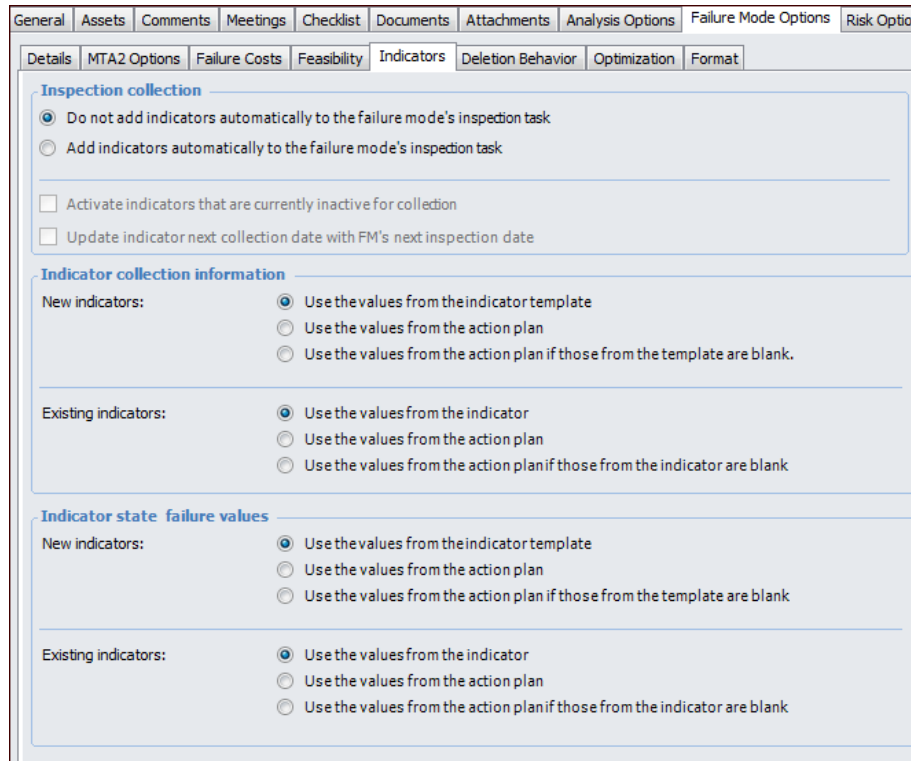
Tip: If you wish to use a custom MEI calculation, create a triggered calculation in the Customization Center. Set the triggering method to **Through a program**. When defining the attribute to calculate, set the options as follows:

- **Class** – Maintenance action plan
- **Contained class** – Maintenance feasibility
- **Attribute to update** – Maintenance efficiency index
- **Data type** – Float magnitude
- **Result value type** – Derived value

- **In case of failure** – Leave value unchanged

To Set Indicator Options

1. Select the **Indicators** tab.



The screenshot shows the 'Indicators' tab within a software application. The interface includes a top navigation bar with tabs: General, Assets, Comments, Meetings, Checklist, Documents, Attachments, Analysis Options, Failure Mode Options, and Risk Options. Below this is a sub-navigation bar with tabs: Details, MTA2 Options, Failure Costs, Feasibility, Indicators (selected), Deletion Behavior, Optimization, and Format. The main content area is divided into three sections:

- Inspection collection**: Contains two radio buttons. The first, 'Do not add indicators automatically to the failure mode's inspection task', is selected. The second is 'Add indicators automatically to the failure mode's inspection task'. Below these are two checkboxes: 'Activate indicators that are currently inactive for collection' and 'Update indicator next collection date with FM's next inspection date'.
- Indicator collection information**: Contains two groups of radio buttons. The first group, 'New indicators:', has three options: 'Use the values from the indicator template' (selected), 'Use the values from the action plan', and 'Use the values from the action plan if those from the template are blank.' The second group, 'Existing indicators:', also has three options: 'Use the values from the indicator' (selected), 'Use the values from the action plan', and 'Use the values from the action plan if those from the indicator are blank'.
- Indicator state failure values**: Contains two groups of radio buttons. The first group, 'New indicators:', has three options: 'Use the values from the indicator template' (selected), 'Use the values from the action plan', and 'Use the values from the action plan if those from the template are blank.' The second group, 'Existing indicators:', also has three options: 'Use the values from the indicator' (selected), 'Use the values from the action plan', and 'Use the values from the action plan if those from the indicator are blank'.

2. Specify whether indicators on the action plan are automatically added to its inspection task. You can choose one of the following:
 - **Do not add indicators automatically**
 - **Add indicators automatically** – when an inspection task is added, indicators currently on the action plan are added to the standard task. When indicators are subsequently added to the action plan, they are automatically added to the standard task.
3. If indicators are added automatically, you can have inactive indicators activated. When an existing standard task is selected as the inspection task, its indicators are checked when it is added to the action plan. If collection has been deactivated for any of the indicators, they are activated.

To enable this functionality, select **Activate indicators that are currently inactive for collection**.

4. When developing a failure mode on an RBI analysis, you can calculate the next inspection date on a failure mode and then update the indicators' next reading dates. Indicators are updated when the action plan is marked "Facilitation Complete". On the indicator, "Next reading due" is set to the failure mode's next inspection date. The Next reading date source box displays "Failure mode degradation rate".

To enable this functionality, select **Update indicator next collection date with FM's next inspection date**.

5. Specify where an indicator that is created from an indicator template gets its collection information. You can choose one of the following:
 - **Use the values from the indicator template**
 - **Use the values from the action plan**
 - **Use the values from the action plan if those from the template are blank**

Note: When you create an indicator based on an indicator template, the system checks to see if the asset already has an indicator based on that template. If such an indicator exists, it is used in the analysis, and a new indicator is not created. In this situation, the indicator is not affected by the options described above. If you want the indicator to be updated with the action plan's values, be sure to set the appropriate option for adding existing indicators to analyses, as described next.

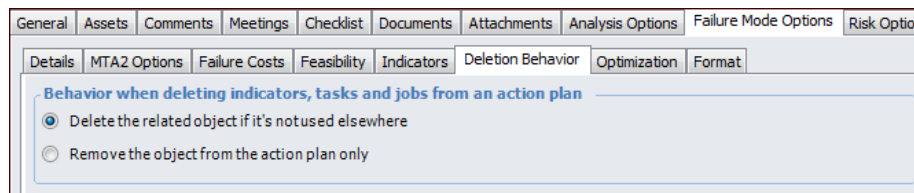
6. For existing indicators that are identified on action plans, specify where the indicator gets its collection information. You can choose one of the following:
 - **Use the values from the indicator**
 - **Use the values from the action plan**
 - **Use the values from the action plan if those from the indicator are blank**
7. Specify where an indicator that is created from an indicator template gets its failure-tracking values. You can choose one of the following:
 - **Use the values from the indicator template**
 - **Use the values from the action plan**
 - **Use the values from the action plan if those from the template are blank**
8. For existing indicators that are identified on action plans, specify where the indicator gets its failure-tracking values. You can choose one of the following:

- Use the values from the indicator
- Use the values from the action plan
- Use the values from the action plan if those from the indicator are blank

Note: If indicators are to be updated, they are modified when the action plan's status changes to "Implementation completed".

To Set Deletion Behavior Options

1. Select the **Deletion Behavior** tab.

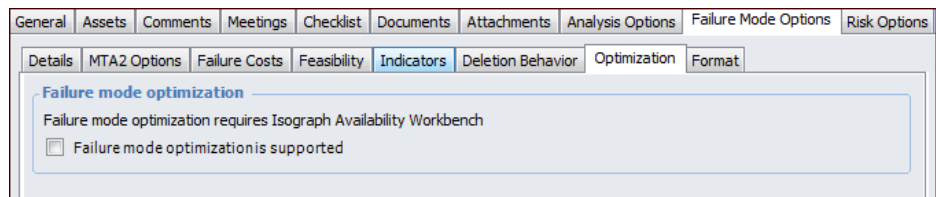


The screenshot shows the 'Deletion Behavior' tab selected in the software interface. The tab is part of a larger set of tabs including General, Assets, Comments, Meetings, Checklist, Documents, Attachments, Analysis Options, Failure Mode Options, and Risk Options. Below the tabs, there are sub-tabs: Details, MTA2 Options, Failure Costs, Feasibility, Indicators, Deletion Behavior, Optimization, and Format. The 'Deletion Behavior' sub-tab is active, displaying the title 'Behavior when deleting indicators, tasks and jobs from an action plan'. Below the title, there are two radio button options: 'Delete the related object if it's not used elsewhere' (which is selected) and 'Remove the object from the action plan only'.

2. Specify how APM is to respond when you delete an indicator, standard task, or standard job from an action plan.

To Enable Optimization

1. Select the **Optimization** tab.

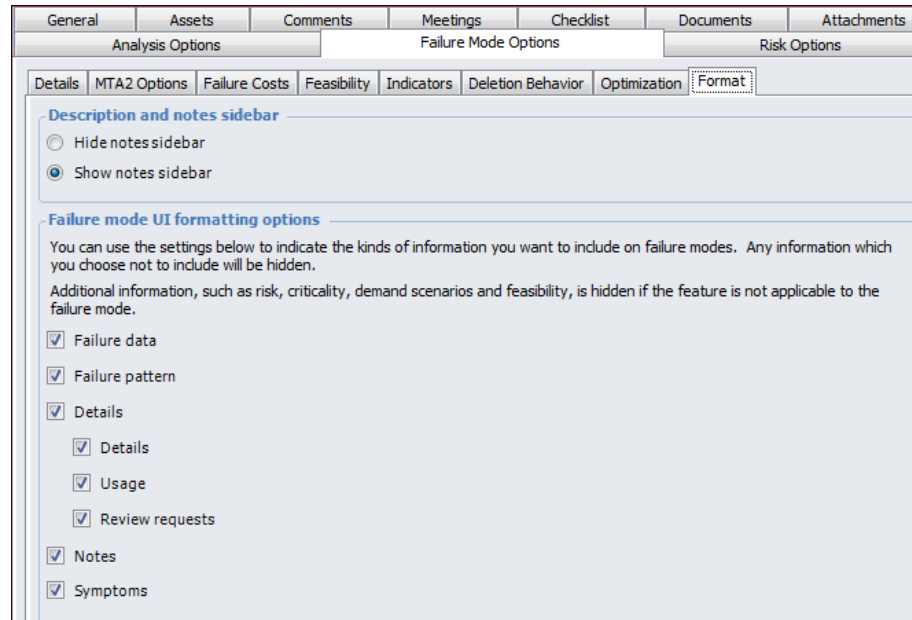


The screenshot shows the 'Optimization' tab selected in the software interface. The tab is part of a larger set of tabs including General, Assets, Comments, Meetings, Checklist, Documents, Attachments, Analysis Options, Failure Mode Options, and Risk Options. Below the tabs, there are sub-tabs: Details, MTA2 Options, Failure Costs, Feasibility, Indicators, Deletion Behavior, Optimization, and Format. The 'Optimization' sub-tab is active, displaying the title 'Failure mode optimization'. Below the title, there is a text label 'Failure mode optimization requires Isograph Availability Workbench' and a checkbox labeled 'Failure mode optimization is supported', which is currently unchecked.

2. Select **Failure mode optimization is supported**. When this option is selected, the **Optimization** view is available in the analysis window.

To Set Format Options

1. Select the **Format** tab.



The screenshot shows the Maintenance Action Plan window with the **Format** tab selected. The window is divided into several sections:

- General** tab: Contains tabs for Details, MTA2 Options, Failure Costs, Feasibility, Indicators, Deletion Behavior, Optimization, and **Format**.
- Description and notes sidebar**: Contains two radio buttons: **Hide notes sidebar** and **Show notes sidebar** (selected).
- Failure mode UI formatting options**: Contains a text box explaining that settings indicate the kinds of information to include on failure modes. It lists several options with checkboxes:
 - ☒ Failure data
 - ☒ Failure pattern
 - ☒ Details
 - ☒ Details
 - ☒ Usage
 - ☒ Review requests
 - ☒ Notes
 - ☒ Symptoms

2. Set the options for the appearance of the Maintenance Action Plan window:

Setting Name	Description
Description and notes sidebar	Hide or show the Failure mode note area in the Maintenance Action Plan window.
	Tip: The analyst can add information to the Notes tab located in the Maintenance Action Plan window's Facilitation view, Notes tab, if available.

Failure data	When this option is selected, the Failure Data tab appears in the Maintenance Action Plan window.
Failure pattern	When this option is selected, the Failure Pattern tab appears in the Maintenance Action Plan window.
Details	When this option is selected, the Details tab appears in the Maintenance Action Plan window.
Details	When this option is selected, the second Details tab appears on the Details tab in the Maintenance Action Plan window.
Usage	When this option is selected, the Usage tab appears on the Details tab in the Maintenance Action Plan window.
Review requests	When this option is selected, the Review Requests tab appears on the Details tab in the Maintenance Action Plan window.
Notes	When this option is selected, the Notes tab appears on the Details tab.
Symptoms	When this option is selected, the Symptoms tab appears on the Details tab in Maintenance Action Plan windows.

Setting Risk Analysis Options for an Analysis

This topic explains how to set the risk analysis options for an analysis. If the analysis uses an analysis type, the risk analysis settings are copied from the analysis type. You can review and change them as required.


There are four initial options for risk analysis:

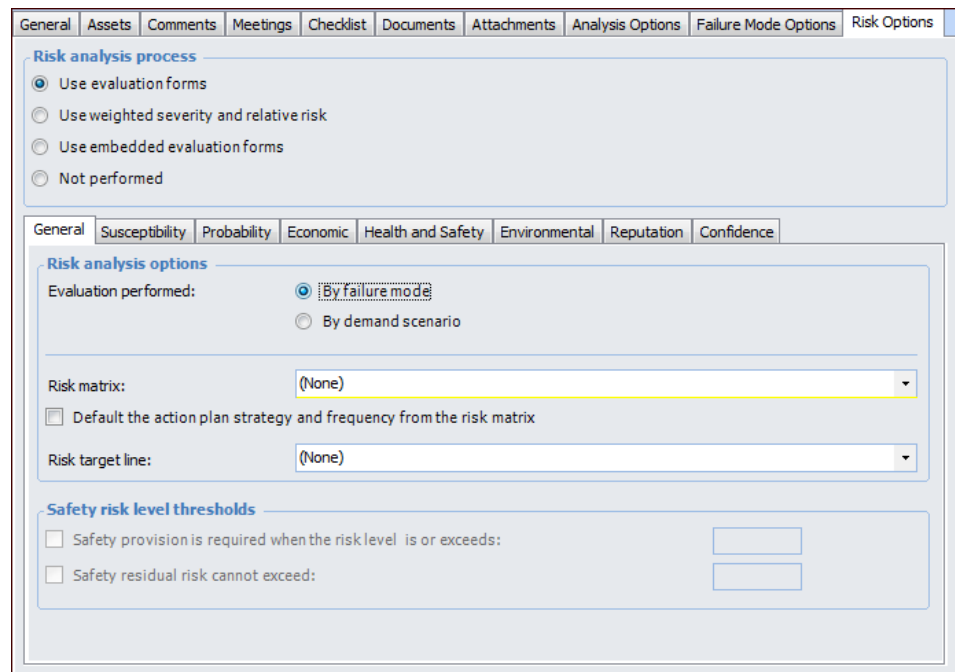
- **Use evaluation forms** – The analysis team uses pop-up questionnaires to evaluate the probability of failure, consequences (economic, health and safety, environmental, and reputation), and confidence factors. APM then calculates the risk and shows it in the risk matrix. This process can be used with failure modes or demand scenarios.
- **Use weighted severity and relative risk** – The analyst assesses the severity of economic, health and safety, environmental, and reputation consequences, assigning a number (weighting) to each factor. The analyst also enters the probability of failure and the confidence factor. APM then calculates the relative risk and shows it in the risk matrix. This process can be used with failure mode risk analysis only; it cannot be used to evaluate demand scenarios.
- **Use embedded evaluation forms** – The analysis team selects options in the **Risk** tab of the Maintenance Action Plan window to evaluate probability and consequence factors. Safety analyses (SIF and HAZOP) use this type of form.
- **Not performed** – Risk analysis features are not shown in the analysis window.

This topic explains how:

- [To Set Options for Using Pop-up Evaluation Forms](#)
- [To Set Options for Using Weighted Severity and Relative Risk](#)

To Set Options for Using Pop-up Evaluation Forms

1. Open the Strategy Development Analysis window.
2. Make sure that editing  is enabled.
3. On the **Properties** view, select the **Risk Options** tab. Click **Use evaluation forms**.

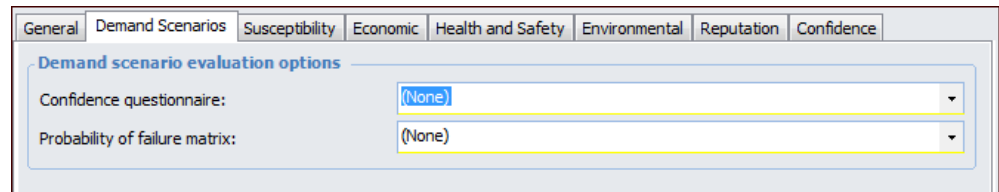


The screenshot shows the 'Risk analysis options' dialog box. The 'General' tab is selected. Under 'Risk analysis process', 'Use evaluation forms' is selected. Under 'Risk analysis options', 'By failure mode' is selected. The 'Risk matrix' dropdown is set to '(None)'. The checkbox 'Default the action plan strategy and frequency from the risk matrix' is unchecked. The 'Risk target line' dropdown is also set to '(None)'. Under 'Safety risk level thresholds', two checkboxes are present: 'Safety provision is required when the risk level is or exceeds:' and 'Safety residual risk cannot exceed:', each followed by an empty input field.

4. On the **General** tab, select whether risk analysis is performed on failure modes or on demand scenarios. If you select **By demand scenario**, the **Demand Scenarios** tab is added and the **Probability** tab is removed.
5. Set the following options:

Setting Name	Description
Risk matrix	The risk matrix specified as the default for risk analyses of this type. The matrix displays the results of the failure mode's probability and severity evaluations, as well as its relative risk (criticality).
Default the action plan strategy and frequency from the risk matrix	If this option is selected, when the risk analysis has been performed, the recommended strategy and frequency (if applicable) are copied from the risk matrix entry to the action plan.
Risk plot target line	Style of target line for use in charts, for example, the failure mode risk tolerance line.

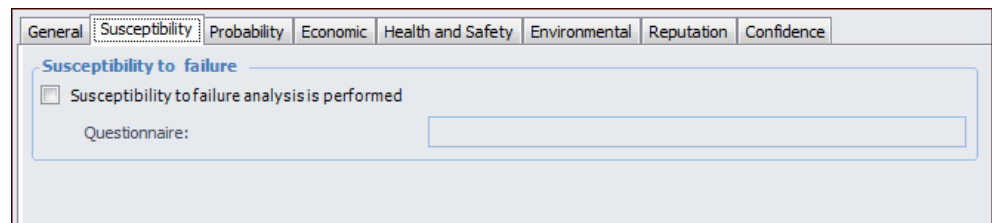
6. If risk analysis is performed on demand scenarios, select the **Demand Scenarios** tab.



7. Set the following options:

Setting Name	Description
Confidence questionnaire	Questionnaire used to perform the confidence evaluation for likelihood of failure.
Probability of failure matrix	Matrix to use when the probability of failure is based on a demand scenario.

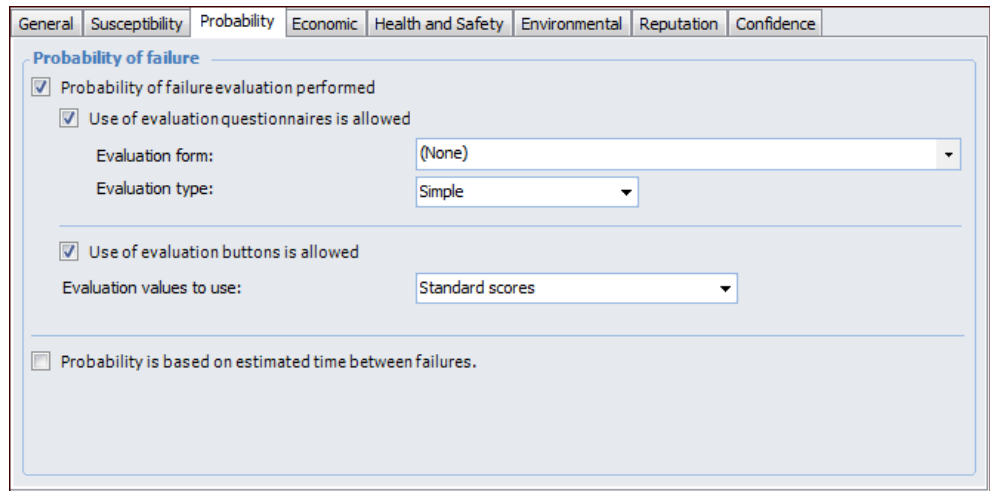
8. If risk analysis includes susceptibility to failure analysis, select the **Susceptibility** tab.



9. Set the following options:

Setting Name	Description
Susceptibility to failure analysis is performed	A susceptibility to failure evaluation examines the asset's non-age related degradation patterns. The evaluation uses a questionnaire to review the asset's composition and materials, for example.
Questionnaire	A susceptibility to failure questionnaire presents the analyst with a series of questions. Like a decision diagram, the response to one question determines the next question, and so on, until a conclusion is reached.

10. If risk analysis is performed on failure modes, select the **Probability** tab.



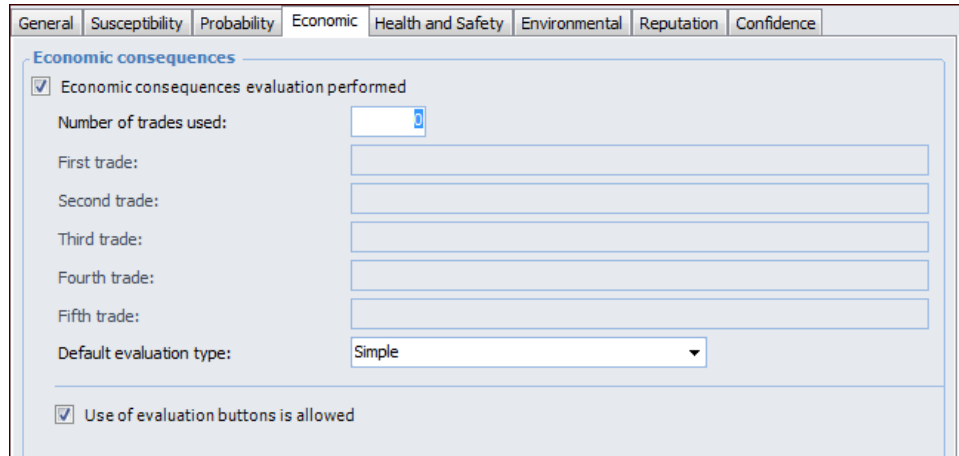
11. Set the following options:

Setting Name	Description
Evaluation performed	When selected, this option allows the evaluation to be performed.
Use of evaluation questionnaires is allowed	When this option is selected, analysts can fill in an online form.
Evaluation form	Evaluation form that users use to perform the analysis.
Evaluation type	<p>Evaluation forms can have these types:</p> <ul style="list-style-type: none"> • Simple – The evaluator can select one statement for each category on the form. • Detailed – The evaluator can select two statements for each category on the form.
Use of evaluation buttons is allowed	When this option is selected, analysts can simply click the button that represents the result of their evaluation.
Evaluation values to use	The type of values used in the evaluation, for example, standard scores or alternates.

Probability is based on estimated time between failures

The probability of failure is determined by the estimated time between failure (ETBF) without maintenance tasks. When this option is enabled, the **Estimated time between failures without maintenance** box appears in the Failure Mode window, **Criticality** tab.

12. Select the **Economic** tab.



13. Set the following options:

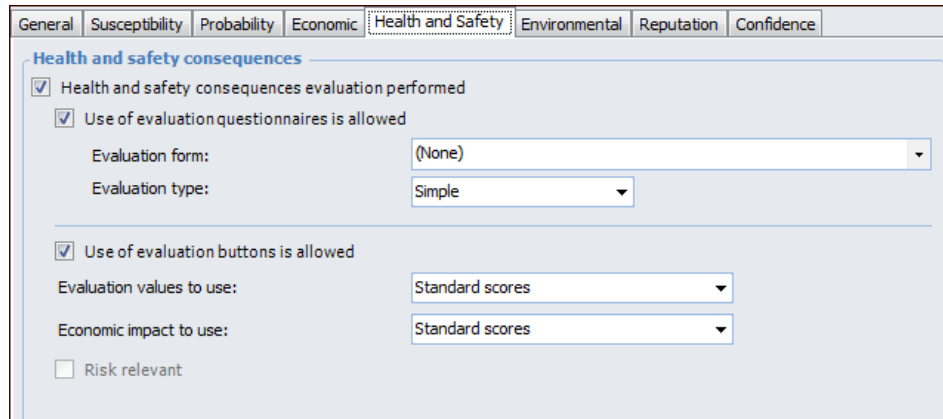
Setting Name	Description
Evaluation performed	When selected, this option allows the evaluation to be performed.
Number of trades	The number of trades used in economic consequence and feasibility evaluations to estimate labor costs for a failure. The maximum number is 5.

14. For each of the trades, select a value from the list defined for the site.

15. Select the default evaluation type:

- **Simple** – The evaluator can select one statement for each category on the form.
- **Detailed** – The evaluator can select two statements for each category on the form.

16. When **Use of evaluation buttons is allowed** is selected, analysts can simply click the button that represents the result of their economic evaluation. If this option is not selected, the buttons are disabled.
17. Select the **Health and Safety** tab.



18. Set the following options:

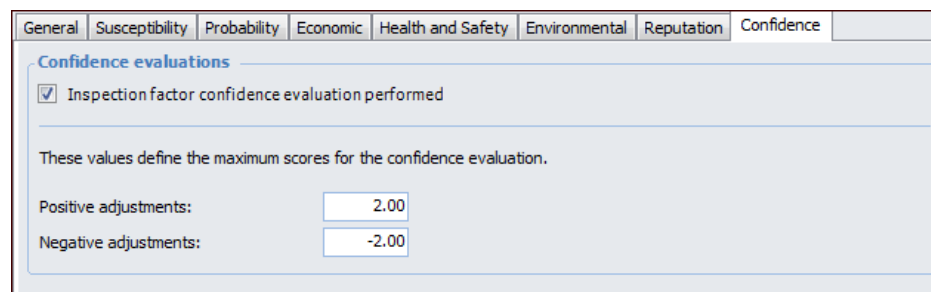
Setting Name	Description
Evaluation performed	When selected, this option allows the evaluation to be performed.
Use of evaluation questionnaires is allowed	When this option is selected, analysts can fill in an online form.
Evaluation form	Evaluation form that users use to perform the analysis.
Evaluation type	<p>Evaluation forms can have these types:</p> <ul style="list-style-type: none"> • Simple – The evaluator can select one statement for each category on the form. • Detailed – The evaluator can select two statements for each category on the form.
Use of evaluation buttons is allowed	When this option is selected, analysts can simply click the button that represents the result of their evaluation.

Evaluation values to use The type of values used in the evaluation, for example, standard scores or alternates.

Economic impact and range to use The type of values used in the evaluation for the economic impact and range, for example, standard scores or alternates.

19. Select the **Environmental** and **Reputation** tabs in turn and set the options for using evaluation questionnaires and buttons.

20. Select the **Confidence** tab.



21. Change the default settings as required:

Setting Name	Description
Inspection factor confidence evaluation performed	A confidence evaluation is performed to determine the inspection factor. This option is only relevant when risk analysis is performed using pop-up evaluation forms. The Confidence tab appears in the Maintenance Action Plan window.
Positive adjustments	The maximum positive score for the confidence questionnaire. For example, if the positive adjustment is “2.0” and the sum of the selected responses’ confidence adjustments is “2.10”, APM retrieves the confidence factor assigned an evaluation score of “2.0”.

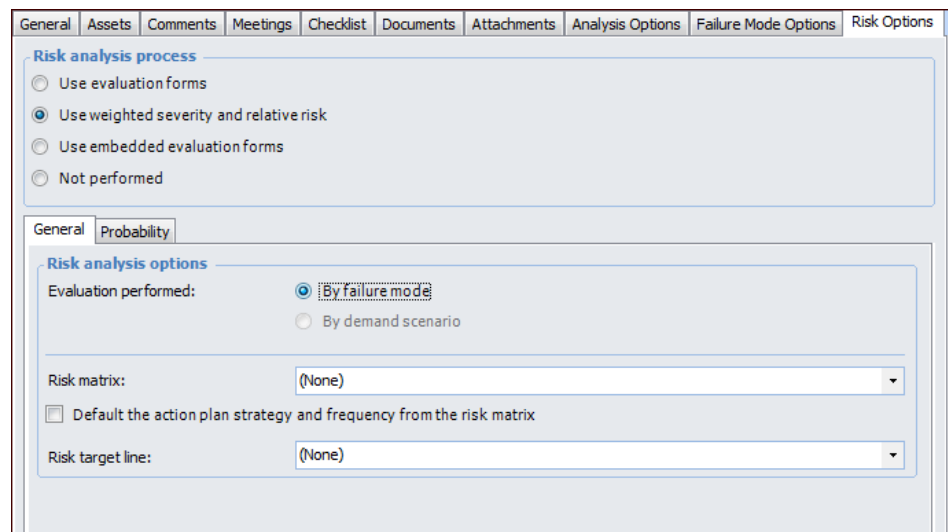
Negative adjustment

The maximum negative score for the confidence questionnaire. For example, if the negative adjustment is “-2.0” and the sum of the selected responses’ confidence adjustments is “-2.10”, APM retrieves the confidence factor assigned an evaluation score of “-2.0”.

Note: If you set the positive and negative adjustments to 0.00, the confidence evaluation questionnaire’s adjustment values are used.

To Set Options for Using Weighted Severity and Relative Risk

1. In the Strategy Development Analysis window, **Properties** view, select the **Risk Options** tab. Click **Use weighted severity and relative risk**.



The screenshot shows the 'Risk Options' tab in the 'Strategy Development Analysis' window. The 'Risk analysis process' section contains four radio buttons: 'Use evaluation forms', 'Use weighted severity and relative risk' (selected), 'Use embedded evaluation forms', and 'Not performed'. Below this, the 'Risk analysis options' section is visible. It has two sub-tabs: 'General' and 'Probability'. Under 'General', the 'Evaluation performed:' section has two radio buttons: 'By failure mode' (selected) and 'By demand scenario'. Below that, the 'Risk matrix:' dropdown is set to '(None)'. There is a checkbox labeled 'Default the action plan strategy and frequency from the risk matrix' which is currently unchecked. At the bottom, the 'Risk target line:' dropdown is also set to '(None)'.

2. On the **General** tab, set the following options:

Setting Name
Description
Risk matrix

The risk matrix specified as the default for risk analyses of this type. The matrix displays the results of the failure mode’s probability and severity evaluations, as well as its relative risk (criticality).

Default the action plan strategy and frequency from the risk matrix If this option is selected, when the risk analysis has been performed, the recommended strategy and frequency (if applicable) are copied from the risk matrix entry to the action plan.

Risk plot target line Style of target line for use in charts, for example, the failure mode risk tolerance line.

3. Select the **Probability** tab. To determine the probability of failure based on ETBF, select **Probability is based on estimated time between failures**. When this option is enabled, the **Estimated time between failures without maintenance** box appears in the Maintenance Action Plan window, **Criticality** tab.
4. Select the type of values used in the evaluation, for example, standard scores or alternates.

Adding Assets to an MTA2

In a new analysis, the **Properties** view, **Assets** tab displays the primary asset or system and its asset type. The second **Assets** tab and the **Hierarchy** tab display the primary asset and its descendants, if included in the analysis. As the analysis progresses, you might find it necessary to add assets to the analysis.

When you create an analysis that includes the primary asset's descendants, a snapshot is taken of the asset's physical hierarchy. This analysis hierarchy remains static. That is, any changes made to the site's physical hierarchies are not automatically made to the analysis hierarchy. However, when you add assets to an analysis, the analysis hierarchy is refreshed with any changes that have occurred to the physical hierarchy. Also, at any time you can update the analysis hierarchy to reflect changes. For more information, see [“Updating the Asset Hierarchy Snapshot” on page 307](#).

Tip: An asset can be added to an analysis by dragging the asset from a table and dropping it on the analysis' list of assets. For example, you can drag an asset from the site's list of assets and drop it on the analysis' list of assets. If analysis options specify that descendants be included, the copied asset's descendants are added to the analysis. The asset's failure modes are not copied to the analysis.

Assets are given sequence numbers as they are added to the analysis. The asset's sequence number contributes to the failure mode's reference number. You can change the sequence numbers of assets and failure modes using the **Move Up** and **Move Down** buttons on the **Assets** tab. For example, you might wish to renumber the assets after you copy failure modes from another analysis because the assets bring their sequence numbers with them.

Tip: In the **System Information** view, you can review information about the analysis assets. You can also edit the following properties from the **Assets** tab:

- Asset description
- Process description
- Degradation description

In addition, you can add and edit operating parameters on the **Operating Window** tab. Changes that you make in the **System Information** view are saved to the asset record.


Tip: After the analysis is completed, you can return and see a snapshot of an asset's properties as they were at the time the asset was analyzed. In the Strategy Development Analysis window, select the **Properties** view and then the **Assets** tabs (or the **System Information** view, **Assets** tab, and then the **Hierarchy** tab). Right-click the asset in the table and click **Asset Snapshot**. The Asset Snapshot dialog displays the information that was current either on the date that the asset was added or on the date that the analysis status changed to "Analysis completed".

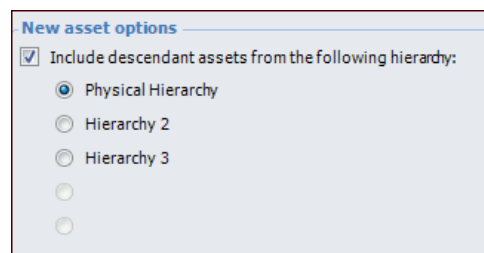
You can add assets to the analysis by browsing for existing assets or by creating one or more child assets in the analysis. When creating assets, the new child assets are added to the parent asset's hierarchy.

This topic explains how:

- [To Browse for Assets](#)
- [To Create Assets](#)

To Browse for Assets

1. Open the analysis.
2. Make sure that editing  is enabled.
3. Select the **Properties** view, **Analysis Options** tab. This tab shows the settings that apply when you add assets to the analysis. For example:



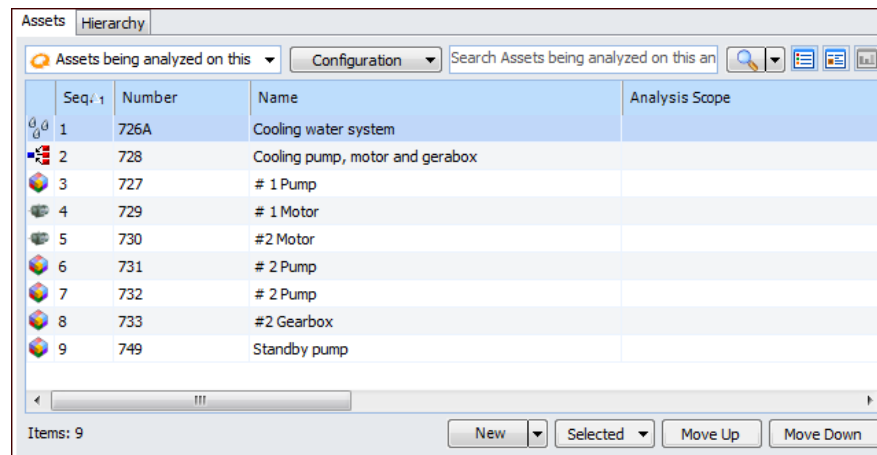
4. To include child assets, ensure that **Include descendant assets** is selected and choose the hierarchy to take them from. APM duplicates the physical hierarchy for the asset and its descendants in the analysis asset hierarchy.

Note: Descendants that are already included in the analysis are ignored when the analysis is updated. Component assets and their descendants cannot be included in the analysis.

5. Select the **Assets** tab and the second **Assets** tab. In the **New** list, click **Browse**. The Browse Assets dialog appears.

Tip: You can also select the **Hierarchy** tab and click **Browse**.

6. Select one or more assets.
7. Click **OK**. The dialog closes and the assets are added to the list to be analyzed. If you chose to include descendants, they are also added to the analysis hierarchy. If the new asset's parent is not included in the analysis hierarchy, the asset is placed beneath the primary asset.



Tip: To re-sequence an asset, select it in the table and click **Move Up** or **Move Down** until it is in the correct position. The asset sequence numbers are changed appropriately.

To Create Assets

1. On the **General** tab, select the **Assets** tab and the second **Assets** tab.
2. Open the Create Multiple Assets window in either of these ways:
 - Click the **New** list and then **Assets**. By default, the primary asset is designated the parent.
 - Right-click an analysis asset and click **Create Multiple Child Assets**. By default, the asset you selected is designated the parent.

Tip: You can also create assets on the **Hierarchy** tab. Click **New** or right-click an asset and click **Create Multiple Child Assets**. The Create Multiple Assets window appears.

3. Enter and select options on the **Creation Options** tab:

Setting Name	Description
Number to create	Specify the number of items to create.
Assign asset number as follows	Select this option to specify names and numbers for the new assets. Note: If you do not specify numbers, APM assigns the assets unique, sequential numbers. If you do not specify names, the new assets are not named.
Start at	Specify the number for the first new item. The second item's number is the starting number plus the increment amount, and so on.
Increment by	Enter a value by which to increment the number on each subsequent item.

Prefix with Enter a value to add to the beginning of each number.

Note: If the assigned number already exists, “(2)” is added to the asset number.

Name Specify the name to be given to the items.

Include asset number in the asset name Select this option to have the asset number included in the asset name.

Insert at Select whether the item number is inserted at the beginning or end of the name.

4. In the **Asset details** area, select the options for the new assets:

Setting Name	Description
Type	Asset types are groups of settings that define the characteristics of your organization's assets. For example, you might create asset types called “pumps” or “piping and valves.” The asset type contains basic information, policies, and permissions, such as whether or not standard jobs can be created for assets of the type. When you create an asset in APM, you must specify an asset type, which then determines the information and functionality available for the asset.
Subtype	<p>If the asset type specifies that a subtype is available for the asset, it is shown in this box. If more than one subtype is available, you can change the default selection.</p> <p>If the asset type has one or more default subtypes, those subtypes are added to the Creation Options tab. A tab is added to the window for each default subtype. These specifications tabs will appear on the new child assets.</p>

Classification

When you select an asset type, APM enters the asset classification automatically. You might be able to change the classification for the asset, depending on the asset type that was selected. Selecting the correct classification is important because it affects how APM treats the asset.

You can select from these APM classifications:

- Maintainable assets can be worked on. Users can enter work requests and work orders for them, and costs can be charged to them.
- System assets group assets that represent a system, such as a gas treatment system. These assets are treated in the same manner as maintainable assets in that users can enter work requests and work orders for them, and costs can be charged to them.
- Subsystem assets group assets that represent a subsystem of a system, such as heating, cooling, and dehydration subsystems. These assets are treated in the same manner as maintainable assets in that users can enter work requests and work orders for them, and costs can be charged to them.
- Component locations indicate where a component is located on a maintainable asset or asset group.
- Organizations represent organizational units, such as departments. They are often used to group other types of assets so that you can view costs at appropriate levels.
- Asset groups collect similar assets together to make it easier for or compare data. For example, all 100hp motors could be represented by an asset group.

Note: You cannot create component assets using the Create Multiple Assets window.

Consequence priority Consequence priorities are often used when sorting and analyzing the work backlog for scheduling or when analyzing asset failure information. APM also uses consequence priorities to determine whether or not to push indicator alarms up the physical hierarchy so that they will be visible on higher levels in the indicator monitoring panel.

Warning: The ranking number assigned to consequence priorities is also used to calculate alarm notification rankings for indicator alarms. If you do not select a priority setting for an asset, alarm notifications might not be pushed up the hierarchy to be displayed on a parent asset. This can affect the display of the alarm in the site's **Indicators** view.

Status Asset status represents the operational state of an asset and whether or not it is available for use. APM uses the status of an asset to determine whether or not work is triggered and whether or not components are available for installation.

Material Type The type of the material, for example, stainless steel or aluminum.

Material Grade The grade of the material type.

P&ID Piping and instrumentation diagram associated with the asset. In APM, P&IDs are included with standard documents and can be added to assets and safety provisions for reference.

In-service Date The date that this asset was first put into service.

5. Select the **Location** tab. This tab displays information about the parent asset in the physical and any alternate hierarchies. For example:

6. To change the parent asset, click the browse icon and select another analysis asset.
7. Provide the following information:

Setting Name	Description
Hierarchy code	<p>A hierarchy code is a string of up to 10 letters and numbers that identifies an individual asset or site. APM uses the hierarchy code for the asset, its parent assets, and the site to create the hierarchy location.</p> <p>For the hierarchy location to be useful, enter a code that gives users some indication of the asset's function and location. For example, if a generator set is located on the north side of the plant, you might enter "NGenSet". If the generator set has a pump location, you might enter "PmpStation" on the component location asset, and "Pump1" on the record for the pump component asset.</p>
Location	Describe the physical location of the asset.
Map coordinates	<p>The longitude and latitude coordinates of the physical location of the object.</p> <p>Note: Latitude can have values ranging from -090.000 to +090.000. Longitude values can be from -180.000 to +180.000. For values outside these ranges, APM will accept the values and adjust accordingly. For example, a longitude value of +200.0 will translate to -160.0 on the map.</p>

Tip: You can click the browse icon and point to the location on a map to have APM assign the coordinates. For more information, see [Setting Map Coordinates](#).

Area An asset can be associated with an area that identifies its physical location at the site. The area is used on checksheets to show all of the indicators within a particular area of the site. A bar code identifier can also be associated with an area.

Closest warehouse The default warehouse for the asset, which is the default “deliver to” warehouse for purchases that are charged to this asset. If this box is left blank, APM uses the warehouse of the parent asset.

8. When the enterprise and sites are set up in APM, up to five different hierarchies can be created to organize assets. The first hierarchy is the comprehensive physical hierarchy. Most (if not all) of your assets should be included in this hierarchy.

If you are using additional hierarchies, you can select parent assets in alternate hierarchies to establish the position of the new assets. Click a browse icon to select a parent asset.

9. Select the **Description** tab to add information to be added to each asset’s description.
10. Click **OK**. The child assets are created and added to the asset hierarchy.


Excluding Assets from an Analysis

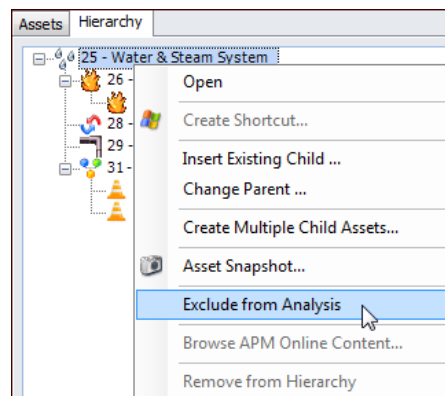
When performing an analysis, you might find that one or more assets do not need to have failure modes and action plans created for them. For example, the primary asset might not require analysis although its descendants do. You can exclude the asset from the analysis, as long as it does not have action plans defined for it, so that the analysis can be completed and closed. You can also add an excluded asset back into the analysis, if necessary.

An advantage of excluding assets is that they cannot be added back into the analysis when you update the asset hierarchy snapshot. For example, if you delete an analysis asset, rather than excluding it, it can be returned to the analysis when the hierarchy is updated. This occurs if the deleted asset is the descendant of another asset in the analysis.

This topic explains how to exclude an asset and how to return an excluded asset to the analysis.


To Exclude an Asset

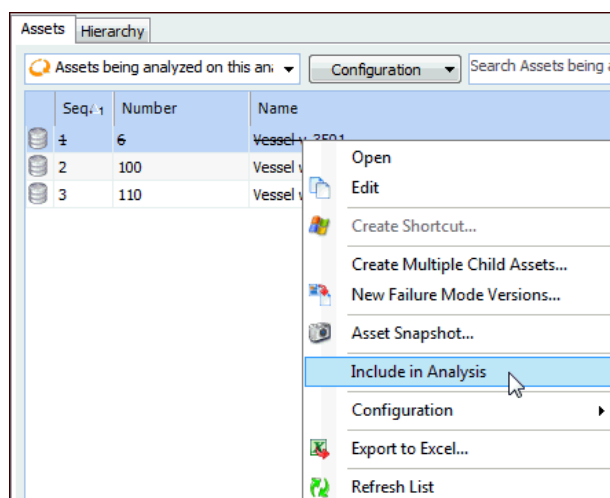
1. Open the analysis.
2. Make sure that editing  is enabled.
3. Select the **Properties** view, **Assets** tab.
4. Select the second **Assets** tab or the **Hierarchy** tab.
5. Right-click the asset and click **Exclude from Analysis**.



The asset is shown as crossed out in the **Assets** tab.

To Include an Excluded Asset

1. Open the analysis.
2. Make sure that editing  is enabled.
3. Select the **Properties** view, **Assets** tab.
4. Select the second **Assets** tab or the **Hierarchy** tab.
5. Right-click the asset and click **Include in Analysis**.



The asset is added back into the analysis and action plans can be developed for it.

Working with Asset Scope on an MTA2

In some cases, assets are large enough to warrant separate analyses for different sections. For example, when the top portion of a large vessel contains gas and the bottom holds liquid, separate analyses or action plans are needed to define and respond to different failure modes and effects. In this case, you can select the analysis option **Allow the scope of the analysis to be defined by asset**.


For an analysis asset, you can provide a description of the analysis scope. The same asset can be added to the analysis as many times as required, each with a difference scope description. You can then create failure modes for each of the analysis assets from the **Facilitation** view, **By Asset** and **By Hierarchy** tabs.

The scope description appears in tables that display the analysis assets and in reports.

This topic explains how:

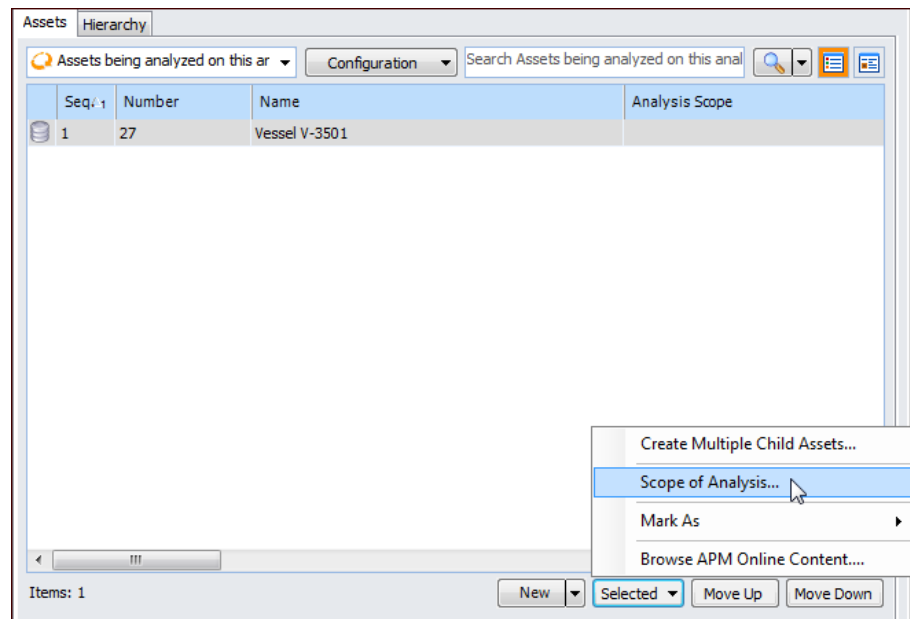
- [To Enable Asset Scope on an Analysis](#)
- [To Add a Scope Description to an Analysis Asset](#)
- [To Add an Analysis Asset](#)
- [To Create a Failure Mode for a Scoped Asset](#)

To Enable Asset Scope on an Analysis

1. Open the analysis.
2. Make sure that editing  is enabled.
3. Select the **Properties** view, **Analysis Options** tab.
4. Click **Allow the scope of the analysis to be defined by asset**.

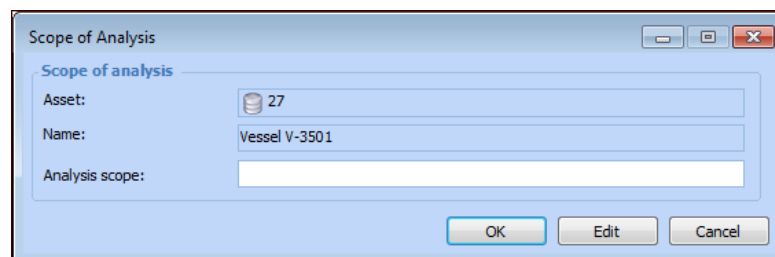
To Add a Scope Description to an Analysis Asset

1. In the Strategy Development Analysis window, select the **Properties** view, **Assets** tab.
2. On the second **Assets** tab, select the asset, click the **Selected** list, and then **Scope of Analysis**. For example:



Tip: You can also right-click an asset on the **Assets** or **Hierarchy** tab and click **Scope of Analysis**.

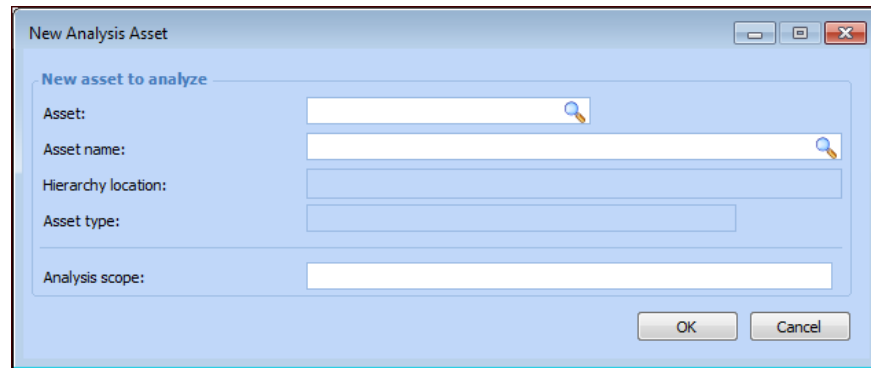
The Scope of Analysis dialog appears:



3. Describe the section of the asset to be analyzed.
4. Click **OK**. The dialog closes and the description appears in the Analysis Scope column of the Assets table.

To Add an Analysis Asset

1. In the Strategy Development Analysis window, select the **Properties** view, **Assets** tab.
2. On the second **Assets** tab, click the **New** list and then **Analysis Asset**. The New Analysis Asset dialog appears.



The 'New Analysis Asset' dialog box contains the following fields:

- Asset: (text field with a browse icon)
- Asset name: (text field with a browse icon)
- Hierarchy location: (text field)
- Asset type: (text field)
- Analysis scope: (text field)





Buttons: OK, Cancel

3. Click a browse icon to open the Asset Selector dialog. Select the asset and click **OK**. The dialog closes and the asset information is added to the New Analysis Asset dialog.
4. Describe the section of the asset to be analyzed.
5. Click **OK**. The asset is added to the table. For example:

Assets		Hierarchy	
Assets being analyzed on this		Configuration	Search Assets being analyzed on this an
Seq. 1	Number	Name	Analysis Scope
1	167	Benzene tank	Top
2	167	Benzene tank	Bottom

To Create a Failure Mode for a Scoped Asset

1. In the Strategy Development Analysis window, select the **Facilitation** view, **By Asset** or **By Hierarchy** tab.
2. In the left table, select the asset you wish to analyze. For example:

Info Worksheet		Feasibility	By Asset	By Hierarchy	Failure Modes	Requests				
Assets by sequence					Configuration	Failure modes				
	Seq. 1	Number	Name	Analysis Scope				A 1	FM 2	FM Number
	1	6	Vessel v-3501							
	2	14	Pressure relief valve							
	3	24	Benzene tank	Top						
	4	24	Benzene tank	Bottom						


3. Click **New** at the bottom of the Failure modes table. The Maintenance Action Plan window appears.
4. Develop the failure mode. For detailed information, see [“Creating Failure Modes”](#) on page 112.

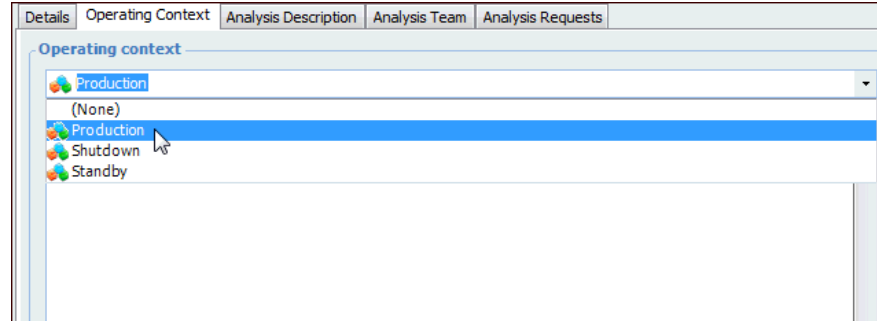
Recording the Primary Asset's Operating Context

The analysis team needs a good understanding of the circumstances in which the primary asset operates in order to define failure modes and action plans. Recording the operating context in APM involves selecting an operating context from the list and then entering a detailed description. The description typically includes how and where the asset is used and the performance criteria that apply to output, throughput, safety, environmental integrity, and so on.

Note: Operating context values are defined at the site level, in the Strategy Development settings. For more information, see “Setting up Operating Contexts” in Help.

To Record the Assets' Operating Context

1. Open the analysis and select the **Properties** view, **General** tab.
2. Make sure that editing  is enabled.
3. Select the **Operating Context** tab.
4. Select an operating context from the list.



Tip: To create an operating context, right-click in the **Operating context** box and click **New**.


5. In the box, you can enter a detailed operating context statement.

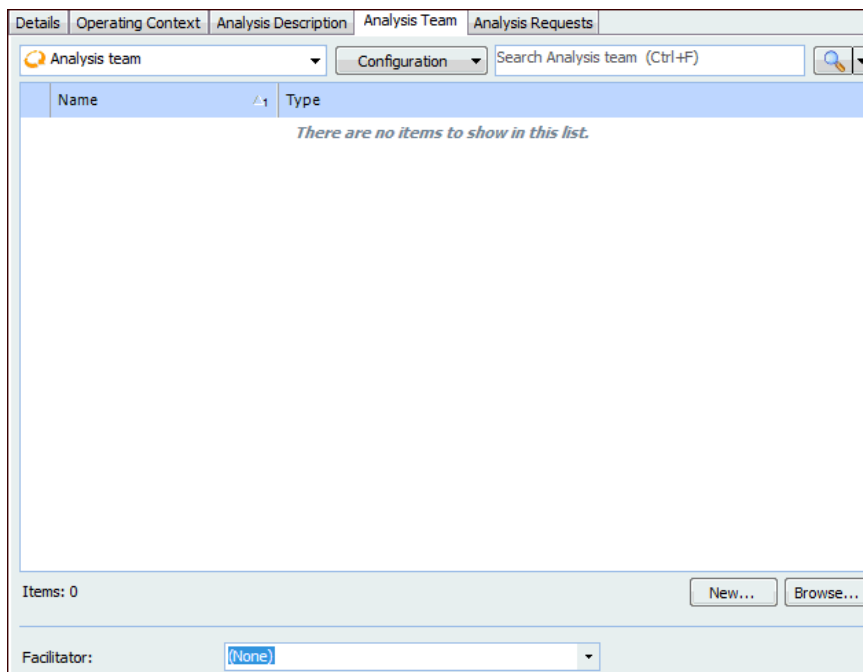
Adding Team Members to an Analysis

You can maintain a list of the team members who are working on the analysis. You can also designate one member as the facilitator of the team.

Because it is common for some of the team members to be from external organizations or to be employees who otherwise have no contact with the APM system, it is not necessary for the team members to have APM employee records. For these consultants, you can record names, job titles, and companies or departments.

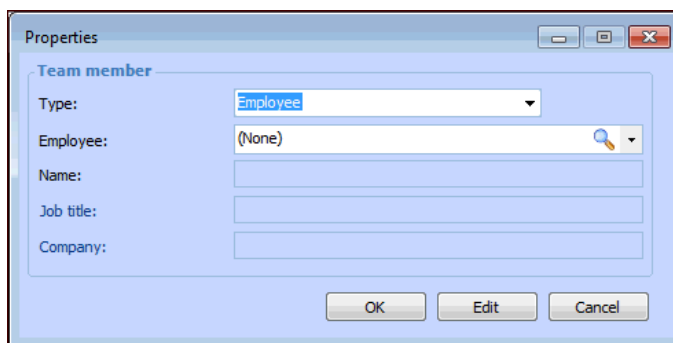
To Add Team Members

1. From an open analysis, select the **Properties** view, **General** tab, **Analysis Team** tab.
2. Make sure that editing  **Edit** is enabled.



The screenshot shows the 'Analysis Team' tab in a software application. The interface includes a tab bar at the top with 'Details', 'Operating Context', 'Analysis Description', 'Analysis Team' (selected), and 'Analysis Requests'. Below the tabs, there is a search bar labeled 'Search Analysis team (Ctrl+F)' and a 'Configuration' dropdown. The main area is a table with columns 'Name' and 'Type'. The table is empty, displaying the message 'There are no items to show in this list.' At the bottom, there is a status bar showing 'Items: 0' and buttons for 'New...' and 'Browse...'. Below the status bar, there is a 'Facilitator:' label and a dropdown menu currently set to '(None)'.

3. To quickly add one or more employees to the team, click **Browse**. The Browse Employees dialog appears. Select the employees and click **OK**. They are added to the **Analysis Team** tab.
4. To create a team member record, click **New**. The Properties dialog appears.



5. If the member does not have an APM employee record, select **Consultant** from the **Type** list and provide the member's name, job title, and company or department.
6. If the member has an APM employee record, select **Employee** from the **Type** list. Select the employee from the list or click the browse icon to select the employee or create a new record. The employee is added to the **Employee** box.
7. Click **OK** to save the information and close the dialog.
8. On the **Analysis Team** tab, select the team leader from the **Facilitator** list.

Entering and Reviewing Comments on an Analysis

The commenting feature helps the analysis team keep track of their work in analyzing assets. The team can record comments on the analysis and its failure modes, attach documents to comments, respond to comments, mark them as reviewed, and view the status of comments.

This topic explains how:

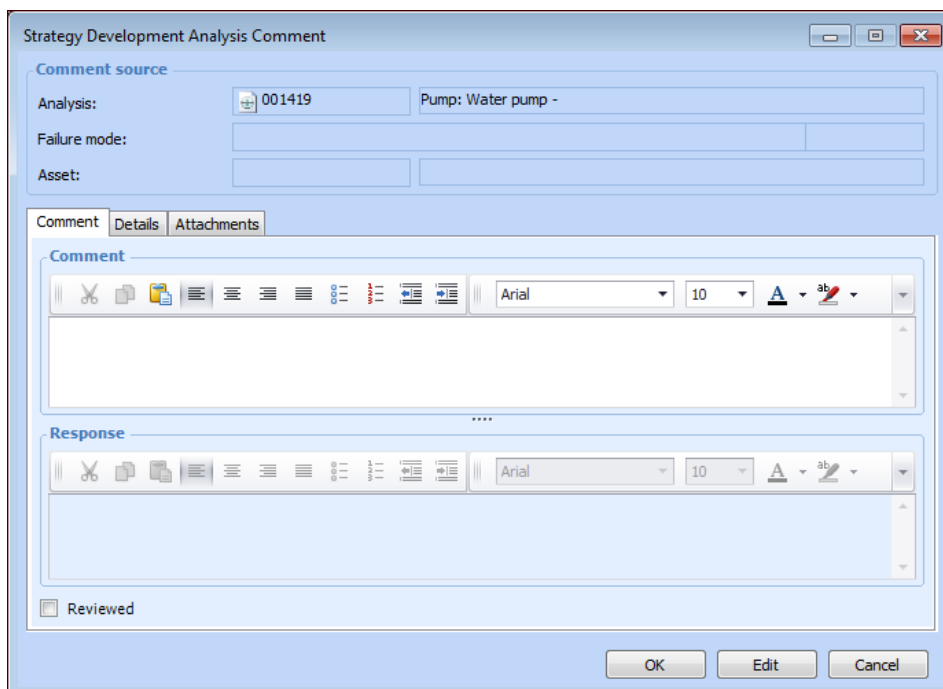
- [To Enter a Comment on an Analysis or Failure Mode](#)
- [To Edit or Respond to a Comment](#)
- [To Review, Delete, or Copy a Comment](#)

To Enter a Comment on an Analysis or Failure Mode

1. Do one of the following:
 - Analysis – Open the Strategy Development Analysis window, select the **Properties** view, and then the **Comments** tab.
 - Failure mode – Open the Maintenance Action Plan window and select the **Comments** view.

The **Comments** tab or view lists existing comments, showing who entered them and when, the responses, and their statuses.

2. Click **New** to add a comment. The Strategy Development Analysis Comment window appears, where you can record information and add attachments. For example:

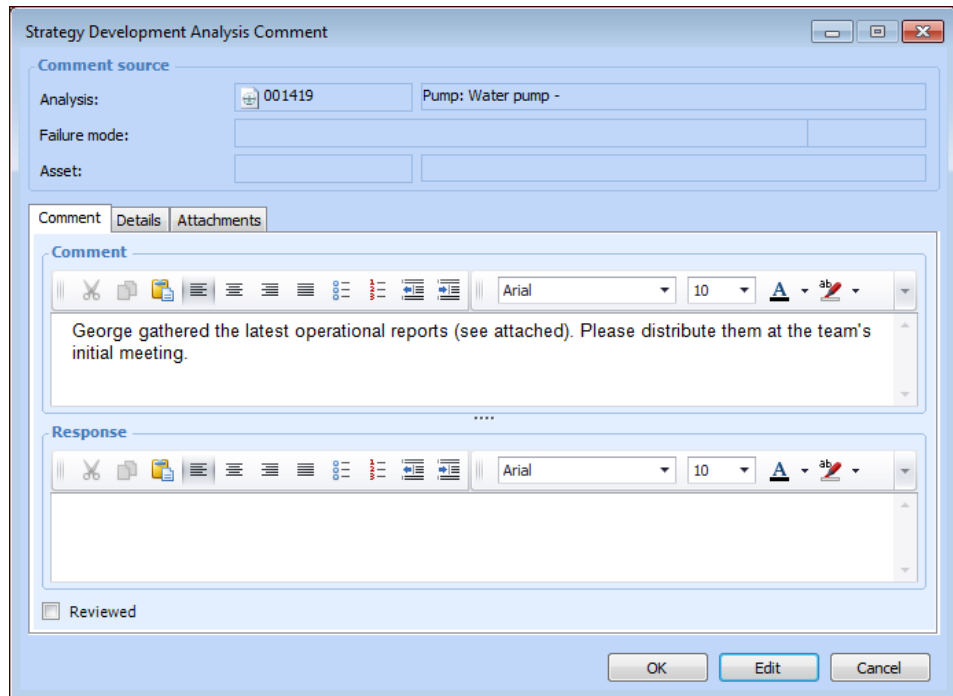


For more information about adding attachments, see “Adding Attachments to Objects” in Help.

3. Click **OK** to close the window.

To Edit or Respond to a Comment

1. Double-click the comment in the **Comments** tab or view to open the window.
2. Click **Edit** to modify the comment, add a response, or mark the comment as reviewed. You can also add attachments and view details about the comment’s history.



3. Click **OK** to close the window.

To Review, Delete, or Copy a Comment

1. To mark a comment as reviewed, select it in the **Comments** tab or view and click **Mark as Reviewed**. The **Reviewed By**, **Reviewed On**, and **Reviewed** columns are populated for that comment.
2. To delete a comment, right-click it in the **Comments** tab or view and click **Delete**. The comment is removed from APM.
3. To copy a comment, right-click it in the **Comments** tab or view and click **Copy**. The Comment window opens showing a copy of the original. When you are finished working with the comment, click **OK** to close the window.

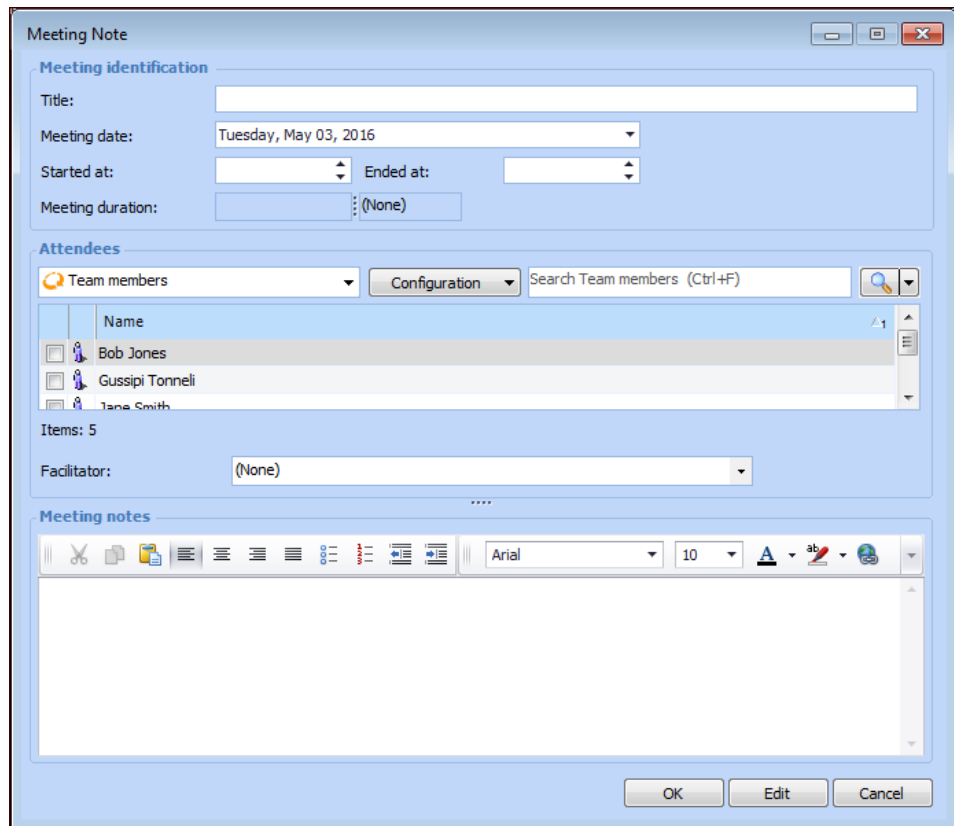
Recording Team Meetings on an Analysis

Use the meeting note feature to record information about team meetings for future reference.

This topic explains how to use the meeting note feature.

To Record Meetings on an Analysis

1. Open the analysis, select the **Properties** view and the **Meetings** tab. This tab lists existing meeting notes.
2. Click **New**. The Meeting Note window appears.



The screenshot shows the 'Meeting Note' dialog box. It is divided into three main sections: 'Meeting identification', 'Attendees', and 'Meeting notes'. The 'Meeting identification' section includes fields for 'Title', 'Meeting date' (set to 'Tuesday, May 03, 2016'), 'Started at', 'Ended at', and 'Meeting duration' (set to '(None)'). The 'Attendees' section has a 'Team members' dropdown, a 'Configuration' button, and a search bar. Below this is a list of attendees with checkboxes: 'Bob Jones', 'Gussipi Tonnelli', and 'Jane Smith'. The 'Facilitator' dropdown is set to '(None)'. The 'Meeting notes' section features a rich text editor with a toolbar (including cut, copy, paste, bold, italic, underline, link, unlink, bulleted list, numbered list, indent, outdent, and text color) and a large text area for notes. At the bottom are 'OK', 'Edit', and 'Cancel' buttons.

3. You can now describe the meeting, enter the date and time, identify the team members who attended and the facilitator, and record the minutes.
4. Click **OK** to close the window.

Working with the Analysis Checklist

An analysis checklist is a list of “things to do” to remind the team of the steps they need to consider when performing the analysis. For each item that you add to APM settings, you can specify the varieties of analysis it applies to, identify it with an icon, and provide a description.

When recording an analysis, you can mark analysis checklist items as “Performed” and provide comments for them. APM records the employee who checked off the item, the date, and time. The analysis team can view the status of checklist items in the analysis window, **Properties** view, **Checklist** tab.

In the analysis, you can also add checklist items that were added to the site’s Strategy Development settings after the analysis was created.

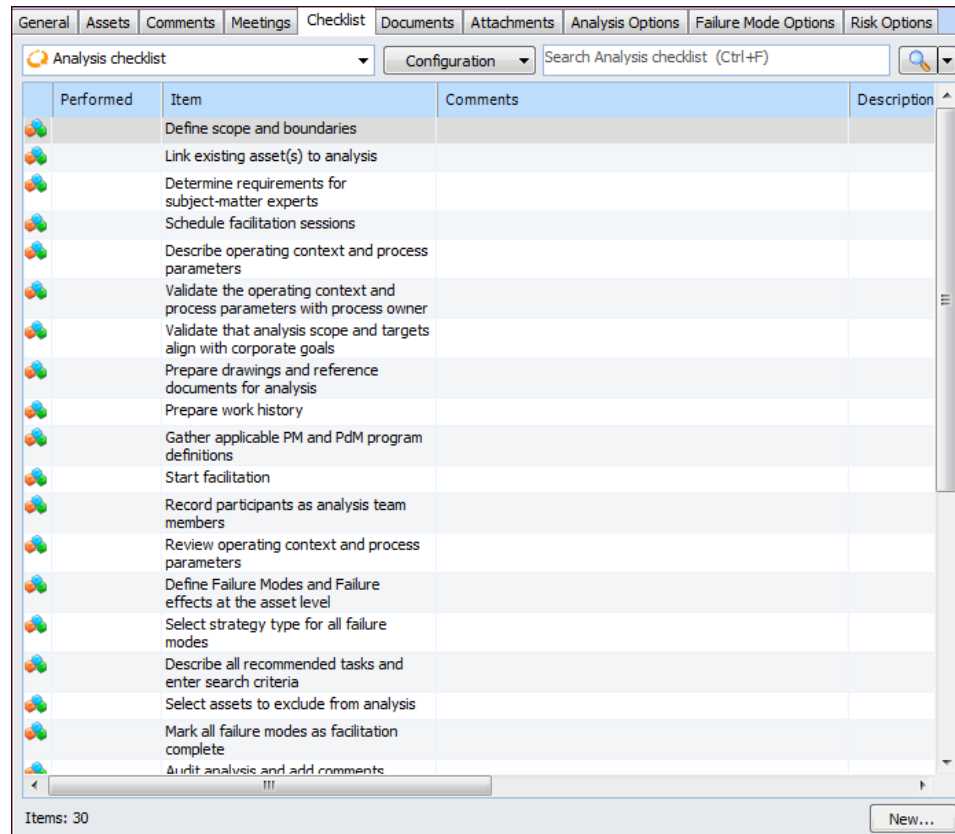
For information about adding checklist items to the site’s Strategy Development settings, see “Setting up Checklist Items” in Help.


This topic explains how:

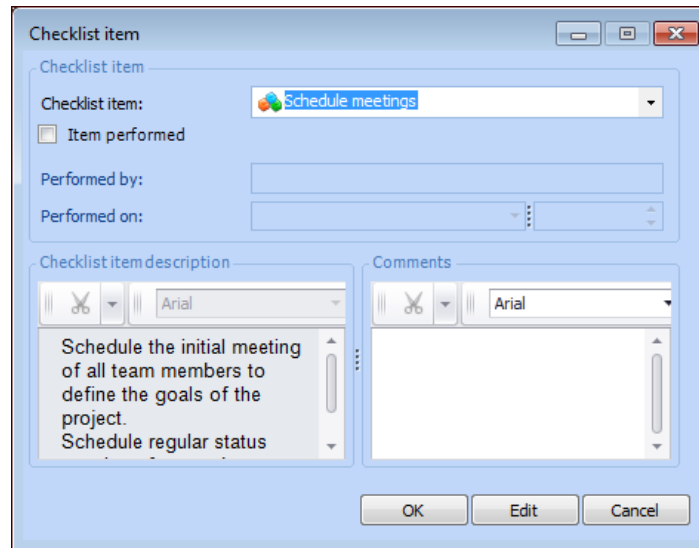
- [To Mark a Checklist Item as Performed](#)
- [To Add an Item to the Checklist](#)

To Mark a Checklist Item as Performed

1. On the analysis window, select the **Properties** view, **Checklist** tab. This tab lists the checklist items defined for the type of analysis on the site. For example:



2. Make sure that editing  is enabled.
3. Double-click the item in the list to open the Checklist item window. For example:



4. Click **Item performed**. APM automatically enters your name and the date and time that you marked the item as performed.
5. In the **Comments** box, provide additional information about the task.
6. Click **OK** to close the window. The **Checklist** tab displays a check mark for the task in the **Performed** column. The **Performed On** and **Performed By** columns are populated for the item.

To Add an Item to the Checklist

1. On the analysis window, select the **Properties** view, **Checklist** tab. This tab lists the checklist items defined for the type of analysis on the site.
2. Click **New**. The Checklist Item window appears. The **Checklist item** list contains any items that were defined in the site's settings after the current analysis was created.
3. Select an item in the list. If appropriate, you can mark the item as performed and enter comments.

Tip: To add an item, right-click in the **Checklist item** box and click **New**. The Properties dialog appears, where you can name and describe the item and select the analysis types to which it applies. When you click **OK**, the item is added to Strategy Development settings as well as the current analysis.

4. Click **OK** to close the window. The item is added to the **Checklist** tab.



Chapter 3 **Developing Failure Modes**

A failure mode is a single event that causes a functional failure. For example, if a pump's impeller becomes worn, the pump cannot convey liquid at the required rate. The failure mode consequences are analyzed in maintenance task analyses to arrive at the recommended actions that prevent or mitigate failures. The topics in this section explain how to create failure modes, perform risk analysis and feasibility evaluations, and develop action plans.


Contents

Creating Failure Modes	112
Creating Analysis Requests for Failure Modes	118
Evaluating Susceptibility to Failure	124
Performing Failure Mode Risk Analysis	127
Performing Risk Analysis with Weighted Severities	144
Performing Demand Scenario Risk Analysis	147
Viewing Risk Analyses for Failure Modes	160
Recording Failure Data	164
Evaluating the Feasibility of Maintenance Tasks	171
Developing Primary Action Plans	178
Creating Secondary Action Plans	184
Calculating a Failure-Finding Interval	186
Adding Indicators, Tasks, and Work to Action Plans	192
Reviewing Indicator Collection Information	203
Adding Standard Documents to Action Plans	205
Recording and Reviewing Failure Mode Details	207
Adding Symptoms to a Failure Mode	210

Creating Failure Modes

A failure mode is a single event that causes a functional failure. For example, if a pump's impeller becomes worn, the pump cannot convey liquid at the required rate. The failure mode consequences are analyzed in maintenance task analyses to arrive at the recommended actions that prevent or mitigate failures.


There are several ways to add failure modes to an analysis:

- If you subscribe to the APM Online Content Library, you can access available libraries of failure modes using the Internet. Select the **Facilitation** view and the **By Asset** or **By Hierarchy** tab. Select the asset and click **Browse APM Online Content**. For more information, see “Activating and Using APM Online Content Library” in Help.
- The **MTA2 Process Flow** view is available in the analysis window if a custom process flow has been created for MTA2 analyses. This view provides steps that display panels in the order used by your organization to develop failure modes. To create the first failure mode in a process flow, select the table view by clicking .
- You can add failure modes and their action plans to an MTA2 by copying them from another analysis or template. For more information, see “[Copying Failure Modes](#)” on page 211.
- Create each failure mode individually using the Maintenance Action Plan window. On the **Info Worksheet** tab, click the **New** list and then **From Scratch** to open this window.
- Use the form view on the **Info Worksheet** tab to add two or more failure modes. You can use this method when the analysis already has at least one failure mode.

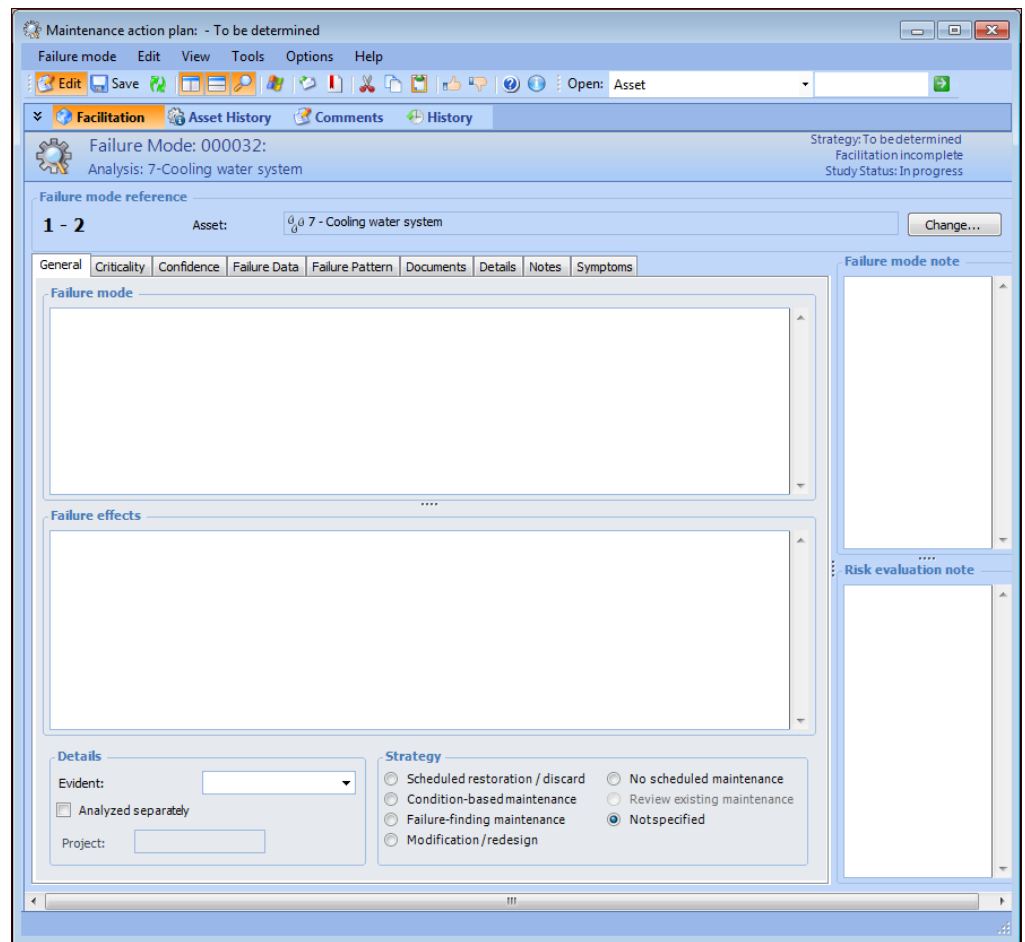
This section explains how to create an individual failure mode using the Maintenance Action Plan window. When the first failure mode has been added, you can use the form view to quickly add several failure modes with their failure effects and recommended strategies. See:

- [To Create a Failure Mode](#)
- [To Develop Failure Modes Using the Form View](#)

To Create a Failure Mode

1. Open the analysis, select the **Facilitation** view, and then the **Info Worksheet** tab.
2. Make sure that editing  is enabled.

3. Click the **New** list and then **From Scratch**. The Maintenance Action Plan window appears.



The **Failure mode reference** area displays the unique identifier for the failure mode, which consists of the asset's sequence number and the failure mode number.

Tip: You can hide the notes boxes by selecting an option in the analysis' failure mode options. In the Strategy Development Analysis window, select the **Properties** view and the **Failure Mode Options** tab. On the **Format** tab, click **Hide identification section**.

4. To assign the failure mode to another asset in the analysis:
 - Click **Change**. The Change Asset dialog appears.
 - Browse for an asset and enter a note, if required.
 - Click **OK**. The dialog closes and the asset number and name are shown in the **Asset** box.

Tip: You can also change one or more failure mode's assets on the Strategy Development Analysis window by selecting the **Implementation** view and the **Action Plans** tab. Select the failure modes, right-click, and click **Change Asset**.

5. On the **General** tab, enter a description in the **Failure mode** box.
6. In the **Failure effects** box, describe what happens when the failure mode occurs.
7. In the **Evident** list, select "Yes" or "No". A failure mode is evident if its effects become apparent to the operating crew under normal circumstances if the failure mode occurs on its own.
8. If you wish to analyze a complex failure mode in its own MTA2, select **Analyzed separately**. The **Link** button becomes available. You can link the failure mode to an analysis request that is tracked by a project. See ["Creating Analysis Requests for Failure Modes"](#) on page 118.

You can then close the Maintenance Action Plan window. The current analysis maintains a reference to the failure mode, but you cannot assign it a recommended strategy.




9. Select the recommended strategy. The options are:
 - **Scheduled restoration/discard:** Scheduled restoration entails restoring the initial capability of an existing asset at or before a specified age limit, regardless of its apparent condition at the time. Scheduled discard or replacement tasks entail discarding an asset at or before a specified age limit, regardless of its condition at the time.
 - **Condition-based maintenance** entails checking for potential failures so that action can be taken to prevent the functional failure or to avoid the consequences of the functional failure. On-condition tasks are so called because the items that are inspected are left in service on the condition that they continue to meet specified performance standards.
 - **Failure-finding maintenance** involves checking a hidden function at regular intervals to find out whether it has failed. The intervals are calculated based on the required availability of the asset and the reliability of the protected function.
 - **Modification/redesign** is any one-time change to the equipment, training, maintenance or operating procedures, etc.
 - **No scheduled maintenance** means assets are left in service until a functional failure occurs, at which point they are repaired or replaced.

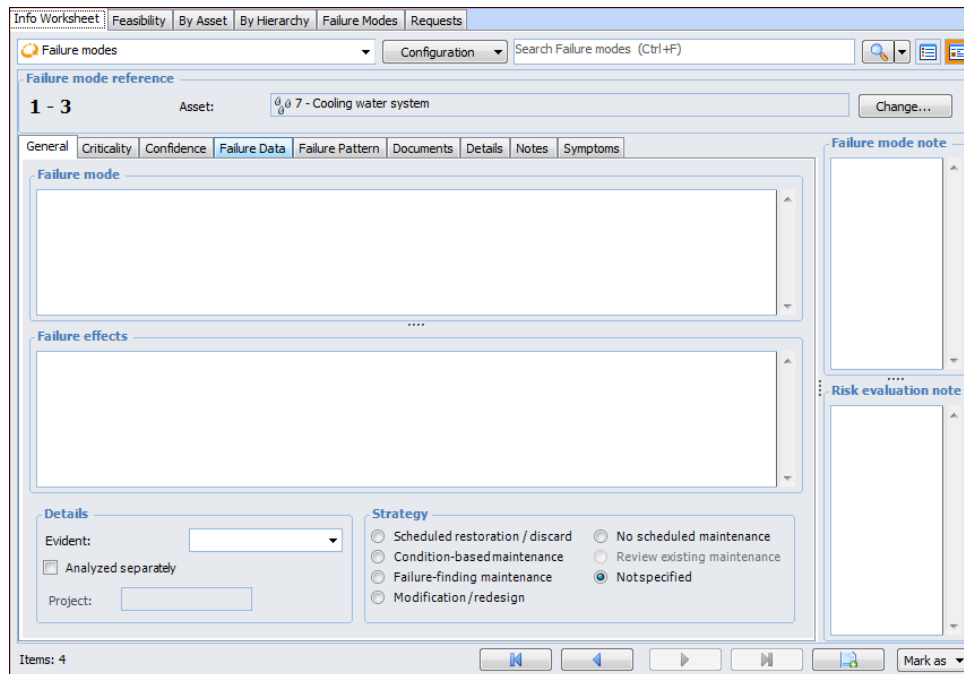
- **Review existing maintenance** is available for secondary action plans only. This strategy alerts the analysis team to review an asset's existing maintenance program to identify items that are no longer required.
- **Not specified** is the default task, and it means that an action type has not been determined.

Tip: At any time, you can select the **Asset History** view for information about the asset's checksheets, failures, work orders, and work requests.

10. Select the **Criticality** tab to perform risk analysis. For more information, see [“Performing Failure Mode Risk Analysis” on page 127](#).
11. Select the **Failure Data** tab to provide failure-tracking information. For more information, see [“Recording Failure Data” on page 164](#).
12. Select the **Failure Pattern** tab to record the failure pattern. For more information, see [“Recording Failure Data” on page 164](#).
13. Select the **Documents** tab to browse for standard documents that are relevant to the analysis.
14. Select the **Details** tab to apply an action plan status, select a failure type and failure classification, assign usage details, and see review requests and related root causes. For more information, see [“Recording and Reviewing Failure Mode Details” on page 207](#).
15. Select the **Notes** tab to add and review the failure mode and risk evaluation notes.
16. Select the **Symptoms** tab to assign keywords or phrases that summarize the evidence an operator would see when the failure occurs or is about to occur. For more information, see [“Adding Symptoms to a Failure Mode” on page 210](#).
17. Select the **Feasibility** view to evaluate whether the proposed maintenance strategies are worth doing; that is, whether implementing the maintenance tasks will cost less than the savings achieved by avoiding the failure. For more information, see [“Evaluating the Feasibility of Maintenance Tasks” on page 171](#).
18. Select the **Implementation** view to develop action plans. For more information, see [“Developing Primary Action Plans” on page 178](#) and [“Creating Secondary Action Plans” on page 184](#).
19. Save the failure mode and close the Maintenance Action Plan window. The failure mode is added to the **Info Worksheet** tab.






To Develop Failure Modes Using the Form View

1. Open the analysis, select the **Facilitation** view and then the **Info Worksheet** tab.
2. Make sure that editing  is enabled.
3. If you have not already done so, create the first failure mode for the analysis.
4. Click  to view failure modes in the form view. Click  at the bottom of the window to add a new failure mode. The **Failure mode reference** area displays the reference numbers for the new failure mode. For example:




The screenshot shows the 'Failure modes' form view. At the top, there are tabs for 'Info Worksheet', 'Feasibility', 'By Asset', 'By Hierarchy', 'Failure Modes', and 'Requests'. Below these is a search bar for 'Failure modes' and a 'Configuration' dropdown. The main area is titled 'Failure mode reference' and shows '1 - 3' for the 'Asset: 0.6 7 - Cooling water system'. Below this are several tabs: 'General', 'Criticality', 'Confidence', 'Failure Data', 'Failure Pattern', 'Documents', 'Details', 'Notes', and 'Symptoms'. The 'Failure Data' tab is active, showing a large text area for 'Failure mode' and another for 'Failure effects'. To the right, there is a 'Failure mode note' section and a 'Risk evaluation note' section. At the bottom, there are 'Details' and 'Strategy' sections. The 'Details' section includes 'Evident' (a dropdown menu), 'Analyzed separately' (a checkbox), and 'Project' (a text field). The 'Strategy' section includes several radio button options: 'Scheduled restoration / discard', 'Condition-based maintenance', 'Failure-finding maintenance', 'Modification / redesign', 'No scheduled maintenance', 'Review existing maintenance', and 'Notspecified' (which is selected). At the very bottom, there are navigation buttons (first, previous, next, last) and a 'Mark as' dropdown.

The buttons at the bottom of the window allow you to navigate between failure modes and to add failure modes to analyses.

Button	Function
	Go to the first object
	Go to the previous object
	Go to the next object
	Go to the last object
	Create an object

Note: In order for the **New** button () to work in the Form view, you must not add filters to the Failure Modes table configuration.

5. Develop the failure mode, as explained in [“To Create a Failure Mode” on page 112](#).
6. When you are ready to create another failure mode, click .
7. When you have finished, save the analysis.

Creating Analysis Requests for Failure Modes

When developing failure modes on an MTA2, you might wish to analyze a complex failure mode in its own MTA2. In the Maintenance Action Plan window, select the **General** tab. In the **Details** area, click **Analyze separately**. The current analysis maintains a reference to the failure mode, but you cannot assign it a recommended action.

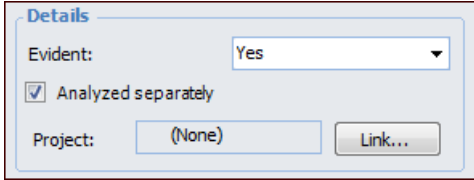
When you select **Analyze separately**, the **Link** button becomes available. You can link the failure mode to an analysis request that is tracked by a project. When you are ready to create the analysis, process the request. Alternatively, you can cancel requests and reopen processed and canceled requests.

This topic explains how:

- To Create an Analysis Request for a Failure Mode
- To Process an Analysis Request
- To Cancel or Reopen an Analysis Request

To Create an Analysis Request for a Failure Mode

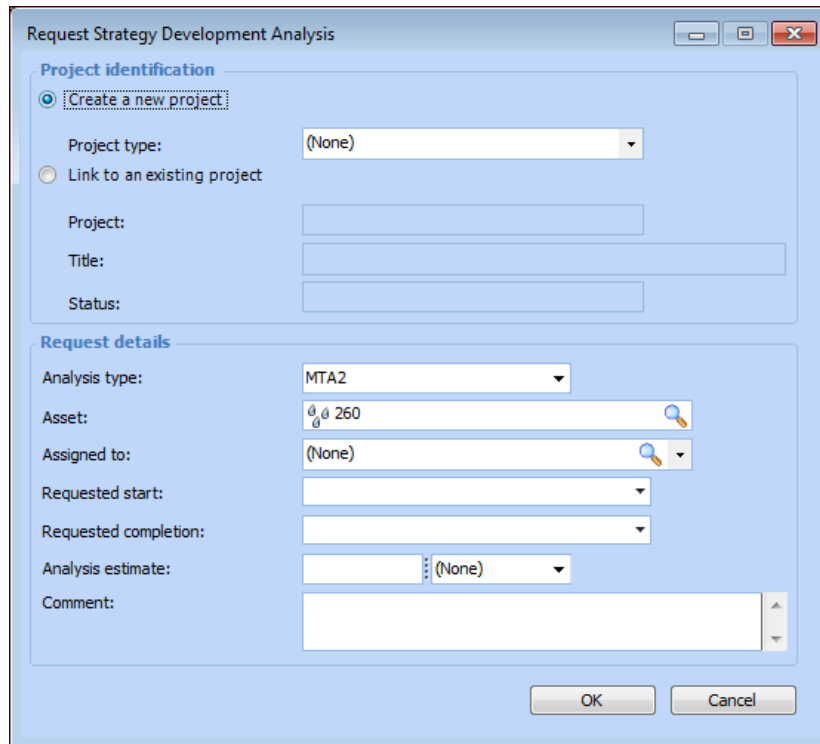
1. Open the failure mode that has been designated “Analyze separately”. For example:



The screenshot shows a dialog box titled "Details". It contains the following elements:

- Evident:** A dropdown menu with "Yes" selected.
- Analyzed separately:** A checked checkbox.
- Project:** A dropdown menu with "(None)" selected.
- Link...:** A button located to the right of the Project dropdown.

2. Click **Link**. The Request Strategy Development Analysis dialog appears.



The dialog box is titled "Request Strategy Development Analysis". It contains two main sections: "Project identification" and "Request details".

Project identification:

- ☒ **Create a new project** (This option is highlighted with a dashed border)
- ☐ Link to an existing project
- Project type: (None) [dropdown]
- Project: [text box]
- Title: [text box]
- Status: [text box]

Request details:

- Analysis type: MTA2 [dropdown]
- Asset: 0 260 [text box with browse icon]
- Assigned to: (None) [dropdown with browse icon]
- Requested start: [text box]
- Requested completion: [text box]
- Analysis estimate: [text box] (None) [dropdown]
- Comment: [text box]

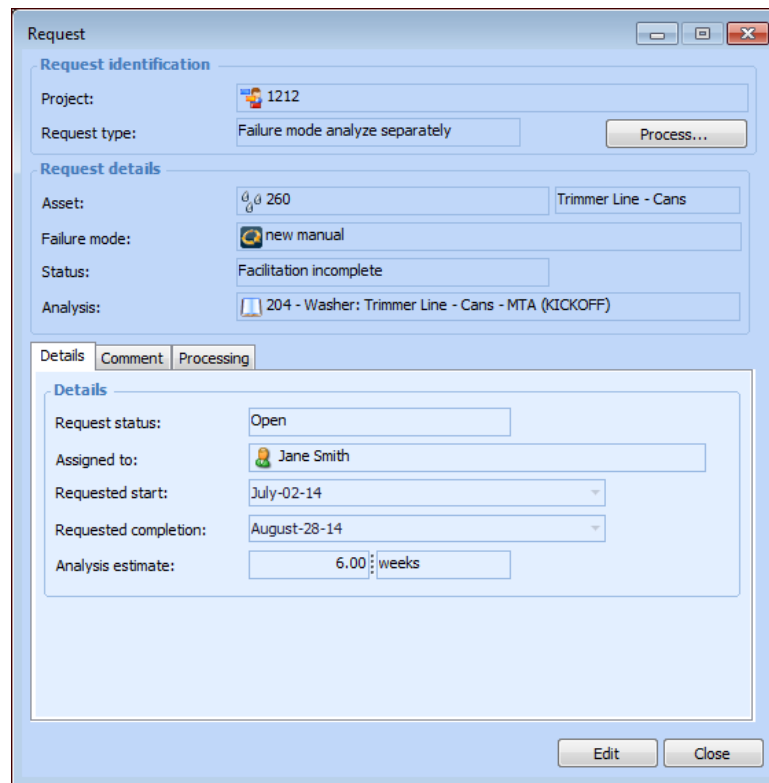
At the bottom right are "OK" and "Cancel" buttons.

3. Do one of the following:
 - To link to a new project, select **Create a new project**. Select a project type from the list.
 - To link to an existing project, select **Link to an existing project**. Click the browse icon (🔍) to select the project and click **OK**. The project's number, title, and status are displayed.
4. Select the type of analysis from the list.
5. Provide information about the requested analysis:
 - Asset to be analyzed
 - Employee assigned to be the project manager
 - Requested start and completion dates – These become the planned start and completion dates in the analysis
 - Estimate of the time required to perform the analysis
 - Comment
6. Click **OK**. The project and analysis request are created. The project number is displayed in the **Project** box. To open its Project window, double-click the icon.
7. Work with the project, as required. For more information, see "Creating and Planning Projects" in Help.

You can view analysis requests and projects in the **Facilitation** view, **Requests** tab. Select the “Analysis requests for the analysis asset” configuration. Double-click an analysis request to view information about it.

To Process an Analysis Request

1. Open the MTA2, select the **Facilitation** view, and then the **Requests** tab. Select the “Analysis requests for the analysis asset” configuration. Double-click an analysis request to view information about it.
2. Double-click the request that you want to process. The Request dialog appears.



The image shows a 'Request' dialog box with two main sections: 'Request identification' and 'Request details'. The 'Request identification' section includes fields for 'Project' (1212), 'Request type' (Failure mode analyze separately), and a 'Process...' button. The 'Request details' section includes fields for 'Asset' (0, 260), 'Failure mode' (new manual), 'Status' (Facilitation incomplete), and 'Analysis' (204 - Washer: Trimmer Line - Cans - MTA (KICKOFF)). Below these sections are three tabs: 'Details', 'Comment', and 'Processing'. The 'Details' tab is active, showing fields for 'Request status' (Open), 'Assigned to' (Jane Smith), 'Requested start' (July-02-14), 'Requested completion' (August-28-14), and 'Analysis estimate' (6.00 weeks). At the bottom right are 'Edit' and 'Close' buttons.

Request identification	
Project:	1212
Request type:	Failure mode analyze separately
<button>Process...</button>	

Request details	
Asset:	0, 260
Failure mode:	new manual
Status:	Facilitation incomplete
Analysis:	204 - Washer: Trimmer Line - Cans - MTA (KICKOFF)

Details	
Request status:	Open
Assigned to:	Jane Smith
Requested start:	July-02-14
Requested completion:	August-28-14
Analysis estimate:	6.00 weeks

3. Click **Process**. The Process Request dialog appears.

4. Select the options that you require:

Setting Name

Description


Analysis level

Select one of the following:

- **Analysis** – You can link to a new or existing strategy development analysis.
- **Failure mode** - You can link to a new or existing failure mode in a new or existing strategy development analysis.

If you link to a new analysis, you can create the function (RCM2), functional failure (RCM2), and failure mode.

If you link to an existing analysis, you can use a new or existing function (RCM2), functional failure (RCM2), and failure mode.

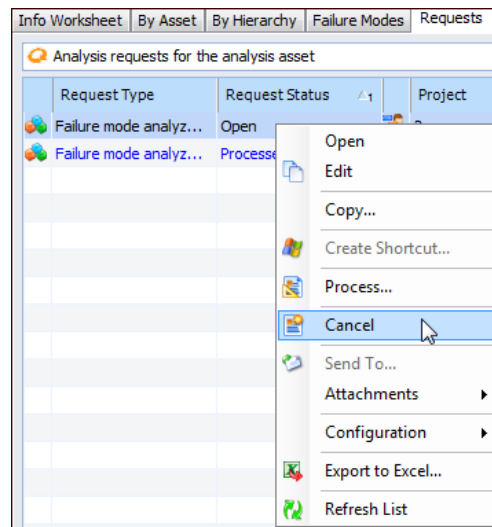
Analysis identification	<p>Select one of the following:</p> <ul style="list-style-type: none"> • New analysis – Select the analysis type and identify the asset. The selected asset's child assets in the physical hierarchy are automatically added to the new analysis. • Analysis – Click the browse icon () to select the analysis.
Function identification	When you are linking to a failure mode in a new or existing RCM2, you can use a new or existing function.
Functional failure identification	When you are linking to a failure mode in a new or existing RCM2, you can use a new or existing functional failure.
Failure mode identification	When you are linking to a failure mode in a new or existing analysis, you can use a new or existing failure mode.

5. Click **OK**. The Strategy Development Analysis window appears, where you can develop the analysis. The request status changes to "Processed".

Tip: In the Request dialog, select the **Processing** tab to view information about processing, including the analysis and failure mode that were created and their completion information.

To Cancel or Reopen an Analysis Request

1. Open the MTA2, select the **Facilitation** view, and then the **Requests** tab. Select the "Analysis requests for the analysis asset" configuration.
2. Right-click the request and click either **Cancel** or **Reopen**. For example:



The request status changes accordingly.

Evaluating Susceptibility to Failure


Susceptibility to failure evaluation examines the asset's non-age related degradation patterns. It can provide an alternative to probability of failure analysis for these failure modes. For example, susceptibility evaluation can be used to determine the vulnerability of atmospheric storage tanks to corrosion under insulation or stress cracking. The evaluation can result in recommended actions, susceptibility ratings, or both.

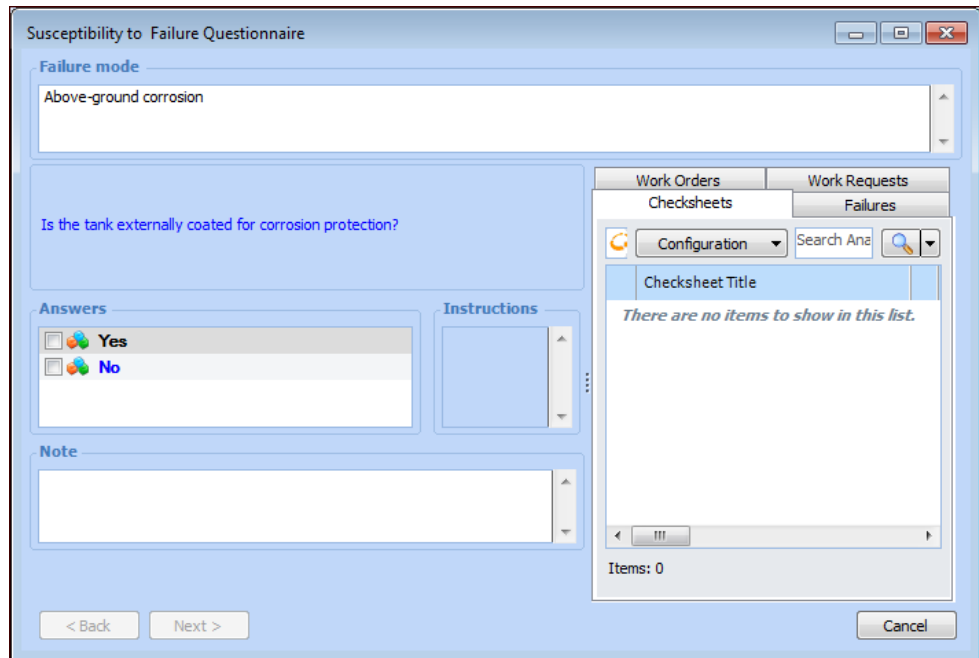
A susceptibility to failure questionnaire presents you with a series of questions. Like a decision diagram, the response to one question determines the next question, and so on, until a conclusion is reached. Along the way, instructions can be displayed to respond to individual answers.

Note: Before you can perform susceptibility evaluation, the questionnaire must be created and then selected in the analysis' risk options. APM users with the Administrator privilege can create questionnaires in the site's strategy development settings. For more information, see "Setting up Susceptibility to Failure Questionnaires" in Help.

This topic explains how to use a susceptibility to failure questionnaire to evaluate a failure mode's asset.

To Evaluate Susceptibility to Failure

1. Open the Maintenance Action Plan window.
2. Make sure that editing  is enabled.
3. Select the **Facilitation** view, **Susceptibility** tab.
4. Click **Analyze**. The Susceptibility to Failure Questionnaire appears. For example:



The **Checksheets**, **Failures**, **Work Orders**, and **Work Requests** tabs display information about the analysis assets to aid in the evaluation.

5. Complete the evaluation, selecting an answer for each question, entering notes, and using the **Next** and **Back** buttons to move between questions. As you move through the analysis, secondary questions, examples, and instructions might be displayed. When you have completed the questionnaire, the **Finish** button is displayed.
6. Click **Finish** to close the dialog. The questions, instructions, and your answers and notes are shown in the **Susceptibility** tab. For example:

General	Degradation Rates	Susceptibility	Criticality	Confidence	Failure Data	Failure Pattern
Question		Answer	Instructions			
Is the tank externally coated for corrosion protection?		Yes				
Has the tank external coating failed, allowing external corrosion ...		Yes	Estimate corrosion rate using field data or the CUI calculati			
Does the tank have wall loss?		No	Continue with routine external inspections			
Is the tank carbon steel, insulated, and operates between -5 an...		Yes	Estimate a corrosion rate using the CUI calculator			
Does the tank have any signs of CUI?		Yes	Strip susceptible areas for inspection when the remnant lif			
Is the process service known to cause SCC?		Yes				
Sulfide: Is sour water stored in the tank?		Yes	Determine susceptibility			
Ethanol: Is the tank post weld heat-treated?		Yes				
Ethanol: Is the tank internally lined?		Yes	No cracking susceptibility as long as lining is maintained			
Ethanol: What is the water content of the ethanol?		> 3% (Low)				
Ethanol: Is the tank nitrogen blanketed to keep out oxygen?		Yes	Low			
Ethanol: Does the ethanol contain trace chloride or sulfate conta...		No				
Ethanol: Does the tank have high plastic strain from daily flexing ...		Yes	M			
Has the tank cycled at least 1300 times over its life?		No	No action needed			
Caustic: Is caustic of any concentration stored about 46 Celsius ...		Yes	Determine the susceptibility			

- Click **Review** when you wish to revisit the analysis, change your answers, or add notes.

Performing Failure Mode Risk Analysis

In the process of evaluating a failure mode, you can quantify the relative risk (criticality) associated with the failure by evaluating the consequences (severity of the effect) and the probability of the failure occurring, assigning values for each factor. APM then calculates the relative risk by multiplying the severity by the probability values.

When the relative risk is established, APM calculates the failure mode's priority using a set of customer-defined rules. The consequence priority rules can be based on the failure mode's severity, relative risk, downtime costs, downtime duration, or a combination. For example, the Extreme priority could be assigned to failure modes whose total severity is equal to 5.0.

You can apply a confidence factor to the analysis to quantify your faith in current maintenance or inspection practices to contain the failure mode's risk. The confidence factor can adjust the inspection factor or the failure mode's position in the risk matrix.

After you have analyzed the failure modes, you can compare failure modes and identify the relative importance of addressing them. The **Risk Assessment** view in the Strategy Development Analysis window includes failure mode lists based on criticality, consequence priority, severity, and relative risk, as well as a risk plot, risk matrix, and lists of the evaluations. This view is also available for the asset.

APM provides two ways to perform failure mode risk analysis:

- Using evaluation forms for in-depth analysis of consequences and confidence factors
- Using a simpler evaluation that allows you to enter weighted severity values, probability values, and confidence factors

With both methods, APM calculates the relative risk and displays it in the risk matrix chart. The method available in the Maintenance Action Plan window depends on the option selected in risk analysis settings.

For instructions on using the simpler evaluation with weighted severities, see [“Performing Risk Analysis with Weighted Severities” on page 144](#).

Note: APM also provides a method of performing risk analysis on safety devices that protect equipment, people, and environments from events such as pressure build-up, fire, or equipment failure. Risk analysis is performed on one or more demand scenarios identified on the failure mode. For more information, see [“Performing Demand Scenario Risk Analysis” on page 147](#).

Note: Before you can perform risk analysis, the severities, probabilities, confidence factors, and risk matrix entries must be set up in the site's risk analysis settings. If you are using evaluation forms, they must also be set up. For more information, see [“Setting up APM for Maintenance Task Analysis” on page 34](#).

This topic explains how:

1. [“To Evaluate the Probability of Failure” on page 129](#) – The probability of failure is the likelihood that the asset will fail due to the failure mode. You can determine the probability score using a questionnaire, by selecting a value directly, or by entering the estimated time between failures without maintenance (ETBF). The options available to you depend on the risk analysis settings.
2. [“To Evaluate Economic Effects of Failure” on page 132](#) – The economic consequence of failure reflects the financial effect of the failure on assets and production. Labor and material costs associated with lost production and with repairing or replacing the damaged equipment are economic consequences. You can use a questionnaire or select a value directly, depending on the risk analysis settings.
3. [“To Evaluate Health & Safety, Environmental, and Reputation” on page 136](#) – Equipment failure can cause hazards in the workplace and environmental damage. Examples are extreme temperatures, noxious fumes, and the release of liquids that cause pollution. Mitigating factors are considered when assessing health and safety and environmental consequences. Reputation consequences measure the impact that negative media attention has on an organization's ability to operate in good faith. The levels of severity can also be associated with monetary costs. You can use questionnaires or select values directly, depending on the risk analysis settings.


When you have finished the evaluations, the risk matrix shows the resulting priority score. In this example, the results are Medium High (criticality) and High (consequences):

General	Criticality	Confidence	Failure Data	Failure Pattern	Documents	Details	Notes	Symptoms
Probability...	Not analyzed	Summary... Risk Plot...						
	Frequent (< 1 year)	Low	Medium	High	High	High		
	Probable (1-3 years)	Low	Medium	Medium-High	High	High		
	Possible (3-10 years)	Low	Medium	Medium	Medium-High	High		
	Unlikely (10 - 30 years)	Low	Low	Medium	Medium	Medium-High		
	Remote (> 30 years)	Low	Low	Low	Medium	Medium		
Economic...	Not analyzed	Damage < \$100K Minor upset	Damage \$100k-1M Major upset	Damage \$1M-10M Unit outage>1 day	Damage \$10M-100M Unit outage>1 wk	Asset loss>\$100M Unit outage>1 mth		
Health and Safety...	Not analyzed	First-aid injury	Medical-aid injury	Lost-time injury	Single fatality or permanent disability	Multiple fatalities		
Environmental...	Not analyzed	Minor incident	Reportable incident	Minor permit violation	Major permit violation	Loss of permit		
Reputation...	Not analyzed	Local	Province-wide	Industry-wide	National	International		
Consequences:	Not analyzed	1 - Negligible	2 - Low	3 - Medium	4 - High	5 - Severe		

4. “To Evaluate Confidence Factors” on page 138 – The confidence rating reflects the confidence that the inspector and materials or corrosion engineer have in current maintenance or inspection practices to contain the failure mode’s risk. The higher the value, the greater their confidence. The failure mode’s criticality rating, mediated by the confidence factor, results in an inspection factor, interval, strategy, or a combination.
5. “Viewing the Risk Analysis Summary” on page 143 – You can view the most recent evaluation results by clicking **Summary** on the **Criticality** tab. The Risk Summary dialog displays tabs for each of the questionnaires used in the analysis.

If the appropriate option is enabled in risk analysis settings, the selected entry in the risk matrix sets the recommended task in the primary action plan (select the **Implementation** view). Condition-based maintenance with or without a frequency can be recommended, as well as modification/redesign.

To Evaluate the Probability of Failure

1. Open the Maintenance Action Plan window.
2. Make sure that editing  is enabled.
3. Select the **Facilitation** view and the **Criticality** tab. For example:

Maintenance action plan: Pump bearing fatigue - Condition-based maintenance

Failure mode: 000044: Pump bearing fatigue
Analysis: 510-Pump 510

Strategy: Condition-based maintenance
Facilitation incomplete
Study Status: In progress

Failure mode reference

9 - 1 Asset: 510 - Pump 510

General Criticality Confidence Failure Data Failure Pattern Documents Details Notes Symptoms

Not analyzed

Summary... Risk Plot...

Probability...	Frequent (< 1 year)	Low	Medium	High	High	High
	Probable (1-3 years)	Low	Medium	Medium-High	High	High
	Possible (3-10 years)	Low	Medium	Medium	Medium-High	High
	Unlikely (10 - 30 years)	Low	Low	Medium	Medium	Medium-High
	Remote (> 30 years)	Low	Low	Low	Medium	Medium

Economic...	Not analyzed	Damage < \$100K Minor upset	Damage \$100k-1M Major upset	Damage \$1M-10M Unit outage>1 day	Damage \$10M-100M Unit outage>1 wk	Asset loss>\$100M Unit outage>1 mth
Health and Safety...	Not analyzed	First-aid injury	Medical-aid injury	Lost-time injury	Single fatality or permanent disability	Multiple fatalities
Environmental...	Not analyzed	Minor incident	Reportable incident	Minor permit violation	Major permit violation	Loss of permit
Reputation...	Not analyzed	Local	Province-wide	Industry-wide	National	International
Consequences:	Not analyzed	1 - Negligible	2 - Low	3 - Medium	4 - High	5 - Severe

4. If probability can be based on the analysis team's estimate of the time between failures, the **Criticality** tab also displays the **Estimated TBF without maintenance** area:

General Criticality Confidence Failure Data Failure Pattern Documents Details Notes Symptoms

Estimated TBF without maintenance

Estimated time between failures without maintenance: (None)

Enter the amount of time and the unit of measure. When the failure mode is saved, the corresponding probability is selected in the risk matrix.

5. To use a questionnaire, click **Probability**. The Probability of Failure Evaluation appears. The evaluation types (Simple, Detailed), categories, and questions available to you depend on the form's design and the asset properties. Here is an example of a simple evaluation:

You can refer to the **History** and **Barriers** tabs for information to aid in the evaluation, for example, historical inspections, failures, and work.

6. Complete the evaluation, selecting options for each category, entering notes, and using the arrow buttons to move between categories. If different evaluation types have been defined in the form's design, you can select **Simple** or **Detailed**, as required by the complexity of the failure mode that you are analyzing.

As you move through the analysis, the **Probability** box displays the most severe probability assigned to your selections. For example, if you select options for three categories, two of which have a result of "Negligible" and one with a result of "High", the score for the evaluation as a whole will be "High". This will be the probability used in the risk analysis.

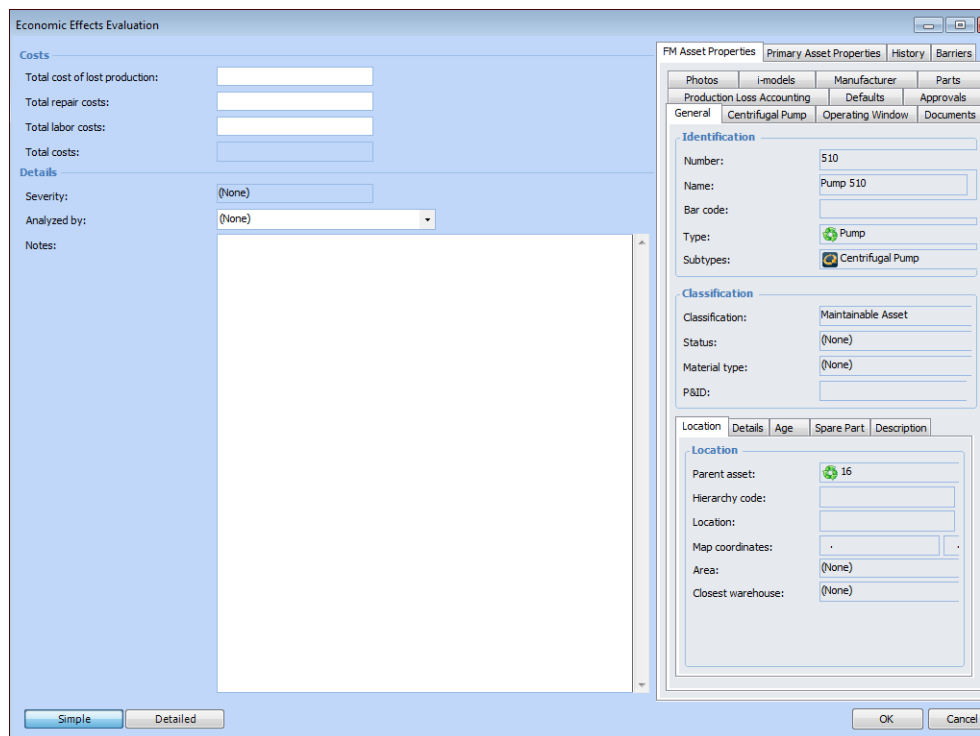
7. In the **Analyzed by** list, select the team member performing the evaluation.
8. In the **Notes** box, you can provide additional information about the analysis. Notes are collected and available in several locations.

9. When you have completed the evaluation, click **OK**. The evaluation form closes and the result (for example, high, medium, low, or negligible) is selected in the risk matrix. For example:

Probability...	Not analyzed
	Frequent (< 1 year)
	Probable (1-3 years)
	Possible (3-10 years)
	Unlikely (10 - 30 years)
	Remote (> 30 years)

To Evaluate Economic Effects of Failure

1. In the risk matrix, click **Economic**. The Economic Effects Evaluation form appears. For example:



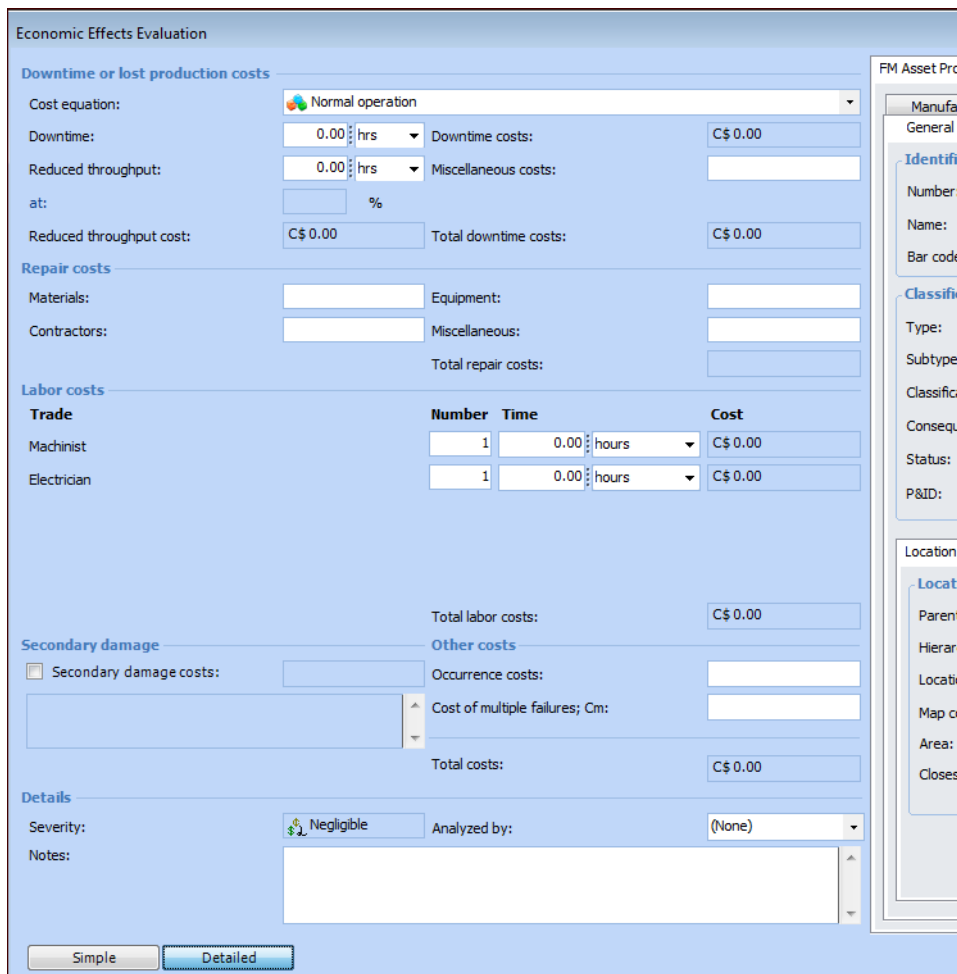
At any time, you can refer to the **FM Asset Properties**, **History**, and **Barriers** tabs for detailed information about the asset.

2. For the simple form, provide the following information. If you wish to perform a detailed analysis, skip to step 3.

Setting Name	Description
Total cost of lost production	Monetary cost of asset downtime in the event of failure. The amount is shown in the site's currency.
Total repair costs	Monetary cost to repair equipment in the event of the asset's failure. The repair cost does not include labor. The amount is shown in the site's currency.
Total labor costs	Monetary cost of labor in the event of the asset's failure. The amount is shown in the site's currency.
Analyzed by	The analysis team member who performed the evaluation.
Note	Additional information about the analysis. Notes are collected and available in several locations.

As you enter amounts in the **Total cost of lost production**, **Total repair costs**, and **Total labor costs** boxes, APM calculates the total amount and the severity.

3. To perform a more detailed evaluation, click **Detailed**. Here is an example of a detailed form:



As information is added to the form, APM calculates the total costs for the failure and displays the **Severity** score. All monetary amounts are shown in the site's currency.

4. Enter information to calculate lost production costs:

Setting Name	Description
Cost equation	If downtime or lost production costs are calculated for the asset, the default cost equation is selected, if applicable. This is the calculation rule used to determine the costs of a downtime incident or reduced throughput.

Tip: Select the **FM Asset Properties** tab and then the **Production Loss Accounting** tab to view the downtime cost rule.

Downtime	Period of time that the asset will not function in the event of a failure.
Downtime costs	APM calculates the downtime cost using the downtime amount and the cost equation.
Reduced throughput	When the failure mode results in reduced production instead of downtime, record the amount of time that reduced throughput is in effect.
Operating at	The percentage of production achieved when the failure results in reduced throughput.
Reduced throughput cost	APM calculates the cost of reduced throughput using the reduced throughput amount, the operating percentage, and the cost equation.
Miscellaneous costs	Additional costs not included in the downtime or reduced throughput costs.
Total downtime costs	The total is calculated by summing all of the amounts in the Lost production costs area.

5. Enter information to calculate repair costs:

Setting Name	Description
Materials	Monetary cost for materials to repair equipment in the event of the asset's failure.
Contractors	Monetary cost for contract workers to repair equipment in the event of the asset's failure.
Equipment	Monetary cost for equipment to repair the asset in the event of failure.
Miscellaneous	Additional monetary cost to repair the asset in the event of failure.
Total repair costs	APM calculates the total repair costs.

6. Enter information to calculate labor costs. The number and types of trades listed in the **Labor costs** area are defined in the Economic Evaluations settings. They vary depending on the trades defined for the site and selected for the evaluation. For each trade, enter the amount of time required to respond to the failure. APM calculates the cost based on the trade's rate.
7. Secondary damage is additional damage caused to other assets by the initial or primary failure. If appropriate, select **Secondary damage costs** and enter an amount and a description of the damage. This information is included in the total costs and shown on the failure mode's **Failure Data** tab.
8. In the **Occurrence costs** box, enter the estimated fixed cost associated with a downtime occurrence. For example, this could be a fixed cost associated with restarting a machine after it has been shut down.

When failure mode optimization requires Isograph Availability Workbench, this attribute is mapped to project effect per occurrence cost in AWB.
9. In the **Cost of multiple failures** box, enter the estimated cost if a protected function fails while its protective device or protective system is in a failed state.
10. In the **Analyzed by** list, select the team member who performed the evaluation.
11. In the **Notes** box, you can enter additional information about the evaluation. Notes are collected and available in several locations.

Note: For information about creating production loss rules, see “Setting up Production Loss Rules on an Asset” in Help.

12. When you are finished the evaluation, click **OK**. The result of the economic evaluation is shown in the risk matrix. For example:

Economic...	Not analyzed	Damage < \$100K Minor upset	Damage \$100k-1M Major upset	Damage \$1M-10M Unit outage>1 day	Damage \$10M-100M Unit outage>1 wk	Asset loss>\$100M Unit outage>1 mth
-------------	--------------	--------------------------------	---------------------------------	--------------------------------------	---------------------------------------	--

To Evaluate Health & Safety, Environmental, and Reputation

1. Click **Health and Safety, Environmental, and Reputation** in turn. The evaluation form appears. The evaluation types (simple, detailed), categories, and questions available to you depend on the form's design and the asset properties.

At any time, you can refer to the **FM Asset Properties** tab for detailed information about the asset.

2. Complete each of the evaluations, selecting options for each category, entering notes, and using the arrow buttons to move between categories. If different evaluation types have been defined in the form's design, you can select **Simple** or **Detailed**, as required by the complexity of the failure mode that you are analyzing.

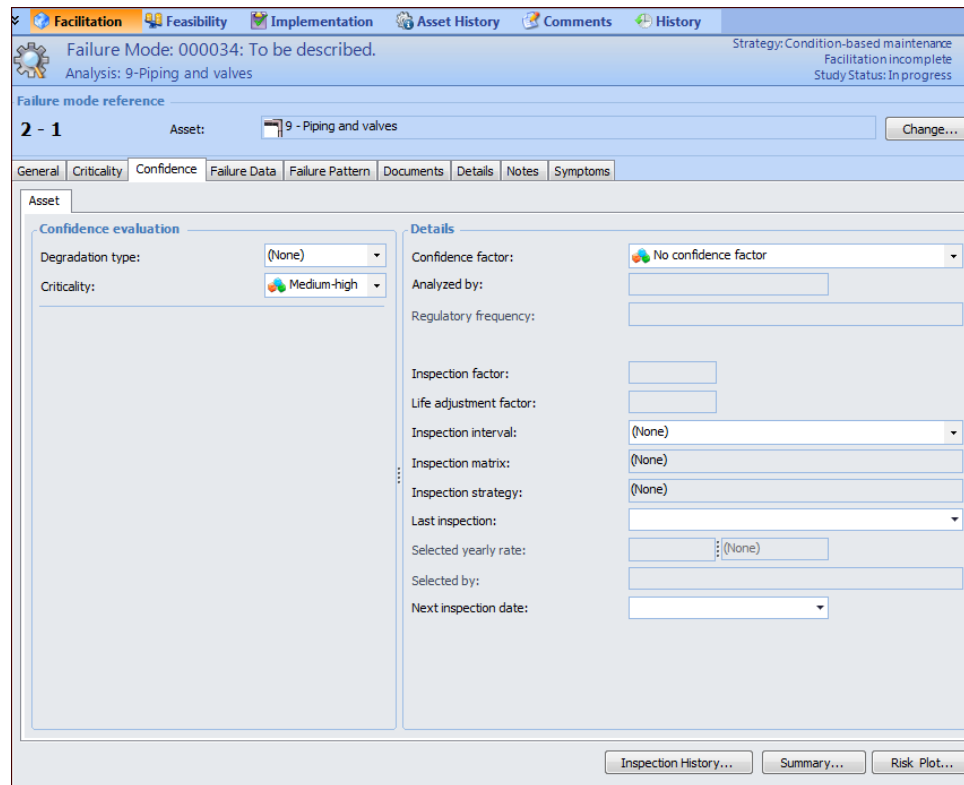
As you move through the analysis, the **Severity** box displays the most severe score assigned to your selections. For example, if you select options for three categories, two of which have a result of “Negligible” and one with a result of “High”, the score for the evaluation as a whole will be “High”. However, if a mitigation category has been defined for the evaluation, its score can raise or lower the severity. The resulting ranking is used in the risk matrix.

3. In the **Analyzed by** list, select the team member performing the evaluation.
4. In the **Note** box, you can provide additional information about the analysis. Notes are collected and available in several locations.
5. When you have completed an evaluation, click **OK**. The evaluation form closes and the result is selected in the risk matrix. For example:

Health and Safety...	Not analyzed	First-aid injury	Medical-aid injury	Lost-time injury	Single fatality or permanent disability	Multiple fatalities
Environmental...	Not analyzed	Minor incident	Reportable incident	Minor permit violation	Major permit violation	Loss of permit
Reputation...	Not analyzed	Local	Province-wide	Industry-wide	National	International

To Evaluate Confidence Factors

1. Select the **Confidence** tab. For example:

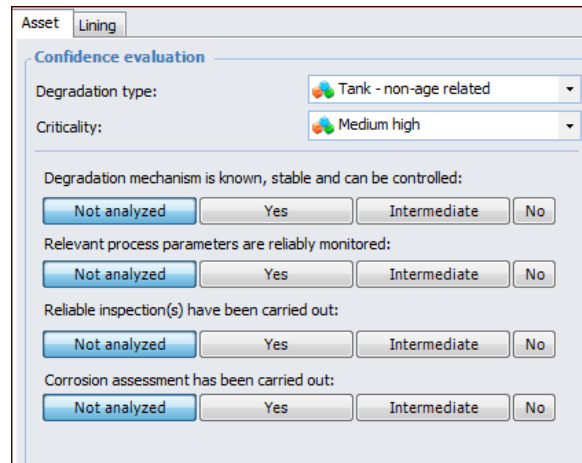


The screenshot shows the Bentley APM Maintenance Task Analysis software interface. The top navigation bar includes tabs for Facilitation, Feasibility, Implementation, Asset History, Comments, and History. The main window displays the 'Failure Mode: 000034: To be described.' and 'Analysis: 9-Piping and valves'. The 'Failure mode reference' section shows '2 - 1' and 'Asset: 9 - Piping and valves'. The 'Confidence' tab is selected, showing a 'Confidence evaluation' section with 'Degradation type: (None)' and 'Criticality: Medium-high'. The 'Details' section includes fields for 'Confidence factor: No confidence factor', 'Analyzed by:', 'Regulatory frequency:', 'Inspection factor:', 'Life adjustment factor:', 'Inspection interval: (None)', 'Inspection matrix: (None)', 'Inspection strategy: (None)', 'Last inspection:', 'Selected yearly rate: (None)', 'Selected by:', and 'Next inspection date:'. At the bottom, there are buttons for 'Inspection History...', 'Summary...', and 'Risk Plot...'.

The **Criticality** box shows the result of the evaluation you performed on the **Criticality** tab.

Note: Degradation types, their confidence statements, and the scores assigned to them are set up in failure mode settings and will vary depending on your organization's requirements.

2. In the **Confidence evaluation** area, select a degradation type. One of the following occurs:
 - The **Confidence factor** box displays the default for the degradation type. If the degradation type's settings allow, you can select another value from the **Confidence factor** list.
 - If the degradation type supports confidence statements, they are displayed in this area. For example:

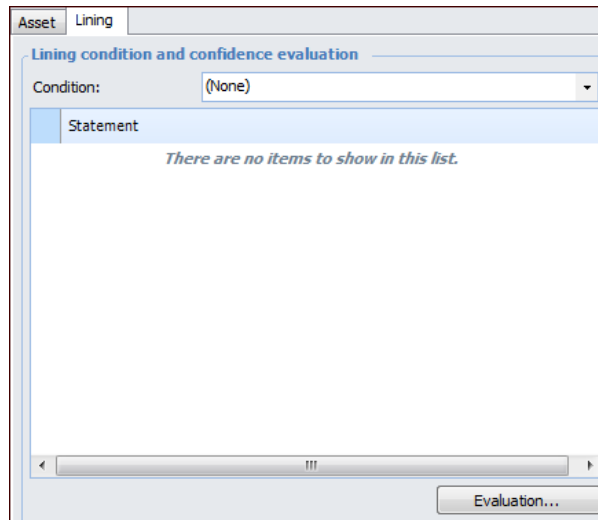


For each confidence statement, click a response, for example, No, Yes, or Intermediate. The **Confidence factor** box displays the result of your selection, indicating if confidence is low or high. The inspection factor, inspection strategy, and interval might also be supplied.

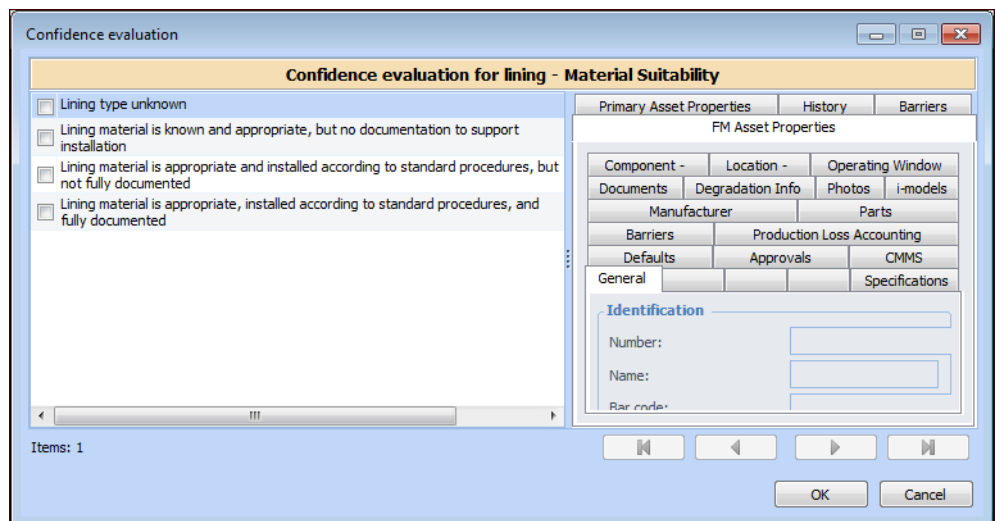
3. The **Lining** tab is available if the asset has lining properties that require confidence evaluation. Select the **Lining** tab. You will see one or more of the following:
 - The **Condition** list is available. Select a value from the list to describe the state of the lining at the time of inspection.
 - Confidence statements are presented as they are on the **Asset** tab. Select the appropriate responses.

Note: If both the **Condition** list and either confidence statements or an evaluation are available, the lesser of the two results determine the life adjustment factor shown in the **Details** area.

- The **Evaluation** button is available. For example:



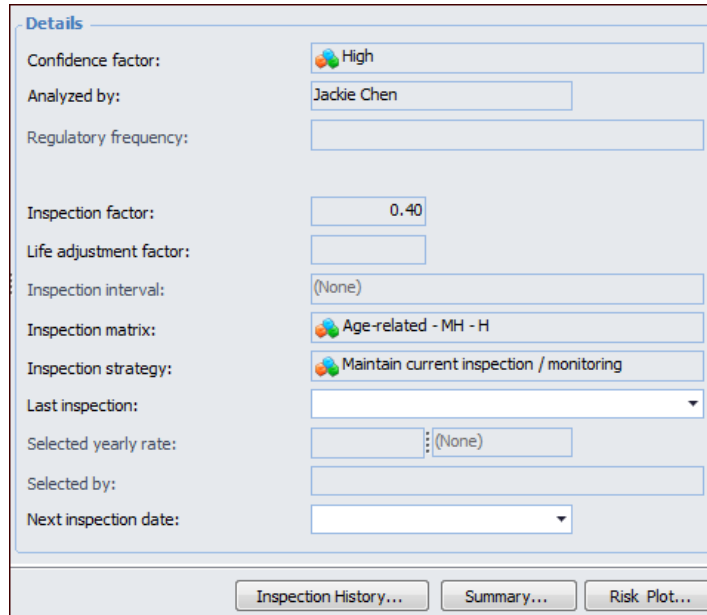
Click **Evaluation** to open the Confidence Evaluation window. For example:



Select a statement and click **OK**. The form closes and the statement is shown in the **Lining** tab. The **Details** area displays the inspection factor, inspection interval, or both, depending on the evaluation form's properties.

4. In the **Details** area, you can add or change the last and next inspection dates.

The **Details** area shows information about the criticality and confidence analyses. The asset and degradation type determine whether inspection interval, inspection strategy, life adjustment factor, or a combination is shown. For example:



The information in this area includes:

Setting Name	Description
Confidence factor	The confidence factor represents the analysis team's faith in current maintenance or inspection practices to contain the failure mode's risk. The confidence factor can adjust the inspection factor or likelihood of failure up or down.
Analyzed by	Team member's name.
Inspection factor	An inspection factor is the portion of the normal frequency to be used when calculating indicator collection dates. For example, an inspection factor of "0.5" means that the indicator reading should be collected at half its normal frequency (1 year instead of 2 years). The greater the confidence factor, the higher the inspection factor, meaning that the interval between inspections is greater. The inspection factor is based on the confidence factor, degradation type, and the consequence priority (criticality) of the failure mode.

Life adjustment factor	A life adjustment factor is a portion of an asset's by-design life span, for example, one tenth of its original estimated life. Typically, a life adjustment factor is used to estimate asset lining's remaining life based on its condition at the time of inspection. This information is used to track the asset's degradation.
Inspection interval	An inspection interval is the period of time (usually years) between regularly scheduled inspections. Intervals are typically used with failure modes for assets prone to non-age related degradation, where process monitoring is more effective in avoiding degradation.
Inspection matrix	Inspection interval factor assigned to the combination of degradation type, criticality, and confidence factor. This factor defines the inspection factor and whether inspections, strategy, and no inspections are allowed.
Inspection strategy	The inspection strategy describes the action to be taken for this combination of degradation type, criticality, and confidence factor. An example is "Maintain current inspection / monitoring".
Last inspection date	Most recent inspection. By default, this field shows the date of the most recent indicator reading. You can change this date, if needed.
Next inspection date	Date on which the next inspection is to be performed.

Viewing the Risk Analysis Summary

1. Click **Summary** to display the results of the risk analysis. For example:

The screenshot shows the 'Risk Summary' window with the 'Summary' tab selected. The window is divided into several sections:

- Details:**
 - Last inspection date: Tuesday, January 13, 2015
 - Selected yearly rate: (None)
 - Selected by:
- Evaluation:**
 - Probability / By: 4 - Probable, Jane Smith
 - Economic / By: 1 - Negligible
 - Health and safety / By: 3 - Medium
 - Environmental / By: 2 - Low
 - Reputation / By: 1 - Negligible
 - Consequences: 3 - Medium
 - Dominant consequences: Not analyzed
 - Criticality: Medium-high
 - Relative risk: 28.00
- Confidence:**
 - Confidence factor: Low
 - Analyzed by: Jane Smith
 - Inspection matrix: Age-related - MH - L
 - Inspection factor: 0.20
 - Inspection strategy: Maintain current inspection
- Matrix:** A 5x5 grid showing the intersection of Probability (1-5) and Consequences (N, L, M, H, E). The cells are color-coded: Green for Low (L), Yellow for Medium (M), and Red for High (H). The cell at Probability 2 and Consequence M is highlighted in orange and labeled 'MH'.

A tab is displayed for each of the questionnaires that were used to evaluation probability of failure and consequence severities.

2. Select a tab to view information about the questionnaire.

Note: If you click a button on the risk matrix, the result is shown on the **Summary** tab.

3. Click **Close** to dismiss the window.

When you have performed risk assessments for all of the failure modes in the analysis, you can compare them using the **Risk Assessment** view. For more information, see [“Viewing Risk Analyses for Failure Modes”](#) on page 160.

Performing Risk Analysis with Weighted Severities

In the process of evaluating a failure mode, you can quantify the relative risk (criticality) associated with the failure by evaluating the consequences (severity of the effect) and the probability of the failure occurring, assigning values for each factor. APM then calculates the relative risk by multiplying the severity by the probability.

You can apply a confidence factor to the analysis to quantify your faith in current maintenance to contain the failure mode's risk. The confidence factor can adjust the relative risk up or down.

When the relative risk is established, APM calculates the failure mode's consequence priority using a set of customer-defined rules. The consequence priority rules can be based on the failure mode's severity, relative risk, downtime costs, downtime duration, or a combination. For example, the Extreme consequence could be assigned to failure modes whose total severity is equal to 5.0.

After you have analyzed the failure modes, you can compare failure modes and identify the relative importance of addressing them. The **Risk Analysis** view in the Strategy Development Analysis window includes failure mode lists based on criticality, consequence priority, severity, and relative risk, as well as a risk plot, risk matrix, and lists of the evaluations. This view is also available for the asset.

APM provides two ways to perform failure mode risk analysis:


- Using a simple evaluation that allows you to enter weighted severity values, probability values, and confidence factors.
- Using evaluation forms for in-depth analysis of consequences and confidence factors.

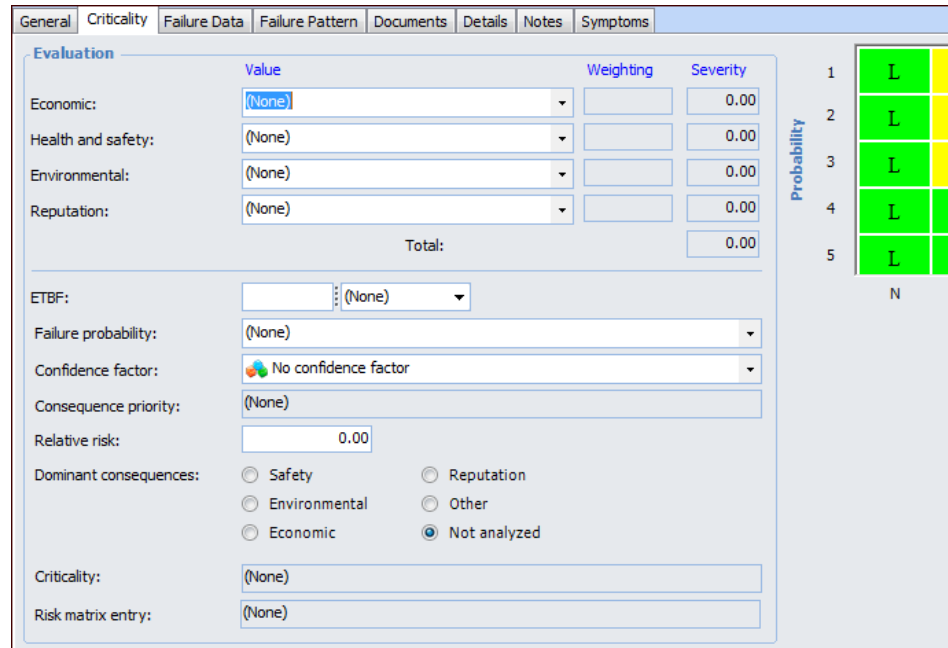
With both methods, APM calculates the relative risk and displays it in the risk matrix chart. The method available in the Maintenance Action Plan window depends on the option selected in risk analysis settings.

For instructions on using evaluation forms, see [“Performing Failure Mode Risk Analysis”](#) on page 127.

Note: Before you can perform risk analyses, the severities, probabilities, failure mode consequence priorities, confidence factors, and risk matrix entries must be set up in the site's strategy Development settings. For more information, see “Risk Analysis Settings” in Help.

To Perform Risk Analysis using Weighted Severities

1. Open the analysis, select the **Facilitation** view, and open the failure mode. The Maintenance Action Plan window appears.
2. Select the **Facilitation** view and **Criticality** tab.
3. Make sure that editing  is enabled.



Value	Weighting	Severity
Economic: (None)	0.00	0.00
Health and safety: (None)	0.00	0.00
Environmental: (None)	0.00	0.00
Reputation: (None)	0.00	0.00
Total:	0.00	

ETBF: (None)

Failure probability: (None)

Confidence factor: No confidence factor

Consequence priority: (None)

Relative risk: 0.00

Dominant consequences:

☐ Safety ☐ Reputation

☐ Environmental ☐ Other

☐ Economic ☒ Not analyzed

Criticality: (None)

Risk matrix entry: (None)

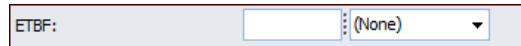
Probability scale: 1, 2, 3, 4, 5

Severity levels: L, L, L, L, L

4. Select a severity value for each of the categories:
 - **Economic:** The economic consequence of failure reflects the financial effect of the failure on assets and production. Labor and material costs associated with lost production and with repairing or replacing the damaged equipment are economic consequences.
 - **Health and safety:** Equipment failure can cause hazards in the workplace. Examples are extreme temperatures, noxious fumes, and the release of liquids that can kill or injure someone.
 - **Environmental:** There is an unacceptable risk that the effects of this failure mode could breach a known environmental standard or regulation.
 - **Reputation:** The impact that negative media attention has on an organization's ability to operate in good faith. Typically, the severity of bad press is evaluated in terms of how far-reaching it is and how long it takes to mitigate.
5. Enter weighting factors for the consequence categories as needed. A weighting factor must be between 0.10 and 2.00. The default is 1.00.

APM calculates the total severity for each of the categories by multiplying the severity by its weighting factor. The failure mode's total severity is calculated as the sum of the categories' severities.

6. If probability can be based on the analysis team's estimate of the time between failures, the **Criticality** tab also displays the **ETBF** box:

The image shows a software interface element for ETBF (Expected Time Between Failures). It consists of a label 'ETBF:' followed by a text input field and a dropdown menu. The dropdown menu currently shows '(None)' with a downward arrow.

Enter the amount of time and the unit of measure. The corresponding probability value is displayed in the **Failure probability** box.

7. You can select a probability of failure from the list. If ETBF is also available, its value changes accordingly.

APM calculates the relative risk for the failure mode by multiplying the total failure mode severity by the probability of failure.

8. Select a confidence factor from the list. The confidence factor is used to adjust the location of a failure mode on the risk matrix based on your faith in the existing maintenance practices and equipment history.

When you have entered all of the information that is required by consequence priority rules, APM calculates the criticality number. The risk matrix entry is shown in the risk matrix chart.

9. Select the most important consequence of failure from the **Dominant consequences** options.

When you have performed risk analyses for all of the failure modes in the analysis, you can compare them using the **Risk Analysis** view. For more information, see [“Viewing Risk Analyses for Failure Modes” on page 160](#).

Performing Demand Scenario Risk Analysis

APM provides a method of performing risk analysis on safety devices that protect equipment, people, and environments from events such as pressure build-up, fire, or equipment failure. Risk analysis is performed on one or more demand scenarios identified on the failure mode.

A demand scenario is a situation that requires that an asset, such as a safety device, be put into operation. Examples of demand scenarios are fire, power failure, and blocked outlet.

When demand scenario analysis is performed, probability of failure is based on the likelihood of failure and demand rate. The analysis team determines the probability by:

- Identifying the likelihood of the failure occurring based on past history or industry experience. This value describes how often the asset has been required to operate. An example of likelihood of failure is “Has happened at this location more than once in the last two years”.
- Completing a confidence evaluation that quantifies the team’s faith in the current maintenance or inspection practices to contain the demand scenario’s risk. The confidence factor can adjust the likelihood of failure up or down.
- Identifying one or more demand scenarios. These are the situations that result in the safety device being required. For each scenario, a demand rate is also selected. The demand rate is the frequency with which the scenario is likely to occur. Demand rates are typically defined in terms of 0-0.5 year, 0.5-1.0 year, and so on.
- The demand rate with the highest criticality is used with the likelihood of failure to determine the probability of failure. APM uses the probability matrix to ascertain the result, and the selected probability of failure is added to the failure mode.

Note: Before you can perform demand scenario analysis, the likelihoods of failure, confidence questions, demand rates, demand scenarios, and probability matrix must be set up in the site’s strategy development settings. For more information, see “Failure Probability Settings” in Help.

This topic explains using evaluation forms to perform demand scenario risk analysis. It explains how:

- [To View the Failure Mode’s Settings](#)
- [To Evaluate Likelihood of Failure and Confidence](#)

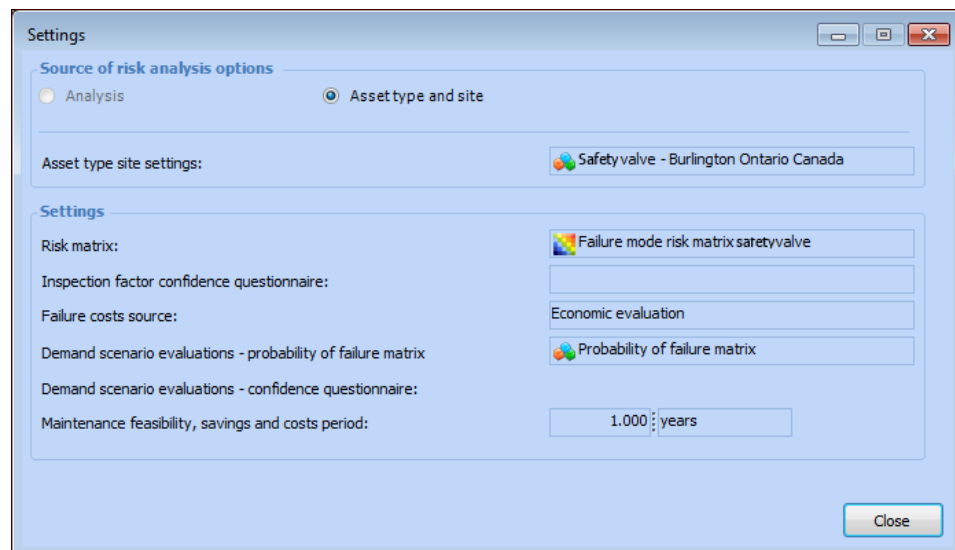
- To Add a Demand Scenario and Evaluate Probability of Failure
- To Evaluate Economic Effects of Failure
- To Evaluate Health and Safety, Environmental, and Reputation Consequences
- To View Failure Mode Criticality

To View the Failure Mode's Settings


The failure mode's default risk analysis options, for example, the selected risk matrix, come from one of these sources:

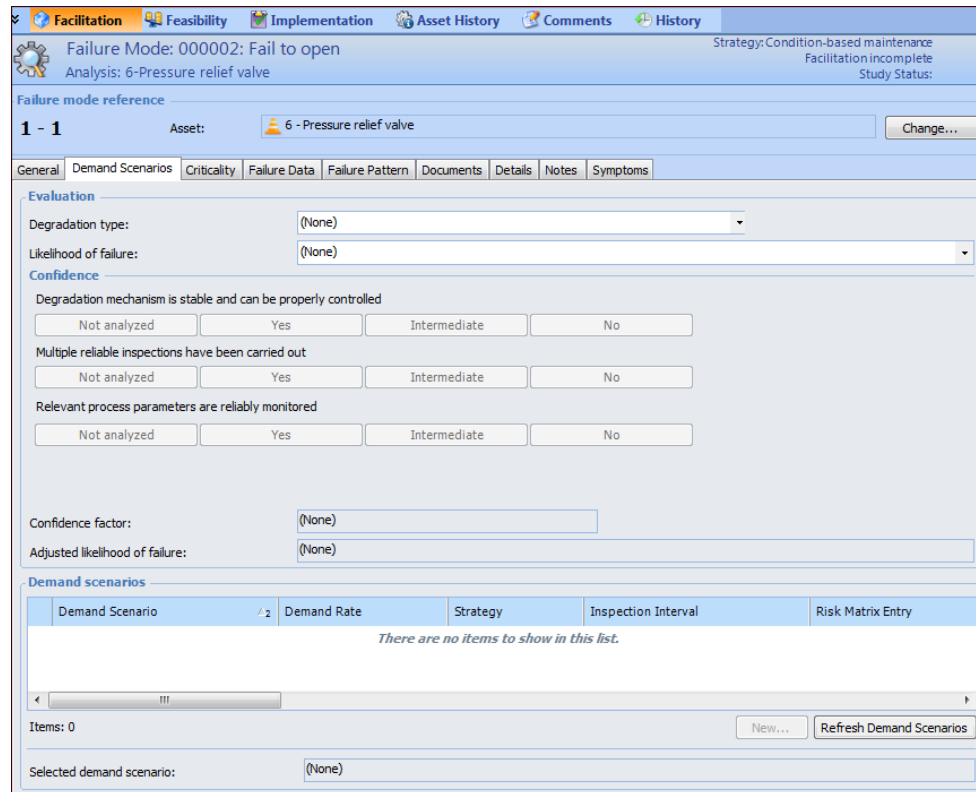
- The strategy development analysis. Risk analysis options can be set manually (**Properties** view, **Risk Options** tab) or derived from the analysis type assigned to the analysis.
- The asset type and the site. The failure mode asset's type definition can include risk analysis settings, including the site where the settings apply.

To quickly see where a failure mode derives its settings, click the **Tools** menu and then **Settings**. The Settings dialog appears, showing the source and settings. For example:



To Evaluate Likelihood of Failure and Confidence

1. Open the Maintenance Action Plan window.
2. Make sure that editing  is enabled.
3. Select the **Facilitation** view and the **Demand Scenarios** tab.



Failure Mode: 000002: Fail to open
Analysis: 6-Pressure relief valve

Strategy: Condition-based maintenance
Facilitation incomplete
Study Status:

Failure mode reference
1 - 1 Asset: 6 - Pressure relief valve Change...

General Demand Scenarios Criticality Failure Data Failure Pattern Documents Details Notes Symptoms

Evaluation

Degradation type: (None)

Likelihood of failure: (None)

Confidence

Degradation mechanism is stable and can be properly controlled

Not analyzed Yes Intermediate No

Multiple reliable inspections have been carried out

Not analyzed Yes Intermediate No

Relevant process parameters are reliably monitored

Not analyzed Yes Intermediate No

Confidence factor: (None)

Adjusted likelihood of failure: (None)

Demand scenarios

Demand Scenario	Demand Rate	Strategy	Inspection Interval	Risk Matrix Entry
There are no items to show in this list.				

Items: 0 New... Refresh Demand Scenarios

Selected demand scenario: (None)

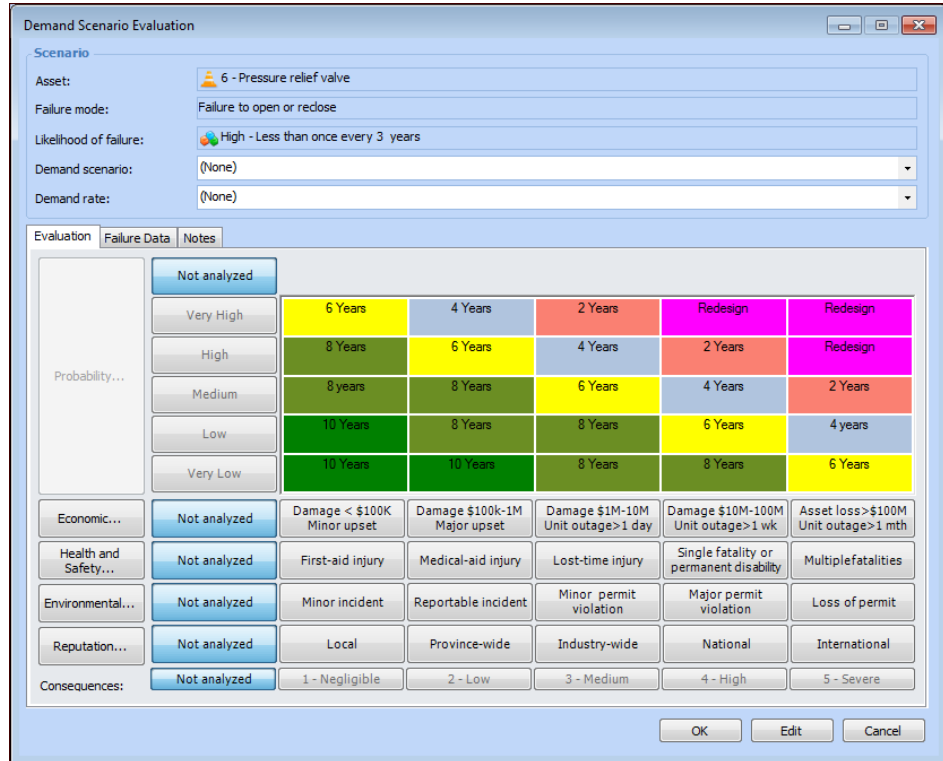
4. Select the degradation type from the list, for example, age-related or non-age-related.
5. Select a likelihood of failure from the list, for example, “Has happened more than once per year at the location”.
6. In the **Confidence** area, select responses to the confidence statements. (These statements are defined in the confidence questionnaire created by your organization.)

The **Confidence factor** box displays the result of your selection, indicating if confidence is low or high. The confidence factor can adjust the likelihood of failure up or down. The result is shown in the **Adjusted likelihood of failure** box.

You are now ready to add the demand scenarios that apply to the asset and complete the probability of failure evaluations for each one.

To Add a Demand Scenario and Evaluate Probability of Failure

1. On the **Demand Scenarios** tab, click **New** to add a demand scenario. The Demand Scenario Evaluation dialog appears. For example:



The dialog box is titled "Demand Scenario Evaluation" and has three tabs: "Evaluation", "Failure Data", and "Notes". The "Evaluation" tab is active.

Scenario

Asset: 6 - Pressure relief valve
 Failure mode: Failure to open or reclose
 Likelihood of failure: High - Less than once every 3 years
 Demand scenario: (None)
 Demand rate: (None)

Evaluation

Probability...	Not analyzed	6 Years	4 Years	2 Years	Redesign	Redesign
Very High		6 Years	4 Years	2 Years	Redesign	Redesign
High		8 Years	6 Years	4 Years	2 Years	Redesign
Medium		8 years	8 Years	6 Years	4 Years	2 Years
Low		10 Years	8 Years	8 Years	6 Years	4 years
Very Low		10 Years	10 Years	8 Years	8 Years	6 Years

Economic... Not analyzed | Damage < \$100K Minor upset | Damage \$100K-1M Major upset | Damage \$1M-10M Unit outage>1 day | Damage \$10M-100M Unit outage>1 wk | Asset loss>\$100M Unit outage>1 mth

Health and Safety... Not analyzed | First-aid injury | Medical-aid injury | Lost-time injury | Single fatality or permanent disability | Multiple fatalities

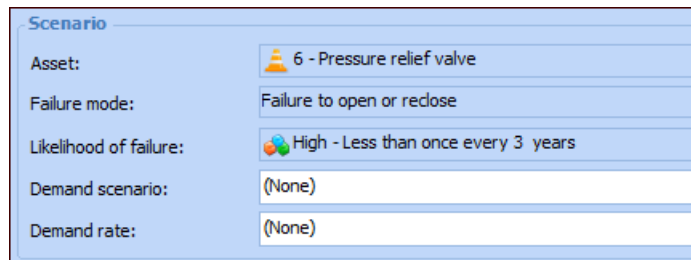
Environmental... Not analyzed | Minor incident | Reportable incident | Minor permit violation | Major permit violation | Loss of permit

Reputation... Not analyzed | Local | Province-wide | Industry-wide | National | International

Consequences: Not analyzed | 1 - Negligible | 2 - Low | 3 - Medium | 4 - High | 5 - Severe

OK Edit Cancel

The **Scenario** area displays the asset and failure mode information, as well as the adjusted likelihood of failure. For example:

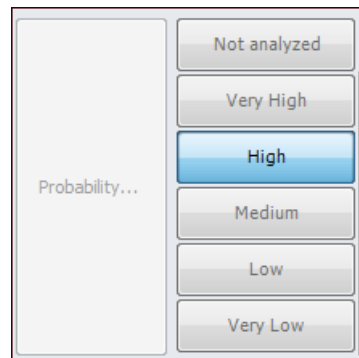


Scenario

Asset: 6 - Pressure relief valve
 Failure mode: Failure to open or reclose
 Likelihood of failure: High - Less than once every 3 years
 Demand scenario: (None)
 Demand rate: (None)

2. From the **Demand scenario** list, select the event that requires the safety device to be put into operation, for example, "Power failure" or "Blocked outlet".
3. If the demand scenario properties include the demand rate, it is displayed in the **Demand rate** box. You can change or add the demand rate if one is not supplied. In the **Demand rate** list, select the frequency with which the device is expected to be needed, for example, "0.5-4 years".

The result of the probability evaluation is shown in the risk matrix chart. For example:

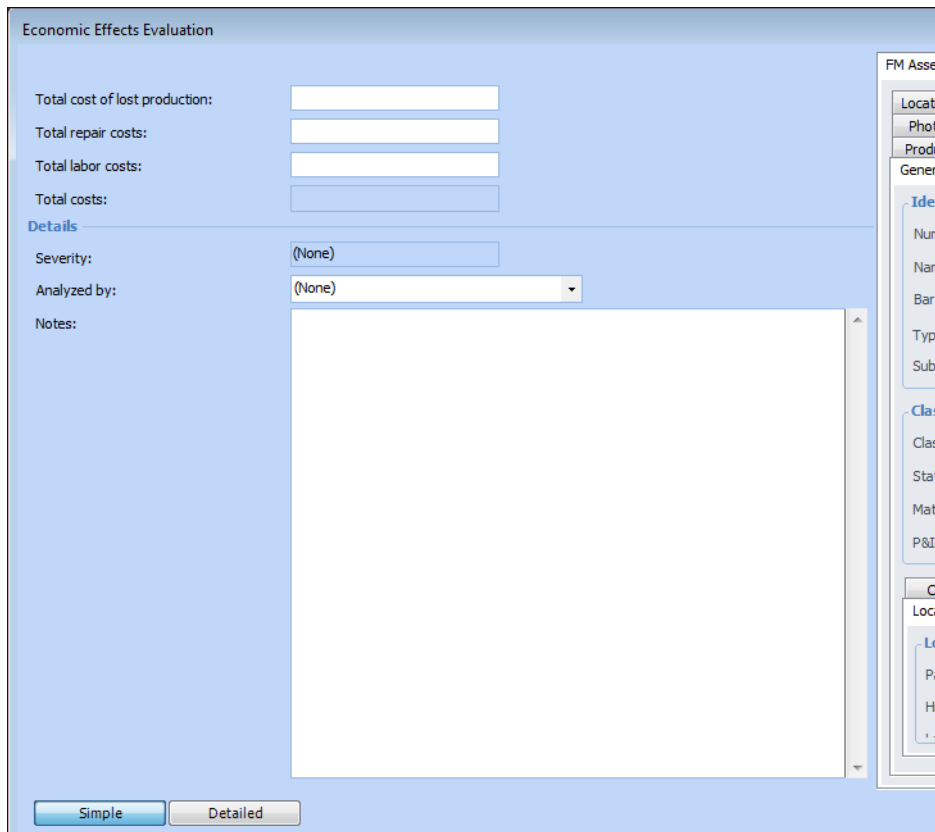


To complete each demand scenario's risk analysis, evaluate the severity of failure consequences. Questionnaires are typically available for economic, health and safety, environmental, and reputation consequences.

Tip: If risk analysis settings allow, you can click the impact buttons in the risk matrix rather than stepping through the questionnaires.

To Evaluate Economic Effects of Failure

1. In the risk matrix, click **Economic**. The Economic Effects Evaluation form appears. For example:



At any time, you can refer to the **FM Asset Properties** tab for detailed information about the asset.

2. For the simple form, provide the following information. If you wish to perform a detailed analysis, skip to step 3.

Setting Name	Description
Total cost of lost production	Monetary cost of asset downtime in the event of failure. The amount is shown in the site's currency.
Total repair costs	Monetary cost to repair equipment in the event of the asset's failure. The repair cost does not include labor. The amount is shown in the site's currency.

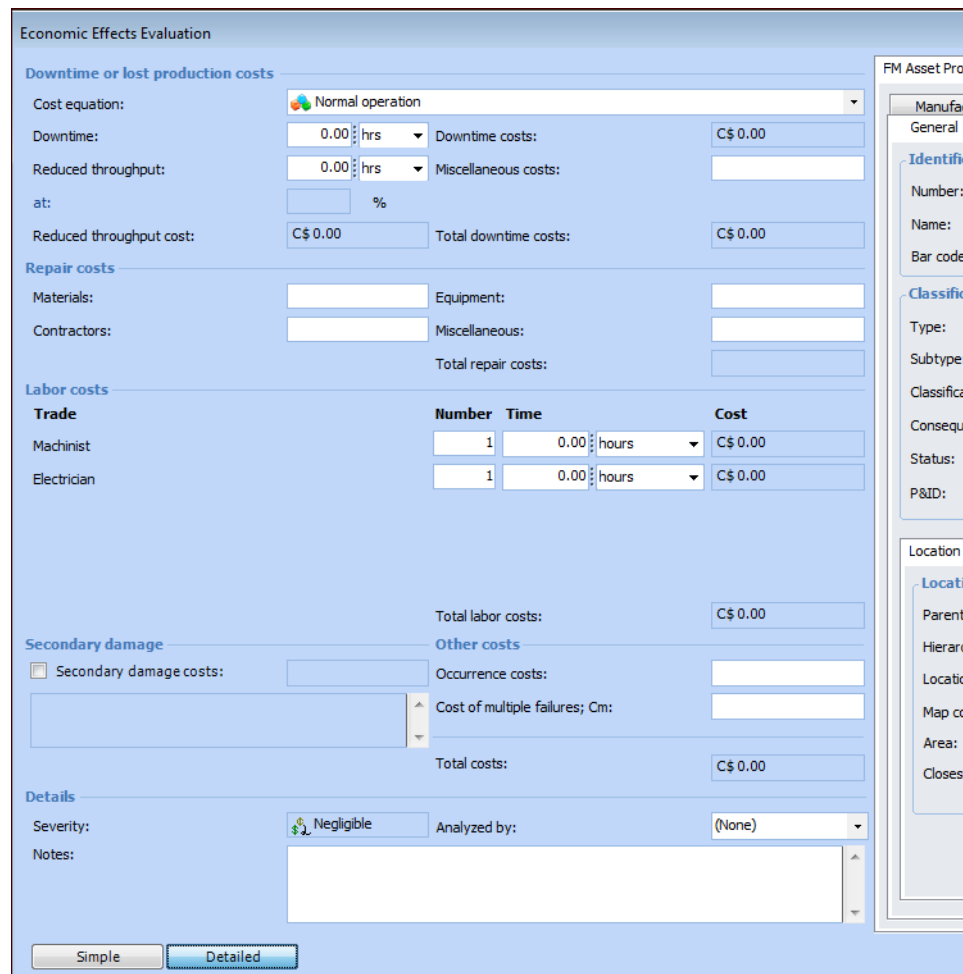
Total labor costs Monetary cost of labor in the event of the asset's failure. The amount is shown in the site's currency.

Analyzed by The analysis team member who performed the evaluation.

Note Additional information about the analysis. Notes are collected and available in several locations.

As you enter amounts in the **Total cost of lost production**, **Total repair costs**, and **Total labor costs** boxes, APM calculates the total amount and the severity.

- To perform a more detailed evaluation, click **Detailed**. Here is an example of a detailed form:



Economic Effects Evaluation

Downtime or lost production costs

Cost equation: Normal operation

Downtime: 0.00 hrs Downtime costs: C\$ 0.00

Reduced throughput: 0.00 hrs Miscellaneous costs:

at: %

Reduced throughput cost: C\$ 0.00 Total downtime costs: C\$ 0.00

Repair costs

Materials: Equipment:

Contractors: Miscellaneous:

Total repair costs:

Labor costs

Trade	Number	Time	Cost
Machinist	1	0.00 hours	C\$ 0.00
Electrician	1	0.00 hours	C\$ 0.00

Total labor costs: C\$ 0.00

Secondary damage

☐ Secondary damage costs:

Other costs

Occurrence costs:

Cost of multiple failures; Cm:

Total costs: C\$ 0.00

Details

Severity: Negligible Analyzed by: (None)

Notes:

Simple Detailed

As information is added to the form, APM calculates the total costs for the failure and displays the **Severity** score. All monetary amounts are shown in the site's currency.

4. Enter information to calculate lost production costs:

Setting Name	Description
Cost equation	If downtime or lost production costs are calculated for the asset, the default cost equation is selected, if applicable. This is the calculation rule used to determine the costs of a downtime incident or reduced throughput.

Tip: Select the **FM Asset Properties** tab and then the **Production Loss Accounting** tab to view the downtime cost rule.

Downtime	Period of time that the asset will not function in the event of a failure.
Downtime costs	APM calculates the downtime cost using the downtime amount and the cost equation.
Reduced throughput	When the failure mode results in reduced production instead of downtime, record the amount of time that reduced throughput is in effect.
Operating at	The percentage of production achieved when the failure results in reduced throughput.
Reduced throughput cost	APM calculates the cost of reduced throughput using the reduced throughput amount, the operating percentage, and the cost equation.
Miscellaneous costs	Additional costs not included in the downtime or reduced throughput costs.
Total downtime costs	The total is calculated by summing all of the amounts in the Lost production costs area.

5. Enter information to calculate repair costs:

Setting Name	Description
Materials	Monetary cost for materials to repair equipment in the event of the asset's failure.
Contractors	Monetary cost for contract workers to repair equipment in the event of the asset's failure.
Equipment	Monetary cost for equipment to repair the asset in the event of failure.
Miscellaneous	Additional monetary cost to repair the asset in the event of failure.
Total repair costs	APM calculates the total repair costs.

6. Enter information to calculate labor costs. The number and types of trades listed in the **Labor costs** area are defined in the Economic Evaluations settings. They vary depending on the trades defined for the site and selected for the evaluation. For each trade, enter the amount of time required to respond to the failure. APM calculates the cost based on the trade's rate.
7. Secondary damage is additional damage caused to other assets by the initial or primary failure. If appropriate, select **Secondary damage costs** and enter an amount and a description of the damage. This information is included in the total costs and shown on the failure mode's **Failure Data** tab.
8. In the **Occurrence costs** box, enter the estimated fixed cost associated with a downtime occurrence. For example, this could be a fixed cost associated with restarting a machine after it has been shut down.

When failure mode optimization requires Isograph Availability Workbench, this attribute is mapped to project effect per occurrence cost in AWB.
9. In the **Cost of multiple failures** box, enter the estimated cost if a protected function fails while its protective device or protective system is in a failed state.
10. In the **Analyzed by** list, select the team member who performed the evaluation.
11. In the **Notes** box, you can enter additional information about the evaluation. Notes are collected and available in several locations.

Note: For information about creating cost equations, see “Setting up Production Loss Rules on an Asset” in Help.

12. When you are finished the evaluation, click **OK**. The result of the economic evaluation is shown in the risk matrix. For example:

Economic...	Not analyzed	Damage < \$100K Minor upset	Damage \$100k-1M Major upset	Damage \$1M-10M Unit outage>1 day	Damage \$10M-100M Unit outage>1 wk	Asset loss>\$100M Unit outage>1 mth
-------------	--------------	--------------------------------	---------------------------------	--------------------------------------	---------------------------------------	--

To Evaluate Health and Safety, Environmental, and Reputation Consequences

1. Click **Health and Safety**, **Environmental**, and **Reputation** in turn. The evaluation form appears. The evaluation types (simple, detailed), categories, and questions available to you depend on the form's design and the asset properties.

At any time, you can refer to the **FM Asset Properties** tab for detailed information about the asset.

2. Complete each of the evaluations, selecting options for each category, entering notes, and using the arrow buttons to move between categories. If different evaluation types have been defined in the form's design, you can select **Simple** or **Detailed**, as required by the complexity of the failure mode that you are analyzing.

As you move through the analysis, the **Severity** box displays the most severe score assigned to your selections. For example, if you select options for three categories, two of which have a result of "Negligible" and one with a result of "High", the score for the evaluation as a whole will be "High". However, if a mitigation category has been defined for the evaluation, its score can raise or lower the severity. The resulting ranking is used in the risk matrix.

3. In the **Analyzed by** list, select the team member performing the evaluation.
4. In the **Note** box, you can provide additional information about the analysis. Notes are collected and available in several locations.
5. When you have completed an evaluation, click **OK**. The evaluation form closes and the result is selected in the risk matrix. For example:

Health and Safety...	Not analyzed	First-aid injury	Medical-aid injury	Lost-time injury	Single fatality or permanent disability	Multiple fatalities
Environmental...	Not analyzed	Minor incident	Reportable incident	Minor permit violation	Major permit violation	Loss of permit
Reputation...	Not analyzed	Local	Province-wide	Industry-wide	National	International

To View Failure Mode Criticality

When you have completed the evaluations for a demand scenario, the risk matrix on the Demand Scenario Evaluation dialog shows the results. For example:

6 Years	4 Years	2 Years	Redesign	Redesign
8 Years	6 Years	4 Years	2 Years	Redesign
8 years	8 Years	6 Years	4 Years	2 Years
10 Years	8 Years	8 Years	6 Years	4 years
10 Years	10 Years	8 Years	8 Years	6 Years

1. Click **OK** to close the Properties dialog. Back on the **Demand Scenarios** tab, the scenario is listed in the Demand scenarios table. For example:

Demand Scenario	Demand Rate	Strategy	Inspection Interval	Risk Matrix Entr
Thermal expansion	0.5 yr - 4 yr	Condition based maint...	4years	4y
Total power failure	4 - 20 yr	Condition based maint...	2 Years	2y
Fire	> 20 yr	Condition based maint...	4years	4y

Items: 3

Selected demand scenario: Total power failure - 4 - 20 yr

The **Selected demand scenario** box displays the scenario with the highest criticality value.

Tip: Scroll to the right in the table to see the Criticality column. The scenario with the highest number is automatically selected to represent the failure mode.

2. Select the **Criticality** tab. This tab shows the risk matrix chart for the selected demand scenario. You can:
 - Click **Demand Scenario** to open the selected scenario's Demand Scenario Evaluation dialog.
 - Click **Summary** to open the Risk Summary dialog. For example:

Risk Summary

Summary | Economic | Health & Safety | Environmental | Reputation

Details

Last inspection date:

Selected yearly rate:

Selected by:

Evaluation

Probability / By:

Economic / By:

Health and safety / By:

Environmental / By:

Reputation / By:

Consequences:

Dominant consequences:

Criticality:

Relative risk:

Demand scenario analysis

Likelihood of failure:

Confidence factor:

Adjusted likelihood of failure:

Demand scenario:

Inspection frequency:

Matrix

1	6Y	4Y	2Y	RD	RD
2	8Y	6Y	4Y	2Y	RD
3	8Y	8Y	6Y	4Y	2Y
4	10Y	8Y	8Y	6Y	4Y
5	10Y	10Y	8Y	8Y	6Y
	N	L	M	H	E

Probability

Consequences

Close

A tab is displayed for each of the questionnaires that were used to evaluation probability of failure and consequence severities.

- Click **Risk Plot** to view a graph of the risk plot.

Viewing Risk Analyses for Failure Modes

After you have assessed the failure modes in an analysis, you can compare failure modes and identify the relative importance of addressing them. The **Risk Assessment** view in the Strategy Development Analysis window includes charts based on severity and relative risk, a risk plot, risk matrix, and summaries. This view is also available for the asset.

Tip: You can also view risk assessments and risk matrix information for all failure modes on the site. On the Site window, select the **Strategy Development** view and tab, and then the **Risk Assessment** tab. To view an asset's information, open the Asset window, and select the **Risk Assessment** view.

The tabs on the **Risk Assessment** view provide the following information.

Risk Assessment

On this tab, you can view the analysis' assets by relative risk. Configurations are provided that list failure modes by relative risk, criticality, consequence priority, and so on. There are also summary charts for failure modes. Here is an example of assets by relative risk:

Risk Assessment

Criticality

Risk Plot

Severity

Relative Risk

Evaluations

Explorer

Assets by relative risk

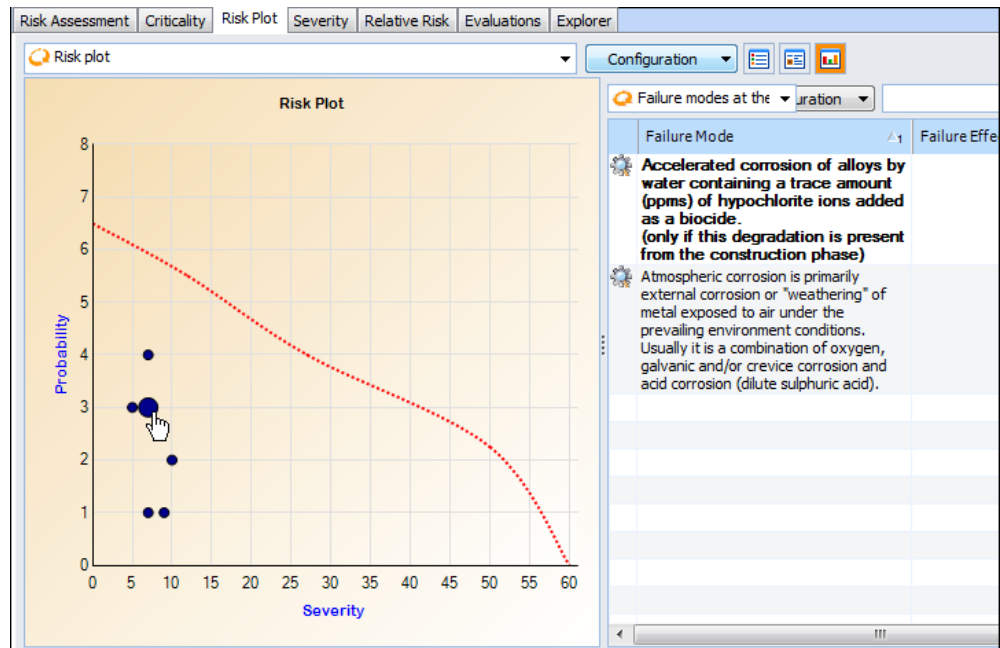
Asset	Asset Name	Total Relative Risk... ₁	Total Severity (Sum) ₂	Economic Severity Total (Sum)
+ S1	Section 1	200.00	10.00	2.00
+ 64	Test Piping and Valves	200.00	10.00	2.00
- S5	Section 5	160.00	8.00	1.00
Failure Mode		Failure Effect		Total Relative Risk
Cavitation is a form of erosion resulting in metal...		A form of erosion caused by the formation and i...		
<div><div>Section 3</div><div>0.0010.002.00</div></div>				
+ S3	Section 3	0.00	10.00	2.00

Criticality

This tab shows a summary chart of failure modes according to criticality. You can also select the “Failure mode list by consequence priority” configuration.

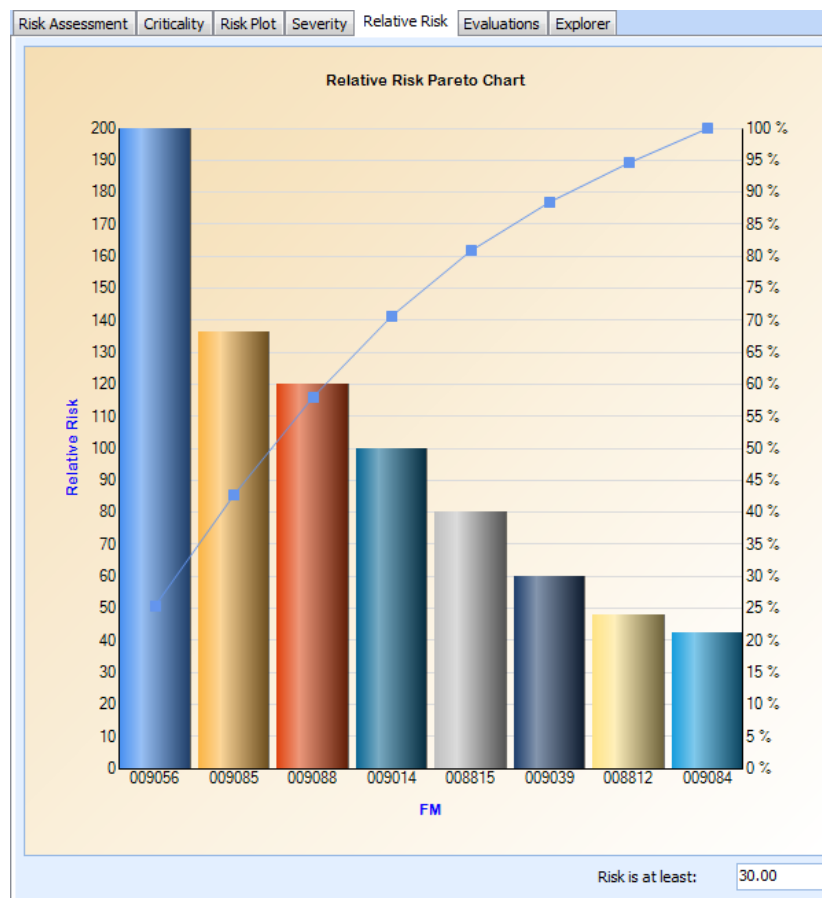
Risk Plot

This tab contains a plot of the failure modes based on their probability and severity. Click a risk plot in the table to view the failure modes. For example:



Severity and Relative Risk

These tabs display Pareto charts for the values. Here is an example of the **Relative Risk** tab:

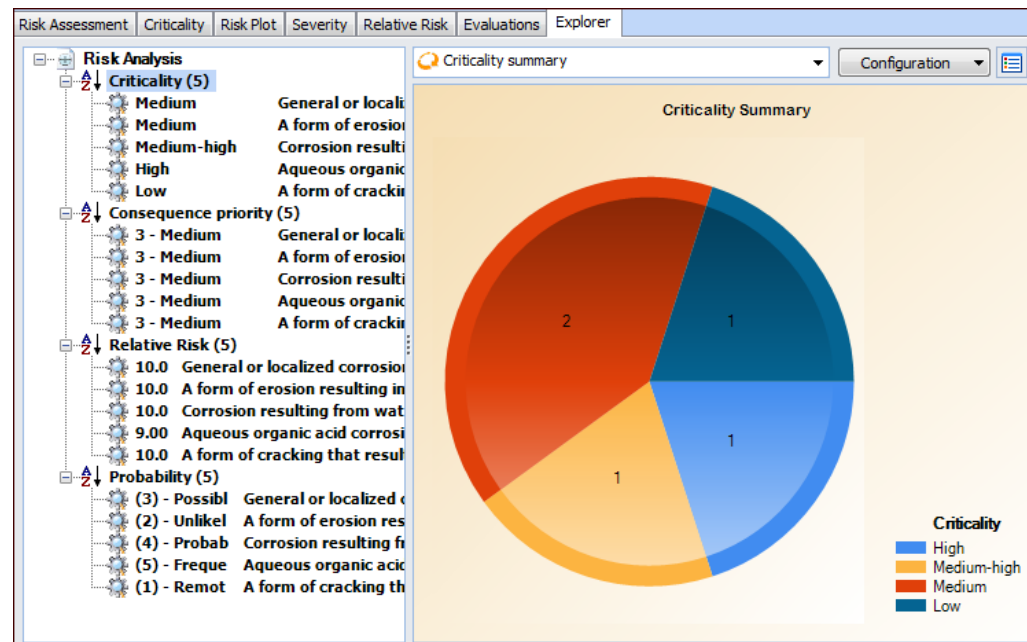


Evaluations

This tab shows lists of failure modes for which probability, economic, health and safety, environmental, and/or reputation evaluations have been performed. Select the **Evaluation Audit** tab to view lists of failure modes for which evaluations have not been performed.

Explorer

This tab shows summaries and details about risk analysis results. The tree contains nodes for criticality, consequence priority, relative risk, and probability scores. Select a node to view summary information. Select an individual failure mode to view its risk matrix. This example shows the criticality summary for an analysis with five failure modes:



Recording Failure Data

You can record information about an asset's failure costs, secondary damage, avoidance savings, statistics, and patterns.

When the team performs risk analysis on the failure mode, the costs incurred by the consequences (health and safety, environmental, reputation) are used in the calculation that determines avoidance savings (if the appropriate failure cost settings are enabled for the analysis).

This is also true of the economic consequence cost, although APM differentiates between the cost assigned to the consequence severity value and the result of the Economic Evaluation questionnaire. There are three possible ways to enter the economic consequence, depending on the analysis' settings:

- The results of the Economic Evaluation questionnaire are used automatically
- If the Economic Evaluation questionnaire is not used, the selected economic severity's monetary impact can be used
- You can manually enter costs on the **Failure Data** tab if criticality evaluation is not performed

Avoidance savings also take into account the cost of multiple failures and secondary damages.

The **Failure Data** tab displays the estimated downtime, downtime costs, downtime per occurrence costs, failure costs, cost of multiple failures, and secondary damage cost. This tab also shows the consequence costs, if supported by the analysis' failure mode settings. The following example shows the results when the detailed economic evaluation has been performed, as well as the other consequence evaluations:

General	Criticality	Confidence	Failure Data	Failure Pattern	Documents	Details	Notes	Symptoms
Failure costs								
Downtime:		3.00 months		Downtime costs:		C\$ 4,796,000.00		
Failure costs:		C\$ 151,000.00		Occurrence costs:		C\$ 75,000.00		
Consequences costs								
Economic:		C\$ 5,022,000.00		Health and safety:		C\$ 101,000.00		
Environmental:		C\$ 100,000.00		Reputation:		C\$ 100,000.00		
Other costs								
Multiple failures (Cm):		C\$ 80,000.00						
<input checked="" type="checkbox"/> Secondary damage		C\$ 250,000.00						
Failure avoidance savings								
Avoidance savings:		C\$ 5,653,000.00		<input checked="" type="checkbox"/> Calculate avoidance savings				
Failure statistics								
Time between failures:		(None)		TBF with inspections and preventive maintenance				
Time to repair:		(None)						

When **Calculate avoidance savings** is selected, APM sums the following values to arrive at the savings:

- Downtime costs
- Failure costs
- Occurrence costs
- Consequence costs
- Cost of multiple failures
- Secondary damage costs


When the failure mode references an indicator with states, the avoidance savings amount is copied from the failure mode to failure records that are created when the indicator's alarms are acknowledged.

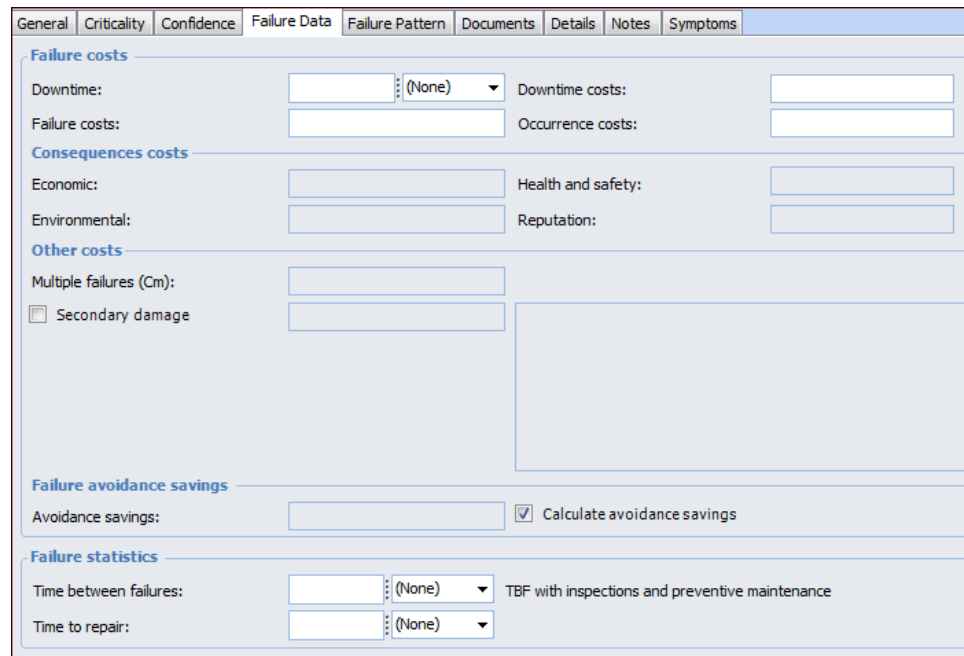
On the **Failure Pattern** tab, you can record random, wear out, and infant mortality patterns. Typically, you will include information about failure patterns when you intend to use Isograph Availability Workbench to analyze and optimize action plans.

This topic explains how:

- [To Record Failure Data](#)
- [To Record Failure Patterns](#)

To Record Failure Data

1. Open the MTA2 and select the **Facilitation** view.
2. Double-click the failure mode to open the Maintenance Action Plan window.
3. Make sure that editing  is enabled.
4. On the **Facilitation** view, select the **Failure Data** tab. This example shows the tab when criticality analysis has not been performed:



The screenshot shows the 'Failure Data' tab in a software window. The window has a tabbed interface with tabs: General, Criticality, Confidence, Failure Data (selected), Failure Pattern, Documents, Details, Notes, and Symptoms. The 'Failure Data' tab contains several sections:

- Failure costs:** Includes fields for 'Downtime' (with a dropdown menu showing '(None)'), 'Downtime costs', 'Failure costs', and 'Occurrence costs'.
- Consequences costs:** Includes fields for 'Economic', 'Health and safety', 'Environmental', and 'Reputation'.
- Other costs:** Includes a checkbox for 'Secondary damage' and a large empty text area.
- Failure avoidance savings:** Includes a field for 'Avoidance savings' and a checkbox labeled 'Calculate avoidance savings'.
- Failure statistics:** Includes fields for 'Time between failures' (with a dropdown menu showing '(None)'), 'Time to repair' (with a dropdown menu showing '(None)'), and a checkbox labeled 'TBF with inspections and preventive maintenance'.

Note: If you performed economic evaluation during risk analysis, the results are displayed in the **Failure costs** area, and the values cannot be changed. If you performed evaluations for Health and Safety, Environmental, or Reputation consequences, the monetary values assigned to the selected severities are displayed in the **Consequence costs** area, and the values cannot be changed.

Tip: If the recommended action is failure-finding maintenance, you can click the **Failure Finding Information** button on the **Failure Data** tab. A dialog appears showing the calculation inputs for the failure finding interval.

5. Record the failure costs:

Setting Name	Description
Downtime	Estimated time that the asset would be out of service if the failure occurs.
Downtime costs	Estimated costs of the downtime if the failure occurs.
Failure costs	Estimated cost to the company if a failure occurs, excluding the cost of downtime.
Occurrence costs	Estimated fixed cost associated with a downtime occurrence. For example, this could be a fixed cost associated with restarting a machine after it has been shut down.

6. Select **Secondary damage** if the failure mode causes failures on other assets. Enter the estimated cost and description of secondary damage.
7. **Calculate avoidance savings** is selected by default so that APM sums the costs of the failure, consequences, multiple failures, and secondary damage. You can clear this option and enter the avoidance saving amount manually.

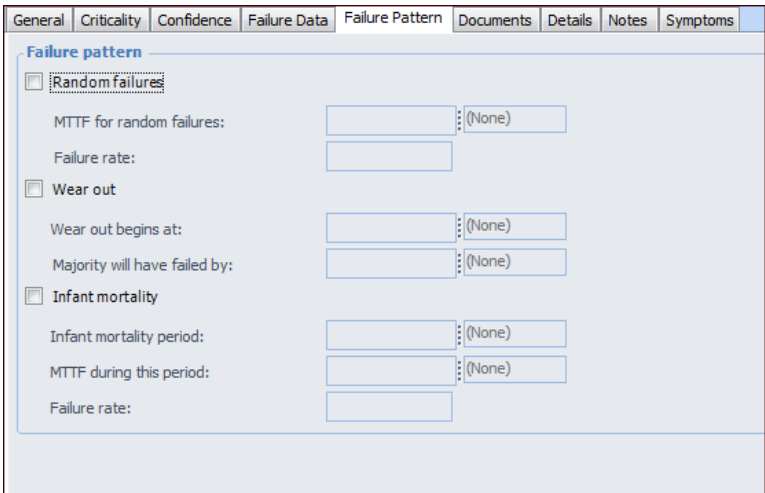
Note: If the action plan references an indicator, the avoidance savings amount can be copied to failure records created when the indicator's alarms are acknowledged.

8. Record failure statistics:

Setting Name	Description
Time between failure	<p>The time between occurrences of the failure when inspections and/or preventative maintenance are performed.</p> <p>When failure mode optimization requires Iso-graph Availability Workbench, this attribute is mapped to the cause's Mean time to failure property in AWB.</p>
Time to repair	The average time it takes to repair the asset and return it to service after a failure occurs.

To Record Failure Patterns

1. Select the **Failure Pattern** tab.



2. Record the failure patterns:

Setting Name	Description
Random failures	Random failures exhibit constant failure rate characteristics; that is, a random failure is just as likely to occur in the first year of operation as it is in the second or third years of operation. Random failures exhibit no infant mortality or wear-out characteristics. When failure mode optimization requires Iso-graph Availability Workbench, this attribute is mapped to the cause's Random On property in AWB.
MTTF for random failures	Estimate of the average, or mean time, until an asset's first failure occurs.
Failure rate	APM automatically calculates the failure rate as the inverse of the MTTF. When failure mode optimization requires Iso-graph Availability Workbench, this attribute is mapped to the cause's random rate property in AWB.

Wear out	<p>Age-related failures that occur due to operational wear.</p> <p>When failure mode optimization requires Iso-graph Availability Workbench, this attribute is mapped to the cause's Wear out On property in AWB.</p>
Wear out begins at	<p>The operating age at which wear-out begins.</p> <p>When failure mode optimization requires Iso-graph Availability Workbench, this attribute is mapped to the cause's Wear out Start age property in AWB.</p>
Majority will have failed by	<p>How long after the wear-out period begins that the majority of assets of this type will have failed.</p> <p>When failure mode optimization requires Iso-graph Availability Workbench, this attribute is mapped to the cause's Wear out Duration property in AWB.</p>
Infant mortality	<p>Rate of failure during the period immediately following an asset's commissioning for service.</p> <p>When failure mode optimization requires Iso-graph Availability Workbench, this attribute is mapped to the cause's Infant On property in AWB.</p>
Infant mortality period	<p>The length of time immediately following an asset's commissioning for service until it reaches its useful life period. The infant mortality period is characterized by a progressive improvement in the failure rate.</p> <p>When failure mode optimization requires Iso-graph Availability Workbench, this attribute is mapped to the cause's Infant period property in AWB.</p>
MTTF during infant mortality period	<p>Estimate of the average, or mean time, until an asset's first failure occurs during the infant mortality period.</p>

Failure rate

APM automatically calculates the failure rate as the inverse of the MTTF during the infant mortality period.

When failure mode optimization requires Iso-graph Availability Workbench, this attribute is mapped to the cause's Infant Rate property in AWB.

Evaluating the Feasibility of Maintenance Tasks

The analysis team can determine if their proposed maintenance strategies are worth doing; that is, whether implementing the maintenance tasks will cost less than the savings achieved by avoiding the failure.

If you have performed risk analysis on the failure mode, when you select the **Feasibility** view, you will see that it displays the estimated time between failures (ETBF), avoidance savings, and initial risk. These values are based on the following:

- ETBF without maintenance – ETBF value assigned to the failure probability score. For example, the “Medium” probability could be assigned the ETBF of 3.500 years.
- Avoidance savings – APM calculates the avoidance savings using:
 - Downtime costs
 - Downtime per occurrence costs
 - Failure costs
 - Consequence costs
 - Cost of multiple failures
 - Secondary damage costs

APM uses the time period specified in feasibility settings to arrive at the savings per period.

Failure costs can include the economic impact values of the consequence severities. For example, in the failure costs settings for the analysis, you can select one or more of the health and safety, environmental, and reputation effects to contribute to the calculation of avoidance savings. The economic evaluation also contributes.

- Initial risk – Overall criticality score from the risk evaluation

To arrive at the residual risk, enter the estimated time between consequences (ETBC), which is the time between unexpected consequences or failures when inspections and preventive maintenance are performed on the asset. APM calculates the remaining risk amount and assigns the corresponding description. You can view the figures for risk reduction and residual risk by clicking **Details** to open the Details dialog.

Next, enter the frequency and costs of implementing the recommended task. You can itemize the costs of labor, repairs, and downtime or lost production on additional tabs. If you performed a detailed economic evaluation, **Copy Economic Evaluation** becomes available when you select

a maintenance task type. When you click this button, information from the Economic Effects Evaluation form is copied to the **Labor**, **Repairs**, and **Downtime** tabs.

APM uses the maintenance efficiency index (MEI) to determine if the cost of the tasks is justified. The MEI is calculated as follows:

$$\text{MEI} = \text{Risk reduction amount} / \text{Task costs every period}$$

You can add as many tasks as needed. To compare the effect of different tasks, you can select or clear the **Include in MEI** setting on individual tasks. The maintenance efficiency index (MEI) value changes accordingly.

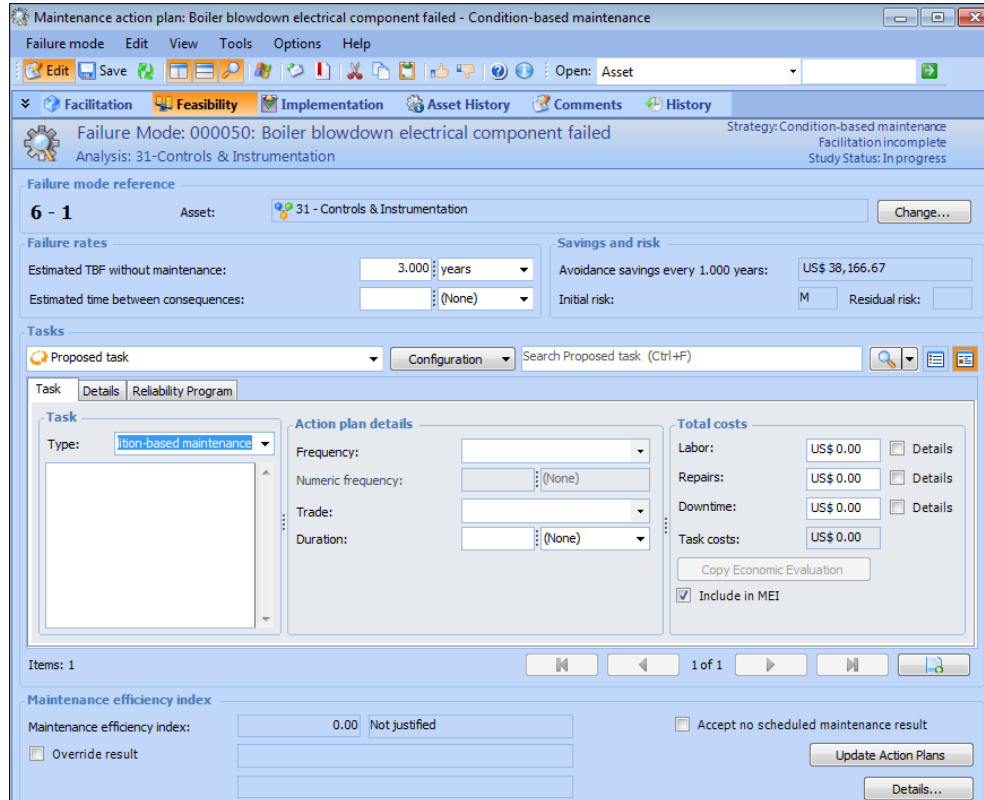
When you establish that the tasks are justified, click **Update Action Plans** to create or refresh the action plan for the recommended task. Secondary action plans are created for any additional tasks.

In some situations, you might have to implement a task that is not justified, for example, to meet regulatory inspection requirements. In this case, you can override the result, record the reason, and update action plans.

To view a summary of the feasibility analysis, open the Details dialog. It displays information such as the projected number of failures per analysis period, the risk reduction value, as well as the costs of the tasks.

To Perform a Feasibility Evaluation

1. In the Maintenance Action Plan window, select the **Feasibility** view. In this example, criticality and confidence evaluations were completed to arrive at the ETBF without maintenance, avoidance savings, initial risk, and proposed task type:



2. If **Estimated TBF without maintenance** does not have a value, enter the estimated time between failures when no maintenance is performed on the asset. The avoidance savings is calculated for the period, based on the ETBF and the avoidance savings calculated in the **Facilitation** view, **Failure Data** tab.
3. To determine the residual risk, enter the estimated time between consequences (ETBC). This is the time between unexpected consequences or failures when inspections and preventive maintenance are performed on the asset. APM calculates the residual risk and displays its description.
4. If appropriate, select a task type from the list. You can describe the task in the text box below.

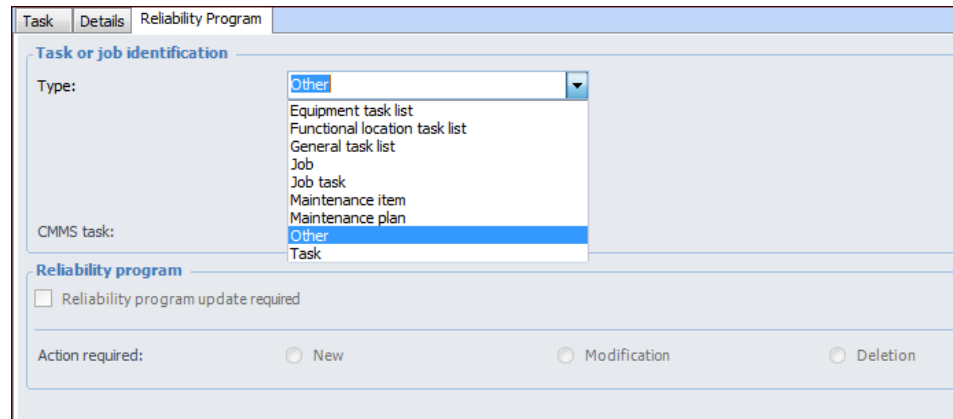
5. The **Action plan details** area contains information that will be copied to the task's action plan when it is created or updated. From the **Frequency** list, select the time period that indicates how often the task should be performed. This information is used in the MEI index calculation, along with task costs.

Tip: For proposed tasks that are performed as needed, for example, restoration or discard, you can select the “As needed” or “When required” frequency defined for your organization. In the **Numeric frequency** box, enter an estimate of how often the task will be performed.

6. In the **Trade** list, select the resource that will be copied to the task's action plan.
7. In the **Duration** box, enter the amount of time that the trade person will need to perform the task.
8. Enter the appropriate amounts for labor, repairs, and downtime costs in the **Total costs** area. The total is calculated and displayed in the **Task costs** box. Alternatively, you can select one or more of the **Details** options. The appropriate tabs (**Labor**, **Repairs**, **Downtime**) are added, where you can itemize the costs in detail.


Note: When you use the **Labor**, **Repairs**, or **Downtime** tab to record detailed information, the corresponding cost box on the **Task** tab displays the resulting total in read-only format.

9. Select the **Reliability Program** tab to reference the appropriate item. You can select an APM standard task, job, or job task. Or, if interoperability settings have been configured for APM, you can reference a task list, maintenance item, or maintenance plan in the connected SAP Plant Maintenance system. Alternatively, you can request a reliability program update in a CMMS system outside of APM. In this example, the **Type** list contains the items available when site interoperability settings specify that both APM and SAP information can be used:



Do one of the following:

- To select an APM object, select “Job”, “Job task”, or “Task”. The appropriate boxes are added for that object. Click the browse icon to select the standard job, job task, or task.
- To select a SAP Plant Maintenance object, select the object, for example, “General task list”. Click the browse icon to select the item.
- To specify that a reliability program update is required in a CMMS system, select “Other”. Describe the task in the **CMMS task** box. Click **Reliability program update required** and then the action required.

10. Add tasks if they are needed by clicking .

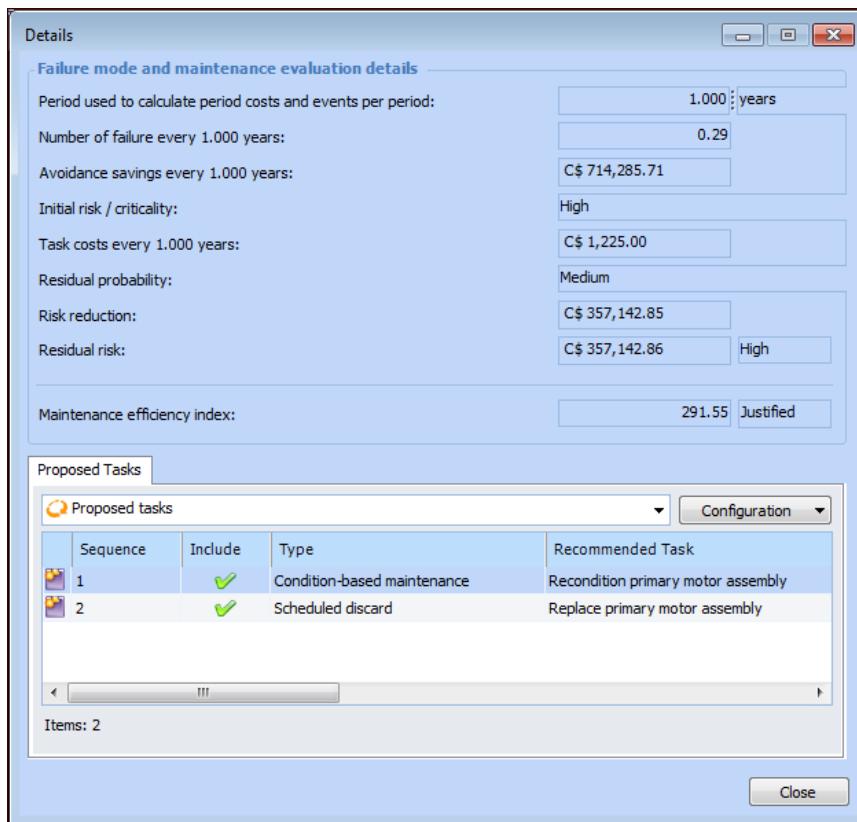
As you enter cost information, the **Maintenance efficiency index** boxes show the resulting index and whether the tasks are justified or not justified.

Note: If you are using a custom MEI calculation, the **Calculate** button is available. Click it to determine if the costs are justified.

Tip: To compare the impact of different tasks, you can select or clear the **Include in MEI** setting on any of the second and subsequent tasks. The **Maintenance efficiency index** value changes accordingly.

Note: You cannot clear **Include in MEI** for the first proposed task.

11. Click **Details** to compare the tasks. The Details dialog displays failure mode and evaluation details. The **Proposed Tasks** tab lists the tasks and their costs. For example:



Details

Failure mode and maintenance evaluation details

Period used to calculate period costs and events per period: 1.000 years

Number of failure every 1.000 years: 0.29

Avoidance savings every 1.000 years: C\$ 714,285.71

Initial risk / criticality: High

Task costs every 1.000 years: C\$ 1,225.00

Residual probability: Medium

Risk reduction: C\$ 357,142.85

Residual risk: C\$ 357,142.86 High

Maintenance efficiency index: 291.55 Justified

Proposed Tasks

Proposed tasks Configuration

Sequence	Include	Type	Recommended Task
1	✓	Condition-based maintenance	Recondition primary motor assembly
2	✓	Scheduled discard	Replace primary motor assembly

Items: 2

Close

Scroll to the right to view costs for each task, the number of times the task is performed for the period, and the cost for the period. You can also double-click a task to view more information about it.

Click **Close** to close the dialog.

12. When the cost is justified, you can click **Update Action Plans**. If action plans have not yet been created, APM adds them to the failure mode. The following information is copied to the action plans:

- Recommended task type
- Recommended task description
- Frequency
- Trade name and duration from the **Task** tab
- Item selected on the **Reliability Program** tab
- From the **Reliability Program** tab, the CMMS task reference and action required

When action plans already exist, the primary action plan is updated with information from the first task on the **Feasibility** view. For a secondary plan, APM searches for one with a matching task type. The

first one it finds is updated with information from the first secondary task on the **Feasibility** view. If a matching task type is not found, a secondary action plan is created.

13. On MTA2 and RCM2 failure modes, if the primary proposed task is not justified, you have the option of selecting **Accept no scheduled maintenance result**. When you click **Update Action Plans**, the primary action plan's task type is set to "No Scheduled Maintenance". Any existing secondary action plans are deleted.
14. If the proposed task is not justified but it needs to be performed anyway, for example, because of regulatory requirements, select **Override result**. Then select a reason from the list of MEI override reasons defined for the site, enter a comment manually, or do both.

When you click **Update Action Plans** to create or revise action plans.

Tip: You can also select **Override result** and provide a reason when a proposed task is justified.

Developing Primary Action Plans

An action plan in a strategy development analysis identifies an asset's failure mode and recommends an action to prevent the failure or mitigate its consequences. For example, MTA2 and SIF action types are condition-based maintenance, failure-finding maintenance, scheduled restoration or discard, modification or redesign, and no scheduled maintenance (run to failure). RBI analyses support actions such as inspections, strategy, and modification or redesign.

Developing an action plan involves describing and setting options for the action. Depending on the action type, you can assign indicators, corrective tasks, or a standard document to the plan. If a failure mode requires more than one type of action, you can create secondary action plans for it.

Tip: If you performed risk analysis on the failure mode, the resulting recommended task and related information might appear in the **Implementation** view, **Primary Action Plan** tab, depending on the analysis risk options. In that case, you cannot change the task type, but you can develop the action plan as needed.


This topic explains how to develop action plans from the Maintenance Action Plan window using the **Implementation** view, **Primary Action Plan** tab.

Tip: You can also quickly add action plans from the Strategy Development Analysis window's **Implementation** view, **Action Plans** tab. Select a failure mode in the table view and press F2 to open the row for editing. Press Tab to move to the next editable field. When you are done, press Enter to close the table to editing.

To Develop Action Plans

1. From the site's **Strategy Development** view, **Strategy Development** tab, select the **MTA2** tab.

Tip: You can also open an analysis from the asset's **Strategy Development** view, **Analyses** tab.

2. Double-click the analysis to open the Strategy Development Analysis window.
3. Double-click the failure mode to open the Maintenance Action Plan window. In the **Facilitation** view, **General** tab, ensure that a strategy has been selected. This makes the **Implementation** view available in the window.
4. Make sure that editing  is enabled.

5. Select the **Implementation** view and the **Primary Action Plan** tab. The information on this tab varies depending on the recommended strategy. Here is an example for condition-based maintenance:

6. In the **Recommended task** area, provide a description of the recommended task in the text box.
7. Set the options for the task.

Note: If APM has been configured for read-only access to an external CMMS (SAP Plant Maintenance) and site interoperability settings specify that SAP Plant Maintenance references are used in action plan details, then “System condition” and “Work center” replace “Operating condition” and “Maintenance group”.

The following table describes the details for each of the types.

Action type	Option or tab	Description
Scheduled Restoration/ Discard	Useful life	Age at which there is a rapid increase in the conditional probability of failure

Action type	Option or tab	Description
	Frequency	Frequency at which the recommended action needs to be performed
	Trade	Type of trades person who will perform the action
	Operating condition	Operating condition of the asset when the action is performed
	Maintenance group	Group that will perform the action
	Technology	PdM technology used in the performance of the action
	Duration	Time required to complete the task
	CMMS task	Select this option if a CMMS task exists for the failure mode and then provide the CMMS reference. This information is for reference only.
	Effectiveness	Estimated success of the recommended task to prevent a failure or mitigate its consequences
	P-F Interval	Interval between the point when a potential failure is detectable and the point when the functional failure occurs
	Frequency	Frequency at which the recommended action needs to be performed
Condition-based maintenance	Trade	Type of trades person who will perform the action
	Operating condition	Operating condition of the asset when the action is performed
	Maintenance group	Group that will perform the action
	Technology	PdM technology used in the performance of the action

Action type	Option or tab	Description
	Duration	Time required to complete the task
	CMMS task	Select this option if a CMMS task exists for the failure mode and then provide the CMMS reference. This information is for reference only.
	Effectiveness	Estimated ability of the recommended task to prevent a failure or mitigate its consequences
Failure finding Maintenance	Failure-finding interval	Interval it is considered safe to wait before performing failure-finding maintenance. The interval is calculated or estimated based on the desired availability and the frequency of failure of the protective device or system. Click the calculator icon to open the Calculate Failure-Finding Interval dialog, provide inputs, and calculate the frequency.
	Frequency	Frequency at which the recommended action needs to be performed
	Trade	Type of trades person who will perform the action
	Operating condition	Operating condition of the asset when the action is performed
	Maintenance group	Group that will perform the action
	Technology	PdM technology used in the performance of the action
	Duration	Time required to complete the action
	CMMS task	Select this option if a CMMS task exists for the failure mode and then provide the CMMS reference. This information is for reference only.

Action type	Option or tab	Description
	Effectiveness	Estimated ability of the recommended task to prevent a failure or mitigate its consequences
Modification/redesign	Trade	Type of trades person who will perform the action
	Modification type	Choose a modification type, for example, Maintenance procedure or Training. Tip: To create a modification type, click in the box and press F3 . The Modification Type dialog appears, where you can provide a name and icon for the type. To attach a procedure to the action plan, click Browse .
No scheduled maintenance	CMMS task	Select this option if a CMMS task exists for the failure mode and then provide the CMMS reference. This information is for reference only.
	Effectiveness	Estimated ability of the recommended task to prevent a failure or mitigate its consequences

Note: For information about using the Calculate Failure-Finding Interval utility, see “[Calculating a Failure-Finding Interval](#)” on page 186.

8. For some actions, you can add an inspection task, indicators, corrective tasks, follow-up work, or standard documents to the analysis. If the action supports it, the appropriate tab appears in the dialog.
 - You can create inspection tasks, indicators, corrective tasks and follow-up work for condition-based maintenance, failure-finding maintenance, or scheduled restoration/discard.
 - You can create corrective tasks and follow-up work when the action type is “No scheduled maintenance”.
 - You can add standard documents and follow-up work for modification/redesign tasks.

For more information, see [“Adding Indicators, Tasks, and Work to Action Plans”](#) on page 192 and [“Adding Standard Documents to Action Plans”](#) on page 205.

9. If you wish to add a secondary action plan for the failure mode, see [“Creating Secondary Action Plans”](#) on page 184.

Creating Secondary Action Plans

Sometimes one action is not enough to deal with a failure mode in a strategy development analysis. For example, an asset's failure mode might require a condition-based maintenance task to check for signs of wear, a physical modification to the asset, and a modification to procedures (for example, training for maintenance personnel). In cases like this, you can add secondary action plans to the failure mode, and you can have more than one task with the same action type. For example, you might need two modification/redesign tasks.


An additional task type is available for secondary action plans: "Review existing maintenance". This action plan alerts the analysis team to review an asset's existing maintenance program to identify items that are no longer required or require modification.

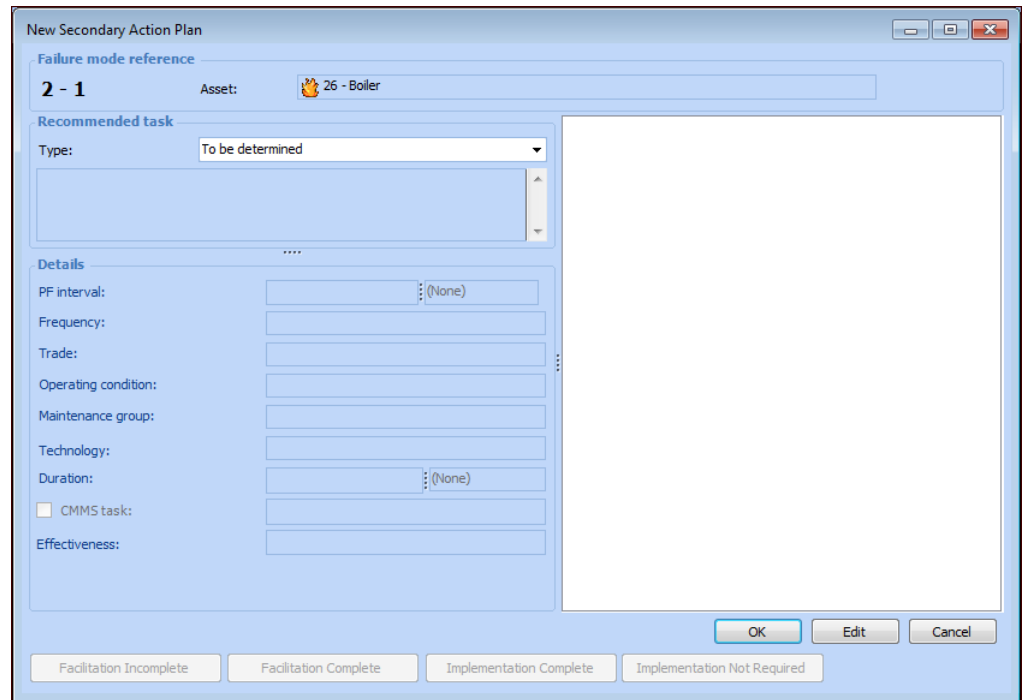
This section explains how to add secondary action plans to existing failure modes.

Tip: The **Action Plans** view in the analysis window lists the action plans for each failure mode. The Action Plan Type column indicates whether the action plan is primary or secondary.

To Create a Secondary Action Plan

1. From the site's **Strategy Development** view and tab, select the **MTA2** tab.

Tip: You can also open a failure mode by opening an asset and selecting the **Strategy Development** view, **Strategy Development** tab, and **Failure Modes** tab.
2. Double-click the analysis to open the Strategy Development Analysis window.
3. Make sure that editing  is enabled.
4. Select the **Facilitation** view, **Info Worksheet** tab. Double-click the failure mode to open the Maintenance Action Plan window.
5. Select the **Implementation** view and the **Secondary Action Plans** tab.
6. Click **New**. The New Secondary Action Plan window appears.



7. Select a task type from the list. The options available change according to the type you select.
8. Complete the options for the action as you would for a primary action plan.
9. If the action type is condition-based maintenance, failure-finding maintenance, scheduled restoration/discard, or review existing maintenance, you can add an inspection task and individual indicators using the **Indicators** tab, corrective tasks using the **Tasks** tab, and work requests or work orders using the **Follow Up** tab. For information, see [“Adding Indicators, Tasks, and Work to Action Plans”](#) on page 192.
10. If the action type is modification/redesign, you can add a standard document to the plan. Click **Browse** to select a document.
11. When you have finished developing the action plan, close the dialog. The action plan is saved and displayed on the **Secondary Action Plans** tab.


Calculating a Failure-Finding Interval

On a maintenance task analysis' action plan, you can recommend a failure-finding maintenance action for a hidden failure and provide the failure-finding interval. A failure-finding interval is the length of time that it is considered safe to wait before performing failure-finding maintenance. The interval is calculated or estimated based on the desired availability and the frequency of failure of the protective device or system. Use the Calculate Failure-Finding Interval dialog to create an FFI.

Note: The failure-finding interval calculator is not available on secondary action plans.

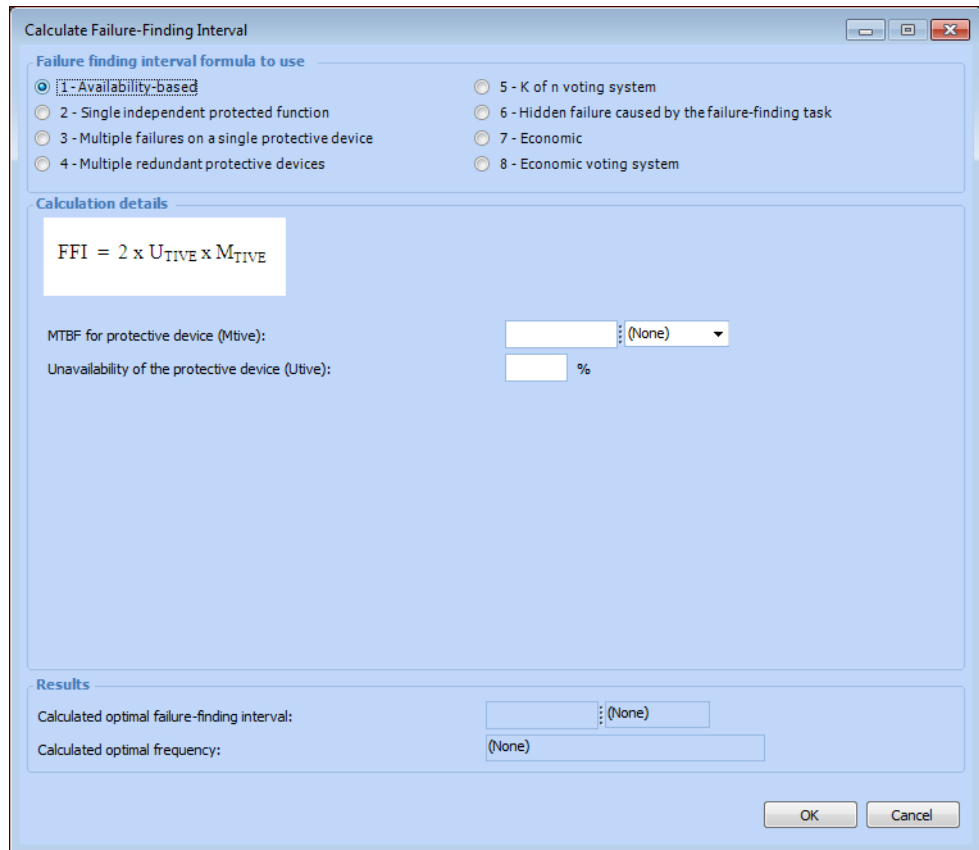
Tip: After calculating the FFI, you can view the calculation inputs in the **Facilitation** view, **Failure Data** tab. Click the **Failure Finding Information** button to open the Failure Finding Info window.

To Calculate a Failure-Finding Interval

1. In the analysis' **Facilitation** view, double-click the failure mode to open the Maintenance Action Plan window.
2. Make sure that editing  is enabled.
3. Select the **Implementation** view and the **Primary Action Plan** tab. For example:

4. Click the calculator icon next to the **Failure finding interval** boxes.

The Calculate Failure-Finding Interval window appears:



Calculate Failure-Finding Interval

Failure finding interval formula to use

- ☒ 1 - Availability-based
- ☐ 2 - Single independent protected function
- ☐ 3 - Multiple failures on a single protective device
- ☐ 4 - Multiple redundant protective devices
- ☐ 5 - K of n voting system
- ☐ 6 - Hidden failure caused by the failure-finding task
- ☐ 7 - Economic
- ☐ 8 - Economic voting system

Calculation details

$$FFI = 2 \times U_{TIVE} \times M_{TIVE}$$

MTBF for protective device (M_{tive}): (None) ▾

Unavailability of the protective device (U_{tive}): %

Results

Calculated optimal failure-finding interval: (None) ▾

Calculated optimal frequency: (None)

OK Cancel

5. Select the formula that you wish to use. When you select a formula, it is displayed below the list. The formula's calculation inputs appear in the **Calculation details** area. The following table provides a brief description of each formula and its inputs.

Formula	Inputs
Availability-based formula	U _{TIVE} = Unavailability of the protective device
$FFI = 2 \times U_{TIVE} \times M_{TIVE}$	M _{TIVE} = Mean time between failure for the protective device

Formula	Inputs
Single independent protected function	M_{TED} = Mean time between failure for the protected function M_{TIVE} = Mean time between failure for the protective device M_{MF} = Allowed mean time between multiple failures
$FFI = \frac{2 \times M_{TIVE} \times M_{TED}}{M_{MF}}$	
Multiple failure modes on a single protective device	M_{TED} = Mean time between failure for the protected function m_1 = Mean time between failure for protective device 1 m_2 = Mean time between failure for protective device 2 m_3 = Mean time between failure for protective device 3 m_4 = Mean time between failure for protective device 4 m_5 = Mean time between failure for protective device 5 M_{MF} = Allowed mean time between multiple failures
$FFI = \frac{2M_{TED}}{\left(\frac{1}{m_1} + \frac{1}{m_2} + \frac{1}{m_3} + \frac{1}{m_4} + \frac{1}{m_5} \right) \times M_{MF}}$	
Multiple redundant protective devices	M_{TIVE} = Mean time between failure for the protective device M_{TED} = Mean time between failure for the protected function M_{MF} = Allowed mean time between multiple failures n = the number of redundant protective devices
Protected system with multiple independent, fully redundant protective devices	
$FFI = M_{TIVE} \times \left[\frac{(n+1)M_{TED}}{M_{MF}} \right]^{\frac{1}{n}}$	

Formula	Inputs
<p>K of n voting system</p> <p>Protected system with a set of parallel protective devices</p> $FFI = M_{TIVE} \left[\frac{(n-r)! r! (r+1) M_{TED}}{n! M_{MF}} \right]^{\frac{1}{r}}$	<p>M_{TIVE} = Mean time between failure for the protective device</p> <p>M_{TED} = Mean time between failure for the protected function</p> <p>M_{MF} = Allowed mean time between multiple failures</p> <p>n = the number of parallel protective devices</p> <p>k = is the number of protective devices required to activate the system</p> <p>r = the number of units which have to be in a failed state in order to cause the whole system to fail:</p> $r = n - k + 1$
<p>Failure finding task causes a hidden failure</p> <p>The failure-finding task could cause the very failure which it is suppose to check and so leave the protective device in a (hidden) failed state from the moment the test is completed</p> $FFI = \frac{2 \times M_{OTHER}}{(1-p)} \left[\frac{M_{TED}}{M_{MF}} - p \right]$	<p>M_{OTHER} = Mean time between failure caused by phenomena other than the test</p> <p>M_{TED} = Mean time between failure for the protected function</p> <p>M_{MF} = Allowed mean time between multiple failures</p> <p>p = if P is the probability that the failure finding test will leave the device in a failed state, p (as a decimal) is the unavailability caused by the testing process</p>

Formula	Inputs
<p>Economic</p> $FFI = \left(\frac{2M_{TIVE} \times M_{TED} \times C_{FF}}{C_M} \right)^{\frac{1}{2}}$	<p>C_M = cost of the multiple failure (cost per event)</p> <p>C_{FF} = cost of doing the failure finding task (per task)</p> <p>M_{TIVE} = MTBF of the protective device</p> <p>M_{TED} = MTBF of the protected function</p>
<p>Economic voting system</p> $FFI = \left[\frac{(M_{TIVE})^n \times (n + 1) \times M_{TED} \times C_{FF}}{n \times C_M} \right]^{\frac{1}{n}}$	<p>C_M = cost of the multiple failure (cost per event)</p> <p>C_{FF} = cost of doing the failure finding task (per task)</p> <p>M_{TIVE} = MTBF of the protective device</p> <p>M_{TED} = MTBF of the protected function</p> <p>n = the number of redundant protective devices</p>

6. Provide the calculation inputs for the formula. When the inputs are supplied, the results of the calculation are shown in the **Results** area. The frequency closest to the failure-finding interval, without being longer than the failure-finding interval, is displayed.
7. Click **OK**. The failure-finding interval is added to the action plan and the frequency is calculated and displayed.

Adding Indicators, Tasks, and Work to Action Plans

When an action plan's recommended action is condition-based maintenance, failure-finding maintenance, or scheduled restoration or discard, you can include the following:

- **Inspection task** – An inspection task is a standard task that lists the indicators to be read to perform an asset inspection. You can add an existing standard task to the action plan or create one from scratch or from a template. When you create an inspection task from scratch, you can add new indicators or specify a dynamic route to collect existing indicators for route assets.

Failure mode settings can specify that indicators are added automatically to inspection tasks. In this case, when you add a manually-collected indicator on the action plan's **Indicators** tab, it is added to the assigned inspection task. Similarly, when you add an inspection task, any manually-collected indicators currently on the action plan are added to it.

Note: You cannot add inspection tasks to action plans on analysis templates.

- **Indicators** – Create or browse for individual indicators to be read when the action is performed.

Tip: After you have added an indicator to an action plan, you can right-click it in the table and click **Review Request Details**. In the Review Request Details dialog that appears, specify the reliability program update required. When the action plan is marked “Facilitation Completed” or “Implementation Completed”, the request is created automatically.

- **Corrective tasks** – You can do one or more of the following, depending on how APM is configured:
 - Create or browse for one or more APM standard tasks, task templates, standard jobs, job tasks, or job templates to correct problems
 - Browse for SAP Plant Maintenance items (for example, equipment task lists) to correct problems if APM has been set up to access external data
- **Corrective action plan tasks** – Request that the reliability program be updated. The action plan task can reference an existing APM or SAP object. Or you can choose to reference a task in an external CMMS

(select “Other”). You can select update options and enter notes to let the planner know whether an object needs to be created, modified, or deleted.

- Follow-up Work – For all types of recommended actions, you can create work requests or work orders to define follow-up work.

Note: You cannot add follow-up work to action plans on analysis templates.

In the process of creating analysis templates, you can add indicator templates, task templates, and job templates. When an analysis is created from the template or when the action plan is copied to another analysis, APM checks the asset for a matching indicator, standard task, or standard job. If a match is not available, a new indicator, task, or job is created using the template. If a match is found on the asset, it is assigned to the action plan.

Tip: To view consolidated information about an analysis’ action plans, recommended actions, indicators, corrective tasks, and projects, select the **Implementation** view in the Strategy Development Analysis window.


Note: If you create an indicator for an action plan and wish to remove it, you can delete it from APM as long as it is not used anywhere else. If it is included on another action plan, you can remove it from the current action plan but not from the system. If the indicator is used on a standard task, a confirmation dialog appears when you attempt to delete it. You can choose to remove the indicator only from the action plan or to delete it from the action plan, the standard task, and the asset. In this case, the indicator is removed from APM altogether.

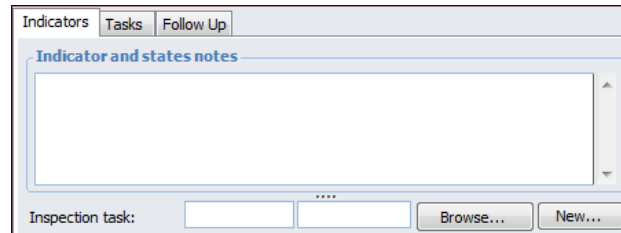
This topic explains how:

- [“To Add an Inspection Task to an Action Plan” on page 193](#)
- [“To Add Indicators to an Action Plan on an Analysis or Template” on page 197](#)
- [“To Add a Corrective Task” on page 199](#)
- [“To Add Follow-up Work to an Action Plan on an Analysis” on page 201](#)

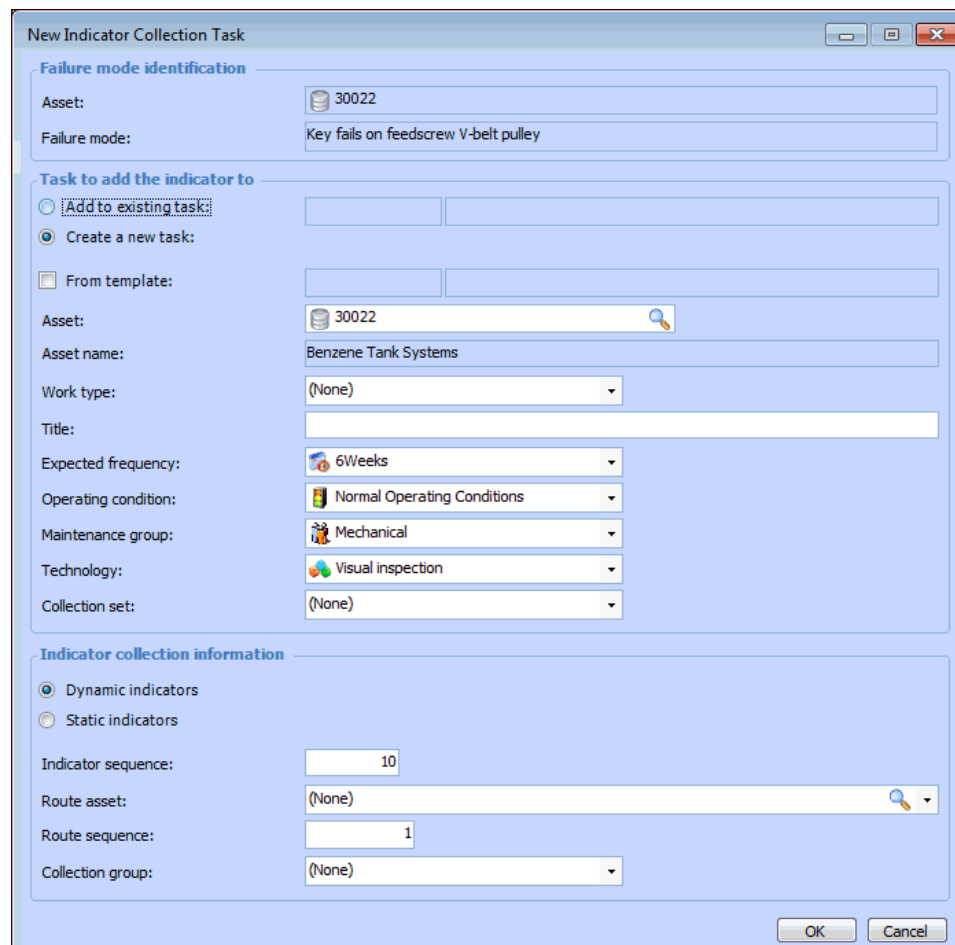
To Add an Inspection Task to an Action Plan

Note: You cannot add inspection tasks to action plans on analysis templates.

1. Open the Maintenance Action Plan window.
2. Make sure that editing  is enabled.
3. On the appropriate action plan tab, select the **Indicators** tab.



4. To add an existing standard task, click **Browse**, select the task, and click **OK**.
5. To create an inspection task, click **New**. The New Indicator Collection Task dialog appears.



New Indicator Collection Task

Failure mode identification

Asset: 30022

Failure mode: Key fails on feedscrew V-belt pulley

Task to add the indicator to

☒ Add to existing task:

☐ Create a new task:

☐ From template:

Asset: 30022

Asset name: Benzene Tank Systems

Work type: (None)

Title:

Expected frequency: 6Weeks

Operating condition: Normal Operating Conditions

Maintenance group: Mechanical

Technology: Visual inspection

Collection set: (None)

Indicator collection information

☒ Dynamic indicators

☐ Static indicators

Indicator sequence: 10

Route asset: (None)

Route sequence: 1

Collection group: (None)

OK Cancel

6. To add the indicator to an existing standard task:

- Click **Add to existing task**.
 - Enter a task number or click the browse icon (🔍) to open the Standard Task Selector dialog. Select a task and click **OK**. The standard task number and name are shown in the New Indicator Collection Task dialog.
7. To create a task, click **Create a new task**. You can create the task from a standard task template or from scratch.
 8. To create the task from a template:
 - Click **From Template**. Enter the template number or click the browse icon (🔍) to select a template. The template number and name are shown in the dialog.
 - In the **Asset** box, click the browse icon (🔍) and select the asset for the indicator. The asset number and name are displayed in the dialog.
 - Select a collection set from the **Collection set** list, if appropriate. A collection set is one of the matching criteria that can be used to select indicators for a standard task's dynamic inspection route.
 - If the analysis' Failure Mode options allow indicators to be added to an inspection task automatically, you can select the indicator collection information. Skip to Step 10.
 9. To create the task from scratch:
 - In the **Asset** box, click the browse icon (🔍) and select the asset. The asset number and name are displayed in the dialog.
 - Select a work type from the list.
 - Enter a descriptive title for the new task.
 - Select a collection set, if appropriate. Collection set is one of the matching criteria that can be used to select indicators for a standard task's dynamic inspection route.

Values for expected frequency, operating condition, maintenance group, and technology are copied from the action plan.
 10. In the **Indicator collection information** area, select whether dynamic or static indicators are added to the task:
 - Dynamic indicators are automatically added to a work order task or checklist when the list of indicators to read is generated from the standard task. The indicator is included if its properties match the selection criteria defined in the standard task's dynamic route. The properties can be any of trade, expected frequency, operating condition, maintenance group, PdM technology, and collection set.

- Static indicators are added manually to the standard task.
11. To add dynamic indicators to the task:
 - Click **Dynamic indicators**.
 - Specify the route asset for the task. A route asset is typically a system asset or large piece of equipment with one or more indicators to be read as part of an inspection task or PM inspection route. Route assets are listed on the standard task in the order in which they are visited.
 - Specify the route sequence of the asset. The sequence number indicates the order in which the asset is to be visited during inspection.
 - Select a collection group, if appropriate. The collection group is a selection criterion for the dynamic route. Collection groups typically identify a location on large assets, for example, the first floor or second floor. Because a large asset can be included more than once on the same route, the collection group is used to pinpoint the stop.
 12. To add static indicators to the task:
 - Click **Static indicators**.
 - Set the first indicator's sequence number.
 13. Click **OK**. The new standard task window appears. You can edit the task as required.

For more information, see “Setting up Standard Tasks” in Help.

To Add Indicators to an Action Plan on an Analysis or Template

1. On the appropriate action plan tab, select the **Indicators** tab.

2. To create an indicator for an analysis or an indicator template for an analysis template, do the following:
 - Click **New** at the bottom of the **Indicators** tab. The Create New Indicator dialog appears, where you can select either **From scratch** or **From template**. To create from a template, select the indicator template.
 - When you click **OK**, the Indicator or Indicator Template window appears, where you can define the indicator or template.
 - When you are finished, save the indicator or template and close the window. The indicator is listed in the table.

For more information, see “Setting up Asset Indicators” in Help.

Tip: In the Create New Indicator dialog, you can also click **Create Multiple** to add two or more indicators (not indicator templates). The Create Multiple Indicators window appears, where you can specify the number to create, the indicator name, number to add to the name, indicator type, and so on. When you click **OK**, the indicators are added to the table. You can then open them individually, and modify them as needed.

3. To attach an existing indicator or indicator template to the action plan:
 - Click **Browse** on the **Indicators** tab. The Browse Indicators dialog appears.
 - Find and select one or more indicators or templates to add to the action plan. You can select indicators for the same or a different asset.
 - If you select an indicator on the failure mode's asset, the action plan will link to the indicator. A new indicator will not be created for the action plan.

However, if you select another asset's indicator, you have the option of either copying or linking to the indicator. If you select **Copy the indicators selected**, a new indicator is created and assigned to the asset referenced on the action plan. If the failure mode is deleted in the future, the indicator is also removed from the system. If you wish to link to an existing indicator instead of copying it, click **Link to the indicators selected**.

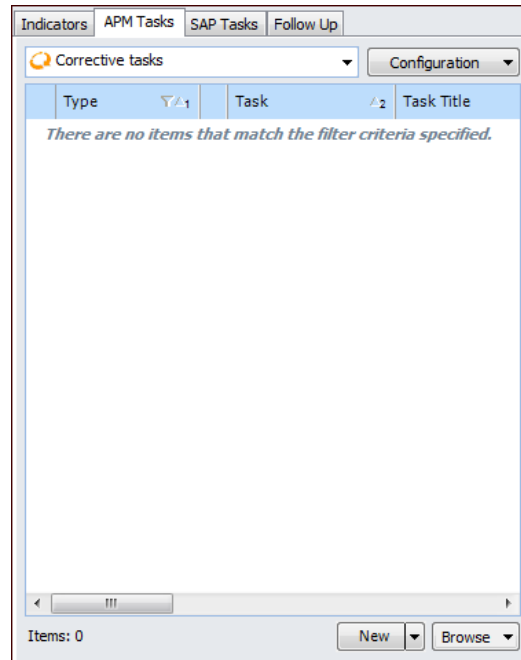
- Click **OK**.

Tip: You can change the position of an indicator in the table by selecting it and clicking **Move Up** or **Move Down**.

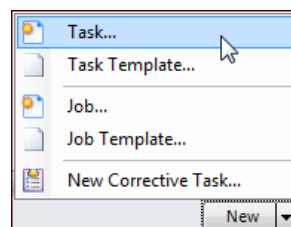
4. Add collection notes or other information that the implementer will need in the **Indicators and states notes** box.

To Add a Corrective Task

1. Tasks tabs for the available data are shown on the appropriate action plan tab. For example, if the site is set up to use both APM and SAP Plant Maintenance objects, the **APM Tasks** and **SAP Tasks** tabs are available:




2. On the **APM Tasks** tab, to add an existing standard task, standard job, job task, or task template:
 - Select an option from the **Browse** list. A selector dialog appears.
 - Find and select the standard task, job, job task, or standard task template.
 - Click **OK**. The item is added to the action plan.
3. On the **APM Tasks** tab, to create a task, job, or template:
 - Select an option from the **New** list:



Note: If you are developing an action plan for an analysis template, your options are to create a task or job template.

- The “Create” dialog appears. For example, the Create Standard Task dialog. Select the options for the object and click **OK**.
- The appropriate window appears, where you can define the task, job, or template.
- Save the object and close the window. The task, job, or template is added to the action plan.

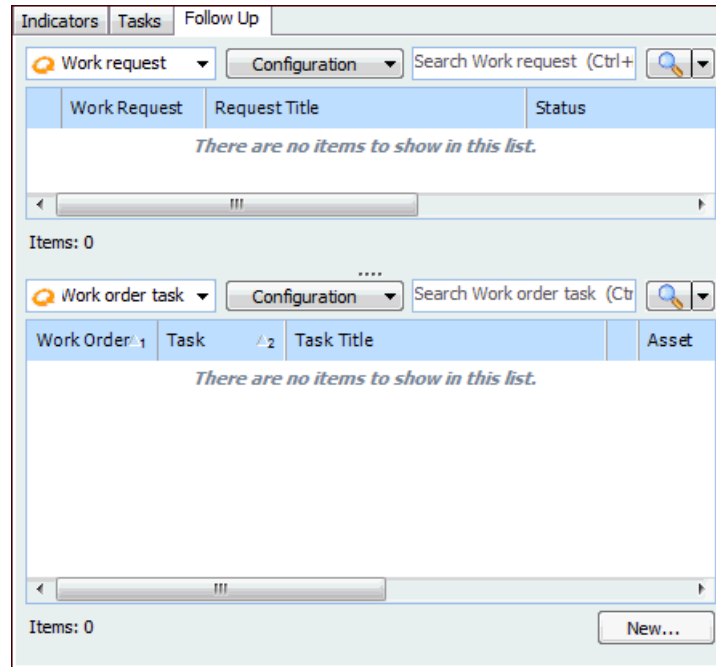
For more information, see:

- “Setting up Standard Tasks” in Help
 - “Setting up Task Templates” in Help
 - “Setting up Standard Jobs” in Help
 - “Setting up Job Templates” in Help
4. On the **SAP Tasks** tab, to add a reference to a SAP Plant Maintenance object, for example, an equipment task list:
 - Select an option from the **Browse** list. The appropriate browse dialog appears.
 - Select filtering options and click  to display the list of objects.
 - Select the object.
 - Click **OK**. The reference is added to the action plan.
 5. To add a corrective action plan task:
 - On the **APM Tasks** tab, click **New Corrective Task** in the **New** list. Or, on the **SAP Tasks** tab, click **New**. The Action Plan Task dialog appears.
 - In the **Type** list, select an object or “Other”.
 - If you selected an object type, click the browse icon to select the item to reference.
 - Enter a reference to the CMMS task, if applicable.
 - Click **Reliability program update required**. Select the update type: create, modify, or delete a reliability program object. Provide instructions in the text box.
 - Click **OK**. The task is added to the appropriate **Tasks** tab.

To Add Follow-up Work to an Action Plan on an Analysis

Note: You cannot add follow-up work to action plans on an analysis template.

1. On the appropriate action plan tab, select the **Follow Up** tab.

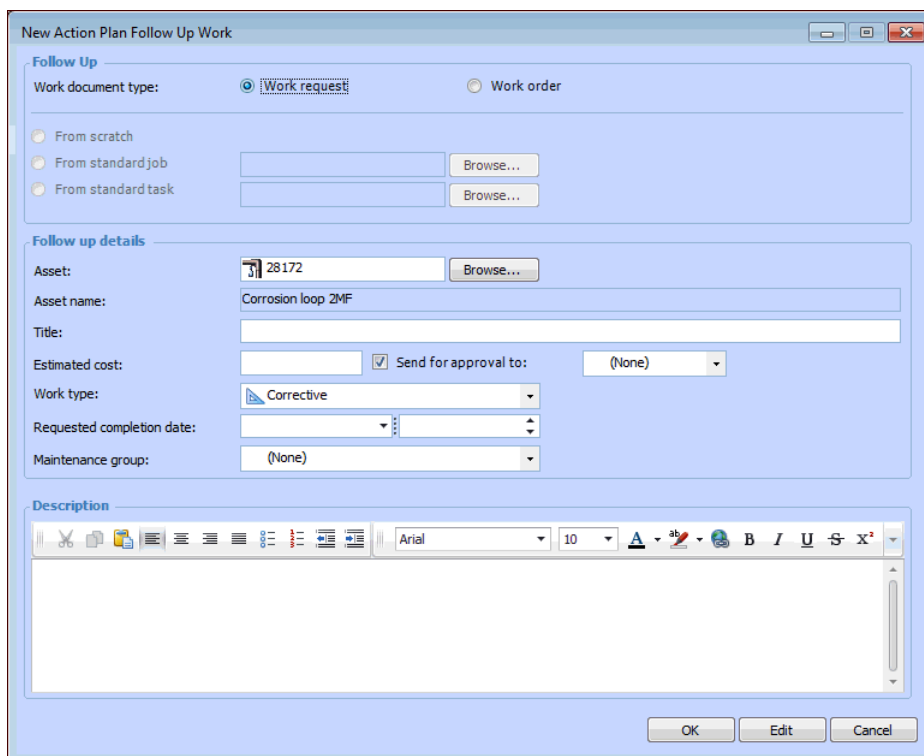


The screenshot shows a software interface with a 'Follow Up' tab selected. The interface is divided into two main sections. The top section is for 'Work request' and the bottom section is for 'Work order task'. Each section has a search bar, a configuration dropdown, and a table. Both tables are empty and display the message 'There are no items to show in this list.'

Work Request	Request Title	Status
There are no items to show in this list.		

Work Order	Task	Task Title	Asset
There are no items to show in this list.			

2. Click **New**. The New Action Plan Follow Up Work dialog appears.



New Action Plan Follow Up Work

Follow Up

Work document type: ☒ Work request ☐ Work order

☐ From scratch

☐ From standard job

☐ From standard task

Follow up details

Asset:

Asset name:

Title:

Estimated cost: ☒ Send for approval to:

Work type:

Requested completion date:

Maintenance group:

Description

3. Select the type of document to create and provide the required information.
4. When you click **OK**, the document is added to the appropriate table in the **Follow Up Work** tab. The Work Order Task or Work Request window appears, where you can define the document.

For more information, see “Creating a Work Request” in Help and “Creating Work Orders and Tasks” in Help.

Reviewing Indicator Collection Information

After you have developed the action plans for the analysis, you can generate a report that identifies which of the indicators assigned to action plans are already included on one or more standard tasks, as well as which are not being collected.

This topic explains how to generate an indicator collection report and view the information.

To Generate an Indicator Collection Report

1. Open the analysis and select the **Implementation** view.
2. Select the **Indicators** tab and then the **Collection** tab.
3. Click **Generate Report**. The information is added to the tab. Here is an example for an MTA2:

The screenshot displays the 'Indicator collection report identification' form within the Bentley software. The form includes the following fields:

- Asset:** 108
- Asset name:** Front Axle, 3500 lb spring
- Collection report profile:** Vehicle: Front Axle, 3500 lb spring - MTA
- Completed on:** June-10-14 2:53:49 PM

To the right of the form is a 'Collection Summary' pie chart. The chart shows 4 items 'Not being collected' (blue) and 1 item 'Collected on a single task' (orange).

Below the form is a table with the following data:

Indicator	Asset	Asset Name
Temperature	108	Front Axle, 3500 lb spring
Temperature	108	Front Axle, 3500 lb spring
Fireman's Switch	28561	Pipe length 1.1
Motor Amps - Manual	28561	Pipe length 1.1

The table is titled 'Indicator collection audit' and has a search bar 'Search Indicator collection audit (Ctrl+F)'. The bottom of the table shows 'Items: 4' and a 'Generate Report' button.

4. On the second **Collection** tab, you can select tabs to view indicators that are not included on a standard task, that are included on two or more tasks, and that are included on one task. The **Tasks** tab lists the standard tasks that the indicators are collected on.

Tip: Right-click in any table and click **Export to Excel** to create a printable spreadsheet of the information.


5. Select the **Details** tab to view information about the report itself, for example, the date when it was generated.
6. Select the **Mismatches** tab to view indicators that are assigned to tasks with differing values.

Adding Standard Documents to Action Plans

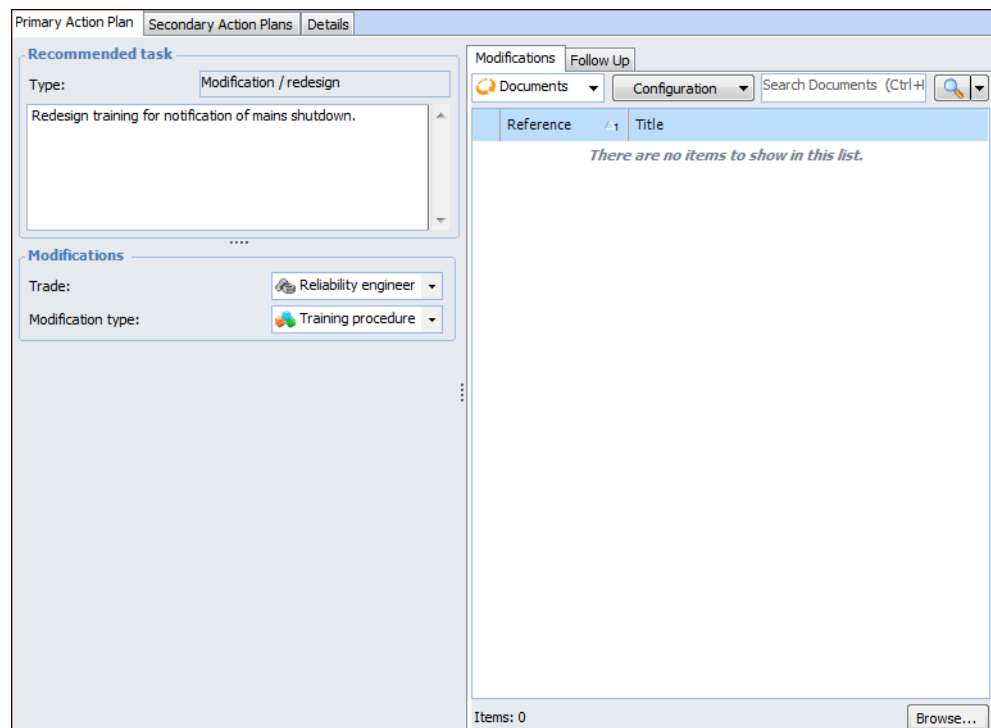
Any primary or secondary action plan that recommends modification or redesign of the asset can have one or more standard documents assigned to it. For example, if a one-time modification is to train trades people to perform a new task, you can attach a standard document that describes the training prerequisites, objectives, and evaluation methods.

Note: For information about adding documents to APM, see “Creating a Standard Document” in Help.

To Add a Standard Document to an Action Plan

1. Open the Maintenance Action Plan window.
2. Make sure that editing  is enabled.
3. Select the **Implementation** view and the appropriate action plan tab.

Note: The recommended task type must be Modification/redesign if you wish to assign a standard document to it.



The screenshot shows the Maintenance Action Plan window with the 'Recommended task' and 'Modifications' tabs. The 'Recommended task' tab is active, showing a task type of 'Modification / redesign' and a description 'Redesign training for notification of mains shutdown.' The 'Modifications' tab is also visible, showing a trade of 'Reliability engineer' and a modification type of 'Training procedure'. The 'Documents' tab is selected, showing a search bar and a list of documents. The list is currently empty, with the message 'There are no items to show in this list.' and a 'Browse...' button at the bottom right.

4. On the **Modifications** tab, click **Browse**. The Standard Document Selector dialog appears.

5. Select a document.
6. Click **OK** in the selector dialog. The document is added to the **Modifications** tab.

Recording and Reviewing Failure Mode Details

Using the **Details** tab on the Maintenance Action Plan window, you can assign a failure type and classification to the failure mode, select an action plan status, and record usage details (criticality, duty code, and severity of usage). The **Details** tab displays information such as review requests and root causes.

The **Details** tab is available in the Maintenance Action Plan window **Facilitation** and **Implementation** views for primary action plans. For secondary action plans, open the Maintenance Action Plan window and select the **Implementation** view.

This topic explains:

- [Failure Mode Information](#)
- [Usage Details](#)

Failure Mode Information

The **Details** tab displays information about the failure mode's analysis and status. For example:

The screenshot shows the 'Details' tab of the Maintenance Action Plan window. The window has a top navigation bar with tabs: General, Failure Data, Failure Pattern, Documents, Details (selected), Notes, and Symptoms. Below this, there are sub-tabs: Details (selected), Usage, Review Requests, and RCA. The main content area is divided into three sections:

- Analysis information:**
 - Analysis: 000002 - Vessel: Vessel v-3501 - MTA2
 - Analysis type: MTA2
 - Status: Analysis in progress
- Status:**
 - Facilitation and implementation: Facilitation incomplete
 - Study status: (None) [Change... button]
 - Action plan status: (None) [dropdown arrow]
- Failure mode details:**
 - Failure type: (None) [dropdown arrow]
 - Failure classification: (None) [dropdown arrow]
 - Library entry based on: (None)

The **Status** area shows the failure mode's status in regard to facilitation and implementation. If action plan statuses have been defined for your organization, you can select a status from the **Action plan status** list.

Note: Action plan status is specific to the failure mode, primary action plan, or secondary action plan to which it is assigned.

In the **Failure mode details** area, you can assign a failure type and classification to the failure mode. Failure types, along with failure classifications, allow failure modes and records to be grouped for easy identification. For example, useful failure types might be Electrical, Environmental, Mechanical, Operational, Safety, and so on. Examples of failure classifications are Lubrication, Operator Error, and Installation Defect.

If the failure mode was created as the result of an analysis request, select the **Review Requests** tab to view the request. You can double-click the request to open its Request dialog, where details such as the project number and analysis estimate are shown.

If the failure mode was created as a result of a root cause analysis, the **RCA** tab lists the root cause. You can double-click the root cause to open its Properties dialog, where the cause statement, solution, and messages are displayed.

For related information, see:


- [“Working with Action Plan Task Statuses” on page 282](#)
- [“Creating Analysis Requests for Failure Modes” on page 118](#)
- [“Overview of RCA” in Help](#)

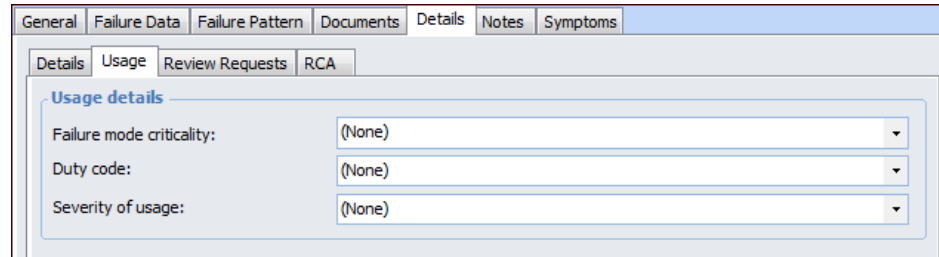
Usage Details

If your organization requires additional usage information for failure modes, you can review or assign values on the **Usage** tab. These details are:

- **Failure mode criticality** – Criticality (or risk) is determined by the combination of the probability of failure and the severity of failure consequences. Criticality is either calculated during a risk analysis or manually assigned.
- **Duty code** – A duty code identifies a duty cycle, which is the time that an asset spends in an active state as a fraction of the total time under consideration. This could mean that the unit runs 50% during its production period of six hours or that it runs every hour for 20 minutes during a 24 hour day (33%), and so on.
- **Severity of usage** – “Severity of usage” describes the environment in which an asset is operating. This could mean an environment that is cold, hot, dirty, damp, and so on.

To Select Usage Details for a Failure Mode

1. In the Maintenance Action Plan window, select the **Details** tab and the **Usage** tab.
2. Make sure that editing  is enabled.



The screenshot shows the Maintenance Action Plan window with the 'Details' tab selected. Within the 'Details' tab, the 'Usage' sub-tab is active. The 'Usage details' section contains three dropdown menus, all currently set to '(None)':

- Failure mode criticality: (None)
- Duty code: (None)
- Severity of usage: (None)

3. Choose a value from the **Failure mode criticality** list, if it is available. If criticality has already been determined by risk analysis, the value in the **Failure mode criticality** box cannot be changed.
4. Select a duty code from the list.
5. Select a severity of usage value from the list.


Adding Symptoms to a Failure Mode

A symptom is a keyword or phrase that summarizes the evidence that an operator, engineer, or technician would see when the failure occurs or is about to occur. For example, “trip-alarm sounds” could be defined as a symptom. Symptoms are assigned to MTA2, RCM2, and RBI failure modes to help maintenance personnel track asset faults to the failure modes that could cause them. Symptoms are listed in the Fault Diagnosis Guide, a report you can print for the site, an asset, or a strategy development analysis.

A Fault Diagnosis Guide lists symptoms and the failure modes that reference them. You can print a Fault Diagnosis Guide report for the site, an asset, or a strategy development analysis (MTA2, RCM2, RBI). The **Analysis Summary** view in every Strategy Development Analysis window contains the **Fault Guide** tab, which lists symptoms, failure modes, and assets.

For information about printing the Fault Diagnosis Guide, see [“Printing MTA2 Reports” on page 296](#).

To Add Symptoms to a Failure Mode

1. In the Maintenance Action Plan window, select the **Facilitation** view and the **Symptoms** tab.
2. Make sure that editing  is enabled.
3. Click **Browse**. The Browse Symptoms dialog appears.
4. Select one or more symptoms and click **OK**. The symptoms are added to the tab.



Chapter 3 **Copying Failure Modes**

The copy function for failure modes includes smart asset mapping, which uses information about the source assets to identify matching assets in the target asset structure. Using the Copy Failure Modes wizard, you can select source and target asset structures, the failure modes to copy, and the criteria for identifying target assets. You can then confirm or change the matches that the system suggests. When you click **Process**, the wizard performs the copy and reports the results.

The topics in this section provide an overview of mapping criteria and processes, instructions for using the Copy Failure Modes wizard, and information about re-opening copy requests.

Contents

Overview of the Copy Failure Modes Wizard	212
Setting Mapping Options for a Failure Mode Copy	221
Browsing for Failure Modes to Add to an MTA2 or Template	231
Copying Failure Modes to an Analysis or Template	244
Copying an Asset's Strategy Development Program	258
Revisiting Failure Mode Copy Requests	270

Overview of the Copy Failure Modes Wizard

The copy function for failure modes includes smart asset mapping, which uses information about the source assets to identify matching assets in the target asset structure. Using the Copy Failure Modes wizard, you can select source and target asset structures, the failure modes to copy, and the criteria for identifying target assets. You can then confirm or change the matches that the system suggests. When you click **Process**, the wizard performs the copy and reports the results.

The Copy Failure Modes wizard is especially useful when you have analyzed one branch of the asset hierarchy (for example, the many assets associated with haul truck #1) and then wish to copy the failure modes to a similar set of assets (haul truck #2). Failure modes can also be copied from one site to another, as long as the source analysis' settings permit it to be used at the target site.

When a failure mode is copied, its primary and secondary action plans are included (if the analysis' implementation method includes action plans). During implementation, use the wizard to efficiently update failure modes by copying indicators, standard tasks, jobs, and procedures into the target analysis.

Tip: You can set up smart mapping processing and mapping options for the site. These settings provide defaults in the Copy Failure Modes wizard, which you can change as required for individual copy requests.

This topic explains the following aspects of failure mode copy requests:

- “Types of Failure Mode Copies” on page 212
- “Steps in the Wizard” on page 213
- “Smart Mapping” on page 216
- “The Failure Mode Copy Process” on page 219

Types of Failure Mode Copies

The Copy Failure Mode wizard is available for all types of failure mode copies. You can:

- Browse for failure modes to copy into the analysis that you are working on
- Select an analysis or template and copy failure modes to a new or existing analysis
- Create an analysis from an existing analysis' failure modes

- Copy an asset's strategy development program, including failure modes

Steps in the Wizard

Using the Copy Failure Modes wizard can involve as many as seven steps, depending on the type of copy you are doing:

1. Select the source analysis or template
2. Identify the target asset structure and mapping options
3. Identify the function and functional failure (RCM2 analysis only)
4. Review the mappings and change them as required
5. Review failure mode mappings if you are copying to existing failure modes
6. Confirm the selections and process the copy
7. Review the results (if you have not deferred processing)

The steps appear at the bottom of each page. The current step is shown in blue. Any step that is not required for your copy is disabled.

Step 1 - Select Source >	Step 2 - Identify Target >	Step 3 - Identify Function	Step 4 - Review Mappings >
Step 5 - Review FM Mappings >	Step 6 - Confirm Selections >		Step 7 - Review Results

Selecting the Source

If you are browsing for failure modes to add to the analysis that you are working on, you must select the source analysis or template.

Note: There are a few restrictions on copying failure modes between different varieties of analysis. For example, you cannot copy failure modes from an MTA2 analysis or template to an RCM2 analysis or template. You can only copy RBI failure modes to a new or existing RBI analysis.

If you are copying failure modes from a source to a target, the source analysis or template, asset or asset type, and failure modes are displayed on the Select Source step. You can review the failure modes and de-selected any that you do not wish to copy.

Smart asset mapping uses the source and target asset structures that you specify to search for matches between assets, failure modes, and so on. By default, the starting point for a structure is the primary asset on the analysis. You might find it useful to return to the Identify Target step

and change the starting points of the asset structures to yield more matches after you have tested the results of the matching process. The closer to parallel that the starting assets are in their respective hierarchies, the more likely it is that usable matches will be found.

Identifying the Target and Setting Mapping Options

In the Identify Target step, you can select the following information, depending on the type of copy you are working on:

- Analysis option – you can have the failure modes copied to a new or existing analysis or template
- Site – you can copy failure modes to another site, as long as the source analysis can be used at other sites
- Analysis – if you are copying to an existing analysis, identify the target
- Asset option – if you are creating a new analysis, specify whether to use new or existing assets. If you choose to create assets, select the parent asset for them
- Target – specify the assets for the target structure

You can also select analysis criteria for matching assets, including:

- Use matches from previous copies
- Restrict matches to assets at the same relative level of the hierarchy
- Match on an asset attribute
- Match on an asset's references-one relationship

For example, assets could be matched based on the source asset's hierarchy code (asset attribute), asset type (reference-one relationship), and function group (reference-one relationship).

To help find matching assets, failure modes, and so on, you can use Trigram searching, a powerful method of searching for text when the exact syntax or spelling of the target object is not known. For example, use the Trigram option to match assets with slightly different titles. It finds objects that match the maximum number of three-character strings in the entered search terms; that is, it finds near matches. You can specify a threshold as a cutoff point, after which a result is no longer considered a match.

Note: If you are running APM with an Oracle database that has case-sensitivity turned on, you might get unexpected results when the matching process compares properties identified in mapping criteria. For example, mapping assets according to their Title attributes might not result in “PUMP” being matched with

“pump”. For information about setting up case-insensitive searches, see “Setting Up an Oracle Database” in the *APM Installation Guide*.

For more information, see [“Setting Mapping Options for a Failure Mode Copy” on page 221](#).

Reviewing Mappings

Once you have selected the source objects, target asset structure, and matching criteria, the system mines the source failure modes to create a list of assets involved in the copy, as well as the trades, employees, and maintenance groups. The system then attempts to map each of the source objects to a corresponding target object.

Depending on the consistency of the data in your source and target structures and the mapping criteria used, this step might simply require a visual confirmation of the system’s suggestions. In cases where the structures are not consistent or the mapping criteria provide too many or too few matches, a more thorough review is required.

For each source asset, you have the option of:

- Accepting the target asset suggested by the system
- Identifying an alternate target asset, which can include another asset in the target structure, the primary target asset, or the source asset
- Requesting that a new asset be created in the target structure. The failure mode information is copied to the new asset
- Excluding the asset from the copy request. The source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it

Confirming Selections and Selecting the Processing Options

Before the copy is started, the Confirm Selections step is displayed. This page provides you with an opportunity to review a summary of the information from the preceding pages and confirm that the values are correct. You are also able to adjust the options at this point by returning to previous pages.

You can also change the default processing options on this page. For example, you can have APM open the target analyses when the copy is finished, specify that the Review Results step not appear, or delay processing.

If **Process later** is selected, when you click **Process**, the copy request is saved and closed. You can finish it manually later or set up a scheduled action to process all pending copy requests for the site or enterprise. As a guideline, use deferred processing when you do not want to tie up your

computer while the copy is performed and you do not want to start working on the new analyses right away. Deferred processing is handy when you have a number of copies to perform (for example, an asset's Strategy Development program is being pushed out to a number of similar pieces of equipment). If you want to start analyzing the new action plans right away, you are best to process the copy now.

Reviewing Results

When the copy is completed (assuming that **Process later** is not selected), the Review Results step presents a list of the failure modes that were created or updated. You can open the Details window to view information about the copy request.

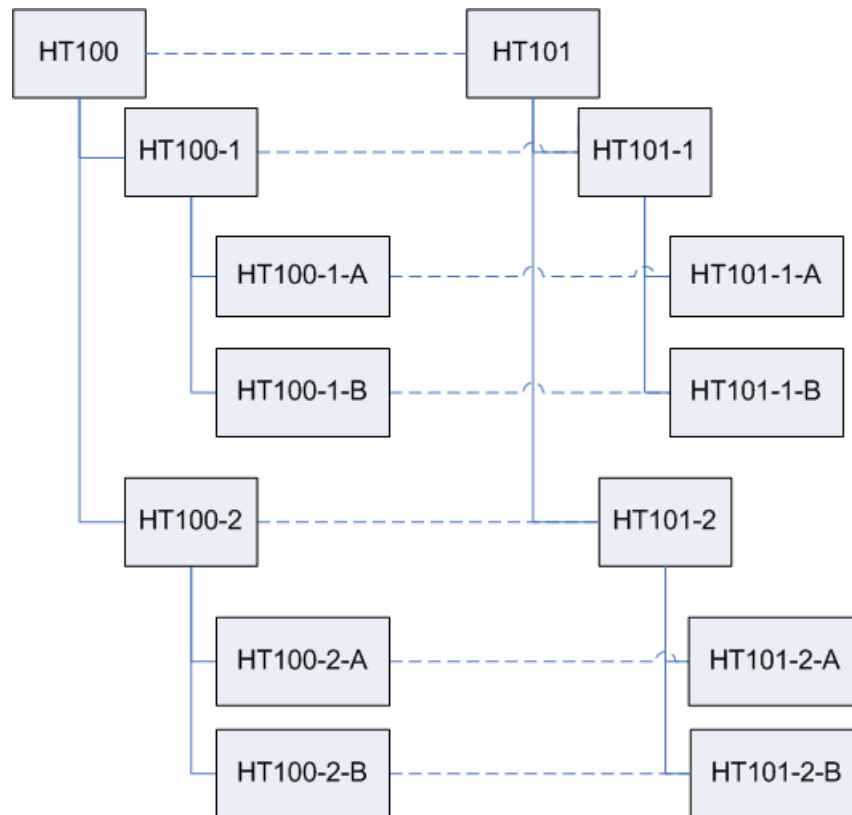
Copying Failure Modes Between Sites

Failure modes can be copied from one site to another, as long as the source analysis' settings permit it to be used at the target site. These settings are located in the analysis' **Properties** view, **Analysis Options** tab.

When you copy failure modes to a different site, their standard documents are copied only if they are valid at the target site. Any employees, maintenance groups, or trades included on the failure modes are mapped to matching objects in the target site, as long as they are valid for use at the target. If they are not valid, the mapping is set to "To Be Determined", and you can specify that the object be excluded or mapped to a different target.

Smart Mapping

The term "smart asset mapping" is used to identify the process where the assets in one branch of the hierarchy are matched to the corresponding assets in another branch of the hierarchy. For example, the assets of one haul truck (HT100) are matched to those of another haul truck (HT101).



Matching Employees, Trades, and Maintenance Groups

You can also select matching criteria for employees, trades (and other resources), and maintenance groups. Mapping criteria for these objects are used most often when failure modes are copied between sites, although they can also be useful for copying within large sites. The system determines if there are any site-specific employees, trades, or maintenance groups that are not valid at the target site. If invalid references exist, they can be mapped to the target site's values as follows:

- Using the results of previous copies. For example, if the trade “mechanic” at Site A was previously mapped to “mechanics” at Site B, the same mapping is suggested.
- If the match cannot be made based on a previous copy, the system can check for a trade in the target site with the same values as the source for the matching criteria.
- If no match is made, you can identify the trade to use.

The employees, trades, and maintenance groups on the source objects are mapped to the target objects based on the identified matches.

Match to Existing Failure Modes

A failure mode's information can be copied into an existing failure mode. A new failure mode is not created. Instead, the information from the source is copied to the target, replacing the values contained in it.

The “match to existing failure modes” option was developed to accommodate the separation of Facilitator and Implementer roles. This allows the Facilitator to create a complete set of failure modes and action plans for the asset being analyzed. The Implementer is able to implement one of the action plans and copy the implementation to other failure modes or action plans.

When failure modes are being copied to existing failure modes, the Review Failure Mode Mappings page is available in the wizard. The Failure Modes page displays the failure modes and their mappings. The mappings are completed in the same manner as asset mappings.

All of the source information is copied to the target failure mode with the exception of:

- Failure mode reference number – the target action plan retains its existing FM reference
- Asset – the target failure mode remains with its existing asset
- MTA2 or RCM2 analysis – the target failure mode remains on the same analysis; it is not moved to the source failure mode's analysis
- Functional Failure and Function – in the case of RCM2 analyses, the target failure mode remains linked to the same functional failure and function; it is not moved to the source failure mode's analysis
- RCM2 reference – the target failure mode retains its existing RCM2 reference number (RCM2 analyses only)

In addition, the source failure mode's indicators, standard task, standard job, trades, and maintenance group are mapped to the target failure mode's assets, trades, and maintenance groups using the same logic as previously described.

Asset Mapping Process

When the matching process starts, the system uses the mapping criteria in this order, assuming that all of the criteria are being used:

1. Previous matches:
 - If a match exists, the previous source asset is suggested for the current copy.
 - If multiple matches are found, the most recent copy is suggested.
 - If no match is found, other criteria are considered.

2. Level of the hierarchy:
 - If a match exists, it is suggested for the current copy.
 - If multiple matches are found, the closest match is suggested.
 - If no match is found, other criteria are considered.
3. Property matching:
 - If an exact match is found, it is suggested.
 - If an exact match is not found and Trigram matching is used, the closest match is suggested.
 - If a single match is found, it is suggested for the current copy.
 - If multiple matches are found, the first matching asset is suggested.
 - If no match is found, the result is displayed in the Review mappings page of the wizard. No copy will be made to the asset unless the asset is mapped manually.

The Failure Mode Copy Process

The copy request is processed when you click **Process** (and the **Process later** option is not selected). Processing consists of the following steps:

1. Assets are created as copies of their source assets for each asset mapping with the setting **Create new**.

When a complete target asset structure is being created, the complete source asset structure is replicated to the new asset. This can include some assets that are not referenced on the copied failure modes. This approach ensures that the new asset structure is complete and the structure is the same as the source asset.
2. Resources are created for the resource mappings with the setting **Create new**. The resource is created as a copy of the source.
3. Maintenance groups are created for the mappings with the setting **Create new**. The maintenance group is created as a copy of the source.
4. Analyses are created for the failure modes that are created.
5. In the case of failure modes on safety analyses (SIF and HAZOP), the safety provisions and HAZOP checklist items are copied.
6. Functions and functional failures required for the new action plans are created (RCM2 only).

7. Failure modes are copied. This logic maps the failure mode's indicators, standard tasks, and standard jobs to the target asset. The target asset's existing objects are used, if available. Otherwise, a new instance is defined for the target asset. For example, if the failure mode refers to the "pump pressure" indicator and a "pump pressure" indicator already exists on the target asset, the existing indicator is used. Otherwise, an indicator is created.
8. Status is updated on the copy request. The status changes to "Processed".

Setting Mapping Options for a Failure Mode Copy

When a failure mode copy is requested, the first thing the system does is copy the site's smart mapping options to the Copy Failure Modes wizard. If the criteria are not changed, the site-level criteria are used.

If the site's mapping settings are not appropriate for the current copy, you can modify them. Perhaps the asset structures involved use different properties than your normal conventions. Using the site-level mapping criteria would result in the system suggesting a number of incorrect mappings. By modifying the criteria, you can ensure that the quality of the system's suggestions are higher, requiring fewer manual changes.

The options are defined in the same manner as the site-level smart mapping options. In addition to defining the criteria for the current copy, you have the option of replacing the site options with the values defined for this copy request. This can be handy if the site options have not been defined or require updating. Define the criteria you want to use and then click **Site Values** and **Save**.

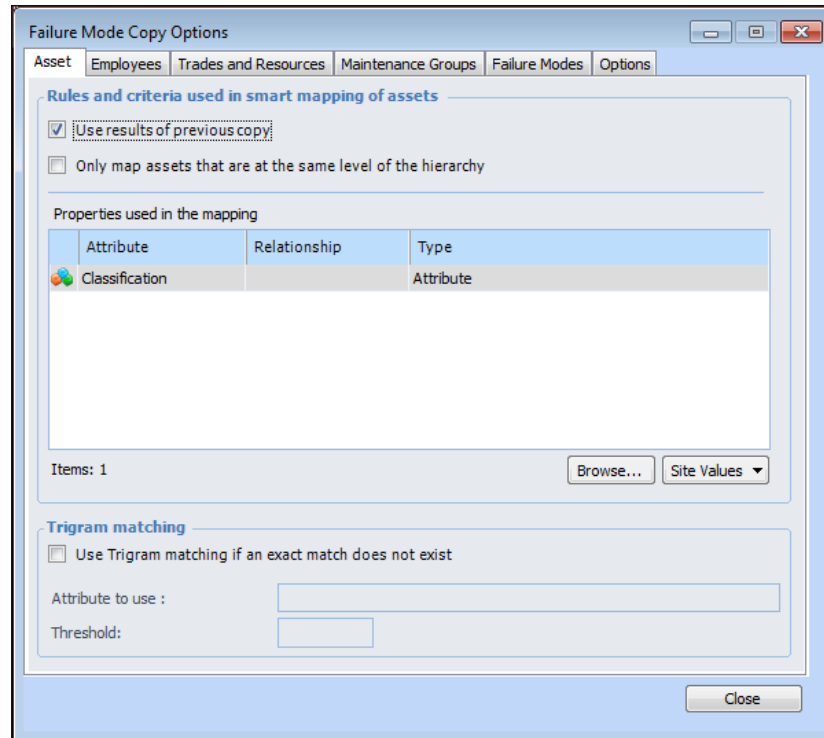
Tip: If you wish to return to the site-level settings, click **Site Values** and then **Reset**. This option is used when you have made a number of changes to the criteria, are unhappy with the resulting suggested mappings, and want to start over.

This topic explains how to use the mapping options in the Copy Failure Modes wizard to ensure that objects are mapped accurately. The following sections explain the general procedure for changing the settings. These settings are then explained in detail:

- “To Set Mapping Options” on page 222
- “Use Results of Previous Copy” on page 222
- “Only Map Assets at the Same Level of the Hierarchy” on page 224
- “Adding Properties to Use in Smart Mapping” on page 224
- “Using Trigram Matching” on page 225
- “Selecting Other Options” on page 227

To Set Mapping Options

1. In the Copy Failure Modes wizard, Identify Target step, click **More Options**. The Failure Mode Copy Options dialog appears.

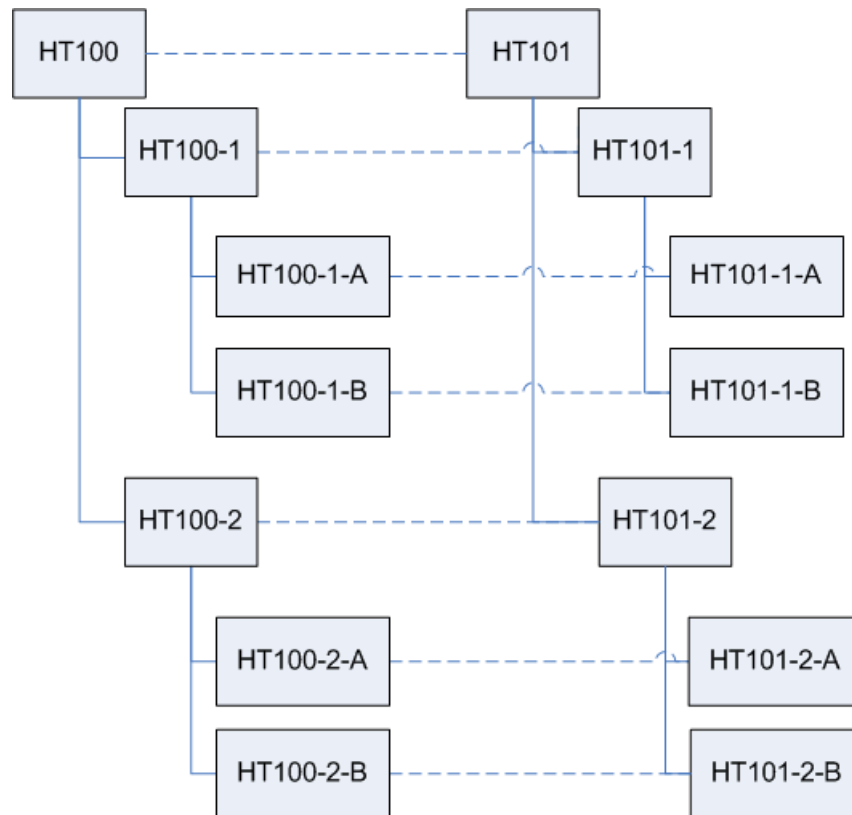


2. Select mapping defaults on the **Asset**, **Employees**, **Trades and Resources**, **Maintenance Groups**, and **Failure Modes** tabs. The following sections explain the options.
3. When you are finished, click **Close**.

Use Results of Previous Copy

When a failure mode copy is performed, the asset mappings are saved by the system. When **Use results of previous copy** is selected, the next time a copy is performed for the same asset structures, the system retrieves the saved asset combinations and reuses them. If more than one match is found, the most recent of the previous mappings is used.

The following example shows similar source and target asset structures for haul trucks #1 and #2. The dotted lines show the mappings.



The following mappings are saved:

Source	Target
HT100	HT101
HT100-1	HT101-1
HT100-1-A	HT101-1-A
HT100-1-B	HT101-1-B
HT100-2	HT101-2
HT100-2-A	HT101-2-A
HT100-2-B	HT101-2-B

Any assets in the structures that were not included in the previous copy are mapped using the remaining criteria. If the option is not selected, previous mappings are disregarded and the suggested mappings are based on the other settings only.

Only Map Assets at the Same Level of the Hierarchy

When this option is selected on the **Asset** tab, APM limits the suggested mappings to assets that are at the same relative level in their hierarchy structure as the source asset. The mapping starts with the starting asset in the source asset structure and the starting asset in the target asset structure. The first-level assets are mapped, then the second-level descendants, and so on. The mappings can also involve ancestors of the starting assets. As with descendants, first-level source ancestors are mapped to first-level target ancestors, and so on up the hierarchy.

Like all of the mapping criteria, it is wise to combine “level in the hierarchy” with one or more other criteria to get reasonable results. If used on its own, this criterion can result in questionable suggestions that require manual adjustments.

If this setting is not selected, the asset hierarchy is not considered in the mappings. Assets from different levels and sections of the hierarchies can be mapped.

Adding Properties to Use in Smart Mapping

You can select from several class attributes and references-one relationships to use as criteria for smart mapping. For example, if you select the Title attribute for the Asset class, exact matches between the source asset’s Title and the Titles of assets in the target hierarchy structure will be suggested as matches. As another example, assets could be matched based on the source asset’s hierarchy code (asset attribute), asset type (reference-one relationship), and function group (reference-one relationship)

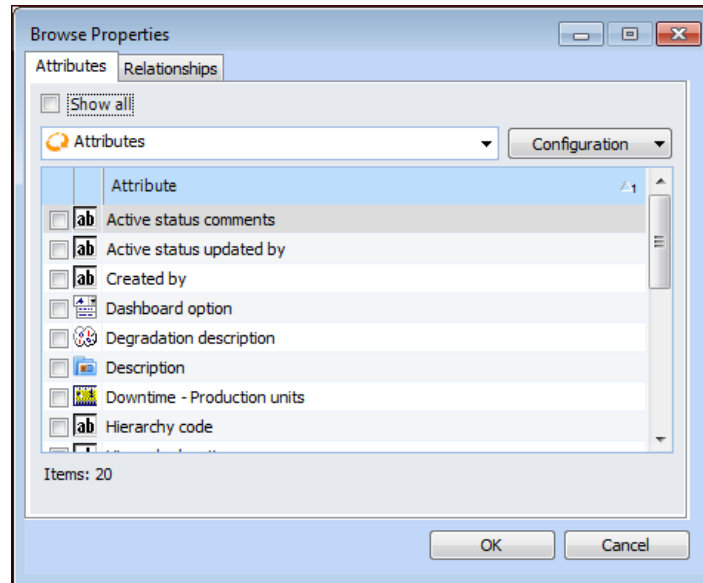
In the case of references-one relationships, the target asset must reference the same instance as the source asset. For example, if Asset type is being used, the source and target asset must reference the same asset type.

You can specify properties for assets, employees, trades and other resources, maintenance groups, and failure modes. Some objects have attributes selected in the wizard by the system, and you cannot remove them. For example, asset Classification is always a criteria in asset mapping to prevent problems with components and locations. Similarly, Unit of Measure and Resource type are default attributes for resources. Trades must be mapped to trades, services to services, and so on. Resources can only be mapped to resources with the same unit of measure.

For background information about class attributes and relationships, see “Object Model Overview” in Help.

To Add Properties to Use in Smart Mapping

1. Click **Browse**. The Browse Properties dialog appears. Here is an example for the Asset class.



The list on each tab contains properties for the class that are best suited for smart mapping.

2. To view all of the attributes that are available for use in smart mapping, select **Show all**.
3. Select the properties you wish to use.
4. Select the **Relationships** tab and make any selections you require.
5. When you are finished, click **OK**. The Properties table now displays the attributes and relationships you selected.

Tip: To remove a property, right-click it in the Properties table and click **Delete**. Click **Yes** in the confirmation message that appears.

Using Trigram Matching

Select **Use Trigram matching** if the string attributes that you selected for smart mapping might not match the target values exactly. Trigram searching is useful for identifying the closest match when the exact syntax or spelling of the target object is not precisely known.

To Use Trigram Matching

1. Click **Use Trigram matching if an exact match does not exist**.
2. Select one of the string attributes that you selected for smart mapping (listed in the table). For example, if you select the Title attribute, the Trigram process searches the candidates for the object whose Title most closely matches the source object's Title.
3. Enter a value in the **Threshold** box if you want to specify a cut-off point for Trigram matching. For example, if the threshold is 0.5, any object that returns a score lower than 0.5 will not be presented as a match.

Reviewing the Results of Trigram Matching

You can see the results of Trigram matching when you are reviewing suggested mappings in the Copy Failure Modes wizard. The **Asset mappings** table includes the following columns. You can also double-click a mapping to view its properties.

- **Suggested Origin** displays the method used for matching. The possible values are:
 - Previous match
 - Suggested
 - Default
 - Manual
 - Other
- **Suggested Match Quality** indicates if exact or partial (Trigram) matching was used. Possible values are:
 - No match suggested
 - Complete match
 - Partial match
- **Closeness** is the score obtained in the Trigram matching process. A closeness value of 1.0 is an exact match.
- **Single Or Multiple Candidates** indicates whether multiple candidates were found. Possible values are:
 - No matches found
 - Not applicable
 - Single candidate
 - Multiple candidates

The following example shows that Trigram matching was used (the suggested match quality is “Partial match”), one partial match was found (single candidate), and a score of 0.545 was obtained. An exact match has a closeness score of 1.0.

Mappings			
Assets Employees Maintenance Groups Trades Other Resources			
Asset mappings		Configuration	Search
Suggestion Origin	Suggested Match Quality	Closeness	Single Or Multiple...
Suggested	Partial match	0.5454546	Single candidate
Suggested	Complete match		No matches found

Selecting Other Options

Other smart mapping options that you can modify on the Copy Failure Modes wizard include processing options, target defaults, and mapping defaults. These determine what selections appear in other pages of the wizard, including the default suggestions presented when an object cannot be matched to a target.

To Select Other Options

1. In the Options dialog, select the **Options** tab.

The screenshot shows the 'Failure Mode Copy Options' dialog box with the 'Options' tab selected. The dialog is divided into three main sections: Processing options, Target defaults, and Mapping defaults.

Processing options:

- ☐ Process later
- ☒ Open target analyses
- ☒ Review results
- ☐ Do not use the mappings with future copies

Target defaults:

Failure modes: ☒ Create new ☐ Copy to existing

Mapping defaults:

- Assets: To be determined
- Trades and other resources: To be determined
- Maintenance groups: To be determined
- Employee: To be determined
- Failure modes: To be determined

A 'Close' button is located at the bottom right of the dialog.

2. Review and change the processing options:

Setting Name	Description
Process Later	If this option is selected at the site level, failure mode copy requests are set to process later by default. The copy request is saved with the status “Process pending”. The user can later open the request to resume defining it or create a scheduled action (Process Failure Mode Copies) to perform the copies for all pending requests.
Open target analyses	Target analyses are opened after the copy request is processed.
Review results	The Results page is displayed after processing (if processing has not been deferred).
Do not use the mappings with future copies	Select this option when the mappings are to be used for a single occasion. This option prevents them from being used in subsequent copy requests that specify “Use the results of previous matches”.

3. Select the default mapping option for failure modes. The options are:
 - **Create new** – a copy of the object is created when the copy request is processed
 - **Copy to existing** – the source failure modes’ properties are copied to the target failure modes
4. The mapping defaults determine which options are suggested by default when a matching target object cannot be found. The options are:

Setting Name	Description
Assets	<p>Select the default mapping option to be suggested if APM cannot identify a matching target. The options are:</p> <ul style="list-style-type: none">• Exclude – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it• Map to primary target asset – the source asset is mapped to the target asset selected as the starting point for the structure• New – a copy of the source asset is created when the copy request is processed. The appropriate indicators, standard tasks, and standard jobs are created on the new asset• Same – the source asset is used as the target. The source object's existing objects are referenced on the target failure modes. For example, the indicators identified on the source are also referenced on the new failure mode.• To be determined – the user determines the mapping method in the wizard
Trades and other resources	<p>Select the default mapping option to be suggested if APM cannot identify a matching target. Possible options are:</p> <ul style="list-style-type: none">• New – a copy of the source objects is created when the copy request is processed• Same – the source object is used as the target• To be determined – the user determines the mapping method in the wizard

Maintenance groups

Select the default mapping option to be suggested if APM cannot identify a matching maintenance group. Possible options are:

- **Blank** – no mapping is suggested if a match is not found. The object can be mapped manually.
- **New** – a copy of the source objects is created when the copy request is processed
- **Same** – the source object is used as the target
- **To be determined** – the user determines the mapping method in the wizard

Employees

Select the default mapping option to be suggested if APM cannot identify a matching target. Possible options are:

- **Blank** – no mapping is suggested if a match is not found. The object can be mapped manually.
- **Same** – the source object is used as the target
- **To be determined** – the user determines the mapping method in the wizard

Failure modes

Select the default mapping option to be suggested if APM cannot identify a matching target. Possible options are:

- **New** – a copy of the source objects is created when the copy request is processed
- **To be determined** – the user determines the mapping method in the wizard

Note: If an option described above does not appear in the corresponding list, permission for it has been denied in the site level settings. For example, it might not be appropriate to create employees when failure modes are copied.

5. When you are finished setting mapping options, click **Close**.

Browsing for Failure Modes to Add to an MTA2 or Template

This topic explains how to copy failure modes into the analysis or template that you are working on.

Using the Copy Failure Modes wizard can involve as many as seven steps, depending on the type of copy you are doing:

1. Select the source analysis or template
2. Identify the target asset structure and mapping options
3. Identify the function and functional failure (RCM2 analysis only)
4. Review the mappings and change them as required
5. Review failure mode mappings if you are copying to existing failure modes
6. Confirm the selections and process the copy
7. Review the results (if you have not deferred processing)

The steps appear at the bottom of each page. The current step is shown in blue. Any step that is not required for your copy is disabled.

Note: When a failure mode is copied, its status changes to Facilitation Incomplete in the target analysis.

Note: If you copy a failure mode from a site that uses a different currency, any monetary amounts defined on the action plan are converted to the asset's site currency. If an exchange rate is not available, the amount is converted at par (for example, one U.S. dollar is equivalent to one Canadian dollar).

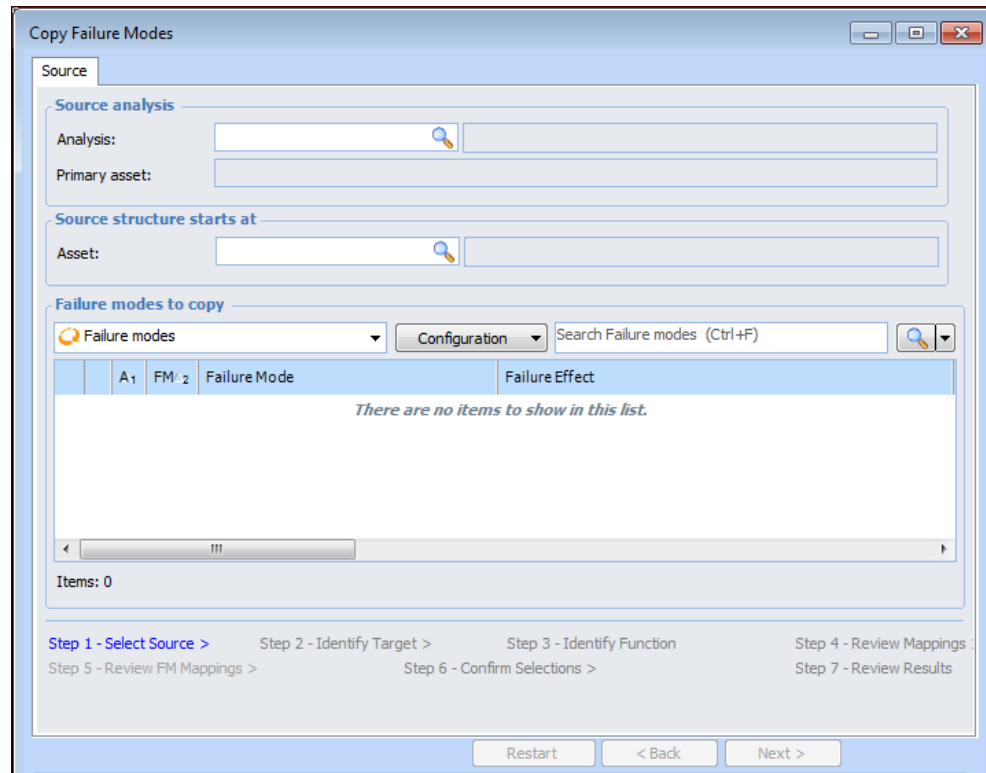
There are differences in the Copy Failure Modes wizard if you are copying from or to a template. The illustrations in the procedure show an analysis-to-analysis copy. Any differences in functionality for templates are explained where they occur.


To Browse for Failure Modes

1. Open the analysis or template into which you wish to copy the failure modes.
2. Click the **Tools** menu, **Failure Modes**, and then **Browse**.

Tip: You can also open the **Facilitation** view, **Failure Modes** tab, and then click the **New** list and **Browse**.

The Copy Failure Modes wizard appears showing the Select Source step.



3. Click the browse icon () in the **Analysis** box to select the source analysis or template. The Strategy Development Analysis Selector dialog appears, displaying analyses appropriate for the target. Select an option from the configuration list to view a specific type of analysis.
4. Select an analysis or template and click **OK**. The **Failure modes to copy** table displays the source's failure modes. If the source is an analysis, the table also contains any failure modes assigned to child assets in the analysis. The primary asset is displayed as the start of the source asset structure. If the source is a template, the asset type is displayed.
5. Select the failure modes that you wish to copy.

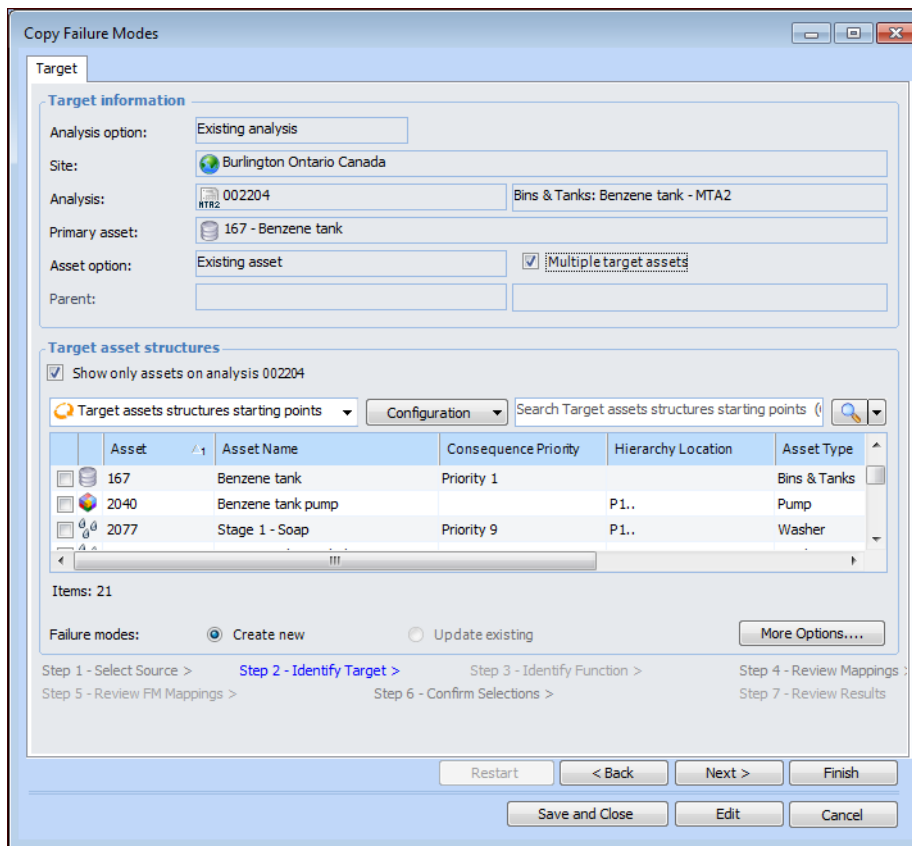
Tip: For quick copies (when you do not need to adjust the mapping options), click **Finish** when you have selected the source and the failure modes to copy. The wizard performs the matching process and goes to the Confirm Selections step. Skip to step 16.

6. Click **Next**. The Identify Target step appears. This page differs depending on the characteristics of the source and target analyses.
 - If the target is an analysis, the matching process starts with the primary assets on the source and target. For example:

The screenshot shows the 'Copy Failure Mode' dialog box with the 'Target' tab selected. The 'Target information' section contains the following fields: Analysis option (Existing analysis), Site (Burlington Ontario Canada), Analysis (001878), Primary asset (167 - Benzene tank), Asset option (Existing asset), and Parent. The 'Source structure starts at' section shows Asset (0-104-03) and Benzeyne Tank - Left Lane. The 'Target structure starts at' section shows Asset (167) and Benzene tank. The 'Options' section has Asset mapping set to 'To be determined' and Failure modes with 'Create new' selected. A 'More Options...' button is located at the bottom right of the 'Options' section. The bottom of the dialog features a progress bar with steps 1 through 7, where 'Step 2 - Identify Target' is the current step. Navigation buttons include 'Restart', '< Back', 'Next >', 'Finish', 'Save and Close', 'Edit', and 'Cancel'.

In some cases, you might wish to change the source asset structure, target asset structure, or both. When the starting assets occupy parallel positions in their respective hierarchies, the mapping process is more likely to result in accurate matches.

- You can select **Multiple target assets** to display the analysis assets in the **Target asset structures** table. For example:



Copy Failure Modes

Target

Target information

Analysis option: Existing analysis

Site: Burlington Ontario Canada

Analysis: 002204 Bins & Tanks: Benzene tank - MTA2

Primary asset: 167 - Benzene tank

Asset option: Existing asset ☒ Multiple target assets

Parent:

Target asset structures

☒ Show only assets on analysis 002204

Target assets structures starting points Configuration Search Target assets structures starting points

Asset	Asset Name	Consequence Priority	Hierarchy Location	Asset Type
167	Benzene tank	Priority 1		Bins & Tanks
2040	Benzene tank pump		P1..	Pump
2077	Stage 1 - Soap	Priority 9	P1..	Washer

Items: 21

Failure modes: ☒ Create new ☐ Update existing More Options....

Step 1 - Select Source > **Step 2 - Identify Target >** Step 3 - Identify Function > Step 4 - Review Mappings >
 Step 5 - Review FM Mappings > Step 6 - Confirm Selections > Step 7 - Review Results

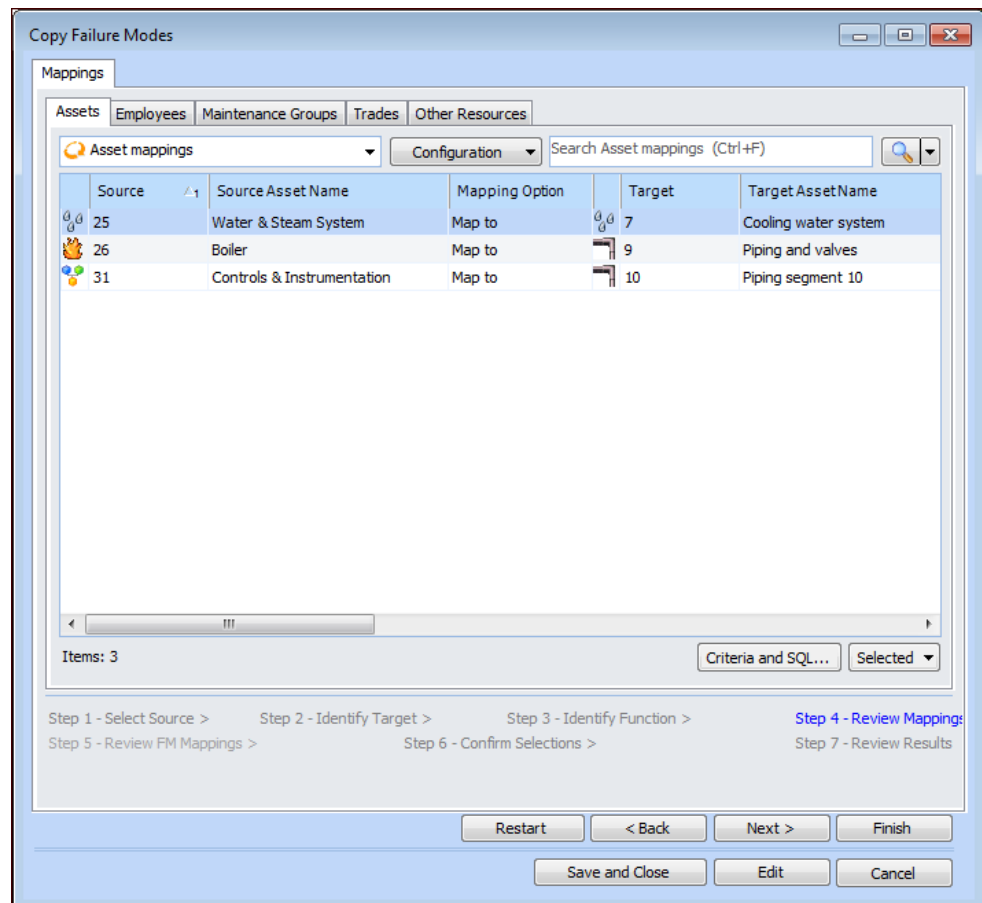
Restart < Back Next > Finish

Save and Close Edit Cancel

You can select the target assets to use in the matching process.

- If you are copying from a template to an analysis, the list is limited to assets of the type supported by the template. To remove this filter, clear the **Limit assets to matching asset type** option.
 - If you are copying from an analysis to a template, only the **Source structure starts at** area is enabled. Skip to step 8.
 - If you are copying from one template to another, both source and target structure areas are disabled. Skip to step 8.
7. If the **Asset mapping** list is available, you can change the asset mapping that will be suggested if APM cannot identify a matching target. The options are:
- **Exclude** – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it
 - **Map to primary target asset** – the source asset is mapped to the target asset selected as the starting point for the structure
 - **New** – a copy of the source asset is created when the copy request is processed

- **Same** – the source asset is mapped to itself
 - **To be determined** – you can select the mapping option later
8. If available, select the option for failure modes:
- **Create new** – a copy of the failure mode is created when the copy request is processed
 - **Update existing** – the source failure modes' properties are copied to the target failure modes
9. To set additional mapping options, click **More Options**. The Options dialog appears. For information about using this dialog, see [“Setting Mapping Options for a Failure Mode Copy”](#) on page 221. Click **Close** when you are finished.
10. Click **Next**. The wizard matches objects as needed and presents the mappings for your review. For example:



Tip: To view information about a source object on any of the mapping tabs, right-click it and click **Source**. For example, the Source dialog that appears for an asset mapping contains tabs for the

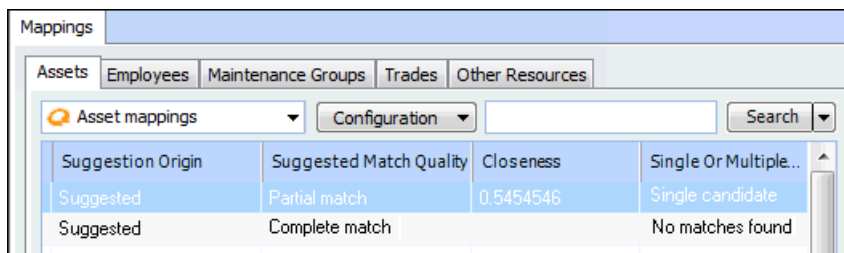
asset's failure modes, indicators, work order tasks, jobs, and job tasks, as well as the corrective tasks, jobs, and job tasks for the indicators. You can also view information about any secondary action plans included in the failure modes.

11. Scroll to the right to review the mappings.

The **Suggestion Origin** column displays the method used for matching. The options are:

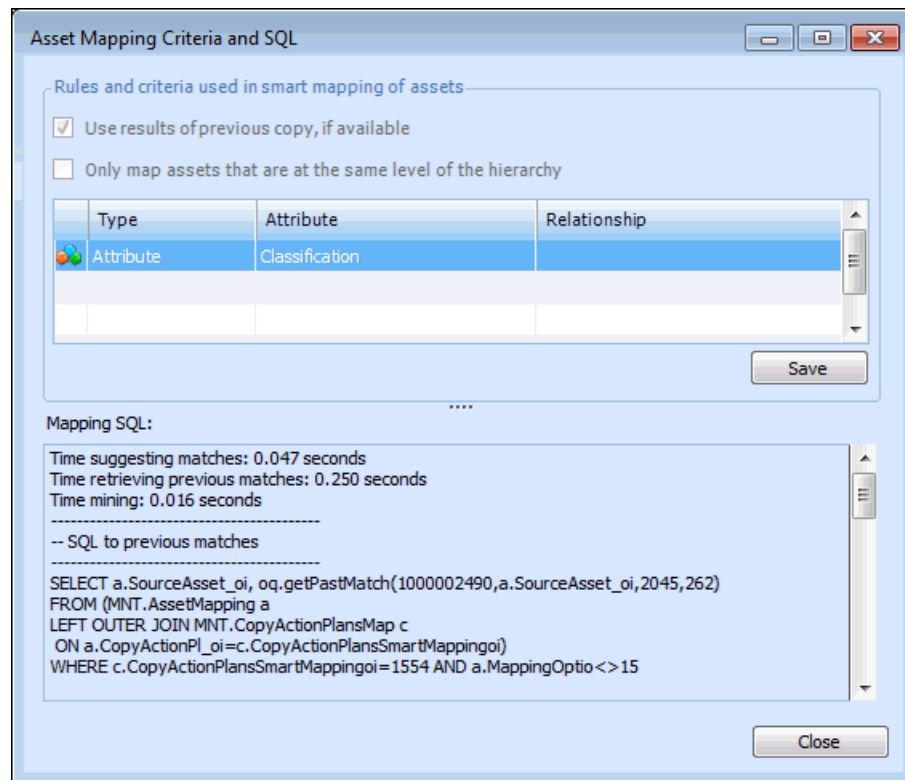
- **Previous match** – the “Use results of previous copy” option is in effect
- **Suggested** – the mapping is based on another criteria, for example, hierarchy level or attribute matching
- **Default** – for assets, the source and target primary assets are automatically matched. For employees, maintenance groups, and trades, the source object is used as the target, provided that it is valid at the target site.
- **Manual** – the user selected the mapping

The **Suggested Match Quality**, **Closeness**, and **Single Or Multiple Candidates** columns show you the results of the smart mapping process. The following example shows that Trigram matching was used (the suggested match quality is “Partial match”), one partial match was found (single candidate), and a score of 0.5454546 was obtained. The candidate matches “Conveyor Belt” with “Conveyor”. An exact match has a closeness score of 1.0.



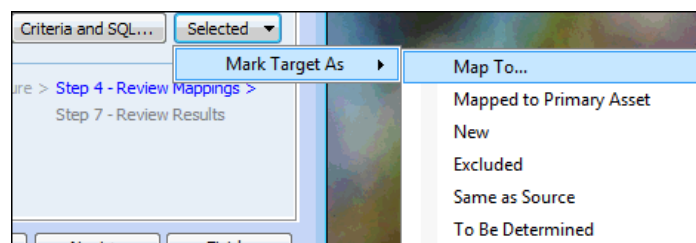
Suggestion Origin	Suggested Match Quality	Closeness	Single Or Multiple...
Suggested	Partial match	0.5454546	Single candidate
Suggested	Complete match		No matches found

12. To view more information about matching process, click **Criteria and SQL**. The Asset Mapping Criteria and SQL window appears. For example:



To see information about mappings for other objects, select their tabs and click **Criteria and SQL**.

13. To make adjustments to a mapping, select it in the table, click **Selected**, **Mark Target As**, and one of the options. Here is an example of the list for asset mappings:



The options are:

- **Map To** – select this option to view the candidates and select another, if you wish. For more information, see [“Manually Changing an Asset Mapping”](#) on page 241.
- **Mapped to Primary Asset** – the source asset is mapped to the target asset selected as the starting point for the structure
- **New** – a copy of the source object is created when the copy request is processed

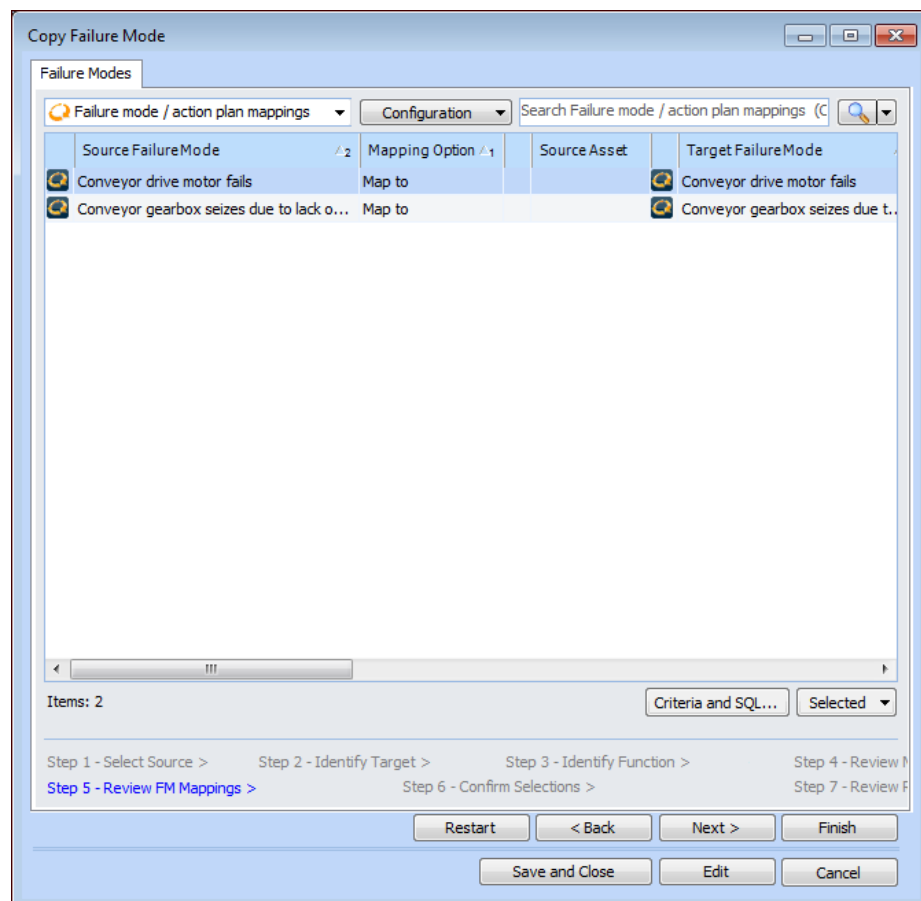
- **Excluded** – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it
- **Same as Source** – the source object is mapped to itself
- **To Be Determined** – you can select the mapping option later

For employees, trades, and maintenance groups, the **Mark as** options are **New**, **Same As Source**, and **To Be Determined**.

Tip: You can also double-click a mapping to review the Asset Mapping dialog.

Note: If a mapping is marked as **To be determined**, the copy request cannot be processed. However, you can save and close it until you decide what to do with it. You can then re-open the request from a **Copy Requests** tab and finish defining and processing it. For more information, see “[Revisiting Failure Mode Copy Requests](#)” on page 270.

14. Click **Next**. If you are updating existing failure modes, the Review FM Mappings step appears.



Review the mappings before proceeding. To change a mapping, right-click it, click **Mark As**, and click one of the options:

- **New** – the wizard creates a failure mode instead of updating the existing one
- **Excluded** – the failure mode is not copied
- **To Be Determined** – you can save the copy request and finish processing it later

15. Click **Next** or **Finish**. The Confirm Selections step appears. For example:

The screenshot shows the 'Copy Failure Modes' dialog box with the 'Failure Modes' tab selected. The 'Action and analysis' section has 'Analysis option' set to 'Existing analysis' and 'Analysis' set to '000008 - Vessel: Vessel V-6987 - MTA2'. The 'Summary' section shows a list of items to be created, with '1' selected. The 'Options' section has checkboxes for 'Process later', 'Open target analyses', and 'Review results' (checked). The bottom shows a progress bar with steps 1-7, where 'Step 6 - Confirm Selections' is active. Buttons at the bottom include 'Restart', '< Back', 'Next >', 'Process', 'Save and Close', 'Edit', and 'Cancel'.

16. Check the items that will be created or updated. If an incorrect copy request is processed, you will have to make the corrections manually. Click **View** to see more details about the items.

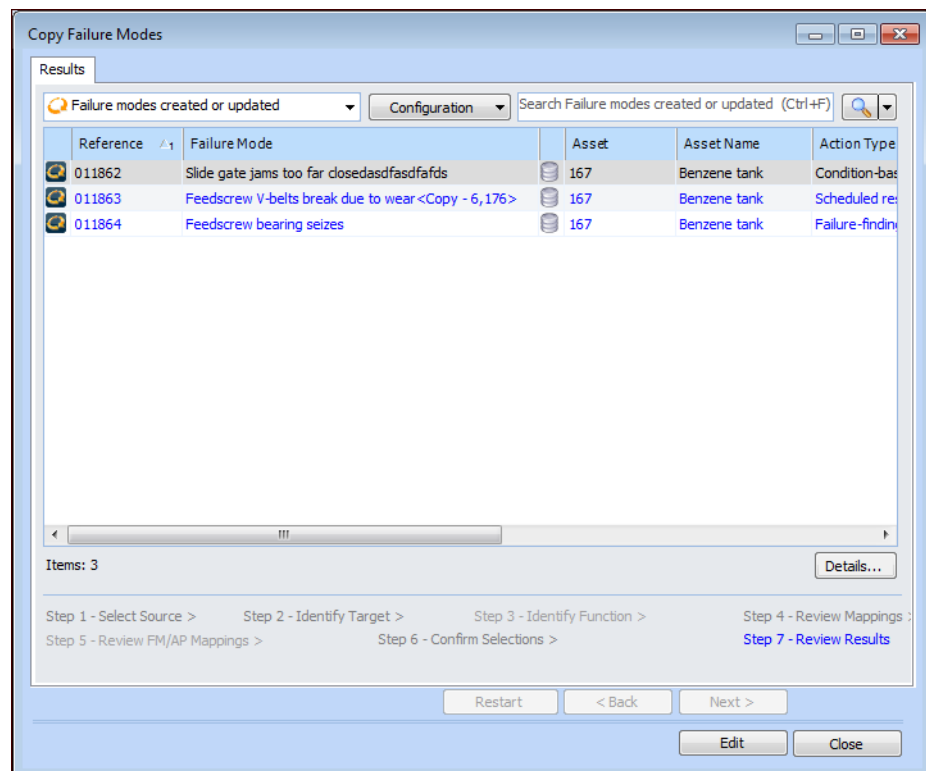
The **Failure Modes** tab shows information about the source failure modes. If you wish to remove a failure mode from the list, right-click it and click **Remove**. Click **Back** to make adjustments on previous pages.

17. On the **Acknowledgment** tab, in the **Options** area, select the processing options:

Setting Name	Description
Process Later	If this option is selected at the site level, failure mode copy requests are set to process later by default. The copy request is saved with the status “Process pending”. The user can later open the request to resume defining it or create a scheduled action (Process Failure Mode Copies) to perform the copies for all pending requests.
Open target analyses	Target analyses are opened after the copy request is processed.
Review results	The Results page is displayed after processing (if processing has not been deferred).

18. Click **Process** or **Finish** if **Process later** is selected. One or more of the following occurs:

- If **Process later** is selected, a confirmation message appears. Click **Yes** to save the copy request to be completed later.
- If processing has not been deferred, the copy is completed. If **Review results** is selected, the Review Results step appears. For example:



To view more information, click **Details**. The Details window displays information about the source and target asset structures, asset mappings, employees, trades, maintenance groups, failure modes, and so on. For example:

	F / 1	FF / 2	FM / 3	Failure Mode	Failure Effect
	1	A	3	Motor gearbox coupling drive cone worn	
	1	A	4	Conveyor gearbox seal worn	
	1	A	6	Conveyor motor fails	

Items: 3

Click **Close** to return to the wizard.

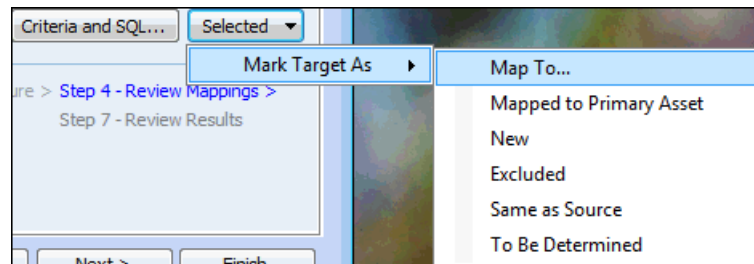
When you are finished reviewing results, click **Close**. You can view the information again on the **Copy Requests** tab for the site or the analysis.

- If **Open target analyses** is selected in the Confirm Selections step, the Strategy Development Analysis window appears.

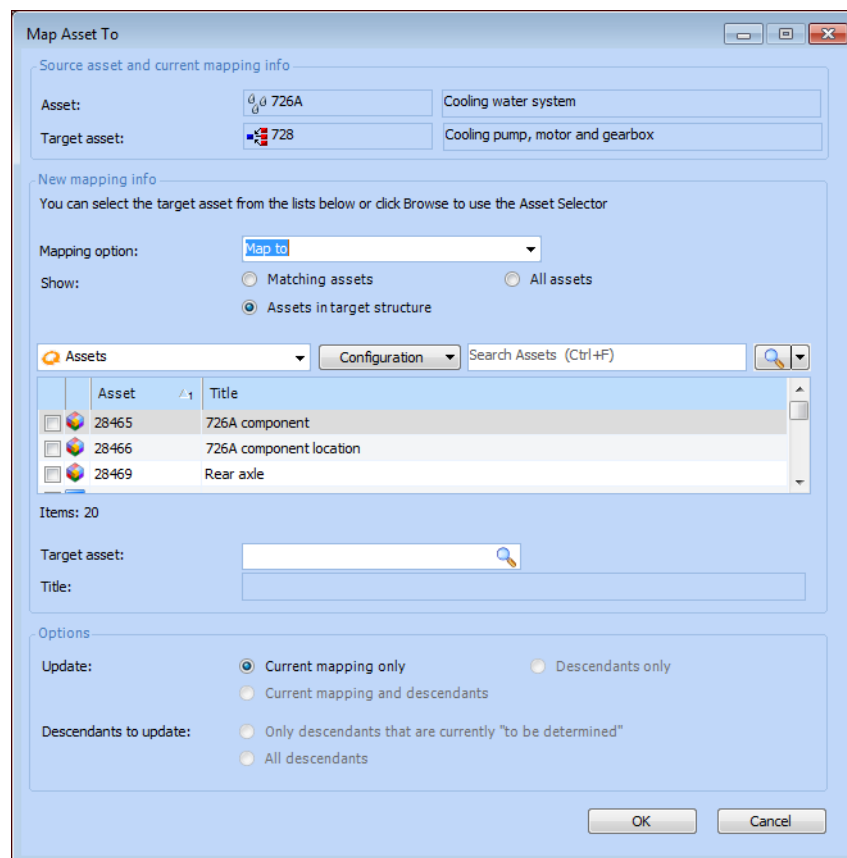
Manually Changing an Asset Mapping

You can change an asset mapping manually in the Review Mappings step of the Copy Failure Modes wizard.

1. Select the mapping in the **Asset mappings** table, click the **Selected** list, then **Mark As** and **Map To**.



The Map Asset To window appears.



2. To change the mapping options, select an option in the **Mapping option** list. The options are:
 - **Exclude** – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it
 - **Map to** – map to a matching asset

- **Map to primary target asset** – the source asset is mapped to the target asset selected as the starting point for the structure
 - **New** – a copy of the source asset is created when the copy request is processed
 - **Same** – the source asset is mapped to itself
 - **To be determined** – you can select the mapping option later
3. If you selected “Map To”, the next step is to select a new target asset. You can adjust the list of assets in the table using the **Show** options:
 - **Matching assets** – displays candidates identified during the original matching process
 - **Assets in target structure** – displays all assets in the target structure
 - **All assets** – displays all assets on the site
 4. Select the new target asset from the table or click **Browse** next to the **Target** box and select a target.
 5. If the target asset has descendant assets in the analysis, you can apply the mapping option to them as well. Select one of the **Update** options:
 - **Current mapping only** – the default selection limits the update to the current mapping
 - **Descendants only** – only descendants of the target asset are remapped
 - **Current mapping and descendants** – both the current mapping and the descendants’ mappings are updated
 6. If you select to update descendants, the **Descendants to update** options are available:
 - **Only descendants that are currently “to be determined”** – only descendants that have not been mapped are updated
 - **All descendants** – descendants that have been mapped are also updated
 7. When you are finished, click **OK** to return to the Review FM Mappings step.

Copying Failure Modes to an Analysis or Template

This topic explains how to copy failure modes from an analysis or template to a new or existing analysis or template.

Using the Copy Failure Modes wizard can involve as many as seven steps, depending on the type of copy you are doing:

1. Select the source analysis or template
2. Identify the target asset structure and mapping options
3. Identify the function and functional failure (RCM2 analysis only)
4. Review the mappings and change them as required
5. Review failure mode mappings if you are copying to existing failure modes
6. Confirm the selections and process the copy
7. Review the results (if you have not deferred processing)

The steps appear at the bottom of each page. The current step is shown in blue. Any step that is not required for your copy is disabled.

Note: When a failure mode is copied, its status changes to Facilitation Incomplete in the target analysis.

Note: If you copy a failure mode from a site that uses a different currency, any monetary amounts defined on the action plan are converted to the asset's site currency. If an exchange rate is not available, the amount is converted at par (for example, one U.S. dollar is equivalent to one Canadian dollar).

The options on the Copy Failure Modes wizard differ slightly depending on whether you are copying from an analysis or template. The illustrations in the procedure show an analysis-to-analysis copy. Any differences in functionality for templates are explained where they occur.

To Copy Failure Modes to an Analysis or Template

1. From the site's **Strategy Development** view and tab, select the appropriate tab. If you wish to copy a template's failure modes, select the appropriate table configuration.

Tip: You can copy failure modes from an MTA2, RCM2, SIF, or HAZOP analysis or template into an MTA2 or MTA2 template. You can also copy action plans from a current practice review into an MTA2 or MTA2 template.

2. Right-click the analysis or template and click **Copy**.

Note: You can also open the analysis or template, click the **Tools** menu, **Failure Modes**, and then **Copy To**. You can also click the **Analysis** menu, **Create**, and then **Copy**.

The Copy Failure Modes wizard appears showing the Select Source step. For example:

The screenshot shows the 'Copy Failure Modes' wizard in the 'Source' tab. The 'Source analysis' section has 'Analysis: 002204' and 'Primary asset: 167 - Benzene tank'. The 'Source structure starts at' section has 'Asset: 167' and 'Benzene tank'. The 'Failure modes to copy' section shows a table with 3 items.

	A ₁	FM: 2	Failure Mode	Failure Effect
<input type="checkbox"/>	1	1	Slide gate jams too far closedasdfsdfafds	This is a rare occurrence which means that the level in the surge ...
<input type="checkbox"/>	1	2	Feedscrew V-belts break due to wear <C...	Motor turns but material flow stops, eventually sounding bin leve...
<input type="checkbox"/>	1	3	Feedscrew bearing seizes	The feedscrew motor trips and activates trip alarm. Material flow...

Items: 3

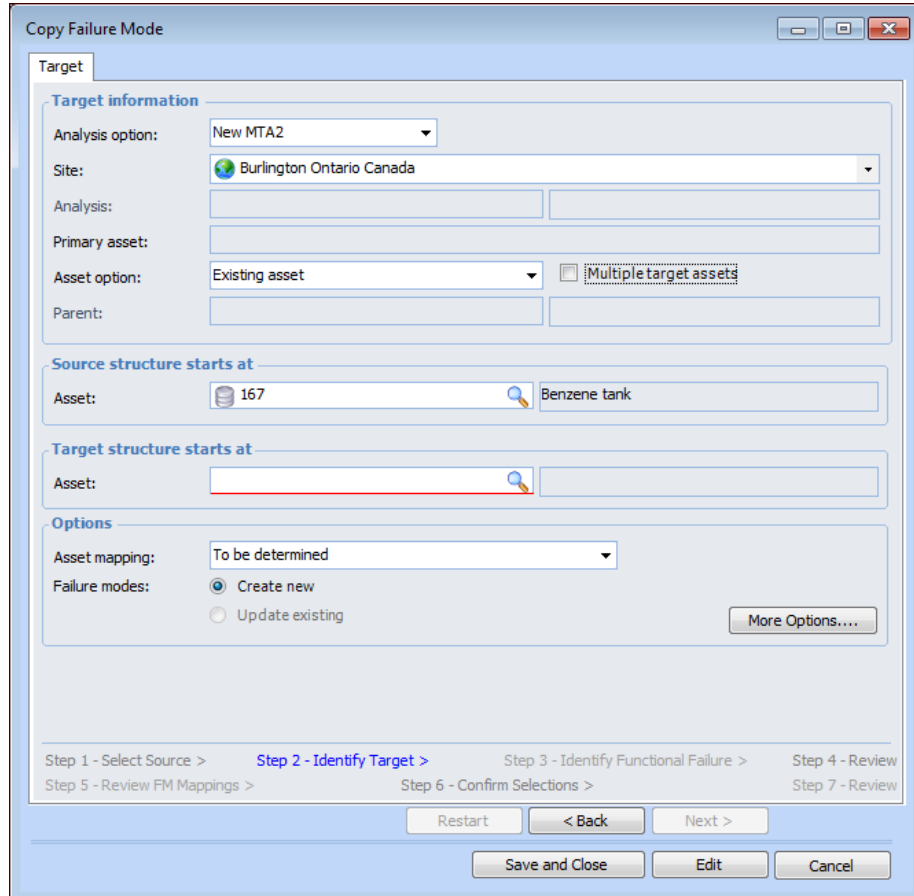
Step 1 - Select Source > Step 2 - Identify Target > Step 3 - Identify Function Step 4 - Review Mappings
Step 5 - Review FM Mappings > Step 6 - Confirm Selections > Step 7 - Review Results

Restart < Back Next > Save and Close Edit Cancel

When the source is a template, the **Primary asset** box displays the asset type and **Source structure starts at** is not available.

Tip: You can also copy individual failure modes or action plans from the current analysis or template to another one. Right-click the failure mode or action plan in a table and click **Copy To**. The Copy Failure Modes wizard appears, displaying the Identify Target step.

3. All of the source failure modes are selected by default. Clear any that you do not wish to copy and click **Next**. The Identify Target step appears. This example shows the step when the source is an analysis:



If the source is a template, the **Asset option** box is set to “Existing asset”.

4. In the **Analysis option** list, select an option:
 - Existing analysis
 - New MTA2
 - New MTA2 template

The options on the Identify Target step change depending on the option you select.

5. Change the target site, if appropriate. If the source analysis is allowed to be used at other sites, those sites are available in the **Site** list.
6. Do one of the following, depending on the analysis option that you selected:

- **New analysis** – If the source is an analysis, in the **Asset option** list, select “Existing asset” or “New asset”. If you choose to create an asset, a browse icon appears in the **Parent** box so that you can select its parent asset.

If you select “Existing asset,” you can select **Multiple target assets** and select one or more target assets in the table.

Alternatively, you can select the starting asset for the target structure by clearing **Multiple target assets**. Then click the browse icon in the **Target structure starts at** box to select a target asset.

If the source is a template, you can only copy failure modes to existing assets. Select **Multiple target assets** to view the **Target asset structures** table, which lists all of the assets on the site that match the template’s asset type. To view other assets, clear the **Limit assets to matching asset type** option. Select the assets to copy to.

- **Existing analysis** – A browse icon appears in the **Analysis** box so that you can select the target analysis or template. The primary asset or asset type is displayed, and the asset option is set to “Existing asset”.

If **Multiple target assets** is selected, the **Target asset structures** table lists the assets on the target analysis. To view other assets, clear the **Show only assets on analysis** option. Select the assets to copy to.

If **Multiple target assets** is not selected, a browse icon appears in the **Target structure starts at** box. Select the starting asset for the target structure.

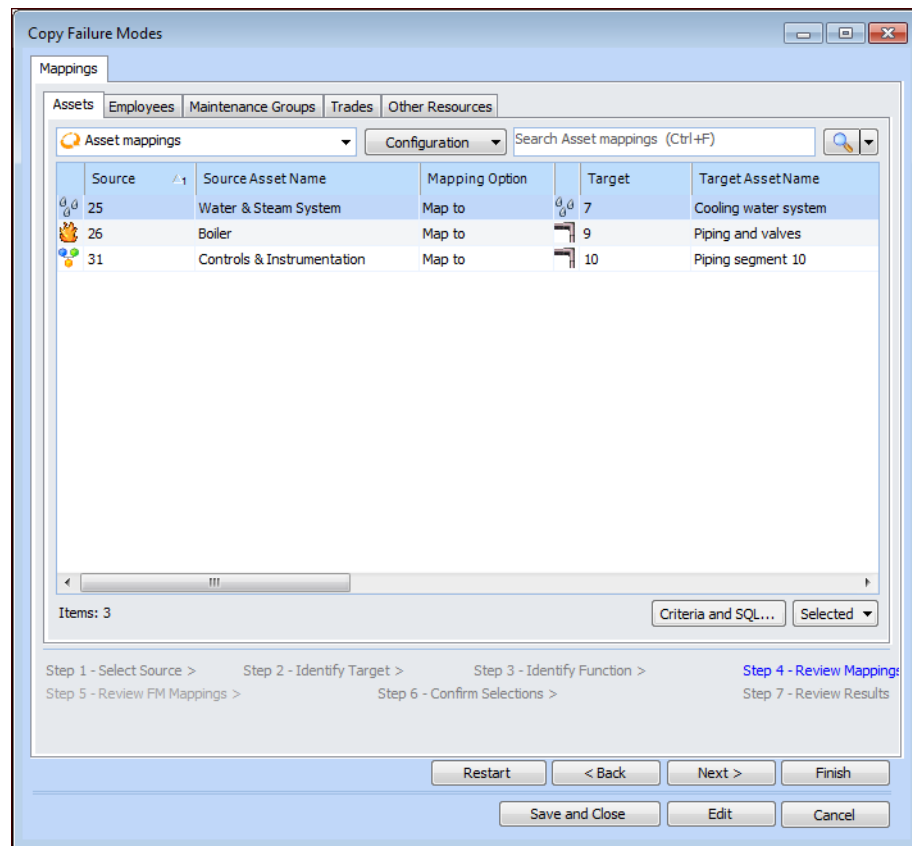
If you are copying from a template to an existing analysis, the **Target asset structures** table lists the assets on the target analysis that match the asset type of the template. To view other assets, clear the **Limit assets to matching asset type** option. Select the assets to include in the matching process.

- **New template** – The **Asset type** list appears in place of the **Asset option** box. Select the asset type from the list.

Tip: In some cases, you might wish to change the source asset structure, target asset structure, or both. When the starting assets occupy parallel positions in their respective hierarchies, the mapping process is more likely to result in accurate matches.

Tip: For quick copies (when you do not need to adjust the mapping options), click **Finish** when you have selected the target options. The wizard performs the matching process and goes to the Confirm Selections step. Skip to step 16.

7. If the **Asset mapping** list is available, you can change the asset mapping that will be suggested if APM cannot identify a matching target. The options are:
 - **Exclude** – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it
 - **Map to primary target asset** – the source asset is mapped to the target asset selected as the starting point for the structure
 - **New** – a copy of the source asset is created when the copy request is processed
 - **Same** – the source asset is mapped to itself
 - **To be determined** – you can select the mapping option later
8. If available, select the option for failure modes:
 - **Create new** – a copy of the failure mode is created when the copy request is processed
 - **Update existing** – the source failure modes' properties are copied to the target failure modes
9. To set additional mapping options, click **More Options**. The Options dialog appears. For information about using this dialog, see [“Setting Mapping Options for a Failure Mode Copy” on page 221](#). Click **Close** when you are finished.
10. Click **Next**. The wizard matches objects as needed and presents the mappings for your review. For example:



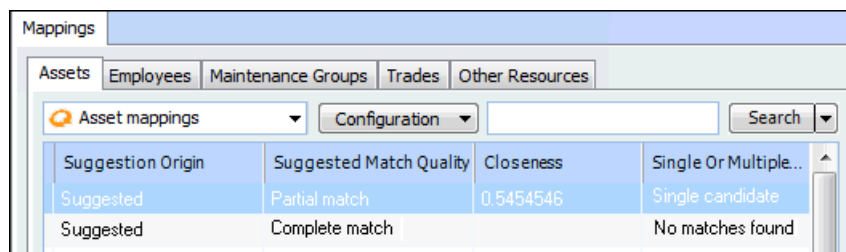
Tip: To view information about a source object on any of the mapping tabs, right-click it and click **Source**. For example, the Source dialog that appears for an asset mapping contains tabs for the asset’s failure modes, indicators, work order tasks, jobs, and job tasks, as well as the corrective tasks, jobs, and job tasks for the indicators. You can also view information about any secondary action plans included in the failure modes.

11. Scroll to the right to review the mappings.

The **Suggestion Origin** column displays the method used for matching. The options are:

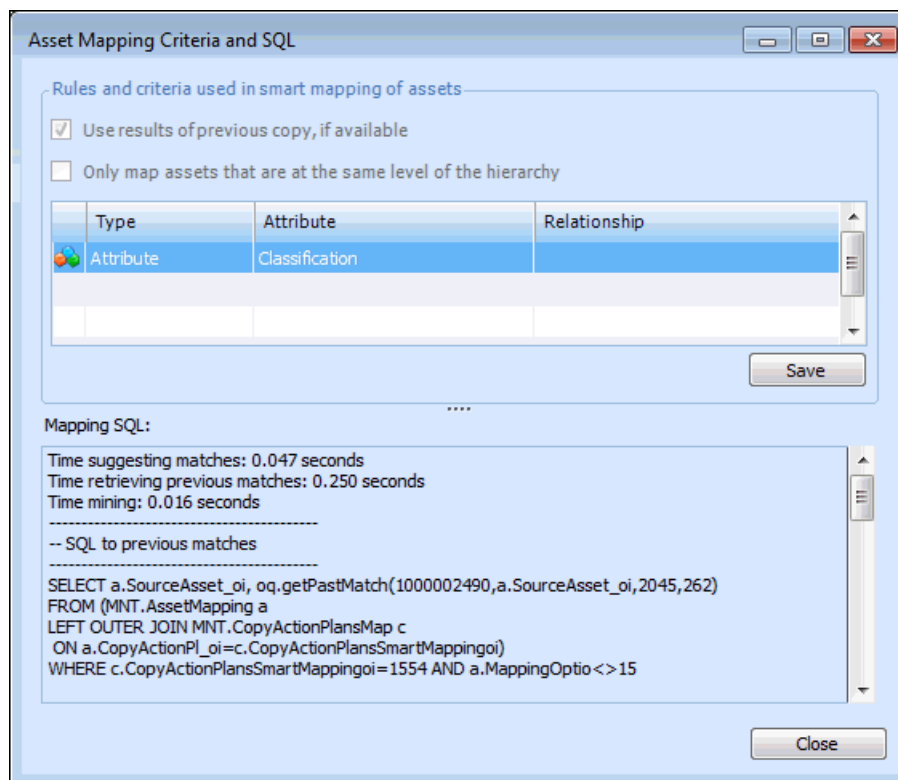
- **Previous match** – the “Use results of previous copy” option is in effect
- **Suggested** – the mapping is based on another criteria, for example, hierarchy level or attribute matching
- **Default** – for assets, the source and target primary assets are automatically matched. For employees, maintenance groups, and trades, the source object is used as the target, provided that it is valid at the target site.
- **Manual** – the user selected the mapping

The **Suggested Match Quality**, **Closeness**, and **Single Or Multiple Candidates** columns show you the results of the smart mapping process. The following example shows that Trigram matching was used (the suggested match quality is “Partial match”), one partial match was found (single candidate), and a score of 0.5454546 was obtained. The candidate matches “Conveyor Belt” with “Conveyor”. An exact match has a closeness score of 1.0.



Suggestion Origin	Suggested Match Quality	Closeness	Single Or Multiple...
Suggested	Partial match	0.5454546	Single candidate
Suggested	Complete match		No matches found

- To view more information about matching process, click **Criteria and SQL**. The Asset Mapping Criteria and SQL window appears. For example:



Asset Mapping Criteria and SQL

Rules and criteria used in smart mapping of assets

☒ Use results of previous copy, if available

☐ Only map assets that are at the same level of the hierarchy

Type	Attribute	Relationship
Attribute	Classification	

Save

Mapping SQL:

Time suggesting matches: 0.047 seconds
 Time retrieving previous matches: 0.250 seconds
 Time mining: 0.016 seconds

-- SQL to previous matches

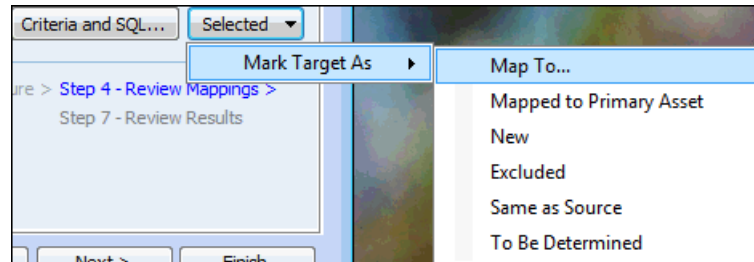
```

SELECT a.SourceAsset_oi, oq.getPastMatch(1000002490,a.SourceAsset_oi,2045,262)
FROM (MNT.AssetMapping a
LEFT OUTER JOIN MNT.CopyActionPlansMap c
ON a.CopyActionPl_oi=c.CopyActionPlansSmartMappingoi)
WHERE c.CopyActionPlansSmartMappingoi=1554 AND a.MappingOptio<>15
  
```

Close

To see information about mappings for other objects, select their tabs and click **Criteria and SQL**.

13. To make adjustments to a mapping, select it in the **Asset mappings** table, click **Selected**, **Mark Target As**, and one of the options. Here is an example of the list for asset mappings:



The options for assets are:

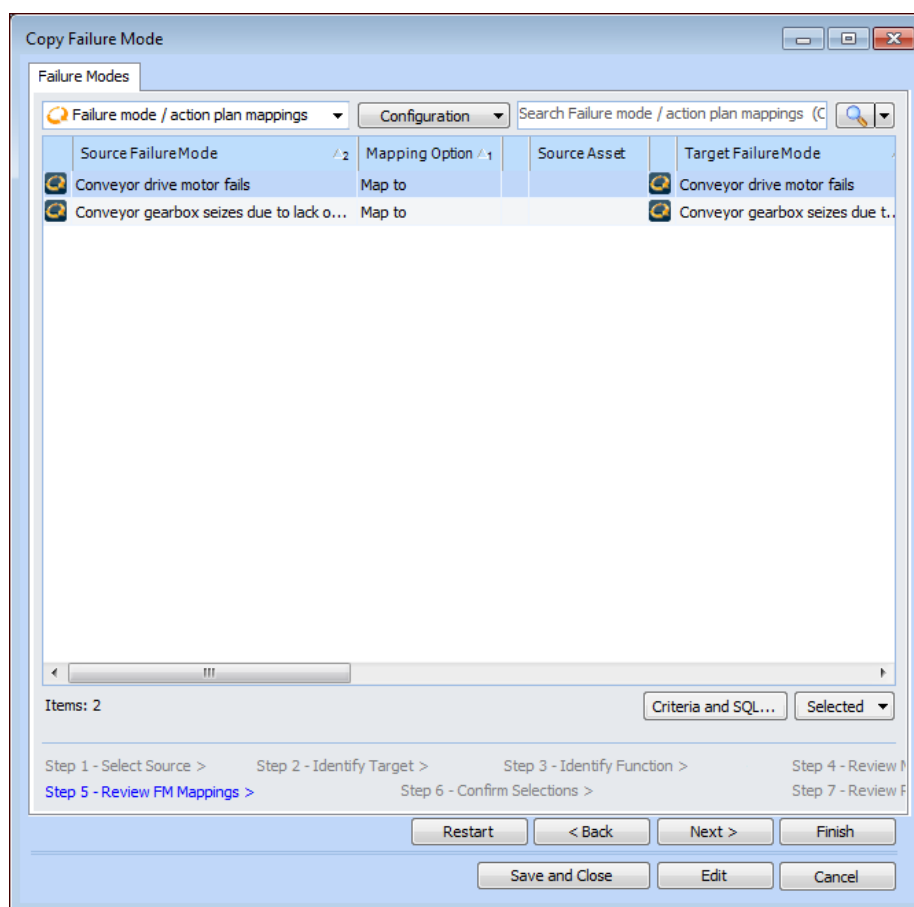
- **Map To** – select this option to view the candidate and select another, if you wish. For more information, see [“Manually Changing an Asset Mapping” on page 255](#).
- **Mapped to Primary Asset** – the source asset is mapped to the target asset selected as the starting point for the structure
- **New** – a copy of the source object is created when the copy request is processed
- **Mark as Excluded** – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it
- **Same as Source** – the source object is used as the target
- **To Be Determined** – you can select the mapping option later

For employees, trades, and maintenance groups, the **Mark as** options are **New**, **Same As Source**, and **To Be Determined**.

Tip: You can also double-click a mapping to review the Asset Mapping dialog.

Note: If a mapping is marked as **To be determined**, the copy request cannot be processed. However, you can save and close it until you decide what to do with it. You can then re-open the request from a **Copy Requests** tab and finish defining and processing it. For more information, see [“Revisiting Failure Mode Copy Requests” on page 270](#).

14. Click **Next**. If you are updating existing failure modes, the Review FM Mappings step appears.



Review the mappings before proceeding. To change a mapping, right-click it, click **Mark As**, and click one of the options:

- **New** – the wizard creates a failure mode instead of updating the existing one
- **Excluded** – the failure mode is not copied
- **To Be Determined** – you can save the copy request and finish processing it later

15. Click **Next** or **Finish**. The Confirm Selections step appears. For example:

16. Check the items that will be created or updated. If an incorrect copy request is processed, you will have to make the corrections manually. Click **View** to see more details about the items.

The **Failure Modes** tab shows information about the source failure modes. If you wish to remove a failure mode from the list, right-click it and click **Remove**. Click **Back** to make adjustments on previous pages.

17. On the **Acknowledgment** tab, in the **Options** area, select the processing options:

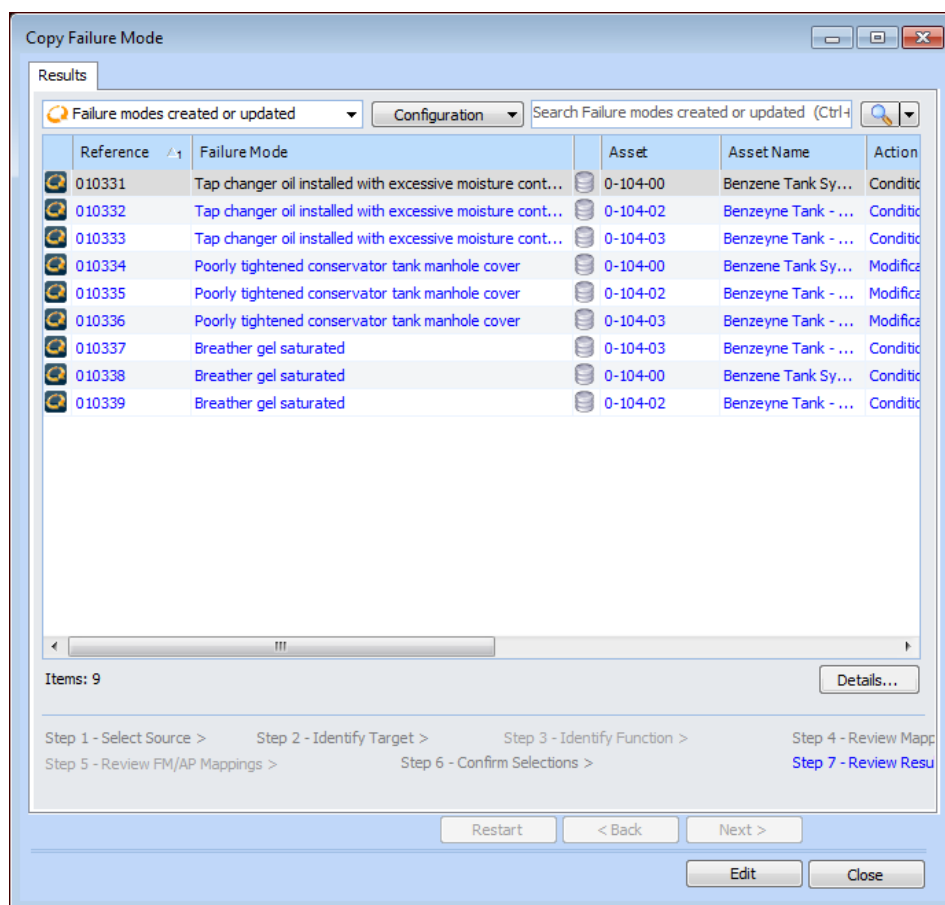
Setting Name	Description
Process Later	If this option is selected at the site level, failure mode copy requests are set to process later by default. The copy request is saved with the status “Process pending”. The user can later open the request to resume defining it or create a scheduled action (Process Failure Mode Copies) to perform the copies for all pending requests.

Open target analyses Target analyses are opened after the copy request is processed.

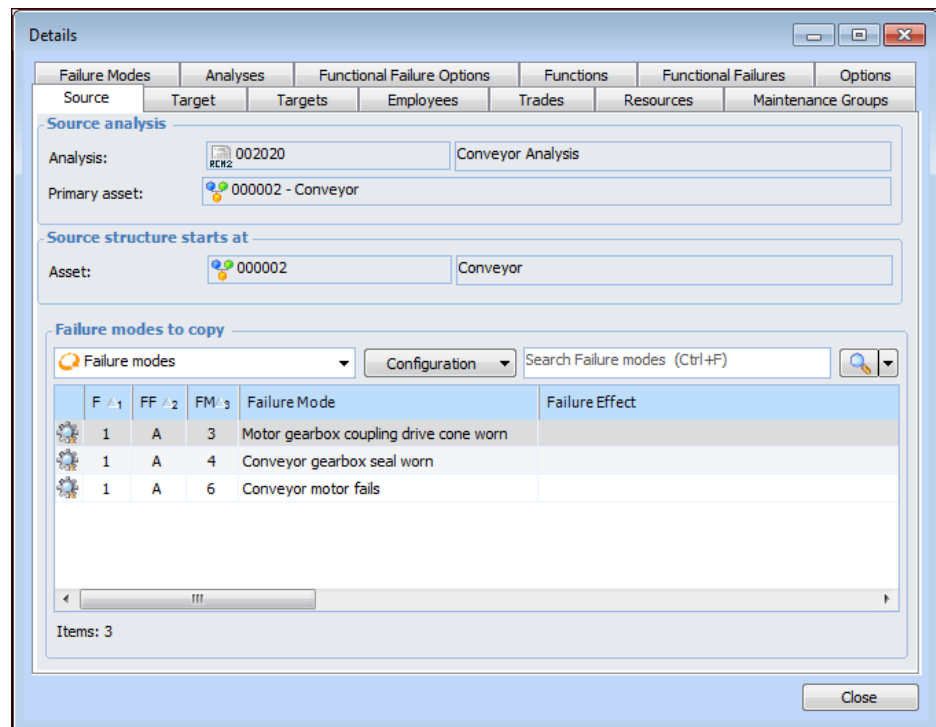
Review results The Results page is displayed after processing (if processing has not been deferred).

18. Click **Process** or **Finish** if **Process Later** is selected. One or more of the following occurs:

- If **Process later** is selected, a confirmation message appears. Click **Yes** to save the copy request to be completed later.
- If processing has not been deferred, the copy is completed. If **Review results** is selected, the Review Results step appears. For example:



To view more information, click **Details**. The Details window displays information about the source and target asset structures, asset mappings, employees, trades, maintenance groups, failure modes, and so on. For example:



Click **Close** to return to the wizard.

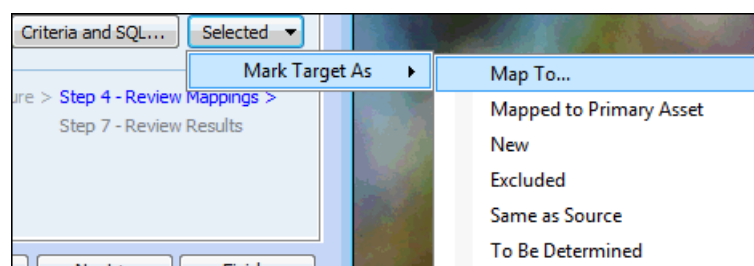
When you are finished reviewing results, click **Close**. You can view the information again on the **Copy Requests** tab for the site or the analysis.

- If **Open target analyses** is selected in the Confirm Selections step, the Strategy Development Analysis window appears.

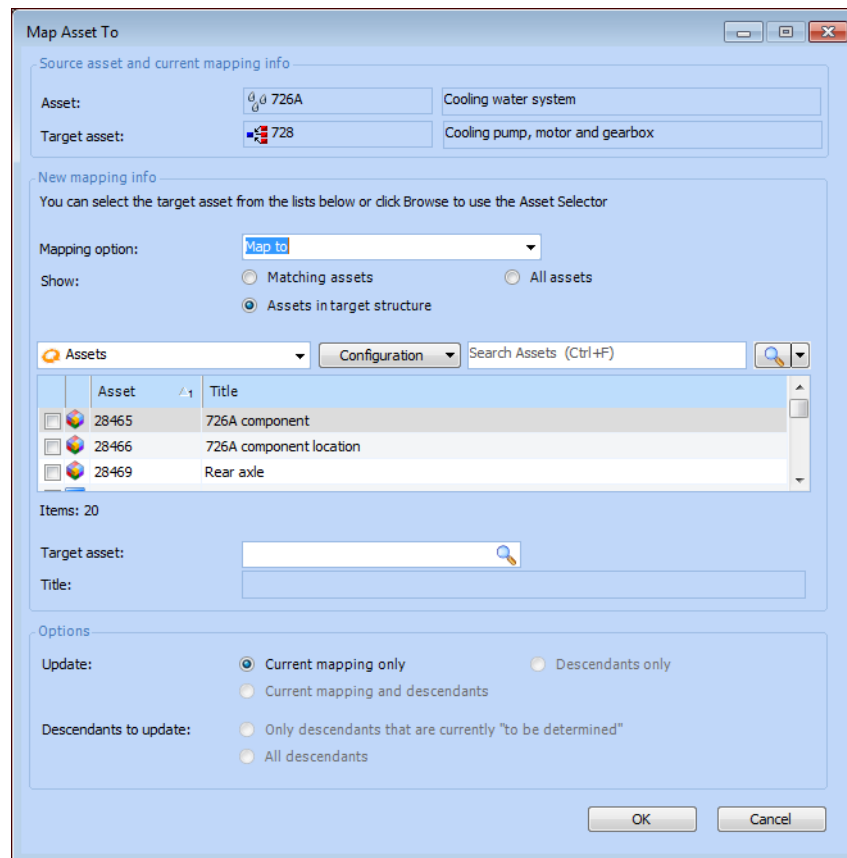
Manually Changing an Asset Mapping

You can change an asset mapping manually in the Review Mappings step of the Copy Failure Modes wizard.

1. Select the mapping in the **Asset mappings** table, click the **Selected** list, then **Mark As** and **Map To**.



The Map Asset To window appears.



2. To change the mapping options, select an option in the **Mapping option** list. The options are:
 - **Exclude** – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it
 - **Map to** – map to a matching asset
 - **Map to primary target asset** – the source asset is mapped to the target asset selected as the starting point for the structure
 - **New** – a copy of the source asset is created when the copy request is processed
 - **Same** – the source asset is mapped to itself
 - **To be determined** – you can select the mapping option later
3. If you selected “Map To”, the next step is to select a new target asset. You can adjust the list of assets in the table using the **Show** options:
 - **Matching assets** – displays candidates identified during the original matching process

- **Assets in target structure** – displays all assets in the target structure
 - **All assets** – displays all assets on the site
4. Select the new target asset from the table or click **Browse** next to the **Target** box and select a target.
 5. If the target asset has descendant assets in the analysis, you can apply the mapping option to them as well. Select one of the **Update** options:
 - **Current mapping only** – the default selection limits the update to the current mapping
 - **Descendants only** – only descendants of the target asset are remapped
 - **Current mapping and descendants** – both the current mapping and the descendants' mappings are updated
 6. If you select to update descendants, the **Descendants to update** options are available:
 - **Only descendants that are currently “to be determined”** – only descendants that have not been mapped are updated
 - **All descendants** – descendants that have been mapped are also updated
 7. When you are finished, click **OK** to return to the Review FM Mappings step.

Copying an Asset's Strategy Development Program

This topic explains how to copy an asset's strategy development program, which allows you to select MTA2, RCM2, RBI, SIF, and HAZOP failure modes and current practice review action plans in a single copy request. You can only copy the objects to new analyses of the same variety, not to existing ones. For example, RCM2 failure modes are copied to new RCM2 analyses and current practice review action plans are copied to new reviews.

Using the Copy Failure Modes wizard to copy strategy development programs can involve as many as five steps:

1. Select the failure modes to copy
2. Identify the target asset structure and mapping options
3. Review the mappings and change them as required
4. Confirm the selections and process the copy
5. Review the results (if you have not deferred processing)

The steps appear at the bottom of each page. The current step is shown in blue. Any step that is not required for your copy is disabled.

Note: When a failure mode is copied, its status changes to Facilitation Incomplete in the target analysis.

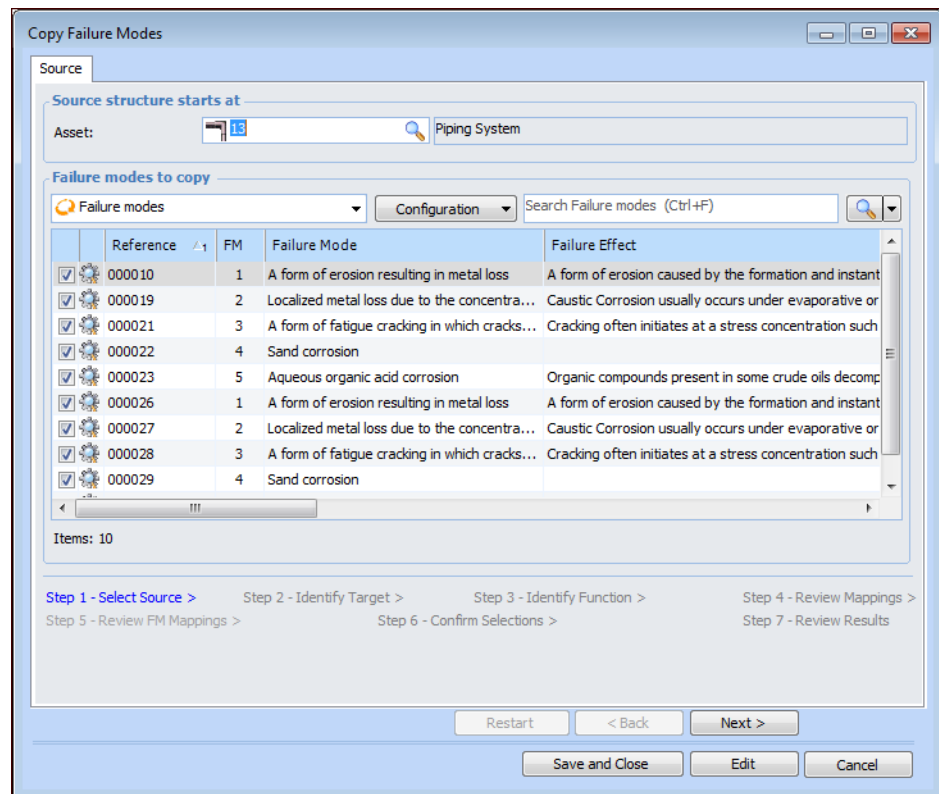
Note: If you copy a failure mode from a site that uses a different currency, any monetary amounts defined on the action plan are converted to the asset's site currency. If an exchange rate is not available, the amount is converted at par (for example, one U.S. dollar is equivalent to one Canadian dollar).

To Copy an Asset's Strategy Development Program

1. From the site window, select the **Assets** view.
2. Right-click an asset in any of the tabs, click **Copy**, and then **Strategy Development Program**.

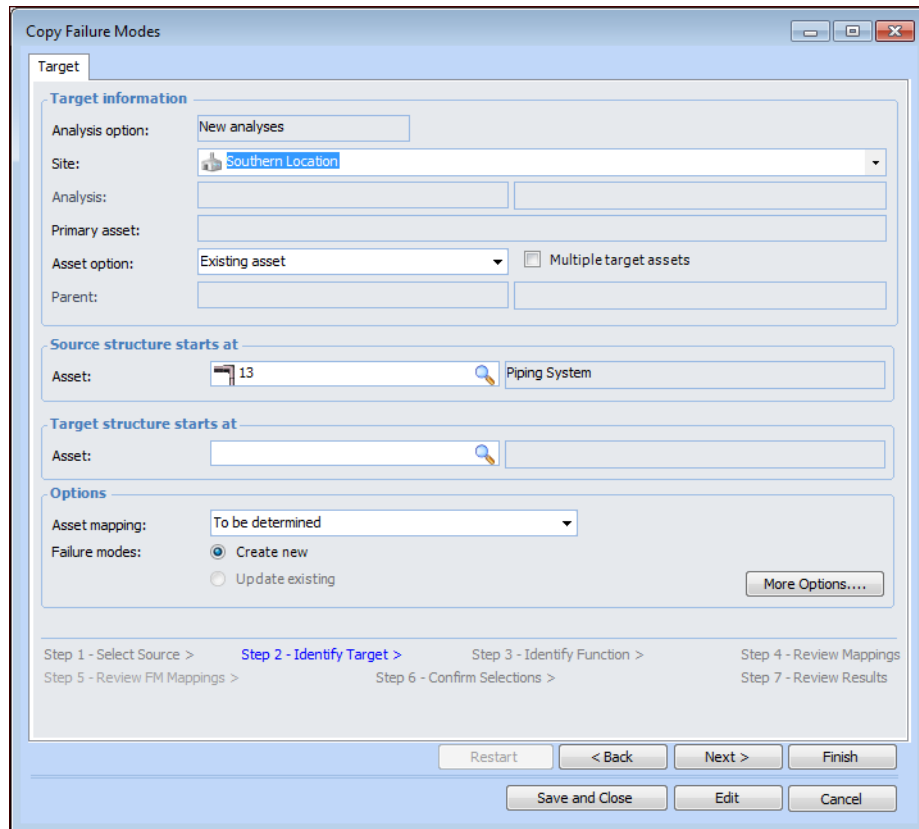
Note: You can also open the asset, click the **Tools** menu, and then **Copy Strategy Development Program**.

The Copy Failure Modes wizard appears, showing the Select Source step. For example:



All of the asset's failure modes are displayed in the table and selected by default. Because only action plans are defined in current practice reviews, their **Failure Mode** and **Failure Effect** cells are blank.

3. Clear any failure modes or action plans that you do not wish to copy and click **Next**. The Identify Target step appears. For example:



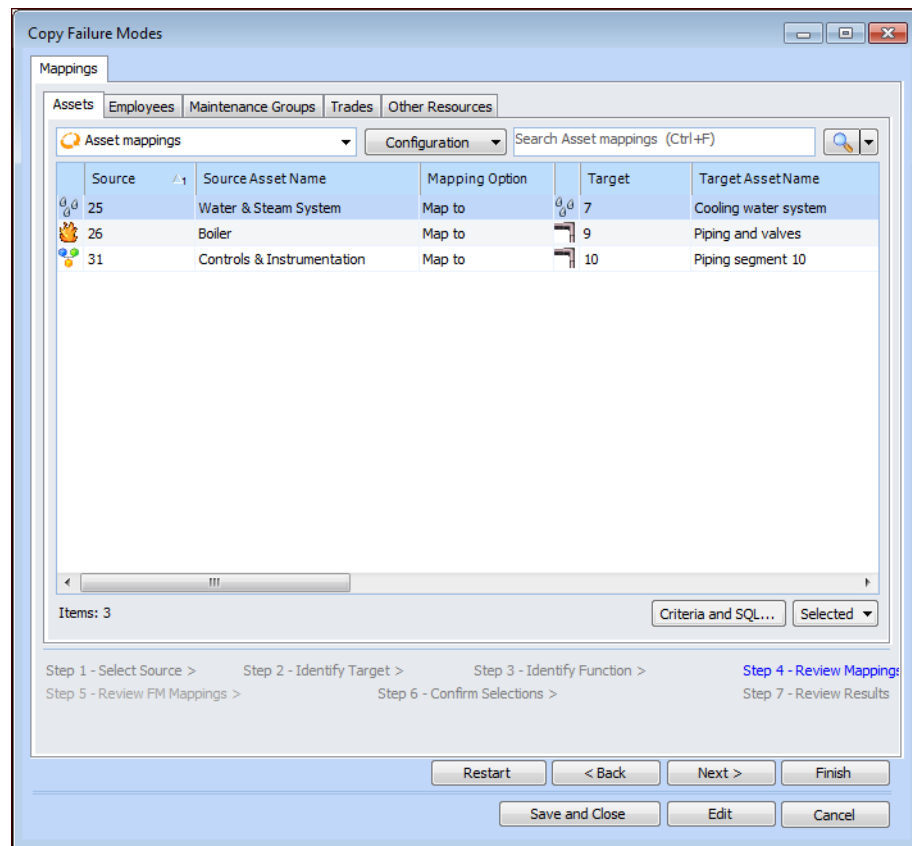
4. Change the target site, if appropriate.
5. In the **Asset option** list, select “Existing asset” or “New asset”. If you choose to create an asset, a browse icon appears in the **Parent** box so that you can select its parent asset.
6. If you are copying to existing assets, select the target asset in either of these ways:
 - Click the browse icon to select the starting asset for the target structure.

In some cases, you might wish to change the source asset structure. When the starting assets occupy parallel positions in their respective hierarchies, the mapping process is more likely to result in accurate matches.
 - Select **Multiple target assets** if you wish to copy to two or more assets and select them in the table.
7. You can change the **Asset mapping** option that determines what will be suggested if APM cannot identify a matching target. The options are:

- **Exclude** – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it
 - **Map to primary target asset** – the source asset is mapped to the target asset selected as the starting point for the structure
 - **New** – a copy of the source asset is created when the copy request is processed
 - **Same** – the source asset is mapped to itself
 - **To be determined** – you can select the mapping option later
8. To set additional mapping options, click **More Options**. The Options dialog appears. For information about using this dialog, see [“Setting Mapping Options for a Failure Mode Copy”](#) on page 221. Click **Close** when you are finished.

Tip: For quick copies (when you do not need to adjust the mapping options), click **Finish** when you have selected the target. The wizard performs the matching process and skips to the Confirm Selections step. Skip to step [13](#).

9. Click **Next**. The wizard matches objects as needed and presents the mappings for your review. For example:



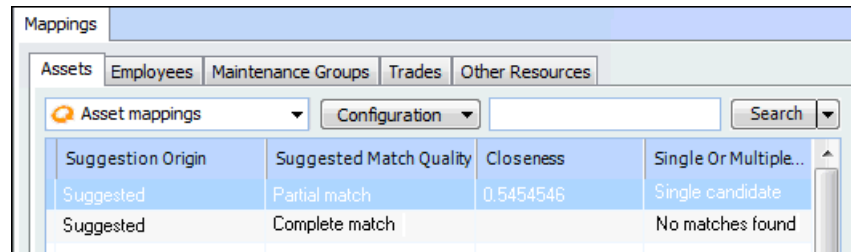
Tip: To view information about a source object on any of the mapping tabs, right-click it and click **Source**. For example, the Source dialog that appears for an asset mapping contains tabs for the asset's failure modes, indicators, work order tasks, jobs, and job tasks, as well as the corrective tasks, jobs, and job tasks for the indicators. You can also view information about any secondary action plans included in the failure modes.

10. Scroll to the right to review the mappings.

The **Suggestion Origin** column displays the method used for matching. The options are:

- **Previous match** – the “Use results of previous copy” option is in effect
- **Suggested** – the mapping is based on another criteria, for example, hierarchy level or attribute matching
- **Default** – for assets, the source and target primary assets are automatically matched. For employees, maintenance groups, and trades, the source object is used as the target, provided that it is valid at the target site.
- **Manual** – the user selected the mapping

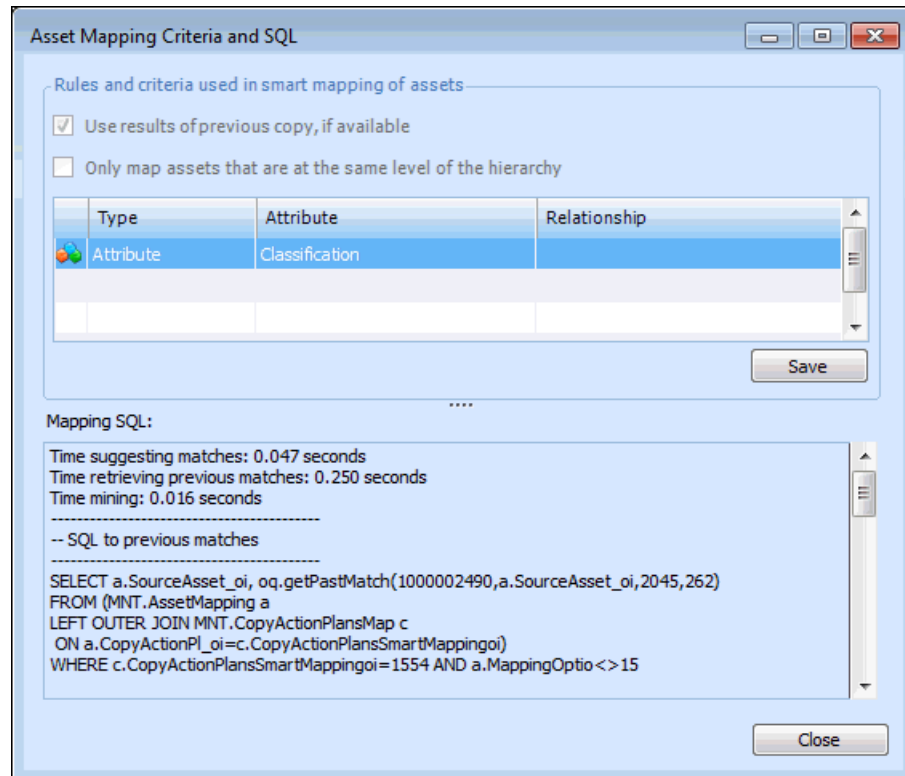
The **Suggested Match Quality**, **Closeness**, and **Single Or Multiple Candidates** columns show you the results of the smart mapping process. The following example shows that Trigram matching was used (the suggested match quality is “Partial match”), one partial match was found (single candidate), and a score of 0.5454546 was obtained. The candidate matches “Conveyor Belt” with “Conveyor”. An exact match has a closeness score of 1.0.



The screenshot shows a window titled 'Mappings' with tabs for Assets, Employees, Maintenance Groups, Trades, and Other Resources. The 'Assets' tab is selected. Below the tabs, there are dropdown menus for 'Asset mappings' and 'Configuration', and a 'Search' button. A table displays the results of the mapping process.

Suggestion Origin	Suggested Match Quality	Closeness	Single Or Multiple...
Suggested	Partial match	0.5454546	Single candidate
Suggested	Complete match		No matches found

11. To view more information about matching process, click **Criteria and SQL**. The Asset Mapping Criteria and SQL window appears. For example:



The screenshot shows a window titled 'Asset Mapping Criteria and SQL'. It contains a section for 'Rules and criteria used in smart mapping of assets' with two checkboxes: 'Use results of previous copy, if available' (checked) and 'Only map assets that are at the same level of the hierarchy' (unchecked). Below this is a table with columns 'Type', 'Attribute', and 'Relationship'. The first row shows 'Attribute' for 'Classification'. A 'Save' button is located to the right of the table. Below the table, there is a section for 'Mapping SQL:' which displays performance metrics and an SQL query.

Rules and criteria used in smart mapping of assets

☒ Use results of previous copy, if available

☐ Only map assets that are at the same level of the hierarchy

Type	Attribute	Relationship
Attribute	Classification	

Save

Mapping SQL:

Time suggesting matches: 0.047 seconds
 Time retrieving previous matches: 0.250 seconds
 Time mining: 0.016 seconds

-- SQL to previous matches

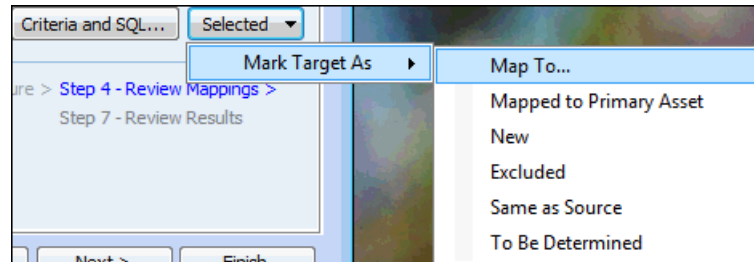
```

SELECT a.SourceAsset_oi, oq.getPastMatch(1000002490,a.SourceAsset_oi,2045,262)
FROM (MNT.AssetMapping a
LEFT OUTER JOIN MNT.CopyActionPlansMap c
ON a.CopyActionPl_oi=c.CopyActionPlansSmartMappingoi)
WHERE c.CopyActionPlansSmartMappingoi=1554 AND a.MappingOptio<>15
  
```

Close

To see information about mappings for other objects, select their tabs and click **Criteria and SQL**.

12. To make adjustments to a mapping, select it in the table, click **Selected**, **Mark Target As**, and one of the options. Here is an example of the list for asset mappings:



The options for assets are:

- **Map To** – select this option to view the candidates and select another, if you wish. For more information, see [“Manually Changing an Asset Mapping”](#) on page 267
- **Mapped to Primary Asset** – the source asset is mapped to the target asset selected as the starting point for the structure
- **New** – a copy of the source object is created when the copy request is processed
- **Mark as Excluded** – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it
- **Same as Source** – the source object is used as the target
- **To Be Determined** – you can select the mapping option later

For employees, trades, and maintenance groups, the **Mark as** options are **New**, **Same As Source**, and **To Be Determined**.

Note: If a mapping is marked as **To be determined**, the copy request cannot be processed. However, you can save and close it until you decide what to do with it. You can then re-open the request from a **Copy Requests** tab and finish defining and processing it. For more information, see [“Revisiting Failure Mode Copy Requests”](#) on page 270.

13. Click **Next** or **Finish**. The Confirm Selections step appears. For example:

Copy Failure Modes

Acknowledgment **Failure Modes**

Action and analysis

Analysis option:

Analysis:

Summary

- ☒ Failure modes will be created
- ☐ No failure modes will be updated
- ☒ Assets will be created
- ☐ No assets have been excluded
- ☒ Analyses will be created
- ☐ No trades or other types of resources will be created
- ☐ No maintenance groups will be created
- ☐ No employees will be created

Options

- ☐ Process later
- ☐ Open target analyses
- ☒ Review results

Step 1 - Select Source > Step 2 - Identify Target > Step 3 - Identify Function > Step 4 - Review Mapping
 Step 5 - Review FM/AP Mappings > **Step 6 - Confirm Selections >** Step 7 - Review Results

14. Review the items that will be created or updated. If an incorrect copy request is processed, you will have to make the corrections manually. Click **View** to see more details about the items.
15. The **Failure Modes** tab shows information about the source failure modes. If you wish to remove a failure mode from the list, right-click it and click **Remove**. Click **Back** to make adjustments on previous pages.
16. On the **Acknowledgment** tab, in the **Options** area, select the processing options:

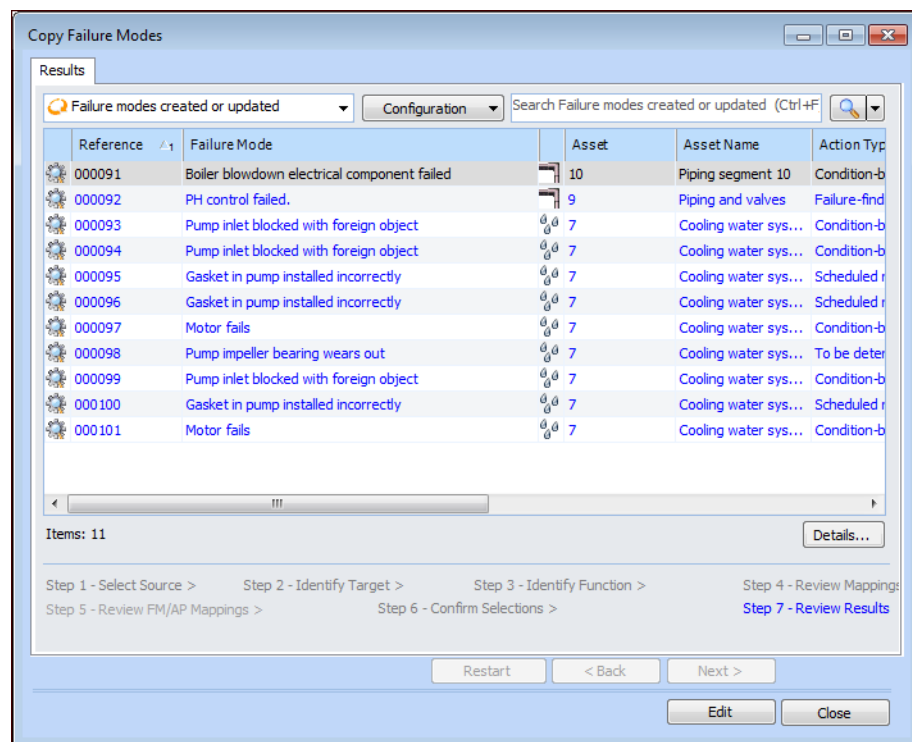
Setting Name	Description
Process Later	If this option is selected at the site level, failure mode copy requests are set to process later by default. The copy request is saved with the status "Process pending". The user can later open the request to resume defining it or create a scheduled action (Process Failure Mode Copies) to perform the copies for all pending requests.

Open target analyses Target analyses are opened after the copy request is processed.

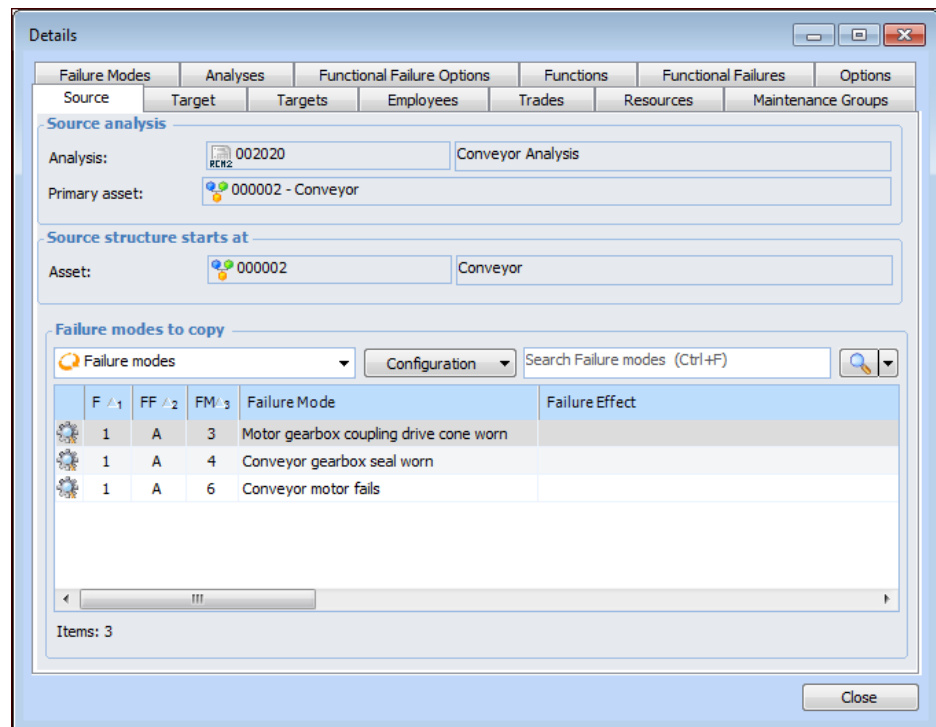
Review results The Results page is displayed after processing (if processing has not been deferred).

17. Click **Process** or **Finish** if **Process later** is selected. One of the following occurs:

- If **Process later** is selected, a confirmation message appears. Click **Yes** to save the copy request to be completed later.
- If processing has not been deferred, the copy is completed. If **Review results** is selected, the Review Results step appears. For example:



To view more information, click **Details**. The Details window displays information about the source and target asset structures, asset mappings, employees, trades, maintenance groups, failure modes, and so on. For example:



Click **Close** to return to the wizard.

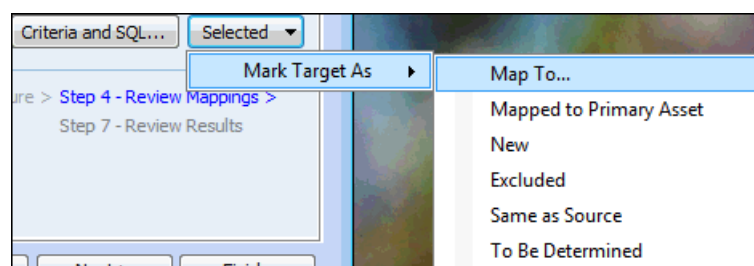
When you are finished reviewing results, click **Close**. You can view the information again on the **Copy Requests** tab for the site or the analysis.

- If **Open target analyses** is selected in the Confirm Selections step, the Strategy Development Analysis window appears.

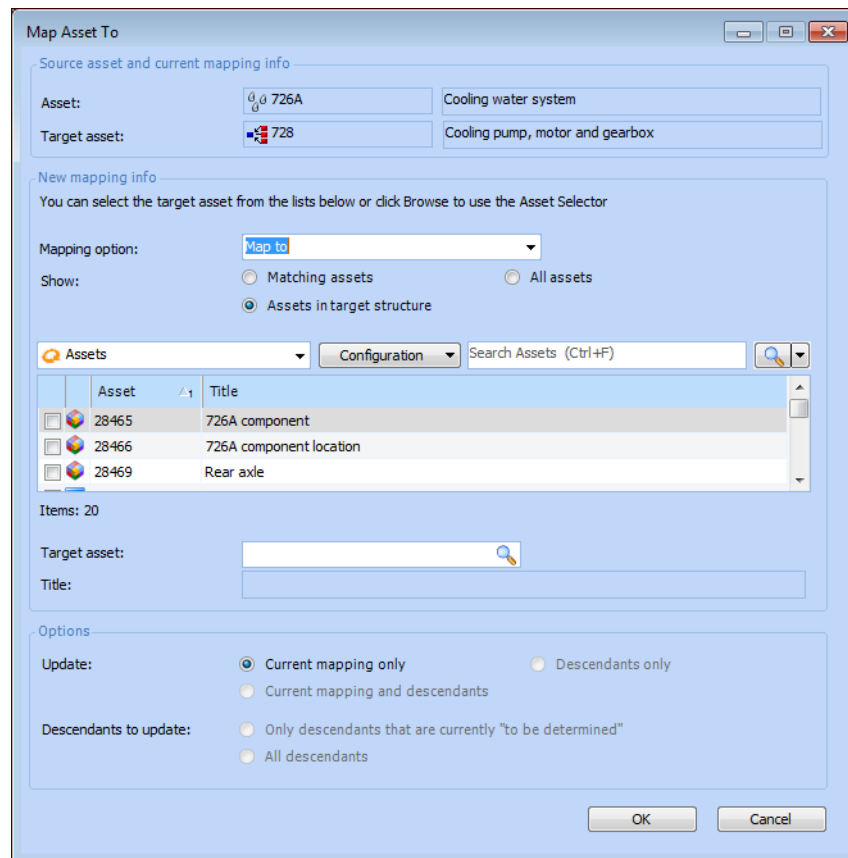
Manually Changing an Asset Mapping

You can change an asset mapping manually in the Review Mappings step of the Copy Failure Modes wizard.

1. Select the mapping in the **Asset mappings** table, click the **Selected** list, then **Mark As** and **Map To**.



The Map Asset To window appears.



2. To change the mapping options, select an option in the **Mapping option** list. The options are:
 - **Exclude** – the source asset is excluded from the copy, as well as any failure modes, indicators, and standard tasks and jobs that refer to it
 - **Map to** – map to a matching asset
 - **Map to primary target asset** – the source asset is mapped to the target asset selected as the starting point for the structure
 - **New** – a copy of the source asset is created when the copy request is processed
 - **Same** – the source asset is mapped to itself
 - **To be determined** – you can select the mapping option later
3. If you selected “Map To”, the next step is to select a new target asset. You can adjust the list of assets in the table using the **Show** options:
 - **Matching assets** – displays candidates identified during the original matching process

- **Assets in target structure** – displays all assets in the target structure
 - **All assets** – displays all assets on the site
4. Select the new target asset from the table or click **Browse** next to the **Target** box and select a target.
 5. If the target asset has descendant assets in the analysis, you can apply the mapping option to them as well. Select one of the **Update** options:
 - **Current mapping only** – the default selection limits the update to the current mapping
 - **Descendants only** – only descendants of the target asset are remapped
 - **Current mapping and descendants** – both the current mapping and the descendants' mappings are updated
 6. If you select to update descendants, the **Descendants to update** options are available:
 - **Only descendants that are currently “to be determined”** – only descendants that have not been mapped are updated
 - **All descendants** – descendants that have been mapped are also updated
 7. When you are finished, click **OK** to return to the Review FM Mappings step.

Revisiting Failure Mode Copy Requests

You can revisit a failure mode copy request after the Copy Failure Modes wizard has been closed. The **Copy Requests** tab is available for the site and individual analyses. The actions you can perform on a copy request include:

- Open the request to view information about the source and target, mappings, and results
- Resume defining and processing pending copy requests
- Keep track of your review process by marking processed requests as “to be reviewed” and “reviewed”

To View and Open Copy Requests

1. Do one of the following:
 - On the Site window, select the **Strategy Development** view and tab, and then the **Copy Requests** tab. This tab displays all of the copy requests for the site. The following configurations are available: failure mode copy requests, processing to be reviewed, not processed, and processed.
 - Open the analysis. On the **History** view, select the **Copy Requests** tab. This tab displays the copy requests that reference the analysis as either a source or target.

The **Copy Requests** tab lists each request’s status, description, source and target, and more. Here is an example for the site:

Strategy Development

Asset Prioritization

Reliability Strategy

RCA

Studies

Change Sets

Summary

Projects

KPIs

Settings

MTA2

RCM2

CPR

RBI

HAZOP

SIF

Damage Mechanisms Library

Action Plans

Failure Modes

Risk Matrix

Risk Assessment

Unwanted Situations

Barriers

Failure Mode History

Action Plan History

Copy Requests

Failure mode copy requests

Configuration

Status	Demand description	Source analysis	Source Title	Source
Process pending				
Processed	Copy strategy development pro...			
Processed	Copy CPR: 000001 - Vessel: Ves...	000001	Vessel: Vessel v-3501 - CPR	CPR
Processed	Copy MTA2: 000016 - Vessel: V...	000016	Vessel: Vessel v-3501 - MTA2	MTA2
Processed	Copy failure modes from MTA2: ...	000016	Vessel: Vessel v-3501 - MTA2	MTA2
Processed	Copy failure modes from MTA2: ...	000016	Vessel: Vessel v-3501 - MTA2	MTA2
Processed	Copy failure modes from MTA2: ...	000016	Vessel: Vessel v-3501 - MTA2	MTA2
Processed	Copy strategy development pro...			
Processed	Copy failure modes to MTA2 te...	000003	Vessel - SIF Template	SIF Te
Processed	Copy RCM2 functions from 0000...	000002	Vessel - RCM2 template	RCM2

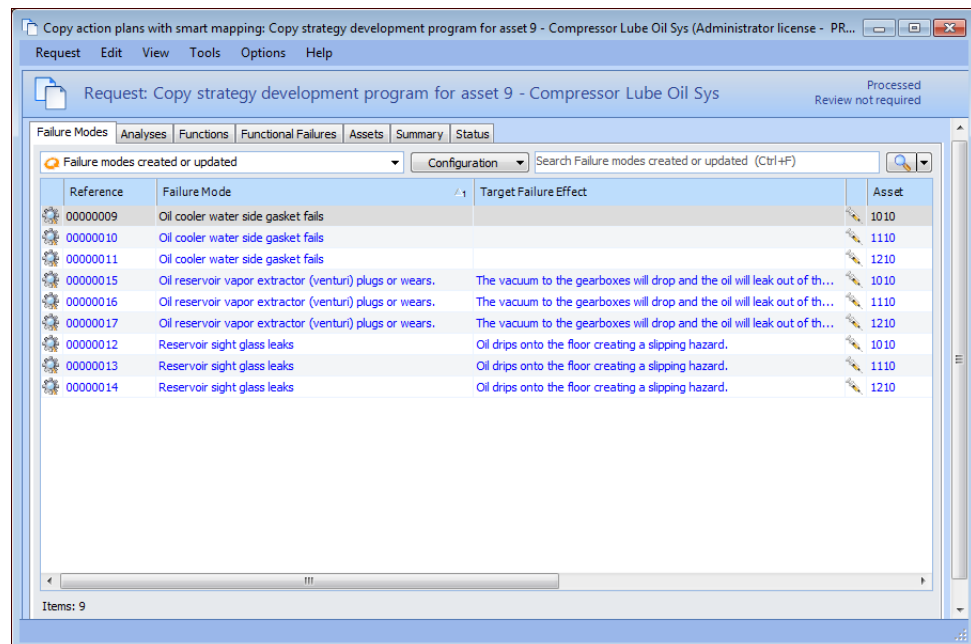
This site and below

Items: 10

Process

The status of the copy request can be one of:

- **Being defined** – the copy request has not yet been fully defined
 - **Ready to process** – the copy request was saved and closed after the matches were reviewed
 - **Process pending** – processing was deferred to be completed later, either manually or by the “Process Failure Mode Copies” scheduled action
 - **Processing started** – processing was canceled after it started
 - **Processed** – the copy process finished without error
2. Double-click a request to open the Copy Action Plans with Smart Mapping window. For example:



Detailed information is available in the three views and many tabs.

To Resume Defining and Processing a Copy Request

If a copy request has not yet been processed, you can resume defining it. You can complete the steps of the wizard and complete the copy.

1. In the site's **Copy Requests** tab, select **Not Processed** from the list of configurations. Only copy requests that have not been completed are displayed.
2. Right-click the request and click **Resume Definition**. The Copy Failure Modes wizard opens, showing the step where the definition process stopped.
3. Complete the steps in the wizard, as explained in [“Browsing for Failure Modes to Add to an MTA2 or Template” on page 231](#) or [“Copying an Asset’s Strategy Development Program” on page 258](#).

To Mark Processed Requests as Reviewed

You can keep track of your review process by marking processed requests as “to be reviewed” and “reviewed”. Only requests with the status “Processed” can be flagged in this way.

1. In the **Copy Requests** tab, select **Processed** from the list of configurations. The list of copy requests changes accordingly.
2. Right-click a request and click either **Mark As Processing to be Reviewed** or **Mark As Processing Reviewed**.

In the **Copy Requests** tab, you can scroll to the right to see the Processing Review Status column. You can also select “Processing to be reviewed” in the list of configurations.



Chapter 4 **Working with Maintenance Task Analyses**

This chapter explains how to change and monitor the statuses of analyses, modify analyses, and access analysis information.

Contents

Changing the Status of Failure Modes and Analyses	276
Sending an Analysis for Approval	280
Working with Action Plan Task Statuses	282
Viewing Information About an Analysis or Template	284
Reviewing Analysis Assets' Reliability Programs	289
Printing MTA2 Reports	296
Linking Action Plans to Projects	301
Working With a Project's Links to Action Plans.	303
Changing the Primary Asset on an Analysis	305
Updating the Asset Hierarchy Snapshot	307
Viewing Failure Modes and Action Plans	308
Viewing Failure Modes for Standard Tasks and Jobs	310
Editing an Asset's Failure Modes	313

Changing the Status of Failure Modes and Analyses

You can keep track of the strategy development process by monitoring the status of analyses and failure modes. For example, the site's **Strategy Development** view and tab, **MTA2** tab displays the statuses of the analyses in the Analysis status column:

Strategy Development	Asset Prioritization	Reliability Strategy	RCA	Studies	Change Sets	Summary	Projects	KPIs	Settings
Risk Assessment	Unwanted Situations	Barriers	Failure Mode History	Action Plan History	Copy Requests				
MTA2	RCM2	CPR	RBI	HAZOP	SIF	Damage Mechanisms Library	Action Plans	Failure Modes	Risk Mat
<div> MTA2 analyses Configuration Search MTA2 analyses (Ctrl+F) </div>									
	FMs	Site	Facilitator	Analysis Status					
NTR2 0	0	Southern Location		New analysis					
NTR2 1	1	Southern Location		Analysis completed					
NTR2 1	1	Southern Location		Analysis in progress					
NTR2 3	3	Southern Location		Closed					

To view the statuses of failure modes, open the analysis, select the **Facilitation** view and then the **By Asset** or **By Hierarchy** tab. The Action plan status column displays each failure mode's status. For example:

Action plan status
Implementation completed
Implementation not required
Facilitation incomplete
Facilitation completed

The following table shows your activities and the resulting status of the analysis and its failure modes. The analysis statuses are also used for templates.

Activity	Analysis Status	Failure Mode Status
Create analysis (before adding failure modes)	New analysis	
Create the first failure mode	Analysis in progress	Facilitation incomplete
Review a failure mode and mark it as Facilitation Completed	Analysis in progress	Facilitation completed
Review of a failure mode's consequence priority reveals that it does not warrant implementation. Mark the failure mode as Implementation Not Required.	Analysis in progress	Implementation not required
Analyze a failure mode that has been marked Facilitation completed and recommend an action plan. Mark the failure mode as Implementation Completed	Analysis in progress	Implementation completed
Mark the last failure mode as Implementation Completed or Implementation Not Required	Analysis completed	Implementation completed or Implementation not required
Mark the analysis as Closed	Closed	Implementation completed or Implementation not required

When working with action plans, keep the following in mind:

- A failure mode cannot be marked Implementation Completed or Implementation Not Required unless it has been marked Facilitation Completed and has a recommended strategy.
- Although a failure mode with the status Implementation Completed or Implementation Not Required cannot be edited, its status can be changed back to Facilitation Incomplete.

When working with the status of analyses, keep the following in mind:

- The status of an analysis or template indicates whether or not all of its failure modes have been marked either Implementation Completed or Implementation Not Required. At that point, the analysis' status changes automatically to Analysis Completed.
- An analysis or template must have the status Analysis Completed before you can mark it Closed.
- If an analysis asset does not need to have failure modes and action plans created for it, you can exclude the asset from the analysis so that the analysis can be closed. For example, the primary asset might not require analysis, although its descendants do. For more information, see [“Excluding Assets from an Analysis” on page 95](#).
- Once closed, the analysis or template cannot be edited. However, you can reopen a closed object.

This topic explains how to change the status of a failure mode. It also explains how to change the status of a completed analysis to Closed or a closed analysis to Analysis Completed.

To Change the Status of a Failure Mode

1. From the site's **Strategy Development** view and tab, select the **MTA2** tab.
2. Open the analysis containing the failure mode. Select the **Facilitation** view and the **Info Worksheet, By Asset**, or **By Hierarchy** tab.
3. Do one of the following:
 - To complete a failure mode, right-click it, click **Mark As**, and then **Facilitation Completed**, **Implementation Completed**, or **Implementation Not Required**.
 - To reopen a completed failure mode, right-click it, click **Mark As**, and then **Facilitation Incomplete**.

To Change the Status of an Analysis or Template

You can change the status of analyses that have the status Analysis Completed or Closed.

1. From the site's **Strategy Development** view and tab, select the **MTA2** tab.

Tip: You can also view the list of analyses from an asset's **Strategy Development** view and tab, **Analyses** tab.

2. Do one of the following:
 - To close an analysis, right-click it and click **Mark as Closed**. The system updates the analysis' status to Closed.
 - To open a closed analysis, right-click it and click **Reopen**. The system updates the analysis' status to Analysis Completed.

Sending an Analysis for Approval

This topic explains how to send an analysis to be approved.

Tip: For general information about the approval process, see “[Document Approvals](#)” in Help. For instructions on approving requests, see “[Approving a Document](#)” in Help.

If your organization uses the APM formal approval process, it is typically employed to vet the analysis when implementation has been completed for all failure modes. An analysis can be sent for approval when:

- The site’s approval settings specify that strategy development analyses must be approved and there is an approval route that includes them
- The analysis type requires approvals

Note: You cannot enable the approval process in the properties of individual analyses. An analysis type that requires the approval process must be assigned to the analysis.

- The analysis has the status “Analysis Completed” or “Closed”
- The analysis’ study status allows it to be sent for approval

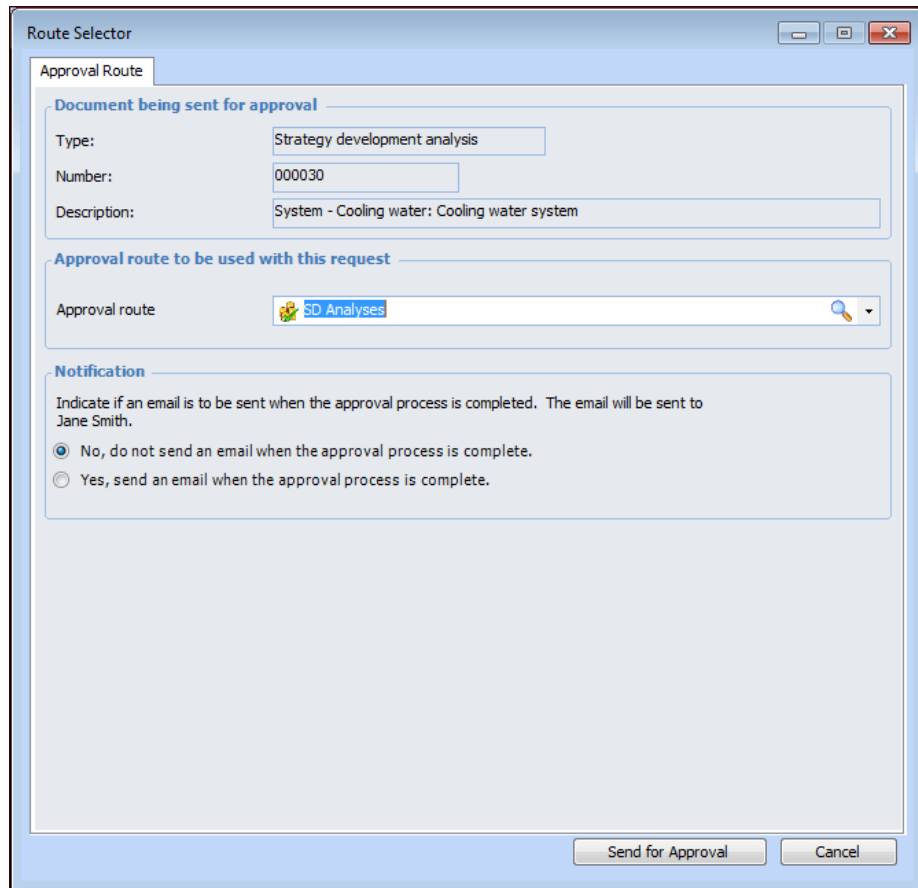
Tip: To view information about the analysis’ approval requests, select the **History** view and the **Approvals** tab. Information about the current and historical requests is displayed.

To Send an Analysis for Approval

1. Open the analysis that you want to send for approval. Click the **Analysis** menu and then **Send for Approval**.

Tip: You can also right-click the analysis in a table and click **Send for Approval**.

The Route Selector dialog appears. For example:



2. Select the **Approval Route** from the list. Only approval routes that are valid for strategy development analyses and the analysis type are listed.
3. Select whether or not the approval request's originator will be notified by email when the approval route is completed. Depending on the site's settings, the originator might be either the originator of the document being sent for approval or the employee who is sending the approval request. The name of the person considered to be the originator is shown in this section.

To have APM automatically send an email to the originator when all approvers have reviewed the request, select **Yes, send an email when the approval process is complete**.

4. Click **Send for Approval**. The approval request is sent to the first approver on the approval route and the approval status is updated (shown in the window banner). If a study status is linked to the event, the status is updated.

Working with Action Plan Task Statuses

You can define action plan task statuses for use with failure modes and action plans in addition to the statuses provided by APM (Facilitation Incomplete, Facilitation Completed, Implementation Completed, and Implementation Not Required). Facilitators and implementers can then use the additional statuses to co-ordinate their efforts, for example, marking an action plan for follow-up or review. The status can be set manually on the Maintenance Action Plan window, **Details** tab.

You can set up the statuses required by your organization in failure mode settings at the site level.

For information about creating action plan task statuses, see “Setting up Action Plan Task Statuses” in Help.


This topic explains how:

- [To Assign a Task Status to an Action Plan](#)
- [Viewing Action Plans’ Task Statuses for the Site](#)

To Assign a Task Status to an Action Plan

1. Open the Maintenance Action Plan window. For example:
 - From the site’s **Strategy Development** view, select the **Action Plans** tab. Locate and double-click the action plan to open the Maintenance Action Plan window.
 - On the Strategy Development Analysis window, select the **Facilitation** view and then the **By Asset** or **By Hierarchy** tab. Locate and double-click the failure mode to open the Maintenance Action Plan window.
2. Select the **Details** tabs.

Tip: To assign a task status to a secondary action plan, select the **Implementation** view in the Maintenance Action Plan window. Select the **Secondary Action Plans** tab. Double-click the action plan to open its Maintenance Action Plan window. Select the **Details** tab.

3. Make sure that editing  is enabled.
4. In the **Action Plan Status** list, select a status. Here is an example for an MTA2 failure mode:

The screenshot shows the 'Details' tab of a software interface. It contains several sections: 'Analysis information' with fields for Analysis (000001 - Relief valve: Pressure relief valve - MTA2), Analysis type (MTA2), and Status (Analysis in progress); 'Status' with fields for Facilitation and implementation (Facilitation incomplete), Study status ((None)), and Action plan task status ((None)); and 'Failure mode details' with a dropdown menu for Failure type (Facilitation follow-up required, Facilitation review complete, Review complete) and Failure classification ((None)).

5. Save the failure mode.

Viewing Action Plans' Task Statuses for the Site

To view action plans with the statuses that you have set up and assigned, select the site's **Strategy Development** view, **Action Plans** tab. Select an asset in the tree to list its action plans in the table. The Action Plan Task Status column displays the statuses assigned to all of the asset's primary and secondary action plans. For example:

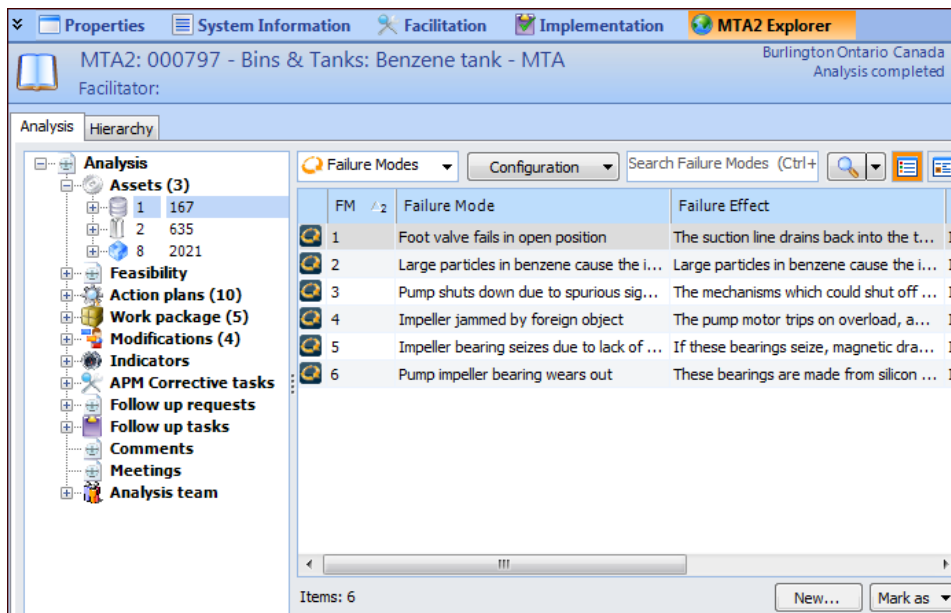
The screenshot shows the 'Strategy Development' view with a tree of assets on the left and a table of action plans for the selected asset on the right. The tree includes 'Southern Location, 5', 'Pressure relief valve, 6', 'Pump, 7', 'Water & Steam System, 21', 'Gas Storage System, 21', and 'Conveyor, 24'. The table lists action plans for the selected asset, showing FM Number, Action Plan Task Status, and Action Plan Type.

FM Number	Action Plan Task Status	Action Plan Type
000017	Facilitation follow-up required	Primary
000016	Facilitation follow-up required	Primary
000015	Review complete	Primary
000014	Facilitation review complete	Primary
000013	Facilitation follow-up required	Primary
000012	Facilitation review complete	Secondary
000011	Facilitation review complete	Primary
000010	Review complete	Primary
000007	Review complete	Primary

Viewing Information About an Analysis or Template

There are several ways to view detailed information about a strategy development analysis or template in the Strategy Development Analysis window:

- To take a comprehensive look at the analysis, select the **MTA2 Explorer** view. Select the **Hierarchy** tab to view assets and their failure modes. The **Analysis** tab displays a tree of the items associated with the analysis, such as assets, feasibility assessments, action plans, indicators, and team members. The table to the right shows information about the item selected in the tree. For example, select an asset to see a list of its failure modes:



The screenshot shows the MTA2 Explorer window for analysis 'MTA2: 000797 - Bins & Tanks: Benzene tank - MTA'. The 'Hierarchy' tab is selected, showing a tree view on the left and a table of failure modes on the right.

Assets (3)

- 1 167
- 2 635
- 8 2021

Feasibility

Action plans (10)

Work package (5)

Modifications (4)

Indicators

APM Corrective tasks

Follow up requests

Follow up tasks

Comments


Meetings

Analysis team

Failure Modes

FM	Failure Mode	Failure Effect
1	Foot valve fails in open position	The suction line drains back into the t...
2	Large particles in benzene cause the i...	Large particles in benzene cause the i...
3	Pump shuts down due to spurious sig...	The mechanisms which could shut off ...
4	Impeller jammed by foreign object	The pump motor trips on overload, a...
5	Impeller bearing seizes due to lack of ...	If these bearings seize, magnetic dra...
6	Pump impeller bearing wears out	These bearings are made from silicon ...

Items: 6

Tip: Select the form view  to view detailed information about individual failure modes.

- To view detailed information about an analysis' failure modes, recommended tasks, action types, corrective tasks, and indicators, select the **Implementation** view, **Action Plans** tab.
- To review how the analysis is implemented, select the **Implementation** view and the **Implementation Audit** tab. This tab provides table configurations that help you determine if implementation is complete. You can view lists of inspection tasks with no indicators, scheduled restoration and discards without corrective tasks, modifications without projects, and so on.

- To view counts of action plans, indicators, and corrective tasks, select the **Analysis Summary** view. This view also lists the symptoms assigned to failure modes on the **Fault Guide** tab.
- To view tables of action plans according to action type, select the **Action Plans** view and then choose the action type from the list of configurations. This view also shows a chart comparing the plans by action type and detailed information about the template on which the analysis is based.

Tip: To view charts of action plans by task type and status, make sure that your employee record includes the Site sidebar setting “APM standard sidebars”.

- To view a history of the changes made to the analysis, select the **History** view. The **History** view displays the **Analysis Audit Info**, **Asset Audit Info**, **Status**, and **Copy Requests** tabs.
- To view the failure modes created from a template’s failure mode, open the Maintenance Action Plan window for the template’s failure mode and click the **Usage** view. This view lists the failure modes created from the template.

This topic explains the information displayed on the **Analysis Summary** view and the **History** view.

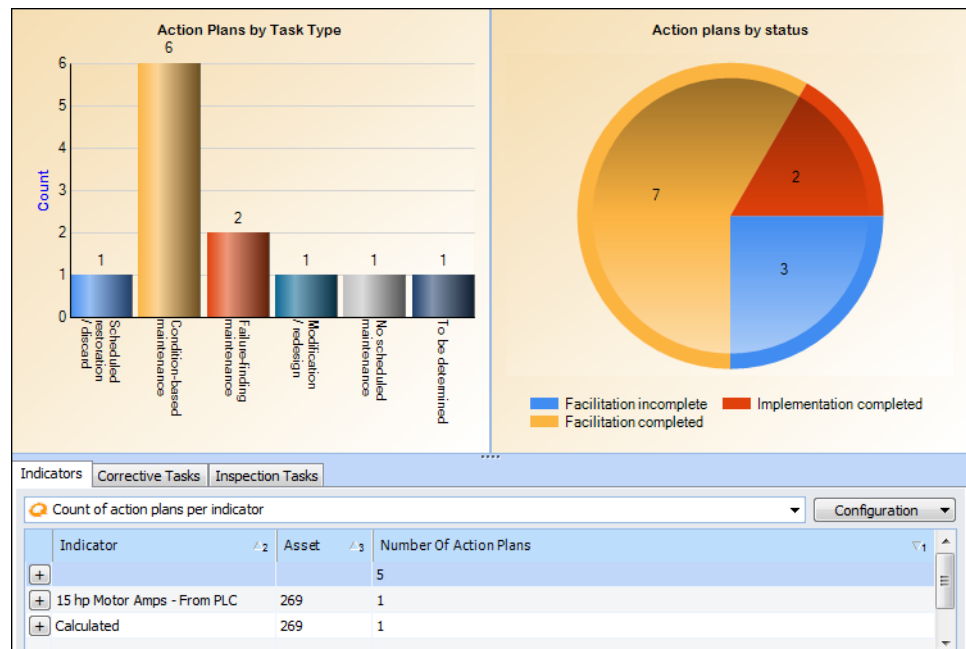
To View an Analysis Summary

1. From the site’s **Strategy Development** view and tab, select the **MTA2** tab.



Tip: You can also open an analysis from the asset’s **Strategy Development** view and tab. Select the **Strategy Development** tab.

2. Double-click the analysis or template that you wish to view. The Strategy Development Analysis window appears.
3. Select the **Analysis Summary** view.

The Action Plans by Task Type and Action Plans by Status charts shown in the following example are set up as sidebar dashboards and assigned to employees. For more information, see “[Dashboards](#)” in Help.



This view displays:

- The **Indicators** tab shows counts of the action plans for each indicator. Click  to expand an indicator's list of action plans.
- The **Corrective Tasks** tab shows counts of the standard tasks and jobs. You can also select configurations that show counts of action plans by task and by job. Click  to see the list of tasks or jobs.

Tip: If APM has been configured for read-only access to an external CMMS (SAP Plant Maintenance), any references to corrective tasks in that system are also displayed in the count of tasks.


- The **Inspection Tasks** tab shows a list of the inspection standard tasks assigned to action plans.
- If you record symptoms on failure modes, select the **Fault Guide** tab to view the symptoms identified in the analysis.

To View Analysis History

In the Strategy Development Analysis window, select the **History** view. For example:






Analysis Audit Info | Asset Audit Info | Status | Copy Requests | Activity Reports

By Event | By Data Element | General


 Audit info

Configuration

Search Audit info (Ctrl+F)



Action Performed	Number Of Updates	Performed On	Performed By	Report Archive Created On
 Updated	2	Friday, April 29, 2016 3:37:30 PM	Deb.Gardiner	 Friday, April 29, 2016 3:37:30 PM
 Updated	2	Friday, April 29, 2016 3:37:03 PM	Deb.Gardiner	
 Updated	1	Friday, April 29, 2016 3:34:45 PM	Deb.Gardiner	
 Created	0	Friday, April 29, 2016 3:32:11 PM	Deb.Gardiner	

Items: 4

 Audit details

Configuration

Search Audit details (Ctrl+F)

Data Element	Old Value	New Value	Audit Type
 Analysis status	Analysis completed	Closed	Value changed
 Closed on		Friday, April 29, 2016 3:37:30 PM	Value changed

Items: 2

This view displays:

- On the **Analysis Audit Info** tab, the **By Event** and **By Data Element** tabs list the actions performed on the analysis, the date when each action was performed, and the APM user who performed it. Whether you view the actions according to event or data element, you can see the new and old values for each data element in the Audit details table.
- On the **Analysis Audit Info** tab in the example, the **By Event** tab displays an icon for the audit report created when the analysis was marked “Closed”. Double-click a report icon to open the document.

Tip: The type of report and its format (for example, PDF or plain text) are defined in the analysis type assigned to the analysis. For information about enabling this feature, see “Setting up Analysis Types” in Help.

- The **General** tab displays the date and time when the analysis was created and last updated, as well as the APM users who performed the actions.
- The **Asset Audit Info** tab displays actions performed on the asset by event and by data element.
- The **Status** tab displays the dates on which milestones were completed on the analysis, as well as its current status.
- The **Copy Requests** tab lists occasions when the current analysis was copied, including the status of the copy, the target analysis, and the APM user who performed the action.

- The **Activity Reports** tab lists the asset activity reports for this analysis, and the asset activity reports in which the analysis is included.

Reviewing Analysis Assets' Reliability Programs

The analysis team can review reliability programs for the analysis assets. Review features include:

- APM provides summaries of assets' strategy development, reliability programs, and work management.
- You can create requests for Reliability Program Reviews for assets, standard tasks, standard jobs, job tasks, and indicators. In the Request dialog, specify an action like create, modify, or delete an item and optionally add a work planning document (work request or work order).
- You can view Reliability Program Review requests at the site or object level. Process an existing request by attaching a work document to monitor the requested action. You can also cancel requests or mark them "Completed".

Tip: Reliability Program Reviews are useful, for example, when you are using CMMS integration because they allow you to track changes that need to be carried out in the CMMS system, outside of APM.

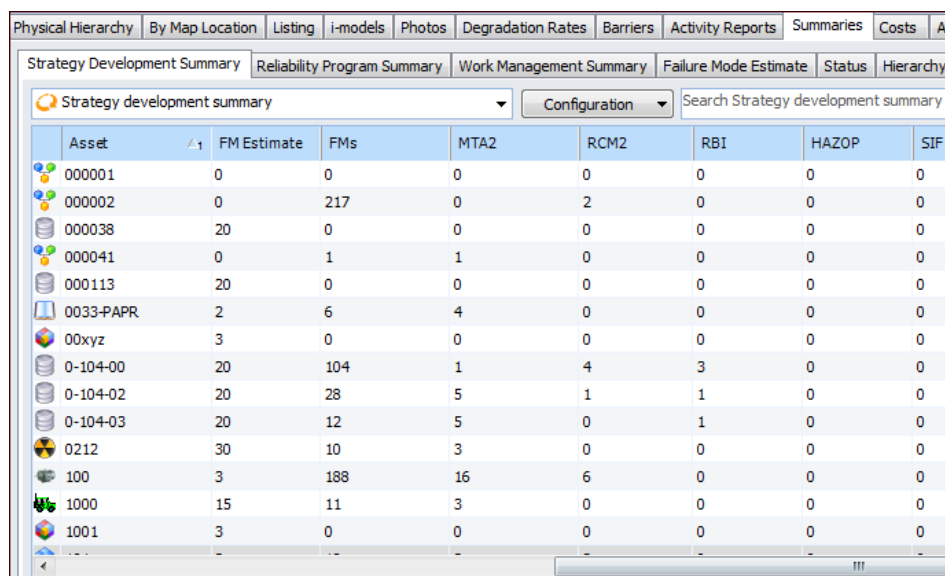
- In strategy development analyses you can do the following:
 - In the Strategy Development Analysis window, select the **System Information** view and the **System** tab to view the primary asset's reliability program. Select the **Assets** tab to view information for other analysis assets.
 - Add a secondary action plan with the recommended task "Review existing maintenance". Add your work document on the **Follow Up** tab. For more information, see ["Creating Secondary Action Plans" on page 184](#).
 - When you add a corrective task or job to an action plan, indicate that a reliability program update is required, specifying whether the update is to create, modify, or delete an object. When the action plan is marked "Facilitation Completed" or "Implementation Completed", the request is created automatically. For more information, see ["Adding Indicators, Tasks, and Work to Action Plans" on page 192](#).
 - When you add an indicator to an action plan, you can right-click it in the table and click **Review Request Details**. In the Request dialog that appears, specify the reliability program update required. When the action plan is marked "Facilitation Completed" or "Implementation Completed", the request is created automatically.

This topic explains how:

- To View Summaries for the Site
- To Request a Reliability Program Review
- To Work with Requests for Reliability Program Reviews

To View Summaries for the Site

1. In the Site window, select the **Assets** view and the **Summaries** tab. For example:



Asset	FM Estimate	FMs	MTA2	RCM2	RBI	HAZOP	SIF
000001	0	0	0	0	0	0	0
000002	0	217	0	2	0	0	0
000038	20	0	0	0	0	0	0
000041	0	1	1	0	0	0	0
000113	20	0	0	0	0	0	0
0033-PAPR	2	6	4	0	0	0	0
00xyz	3	0	0	0	0	0	0
0-104-00	20	104	1	4	3	0	0
0-104-02	20	28	5	1	1	0	0
0-104-03	20	12	5	0	1	0	0
0212	30	10	3	0	0	0	0
100	3	188	16	6	0	0	0
1000	15	11	3	0	0	0	0
1001	3	0	0	0	0	0	0

The **Strategy Development Summary** tab lists the assets, counts of their failure modes, and counts of their MTA2, RCM2, RBI, HAZOP, SIF, CPR, RCA, and RSS analyses.

2. Select the **Reliability Program Summary** tab. This tab lists the assets and counts of their standard tasks, standard jobs, job tasks, indicators, and standard documents.
3. Select the **Work Management Summary** tab. As well as assets, this tab lists counts of all work order tasks that have not been canceled or rejected and have been requested in the past five years. It lists counts of tasks according to their purposes, for example, inspection tasks and corrective maintenance. From the configuration list, you can select “Corrective work orders and failure mode counts”.

Tip: To view similar summaries for an individual asset, open the Asset window, select the **Hierarchies** view and then the **Summaries** tab for the first hierarchy (for example, **Physical Hierarchies**).

To Request a Reliability Program Review

1. Right-click the asset, standard task, standard job, job task, or indicator in a table, click **Reliability Program Review**, and then **New Request**. The Reliability Program Review Request dialog appears. For example:

The screenshot shows the 'Reliability Program Review Request' dialog box. It has a title bar with standard window controls. The dialog is divided into several sections. The 'Asset identification' section at the top contains three text boxes: 'Asset:' with the value '167', 'Name:' with 'Benzene tank', and 'Site:' with a globe icon and 'Burlington Ontario Canada'. Below this is the 'Request' section, which has two radio buttons: 'New' and 'Modification' (which is selected). There is also a 'Deletion' radio button. Below the radio buttons is a 'Request:' text box. At the bottom of the dialog is a tabbed interface with five tabs: 'Description' (selected), 'Planning Document', 'Completion Info', 'Notes', and 'History'. The 'Description' tab is active, showing a rich text editor with a toolbar (including icons for bold, italic, underline, bulleted list, numbered list, link, unlink, and text color) and a large text area. The toolbar also shows 'Arial' as the selected font and '10' as the font size. At the very bottom of the dialog are three buttons: 'OK', 'Edit', and 'Cancel'.

The identification area at the top of the dialog shows the ID number and name of the item you selected, as well as the site. If the request is for a task, job, job task, or indicator, its asset is also identified.


2. Select the type of action requested: **New**, **Modification**, or **Deletion**.
3. In the **Request** box, provide a brief description of the request for identification purposes.
4. On the **Description** tab, enter detailed instructions for the request.
5. You can add a planning document at this time or when the request is processed. To add a work request or work order to track the request's action:
 - Select the **Planning Document** tab and click **Create work document**. For example:

Reliability Program Review Request

Indicator identification

Indicator: Seal Condition

Asset: 104 City Passenger Bus MB 1999

Site:  Burlington Ontario Canada

Request

☐ New ☐ Deletion

☒ Modification

Request: Change collection frequency in CMMS

Description Planning Document Completion Info Notes History

Work planning document


☒ Create work document

Work document type: ☒ Work request ☐ Work order

For new or existing task:


Existing work order and task:

Planning document details

Asset:  104

Asset name: City Passenger Bus MB 1999



























Document title:

Work type:  Corrective

Requested completion:

Maintenance group:

☒ Send for approval (None)

                          Arial 10

OK Edit Cancel

- Select the appropriate options to add a work request or work order. If you select **Work order**, you can create a work order and task, or you can link the request to an existing work order and task.
- If you are creating a work document, provide a title, select a work type, completion date, and maintenance group.
- If work documents need to be approved at this site, select the appropriate approval route.

Tip: If you added a new work document to a request, open the request and select the **Planning Document** tab to view the document number. You can double-click the document's icon to open its window.

6. Select the **Notes** tab to record additional details.
7. Click **OK** to create the request and close the dialog.

To Work with Requests for Reliability Program Reviews

1. On the Site or Asset window, select the **Reliability Program** view, **Review** tab, and **Requests** tab. This tab lists requests made for assets, standard tasks, standard jobs, job tasks, and indicators. Here is an example from the Site window:

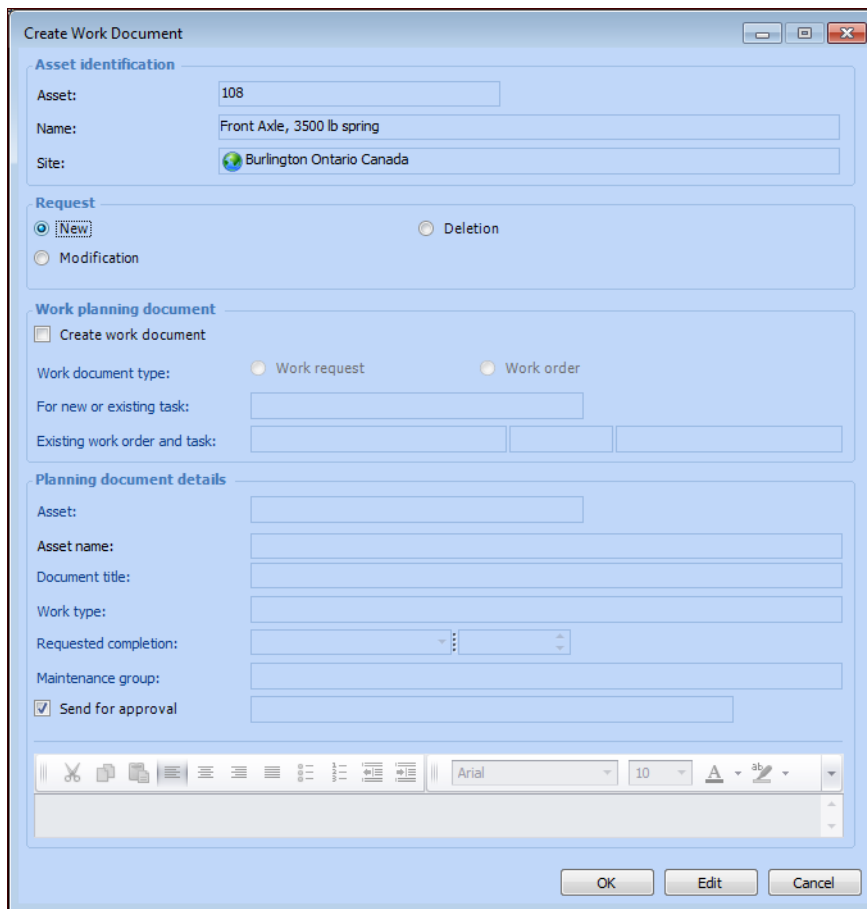
Review Request	Request Type	Request Status	Request Description	Processed	As
Add to new inspection route	Modification	Pending	Add to cooling tower inspection route.		13
Delete this task in CMMS	Deletion	Submitted	Delete this task in CMMS	✓	13
Create task in CMMS	New	Completed	Create task in CMMS		13
Modify job requirements in CMMS	Modification	Canceled			13

Tip: To view requests according to type of object, select the **Assets**, **Tasks**, **Jobs**, **Job Tasks**, and **Indicators** tabs.

Tip: To view requests in a Standard Task, Standard Job, or Indicator window, select the **History** view and then the **Review Requests** tab.

Reliability program requests can have the following statuses:

- Pending – The request does not have a work document.
 - Submitted – A work request or work order has been added to the request.
 - Completed – The request has been marked “Completed”.
 - Canceled – The request has been marked “Canceled”.
2. To process a request, select it in the table, click the **Selected** list, and then **Process Request**. The Create Work Document dialog appears. For example:



- Click **Create work document**.
 - Select the option to add a work request or work order. If you select **Work order**, you can create a work order and task or link the request to an existing work order and task.
 - If you are creating a work document, provide a title, select a work type, completion date, and maintenance group.
 - If work documents need to be approved at this site, select the appropriate approval route.
 - Click **OK** to create the document, update the request, and close the dialog. On the **Requests** tab, the request's status changes to "Submitted". If you created a work document, you can open the Request dialog to view its number on the **Planning Document** tab.
3. To close a request, select it in the table, click the **Selected** list and then **Mark as Completed**. The request's status changes to "Completed".

4. To cancel a request, select it in the table, click the **Selected** list and then **Cancel Request**. The request's status changes to "Canceled".


Printing MTA2 Reports

Several types of analysis reports are provided with APM, which you can print from the Strategy Development Analysis window or from the site's **Strategy Development** view.

You can also create custom reports or modify existing reports. For more information, see “Reports” in Help.

Audit Reports

If audit reports are supported for an analysis type, when an analysis of that type is marked “Closed”, an audit report can be created and added to the analysis's **History** view, **Analysis Audit Info** tab, **By Event** tab. For example:

Analysis Audit Info					
Asset Audit Info Status Copy Requests Activity Reports					
By Event By Data Element General					
Action Performed	Number Of Update	Performed On	Performed By	Report Archive Created On	
Closed	1	February-06-13 8:59:43 AM	Gary Willis		February-06-13 8:59:43 AM
Updated	0	February-06-13 8:59:40 AM	Gary Willis		
Updated	1	February-06-13 8:59:28 AM	Gary Willis		
Updated	0	February-06-13 8:59:25 AM	Gary Willis		
Updated	0	February-06-13 8:59:17 AM	Gary Willis		
Updated	0	February-06-13 8:56:22 AM	Gary Willis		
...					
Data Element	Old Value	New Value	Audit Type		
Analysis status	Analysis completed	Closed	Value changed		

You can double-click the report icon to open the file.

The type of report and its format (for example, PDF or plain text) are defined in the analysis type assigned to the analysis. For information about enabling this feature, see “Setting up Analysis Types” in Help.

Analysis Reports

You can print general reports that are available for all types of strategy development analysis:

- **Asset List:** lists the analysis assets by number, their material types, priority, degradation allowances, in service dates, and names.
- **Criticality Analysis:** lists the failure modes and the scores from their probability, confidence, and consequences evaluations.

- **Failure Mode Details:** lists information about the analysis, including status information, team members, and analysis comments. Then it lists details of each failure mode in the analysis, including reference number, failure effects, criticality evaluation, maintenance feasibility assessment, recommended strategy and details. Each failure mode's indicators and corrective tasks are also listed.
- **Failure Modes:** lists the analysis team, analysis comments, operating context, failure modes, failure effects, and asset information.
- **Fault Diagnosis Guide:** lists the symptoms identified on all failure modes in the analysis.

Tip: You can also print the **Fault Diagnosis Guide** for the site or an asset. On the site window, click the **Site** menu, **Print**, **Failure modes**, and then **Fault Diagnosis Guide**. The site report lists all of the site's symptoms, the failure modes that reference them, and their primary assets. On the asset window, click the **Asset** menu, **Print**, and **Fault Diagnosis Guide**. The asset report lists all of the symptoms identified on the asset's failure modes.

- **Maintenance Feasibility:** lists the analysis information followed by the failure modes and their proposed tasks, probability and consequence analysis results, MEI support, and the results of the feasibility assessment. This includes the ETBF, ETBC, avoidance savings, and original and residual criticality.
- **Modifications:** lists action plans that recommend redesign as the desired or compulsory action. The proposed modification is listed, as well as the trade and modification type.
- **Notes and Comments:** lists analysis assets, failure modes, and notes, as well as analysis comments.
- **Risk Analysis:** lists the analysis number and title, primary asset, and team facilitator. Failure modes are listed by asset, along with the results of their probability and consequence severity evaluations. For each failure mode, the consequence priority and criticality score are displayed.
- **Work Package:** lists failure modes according to the trade assigned to them. The frequency and operating condition are listed, as well as the asset number, recommended action description, and task duration. The report does not include action plans that recommend "No scheduled maintenance" and have no action type, that are analyzed separately, or that have not been analyzed.

You can print a report or save it to a file. When sending a report to a printer, you can include some or all of the files attached to the analysis and its failure modes.

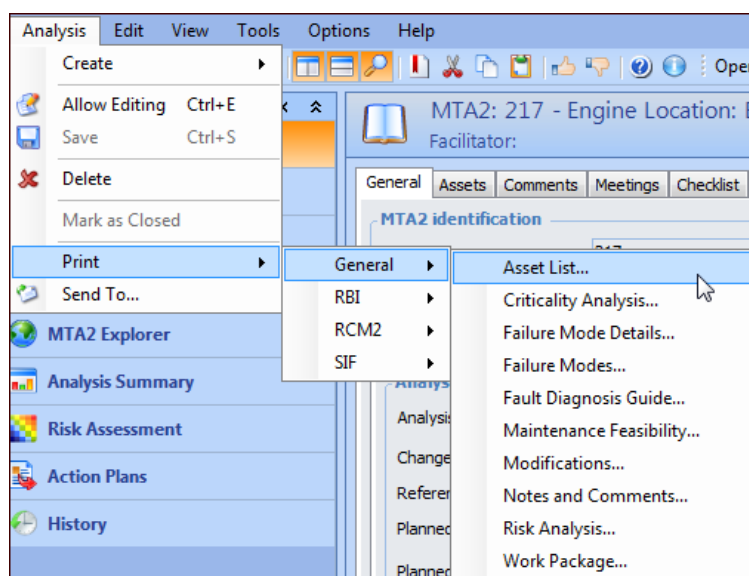
This topic describes how to print analysis reports. For information about saving a report to a file, see “Printing Documents” in Help.

To Print Analysis Reports

1. Open the analysis from the site’s or asset’s **Strategy Development** view and tab.

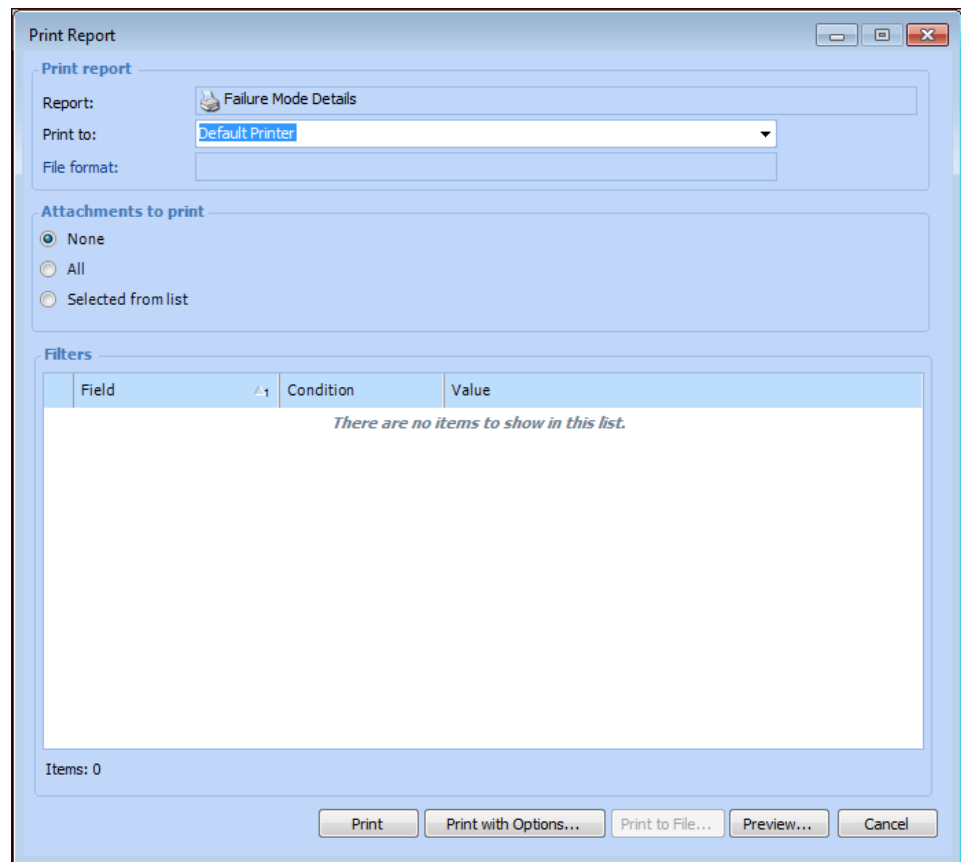
Tip: You can also print the report by right-clicking the analysis in any list, clicking **Print**, **General**, and then the report type.

2. In the Strategy Development Analysis window, click the **Analysis** menu, **Print**, **General**, and then the report you’d like to print.



Tip: You can also print a failure mode’s details report. Open the Maintenance Action Plan window, click the **Failure mode** menu, **Print**, and then **Failure Mode Details**.

The Print Report dialog appears. For example:



3. In the **Print to** box, select “Default Printer”.
4. To print attachments, do one of the following:
 - Click **All** to print files attached to the analysis and its failure modes.
 - Click **Selected from list** to choose the attachments to print. When you click **Print** or **Print with Options**, the Attachments to Print dialog appears, listing the file names, the objects they are attached to, and their attachment types.

Note: You cannot preview a print job that includes attachments.

5. If you are printing the Work Package, select the filter criteria to include.
6. If you are not printing attachments, you can click **Preview** to see what the report will look like before printing it.

Tip: In the Preview dialog, click the **File** menu to print the report, export it to a file, or send it by email in one of several formats.

7. In the Print Report dialog, do one of the following:

- Click **Print**. If you are printing selected attachments, the Attachments to Print dialog appears. Select the attachments and click **OK**.
- Click **Print with Options** to change printer options.

If you are printing selected attachments, the Attachments to Print dialog appears. Select the attachments and click **OK**.

The Print dialog appears, where you can change the printer, select printer properties, and specify the number of copies to print. If you are not printing attachments, you can specify a page range. When you are finished, click **OK**.

The report and any selected attachments are sent to the printer and a progress dialog appears.

Linking Action Plans to Projects

Any action plan that recommends modification or redesign of the asset can be associated with a project to plan and track the modifications. The action plan must have the status **Facilitation Completed** before it can be assigned to a project. You can create a project for an action plan or link an existing project to it. Each action plan can be linked to more than one project. Similarly, a single project can have more than one action plan linked to it.

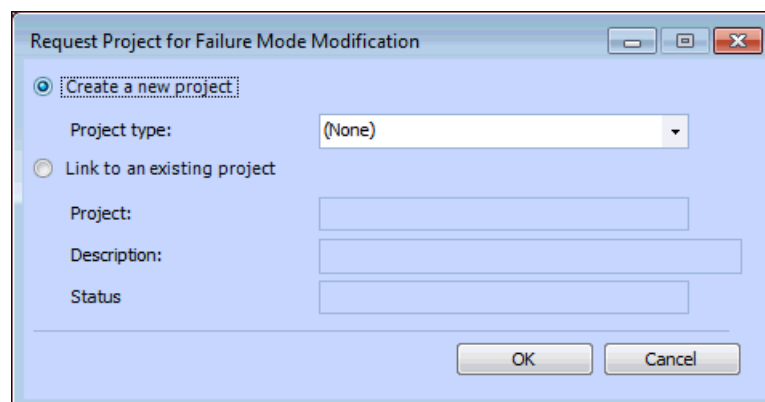
To view the projects linked to an analysis' action plans, select the **Implementation** view, **Projects** tab. When viewing a Project window, you can see a list of the action plans that are linked to it in the **Properties** view, **Action Plans** tab.

This section explains how to link action plans to new and existing projects.


To Link an Action Plan to a Project

1. Open the analysis and select the **Implementation** view, **Action Plans** tab. This tab lists the action plans and shows their statuses and whether they are primary or secondary.
2. Right-click the failure mode in the table, click **Link to Project**, and then **Modifications**. The Request Project for Failure Mode Modification dialog appears.

Note: An action plan must recommend the Modification/redesign action and have the status **Facilitation Completed**, before the **Link to a Project** option is available.

The image shows a dialog box titled "Request Project for Failure Mode Modification". It has a light blue background and standard Windows window controls (minimize, maximize, close) in the top right corner. There are two radio buttons: "Create a new project" (which is selected) and "Link to an existing project". Below the "Create a new project" option, there is a "Project type:" label followed by a dropdown menu currently showing "(None)". Below the "Link to an existing project" option, there are three text input fields labeled "Project:", "Description:", and "Status:". At the bottom right of the dialog are "OK" and "Cancel" buttons.

3. To link the action plan to a new project, do the following:
 - Click **Create a new project**.
 - Select a project type from the list.

- Click **OK**. A new project is created and the Project window appears. The action plan is referenced on the **Properties** view, **Action Plans** tab.
 - Define the properties of the project, as required, and close the window.
4. To link the action plan to an existing project, do the following:
- Click **Link to an existing project**.
 - In the **Project** box, click the browse icon () to open the Project Selector dialog. Select the project and click **OK**. The project name, description, and status are added to the Request Project dialog.
 - Click **OK**. The Project window appears. The action plan is referenced on the project's list of linked action plans. When you are finished, close the Project window.


You can link the action plan to as many projects as required.
The project appears in the **Implementation** view, **Projects** tab.

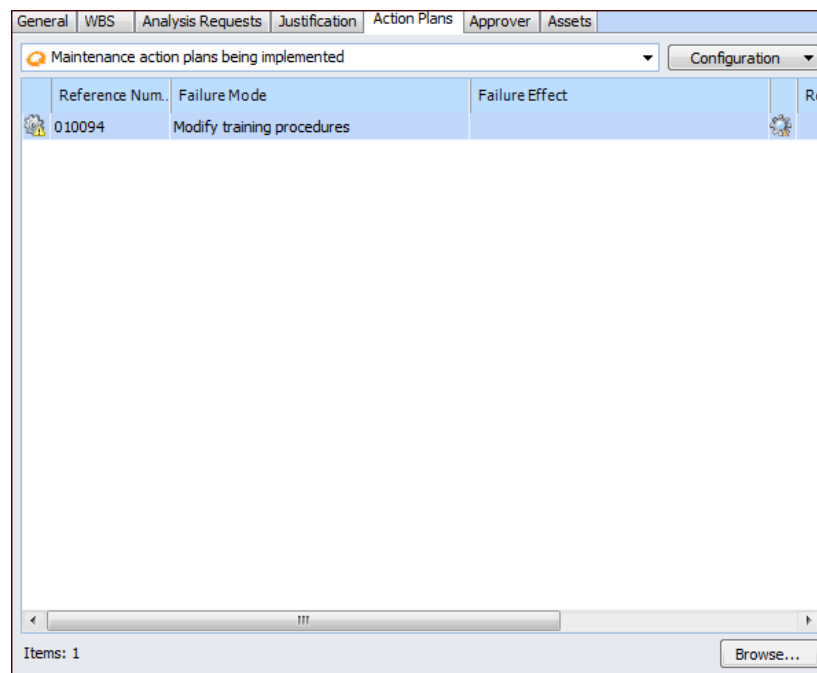
Working With a Project's Links to Action Plans

When viewing a project, you can review the action plans linked to it, link action plans to it, and remove links to action plans. Only action plans that were developed during strategy development analysis, that recommend modification or redesign of the asset, and that have the status Facilitation Completed can be linked to a project.

This topic explains how to add and remove links between a project and action plan.

To Work With a Project's Links to Action Plans

1. From the site's **Strategy Development** view, select the **Projects** tab and open the project.
2. Make sure that editing  **Edit** is enabled.
3. On the **Properties** view, select the **Action Plans** tab. This tab lists the action plans that have been linked to the project.



4. To link an action plan to the project:
 - Click **Browse**. The Failure Mode Selector dialog appears, listing failure modes that recommend modification/redesign and have the status Facilitation Completed.
 - Select one or more failure modes and click **OK**. The action plans are added to the **Action Plans** tab.


5. To remove a link to an action plan, right-click the action plan and click **Remove**. In the confirmation dialog that appears, click **Yes**. The link is removed from the project and the action plan.

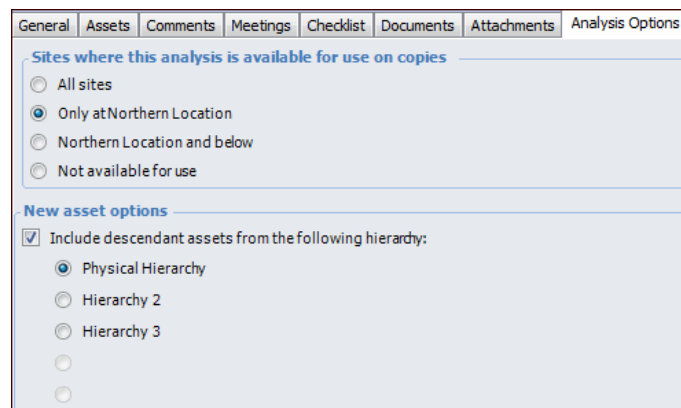
Changing the Primary Asset on an Analysis

In a new analysis, the **Properties** view, **Assets** tab displays the primary asset and, if specified when the analysis was created, the primary asset's descendants. You might find it necessary to change the primary asset in the analysis.

The original asset remains in the analysis. It is displayed under the new primary asset in the analysis asset hierarchy. If the analysis options specify that descendants be included, the new primary asset's child assets are added to the analysis.

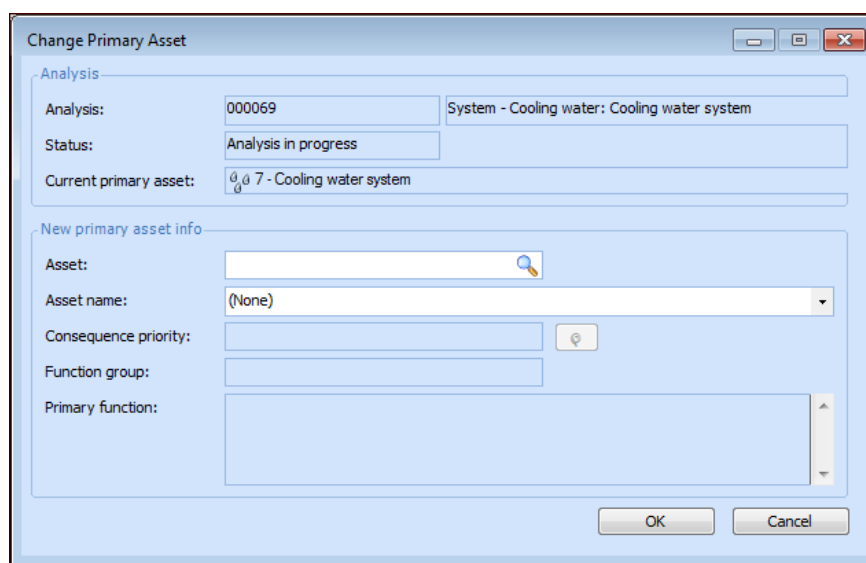
To Change the Primary Asset on an Analysis

1. Open the analysis and select the **Properties** view, **Analysis Options** tab.
2. Make sure that editing  is enabled.
3. In the **New asset options** area, specify whether or not descendant assets are included. If they are, select the hierarchy. For example:



The screenshot shows the 'Analysis Options' tab of a dialog box. It has several tabs at the top: General, Assets, Comments, Meetings, Checklist, Documents, Attachments, and Analysis Options. The 'Analysis Options' tab is active. It contains two main sections: 'Sites where this analysis is available for use on copies' and 'New asset options'. In the 'Sites' section, there are four radio buttons: 'All sites', 'Only at Northern Location' (which is selected), 'Northern Location and below', and 'Not available for use'. In the 'New asset options' section, there is a checked checkbox 'Include descendant assets from the following hierarchy:' followed by four radio buttons: 'Physical Hierarchy' (selected), 'Hierarchy 2', 'Hierarchy 3', and two empty radio buttons.

4. Select the **Assets** tab.
5. In the **Primary asset or system** area, click **Change**. The Change Primary Asset dialog appears. The **Analysis** area displays information about the analysis and current primary asset.



The dialog box is titled "Change Primary Asset" and contains two main sections. The "Analysis" section at the top includes fields for "Analysis:" (000069), "Status:" (Analysis in progress), and "Current primary asset:" (000069 - Cooling water system). The "New primary asset info" section below it includes an "Asset:" field with a browse icon, an "Asset name:" dropdown menu (None), a "Consequence priority:" field with a location pin icon, a "Function group:" field, and a "Primary function:" text area. At the bottom right are "OK" and "Cancel" buttons.

6. In the **Asset** box, click the browse icon to open the Asset Selector dialog. Select the new primary asset and click **OK**. The asset is displayed as the new primary asset.
7. Select the **Hierarchy** tab. The original primary asset is moved under the new primary asset in the analysis hierarchy. Any of the original primary asset's descendants that are not also descendants of the new primary asset are also moved.


Updating the Asset Hierarchy Snapshot

When you create an analysis that includes the primary asset's descendants, a “snapshot” is taken of the asset's physical hierarchy. This analysis hierarchy remains static. That is, any changes made to the site's physical hierarchy are not automatically made to the analysis hierarchy. However, when you add assets to an analysis, you can have APM refresh the analysis hierarchy with any changes that have occurred to the physical hierarchy.

Also, at any time, you can refresh the analysis hierarchy with new information about the physical hierarchy. For example, if a descendant was added to the primary asset in the physical hierarchy, updating the analysis hierarchy adds the descendant to the analysis. If the position of an asset changes in the physical hierarchy, the change is reflected in the analysis.

Note: If you deleted assets from your analysis, updating the snapshot might add them back into the analysis. For example, if you based the analysis on a primary asset and its descendants and then deleted one of the descendants, the update adds it back into the snapshot. However, assets that were excluded from the analysis are not re-included when the analysis hierarchy is updated.

To Update the Asset Hierarchy Snapshot

1. From either the site's or asset's **Strategy Development** view, open the analysis.
2. Make sure that editing  is enabled.
3. Select the **Facilitation** view and the **By Hierarchy** tab.
4. Click **Refresh** at the bottom of the asset hierarchy tree.
5. In the confirmation dialog that appears, click **Yes**. The assets' hierarchy is updated with the latest information from the physical hierarchy.

Viewing Failure Modes and Action Plans

APM provides several ways to view failure modes, action plans, and information about how they are used in analyses.

To view...	Select...
All of a site's failure modes and action plans	<ol style="list-style-type: none"> 1. Strategy Development view and tab on the Site window 2. Either: <ul style="list-style-type: none"> • Failure Modes tab or • Action Plans tab <p>Select an asset to view its failure modes or action plans. You can also view failure modes for assets above and below the current site.</p>
Failure records linked to failure modes	<ol style="list-style-type: none"> 1. Strategy Development view and tab on the Site window 2. Failure Modes tab <p>Select an asset and double-click a failure mode to open the Failure Mode dialog. The Failures view displays failures that have been linked to the analysis.</p>
All of an asset's failure modes, as well as summary charts	<ol style="list-style-type: none"> 1. Strategy Development view and tab on the Asset window 2. Failure Modes tab <p>Charts summarize the number of MTA2, RCM2, CPR, RBI, and SIF analyses, the number of action plans according to status, and the number of action plans according to strategy.</p>

To view...	Select...
An asset's functions, functional failures, and related failure modes	<ol style="list-style-type: none"> 1. Strategy Development view and tab on the Asset window 2. Functions tab <p>This tab shows the primary function, as well as a complete list of the asset's functions.</p> <p>Select the Functional Failures tab to see a list of the functions and functional failures.</p> <p>Double-click a row in either tab to see the failure modes associated with it.</p>
An asset's indicators and failure modes	<ol style="list-style-type: none"> 1. Strategy Development view on the Asset window 2. Indicators and Failure Modes tab <p>Select the asset and an indicator to view the failure modes associated with the indicator.</p>

Viewing Failure Modes for Standard Tasks and Jobs

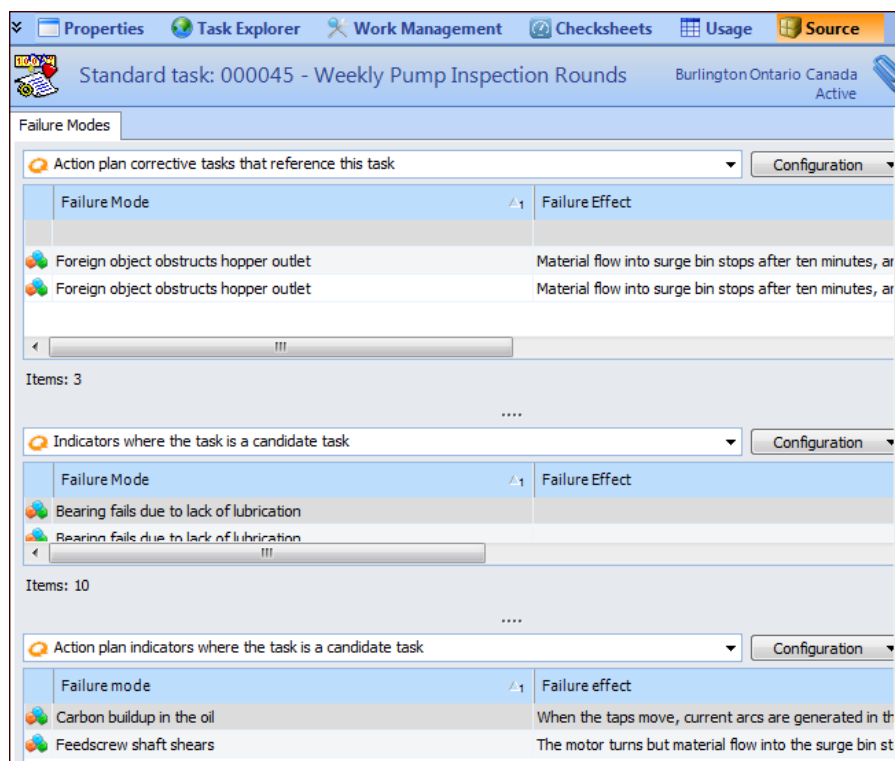
You can view information about where a standard task or job is referenced on failure modes as a corrective action or through an indicator assigned to the failure mode. You can also view tables listing standard tasks and jobs and how they are used.

This topic explains how:

- To View a Standard Task's Failure Modes
- To View a Standard Job's Failure Modes
- To View How Standard Tasks and Jobs are Used

To View a Standard Task's Failure Modes

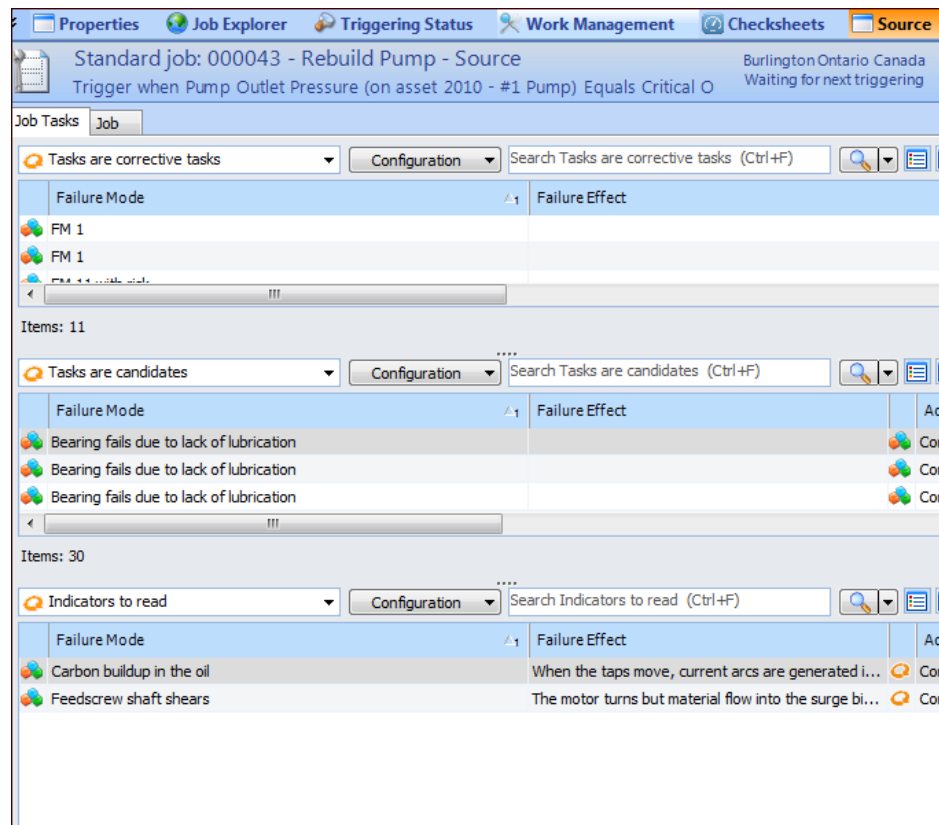
1. On the site's **Reliability Program** view, select the **Program** tab and then the **Tasks** tab.
2. Open the standard task and select the **Source** view.



The **Failure Modes** tab displays the failure modes on which the standard task is referenced as a corrective action. The second table lists the failure modes that include indicators that reference the standard task. The third table lists the failure modes that reference the standard task and indicators.

To View a Standard Job's Failure Modes

1. On the site's **Reliability Program** view, select the **Program** tab and then the **Jobs** tab.
2. Open the standard job and select the **Source** view.



The **Job Tasks** tab displays information about the standard job and its tasks. The **Job** tab displays the failure modes where the job is assigned as a corrective task or candidate.

To View How Standard Tasks and Jobs are Used

1. On the Site or Asset window, select the **Reliability Program** view, the **Program** tab, and the **Tasks** or **Jobs** tab.
2. In the list of configurations, select “Standard task usage” or “Standard job usage”.

For each standard task, the table lists:

- Task number and title
- Asset number and name
- Number of indicators and action plans that include the task as a corrective task
- Number of action plans that include the task as an inspection task
- Number of checksheets, work order tasks, and standard jobs
- Work type

For each standard job, the table lists:

- Job number and title
- Work type
- Asset number, name, and hierarchy location
- Number of indicators that include the job as a corrective job
- Number of action plans, checksheets, and work orders

Editing an Asset's Failure Modes

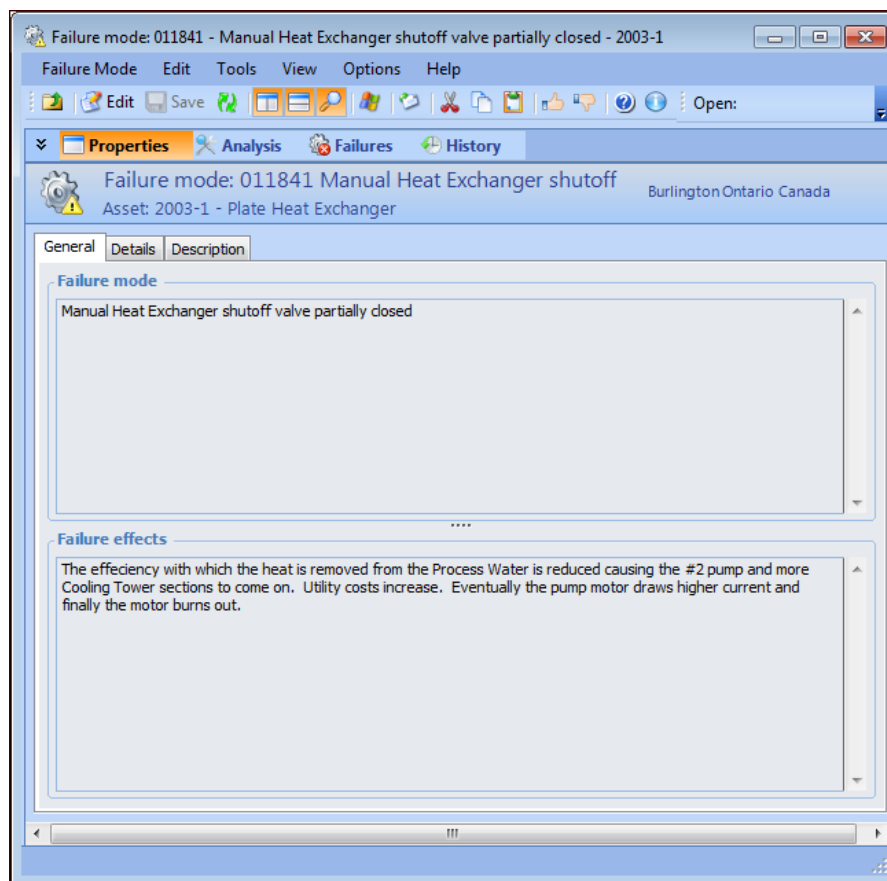
A failure mode is an event that causes an asset to fail to perform its function. For example, if a pump's impeller becomes sufficiently worn, the pump cannot convey liquid at the required rate. Failure modes are described during strategy development analysis, along with the action plans that prevent or mitigate failures.

After failure modes have been created, you can view and modify them from the site's and the asset's **Strategy Development** views. You can change the failure mode definition, failure effect, failure type, failure classification, and description.


To Edit a Failure Mode

1. Open the Failure Mode window in one of these ways:
 - Select the site's **Strategy Development** view. Select the **Strategy Development** tab and the **Failure Modes** tab. Select the asset in the tree and then double-click the failure mode that you wish to edit.
 - Select the site's **Assets** view. Open the asset and select the **Strategy Development** view and tab. On the **Failure Modes** tab, double-click the failure mode that you wish to edit.

The Failure Mode window appears. For example:



The **Analysis** view lists the analyses that include the failure mode. The **Failures** view displays information about any failures tracked against the failure mode.

2. Make sure that editing  is enabled.
3. Change the following information on the **General** tab, as required:
 - You can edit the failure mode description. A failure mode is an event that causes an asset to fail to perform its function. For example, if a pump's impeller becomes worn (failure mode), the pump cannot convey liquid at the required rate.
 - You can edit the failure effect description. A failure effect is the consequence of a failure mode. For example, when a pump's impeller becomes worn (failure mode), the flow through the pump declines until it no longer delivers liquid at the required rate.
4. On the **Details** tab, you can select the failure type and classification that allow failures to be grouped and categorized for reporting purposes.

5. Select the **Description** tab to change the long description for the failure mode.



Chapter 5 **MTA2 Templates**

A maintenance task analysis template (MTA2 template) is a group of settings that can be used as the basis for an analysis. This chapter explains how to create MTA2 templates, create nodes to organize templates in hierarchies, and view those hierarchies.

Contents

Creating an MTA2 Template	318
Setting up a Template Hierarchy	327
Viewing Template Hierarchies	332
Moving an Analysis Template to a Different Site	333

Creating an MTA2 Template

A maintenance task analysis template (MTA2 template) is a group of settings that can be used as the basis for an analysis. An MTA2 template identifies failure modes for a type of asset, rather than for a specific asset. Similarly, it refers to indicator templates, task templates, and job templates, not to specific asset indicators, standard tasks, and standard jobs. It includes a maintenance strategy for each of its failure modes. An MTA2 template can be used in the creation of new analyses and to copy action plans to existing analyses.

You can create a template from scratch or based on an existing analysis. Because the template is based on an asset type rather than a specific asset, there are some key differences between a template and an analysis:

- The asset type, rather than a specific asset, is displayed on the Strategy Development analysis window.
- The **Assets** tab is not available in the **Properties** view.
- No information is displayed in the **Asset** boxes and columns in the analysis.
- You can create or browse for an indicator template, task template, or job template to add to an action plan. When an analysis is created from the template or when the action plan is copied into another analysis, the system checks the asset for an existing indicator, standard task, or standard job based on the template. If it does not find one, a new indicator, task, or job is created using the template.

Note: If your APM environment includes multiple sites, MTA2 templates and failure modes can be used at sites with different site currencies. Any cost monetary amounts defined in failure modes are converted to the asset's site currency. If an exchange rate is not available, the amount is converted at par (for example, one U.S. dollar is equivalent to one Canadian dollar).

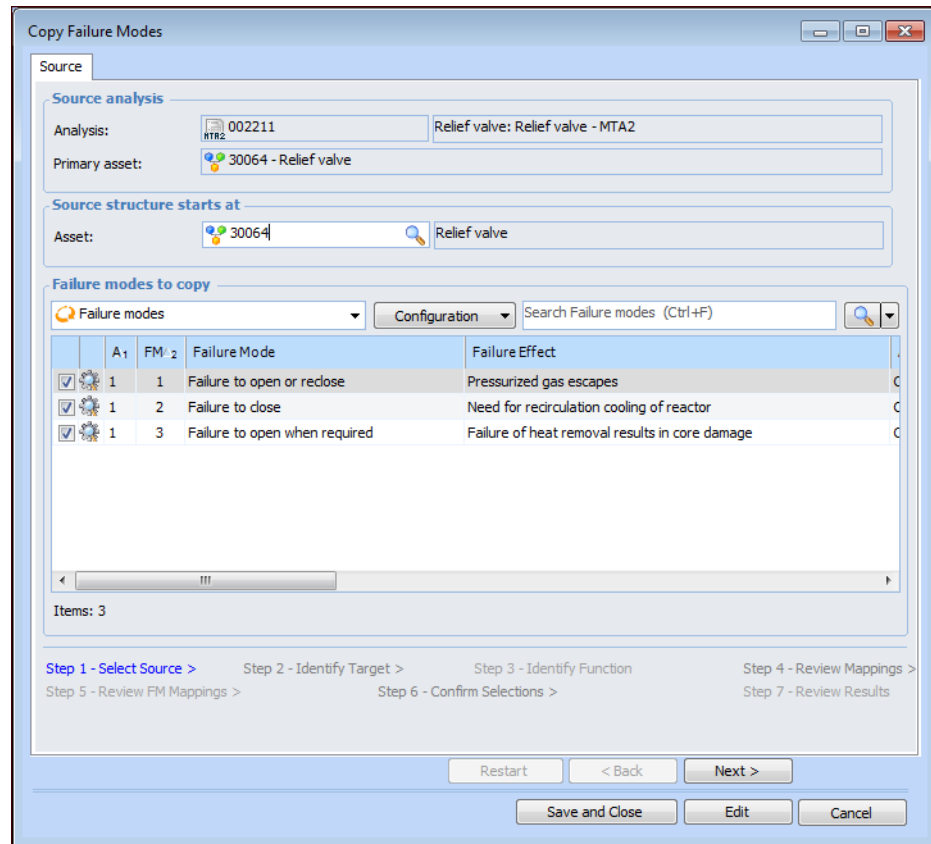
You can organize analysis templates in a hierarchy that includes MTA2 and RCM2 templates. For more information, see [“Setting up a Template Hierarchy”](#) on page 327.

This section explains how:

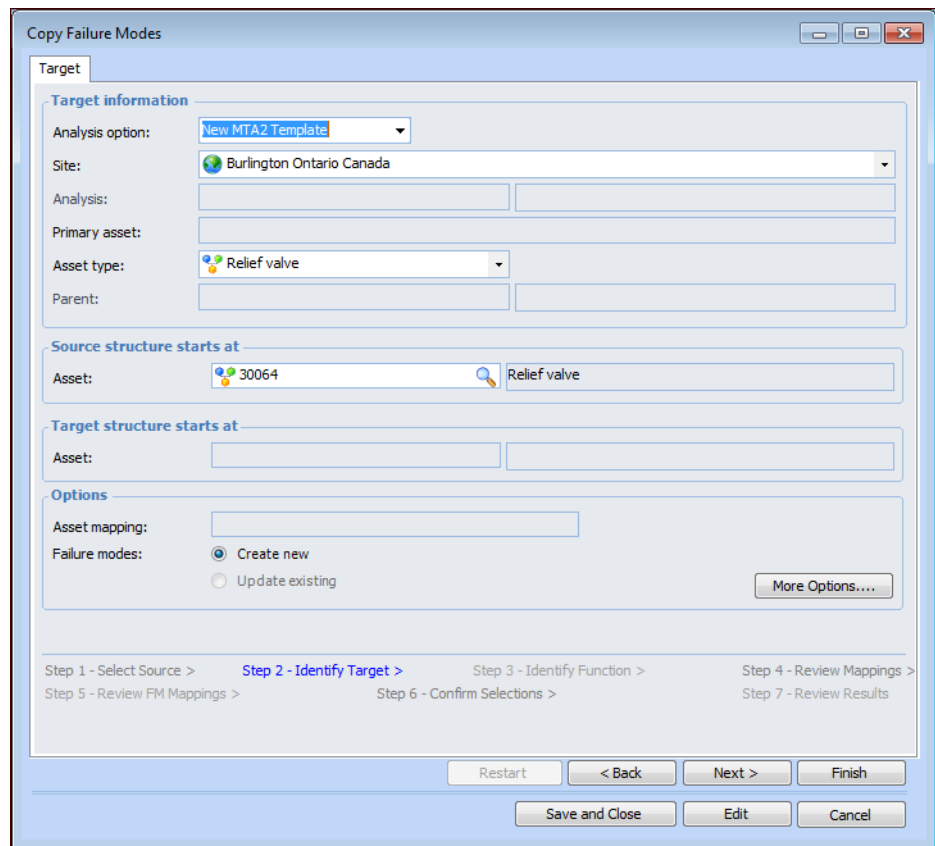
- [To Create an MTA2 Template Based on an Existing Analysis](#)
- [To Create an MTA2 Template from Scratch](#)

To Create an MTA2 Template Based on an Existing Analysis

1. Open the MTA2. The Strategy Development Analysis window appears.
2. Click the **Analysis** menu, **Create**, and then **Copy**. The Copy Failure Mode wizard appears.



3. By default, all of the failure modes are selected. Clear the boxes for the failure modes that you wish to exclude.
4. Click **Next**. The Identify Target step appears.
5. In the **Analysis option** list, select “New MTA2 Template”.



6. Change the target site, if appropriate. If the source analysis is allowed to be used at other sites, those sites are available in the **Site** list.
7. The **Asset type** box displays the asset type of the primary asset of the source analysis. Select another asset type, if appropriate.
8. If you wish to adjust mapping options for copying employees, trades, and maintenance groups, Click **More Options**. For more information, see “[Setting Mapping Options for a Failure Mode Copy](#)” on page 221.
9. Click **Next** to view the Review Mappings step. This page displays matches for employees, trades, maintenance groups, and other resources.
10. Click **Next**. The Confirm Selections step appears. For example:

11. Check the items that will be created or updated. If an incorrect copy request is processed, you will have to make the corrections manually. Click **View** to see more details about the items.
12. The **Failure Modes** tab displays information about the failure modes. If you wish to remove a failure mode from the list, right-click it and click **Remove**. Click **Back** to make adjustments on previous pages.
13. On the **Acknowledgment** tab, in the **Options** area, select the processing options:

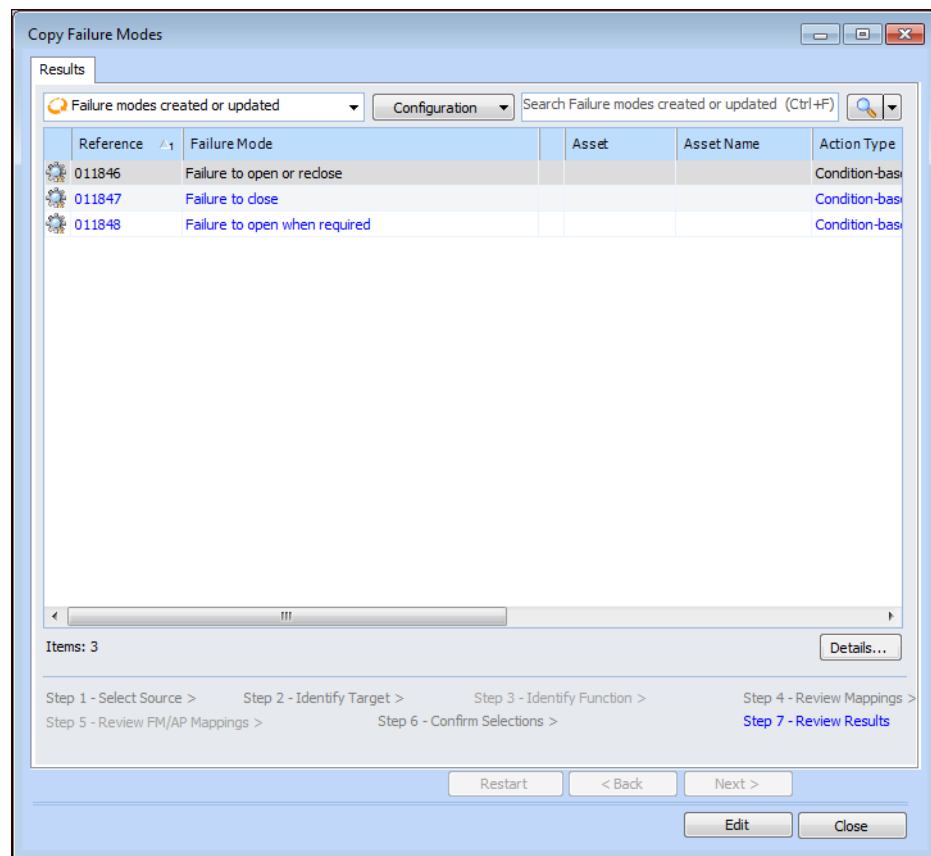
Setting Name	Description
Process Later	If this option is selected at the site level, failure mode copy requests are set to process later by default. The copy request is saved with the status “Process pending”. The user can later open the request to resume defining it or create a scheduled action (Process Failure Mode Copies) to perform the copies for all pending requests.

Open target analyses Target analyses are opened after the copy request is processed.

Review results The Results page is displayed after processing (if processing has not been deferred).

14. Click **Process** or **Finish** if **Process later** is selected. One or more of the following occurs:

- If **Process later** is selected, a confirmation message appears. Click **Yes** to save the copy request to be completed later.
- If processing has not been deferred, the copy is completed. If **Review results** is selected, the Review Results step appears. For example:



To view more information, click **Details**. The Details window displays information about the source and target asset structures, asset mappings, employees, trades, maintenance groups, failure modes, and so on. For example:

F #	FF #	FM #	Failure Mode	Failure Effect
1	A	3	Motor gearbox coupling drive cone worn	
1	A	4	Conveyor gearbox seal worn	
1	A	6	Conveyor motor fails	

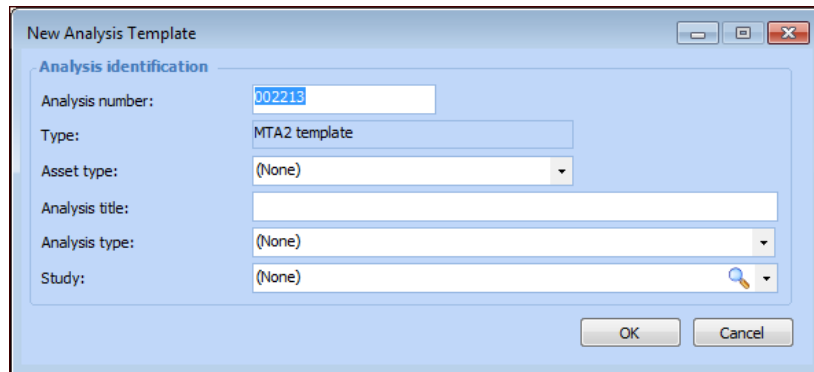
Click **Close** to return to the wizard.

When you are finished reviewing results, click **Close**. You can view the information again on the **Copy Requests** tab for the site or the analysis.

- If **Open target analyses** is selected in the Confirm Selections step, the Strategy Development Analysis window appears.

To Create an MTA2 Template from Scratch

1. Select the site's **Strategy Development** view and tab and the **MTA2** tab.
2. In the list of configurations, select **MTA2 templates**. The tab now lists all of the templates that have been defined for your site or its related sites.
3. Click **New**. The New Analysis Template dialog appears.



The image shows a 'New Analysis Template' dialog box with the following fields and options:

- Analysis identification** (tab)
- Analysis number:** 002213
- Type:** MTA2 template
- Asset type:** (None)
- Analysis title:** (empty text box)
- Analysis type:** (None)
- Study:** (None)
- Buttons:** OK, Cancel

4. Each analysis is assigned an analysis number by APM. You can change the number, but the new value must be unique for the site.
5. Select an asset type from the list.
6. In the **Title** box, the default name for the template follows this pattern:
Asset type – MTA2 template
You can change the title, if you wish.
7. If appropriate, select an analysis type from the list. An analysis type is a collection of preferred settings for strategy development analysis. The settings range from specifying how analysis titles are defaulted, to how avoidance savings are recorded on failure modes, to how risk analysis is performed (if at all).
8. Select an SDA study to associate with the analysis, if appropriate. Study references are used to group, filter, and order analyses.
9. Click **OK**. The Strategy Development Analysis window appears. The **Facilitation** view, **Info Worksheet** tab is shown.
10. To set the general properties of the template, select the **Properties** view. The **General** tab displays information about the template. For example:

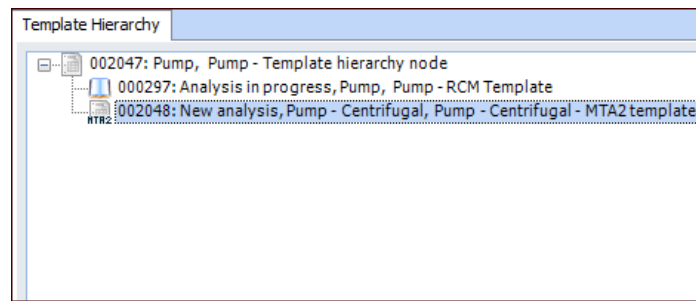
The screenshot shows the 'Strategy development analysis: 002213 - Relief valve - MTA2 template' window. The 'General' tab is active, and within it, the 'Template Details' sub-tab is selected. The 'MTA2 template identification' section shows 'Analysis number: 002213' and 'Title: Relief valve - MTA2 template'. The 'Analysis details' section includes fields for 'Analysis type', 'Change set', 'Study', 'Reference', 'Planned start', and 'Planned completion', all currently set to '(None)'. The 'Analysis status' section shows 'Status: (None)' with a 'Change Status...' button, and fields for 'Effective date' and 'Status comments'.

11. On the **General** tab, select the **Template Details** tab.

This close-up shows the 'Template Details' sub-tab. The 'Template information' section includes 'Asset type' (set to 'Relief valve'), 'Parent template' (with a search icon), and 'Parent template title' (empty).

12. You can change the asset type, if required.

13. To add the new template to a hierarchy, select a parent template, for example, a hierarchy node. In the **Hierarchy** view, the new template appears below the parent and its child templates. For example:



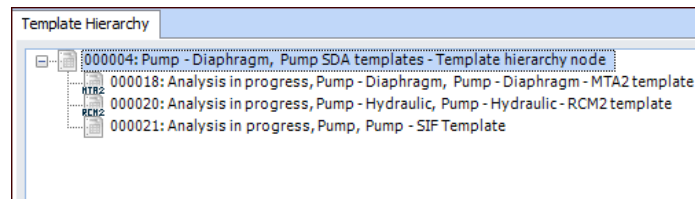
For more information, see [“Setting up a Template Hierarchy”](#) on page 327.

14. Select the **Documents** tab to browse for standard documents that are relevant to the analysis.
15. Select the **Analysis Options** tab to specify the sites where the template’s failure modes are to be available. For example, if the template is available at the current site only, its failure modes cannot be copied to analyses on other sites. You can also prevent the failure modes from being copied by selecting **Not available for use**.
16. Select the **Failure Mode Options** tab and the **Template Options** tab. The **Failure mode descriptions can be changed** option is selected by default. Clear this option if you want failure mode descriptions to be read-only.

You are now ready to develop the template by creating failure modes and more.

Setting up a Template Hierarchy

You can organize strategy development analysis templates into hierarchies. A template hierarchy can contain templates for other varieties of analysis, for example RCM2, as well as templates for different asset types. You can also create hierarchy nodes to group templates in the hierarchy. For example, a general “Pump” hierarchy node could be assigned as the parent of templates that analyze pumps of different kinds:



The simplest way to set up this hierarchy is to create a node for the Pump asset type. Then, in each template’s properties, assign the node as the template’s parent. In any template’s **Hierarchy** view, you can rearrange, add, and remove templates in the hierarchy. This topic explains how:

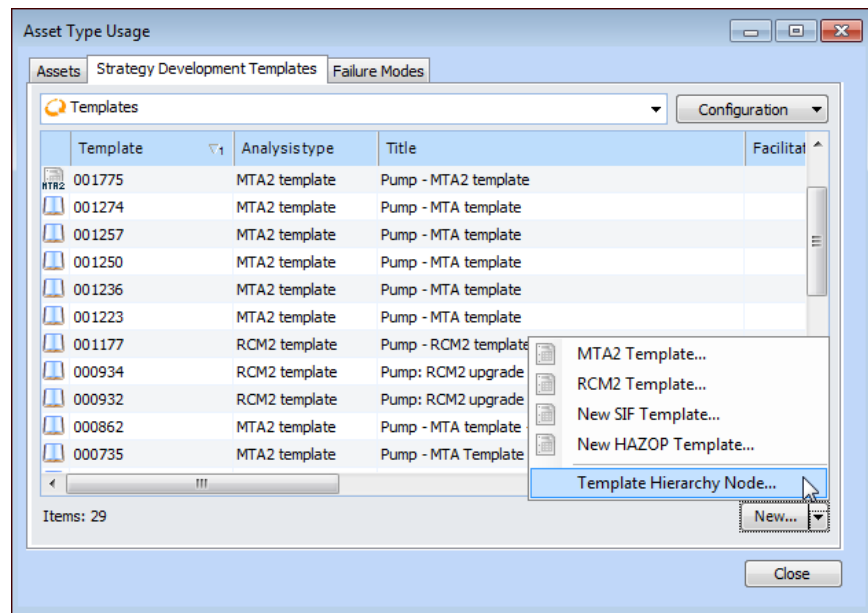
- “To Create a Template Hierarchy Node” on page 327
- “To Assign a Parent to a Template” on page 329
- “To Insert and Position an Existing Template or Node in a Hierarchy” on page 329

To Create a Template Hierarchy Node

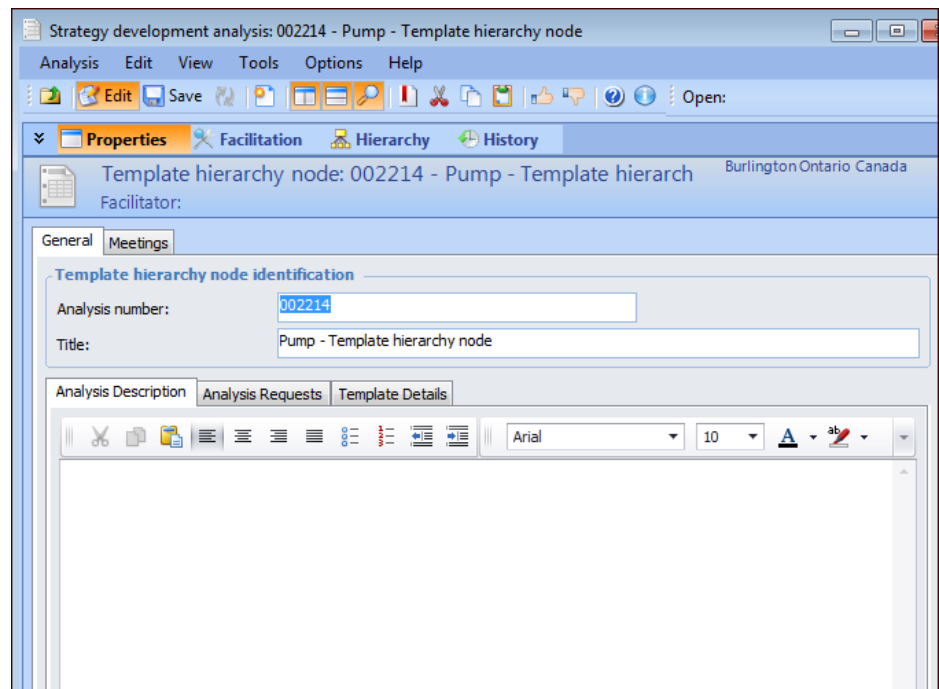
1. From the Site window, select the **Assets** view, **Settings** tab. Select the **Assets** tab and the **Asset management settings** node in the tree.

Tip: You can also select the **Administration** menu, **Asset Management Settings**, and then **Asset Management**. The Asset Management Settings dialog appears.

2. Select the **Asset Types** tab and open the asset type for the template node. The Asset Type window appears.
3. Click **Usage** to open the Asset Type Usage dialog. Select the **Strategy development templates** tab. From the **New** list, select **Template Hierarchy Node**. For example:



The Strategy Development Analysis window appears, open to the **Properties** view, **General** tab.




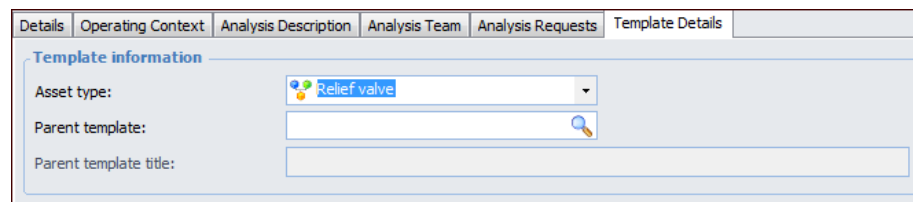
4. Each template is given an analysis number by APM. You can change the number, but the new value must be unique for the site.
5. The default title for the hierarchy node follows the pattern:
Asset type - Template hierarchy node

You can change the title, if you wish.

6. Save the hierarchy node and close the window. The node is added to the **Strategy Development Templates** tab. Close the Asset Type Usage dialog and the Asset Type window.

To Assign a Parent to a Template

1. From the site's **Strategy Development** view and tab, select the tab and configuration for the type of template.
2. Open the template and select the **Properties** view.
3. Make sure that editing  is enabled.
4. On the **General** tab, select the **Template Details** tab.

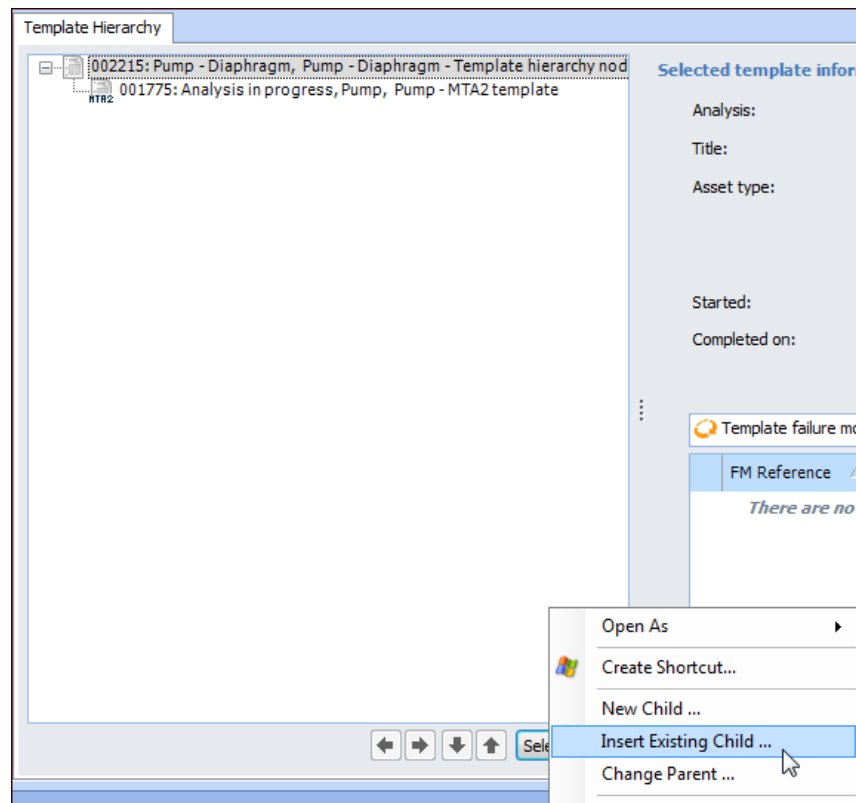


The screenshot shows a software interface with several tabs at the top: Details, Operating Context, Analysis Description, Analysis Team, Analysis Requests, and Template Details. The 'Template Details' tab is active. Below the tabs is a section titled 'Template information'. It contains three fields: 'Asset type' with a dropdown menu showing 'Relief valve', 'Parent template' with a text box and a magnifying glass icon, and 'Parent template title' with a text box.

5. Click the browse icon to select a parent template, for example, a hierarchy node. In the **Hierarchy** view, the template appears below the parent and any existing child templates.

To Insert and Position an Existing Template or Node in a Hierarchy

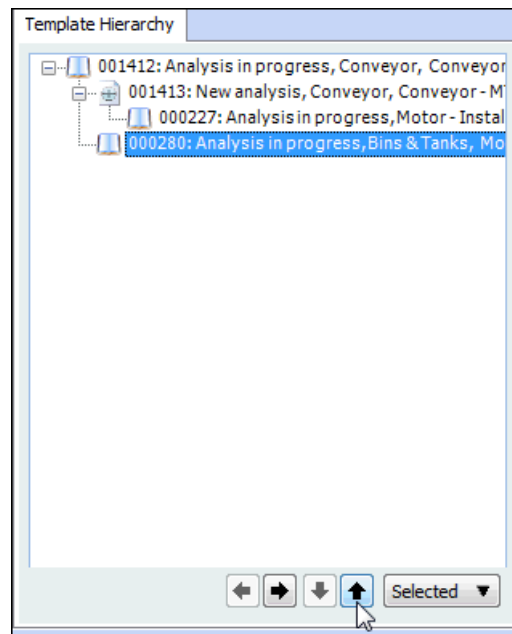
1. From the site's **Strategy Development** view and tab, select the tab and configuration for the type of template.
2. Open the template and select the **Hierarchy** view.
3. Select a node or template in the hierarchy. On the **Selected** list, click **Insert Existing Child**:



Tip: Other useful options in this list are **Change Parent** and **Remove from Hierarchy**.

The Strategy Development Analysis Selector dialog appears. To view a list of templates and nodes, select one of the template configurations.

4. Select the template or node and click **OK**. The template or node is added to the template hierarchy, along with its descendant templates and nodes, if any.
5. You can move templates up or down and left or right in the hierarchy using the arrow buttons at the bottom of the **Template Hierarchy** tab. The availability of the buttons varies depending on the position of the selected template.



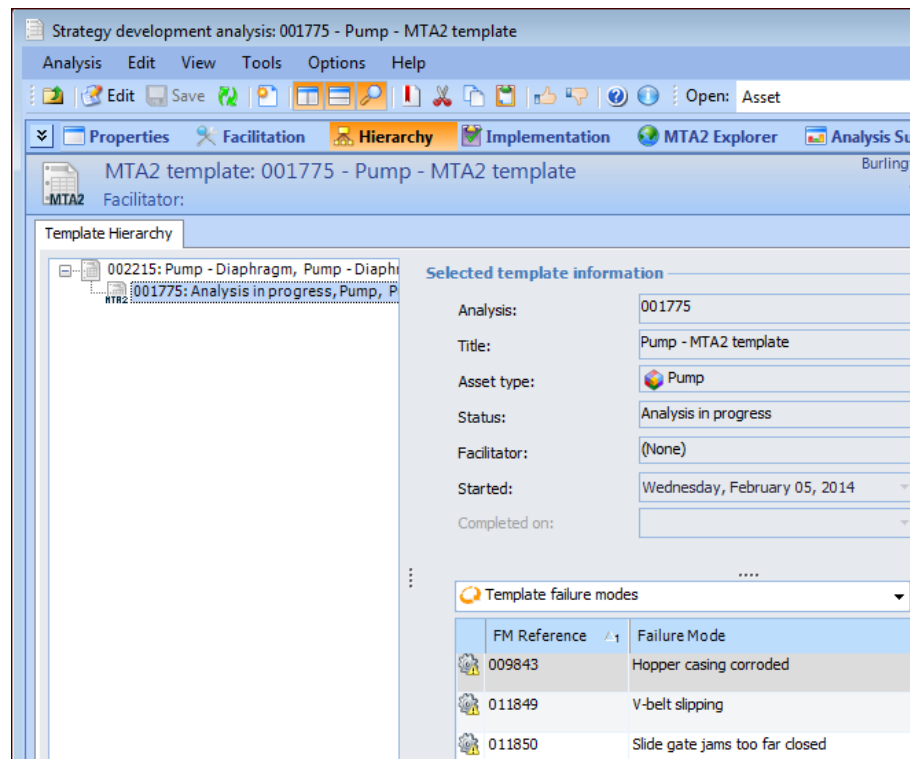
Tip: You can also drag and drop templates to change their positions.

Viewing Template Hierarchies

You can view an individual template's hierarchy, as well as details about the templates.

To View a Template's Hierarchy

1. Open the template and select the **Hierarchy** view.
2. Select a template in the hierarchy to view its details and action plans.
For example:



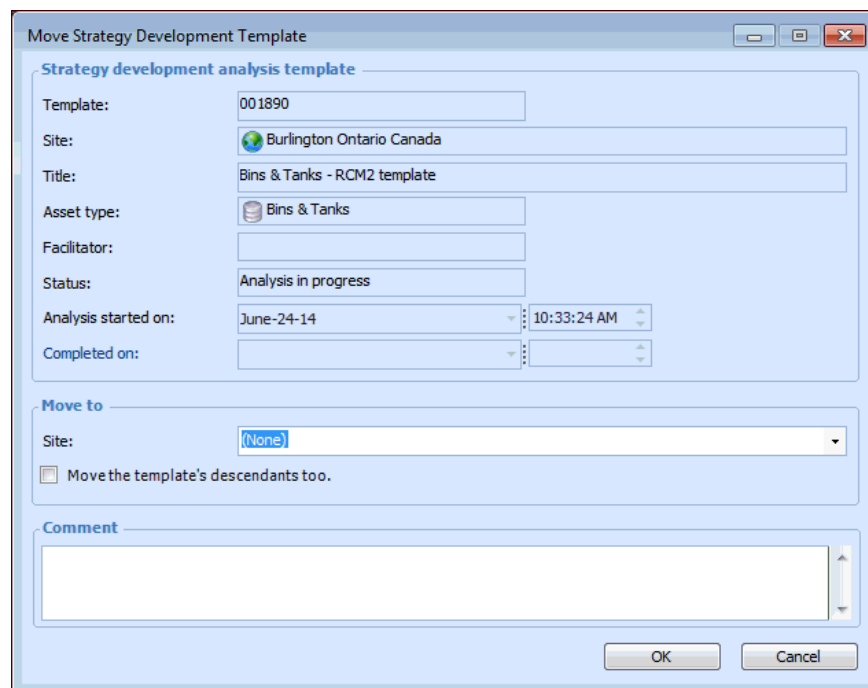
Moving an Analysis Template to a Different Site

You can move a strategy development analysis template from one site to another.

Note: If action plans exist that are based on the template's action plans, the link between the template and action plans might be broken. This occurs if the template is moved to a lower level site or to a different branch of the site hierarchy.

To Move an Analysis Template to a Different Site

1. On the site's **Strategy Development** view and tab, open the template that you wish to move.
2. From the **Tools** menu, select **Move To**. The Move Strategy Development Template dialog appears.



The screenshot shows the 'Move Strategy Development Template' dialog box. It has a title bar with standard window controls. The main area is divided into three sections: 'Strategy development analysis template', 'Move to', and 'Comment'. The 'Strategy development analysis template' section contains fields for Template (001890), Site (Burlington Ontario Canada), Title (Bins & Tanks - RCM2 template), Asset type (Bins & Tanks), Facilitator, Status (Analysis in progress), Analysis started on (June-24-14), and Completed on. The 'Move to' section has a Site dropdown menu currently set to '(None)' and a checkbox labeled 'Move the template's descendants too.' which is unchecked. The 'Comment' section is a large text area. At the bottom right are 'OK' and 'Cancel' buttons.

The **Strategy development analysis template** area displays information about the template you are moving.

3. Select the site that you want to move the template to.
4. If you want to move the template's children in the template hierarchy, select **Move the template's descendants too**.
5. In the **Comment** box, provide a reason or context for the move.

6. Click **OK**. The template is moved to the other site and renumbered.



Index

A

- Action Plan Task Statuses
 - Assigning for MTA2 [282](#)
- Action Plans, MTA2 [178](#)
 - Adding Corrective Tasks [192](#)
 - Adding Follow-up Work [192](#)
 - Adding Indicators [192](#)
 - Adding Inspection Tasks [192](#)
 - Adding Standard Documents [205](#)
 - Creating Primary [178](#)
 - Creating Secondary Plans [184](#)
 - Creating, Overview [24](#)
 - Indicator Collection Reports [203](#)
 - Linking to Projects [301](#)
 - Reopening [276](#)
- Asset Reliability Programs, for MTA2 [39](#)
- Assets [86](#)
 - Adding to MTA2 Analysis [86](#)
 - Changing Primary on MTA2 [305](#)
 - Editing Failure Modes for MTA2 [309](#)
 - Editing in MTA2 [86](#)
 - Excluding from MTA2 [95](#)
 - Strategy Development View [31](#)
 - Updating Hierarchy for MTA2 [307](#)
- Avoidance Savings
 - MTA2 Feasibility Evaluations [171](#)

B

- Before [124](#)

C

- Checklists on Maintenance Task Analyses [107](#)
- Comments on Maintenance Task Analyses [103](#)
- Corrective Tasks
 - Adding to MTA2 Action Plans [192](#)
- Criticality, Assigning to Failure Modes MTA2 [207](#)

D

- Demand Scenario Risk Analysis, MTA2 [147](#)

Documents

- Adding to MTA2 Action Plans [205](#)
- Duty Codes, Assigning to Failure Modes MTA2 [207](#)

E

- Estimated Time Between Consequences
 - MTA2 Feasibility Evaluations [171](#)
- Estimated Time Between Failures
 - MTA2 Feasibility Evaluations [171](#)
- Expected Frequencies
 - Selecting on MTA2 Action Plans [179](#)

F

- Facilitation Completed Status, MTA2 [276](#)
- Failure Data
 - MTA2 [164](#)
- Failure Mode Copy Wizard, MTA2 [211](#)
 - Asset WIP [258](#)
 - Browse for Failure Modes [231](#)
 - Copy in Place [246](#)
 - Copy To [244](#)
 - Mapping Options [221](#)
 - Quick Finish [232](#)
 - Resume Defining [270](#)
 - Smart Copy Settings [212](#)
 - Steps in Wizard [213](#)
 - Trigram Matching [221](#)
 - Viewing Requests [270](#)
- Failure Mode Risk Analysis, MTA2 [144](#)
- Failure Mode Risk Analysis, MTA2 [127](#)
 - Viewing Assessments [160](#)
- Failure Mode Risk Assessment, MTA2
 - Overview [17](#)
- Failure Modes, MTA2 [40](#)
 - Analysis Requests [118](#)
 - Analyze Separately [118](#)
 - Creating [112](#)
 - Demand Scenario Risk Analysis [147](#)
 - Editing for MTAs [309](#)
 - Feasibility Evaluations [171](#)
 - MTA2 Process Flow View [112](#)
 - Options on Analyses [64](#)
 - RCA Source [207](#)
 - Risk Analysis [127](#)
 - Risk Analysis with Weighted Severities

- 144
- Risk Assessment 17
- Risk Options on Analyses 77
- Susceptibility to Failure Evaluations 124
- Symptoms 210
- Usage Details 207
- Viewing 313
- Viewing Risk Analysis 160
- Viewing Standard Tasks and Jobs 310
- Failure Patterns
 - MTA2 164
- Failure-finding Intervals, MTA2 40
 - Calculating 186
- Fault Diagnosis Guide, Printing 297
- Fault Diagnosis Guides
 - MTA2 285
- Feasibility Evaluations
 - MTA2 171
- FFI, Calculating 186
- Follow-up Work
 - Adding to MTA2 Action Plans 192
- Formulas, FFI 188
- Frequencies
 - Selecting on MTA2 Action Plans 179
- Functions, MTA2 41

G

- Glossary, MTA2 39

H

- Hierarchy Node 327

I

- Implementation Completed Status, MTA2 276
- Indicator Collection Reports
 - For MTA2 203
- Indicators
 - Adding to MTA2 Action Plans 192
- Initial Risk
 - MTA2 Feasibility Evaluations 171
- Inspection Tasks
 - Adding to MTA2 Action Plans 192

L

- Linking
 - Removing Project Links to MTA2 Action

- Plans 303

M

- Maintenance Efficiency Index (MEI)
 - MTA2 Feasibility Evaluations 171
- Maintenance Task Analyses 12
 - Failure Tracking 14
 - Isograph Availability Workbench 14
 - Overview 12
 - SAP Plant Maintenance 14
- Maintenance Task Analyses, Settings
 - Failure Mode Options 64
 - Risk Analysis Options 77
- Mark MTA2 Failure Mode as Completed 276
- Meeting Notes on Maintenance Task Analyses 106
- MEI Override Reasons
 - Using in MTA2 Feasibility Evaluations 171

- MTA2 12
 - Adding Assets 86
 - Adding Corrective Tasks 192
 - Adding Follow-up Work 192
 - Adding Indicators 192
 - Adding Inspection Tasks 192
 - Adding Team Members 101
 - Analysis Requests for Failure Modes 118
 - Analysis Summary View 285
 - Analysis Types 34
 - Analyze Failure Mode Separately 118
 - Asset Scope 97
 - Asset Snapshots 86
 - Audit Reports 284, 296
 - Checklist 107
 - Comments 103
 - Condition-based Maintenance 39
 - Copying, Overview 33
 - Creating Failure Modes 112
 - Creating from Scratch 48
 - Creating from Template 54
 - Creating Primary Action Plans 178
 - Creating Templates 318
 - Creating, Overview 24
 - Document Numbering 36
 - Editing Failure Modes 309
 - Employee Roles 34
 - Entering Start Date 48, 54
 - Environmental Consequences 39
 - Excluding Assets 95
 - Failure Consequences 40
 - Failure Data 164
 - Failure Mode Options 64
 - Failure Modes 40
 - Failure Patterns 164
 - Failure-finding Intervals 40
 - Failure-finding Maintenance 40
 - Feasibility Evaluations 171
 - Functions 41
 - Glossary of Terms 39
 - History View 287
 - Implementation Audit 284
 - Indicator Collection Reports 203
 - Meeting Notes 106
 - Moving Templates 333
 - Non-Operational Consequences 42
 - Operating Contexts, Defining 34
 - Operating State 100
 - Operational Consequences 42
 - P-F Intervals 43
 - Preparing APM 34
 - Primary Asset, Changing 305
 - Primary Asset, Selecting 48, 54
 - Primary Functions 43
 - Printing Reports 296
 - Recommended Actions 26
 - Resequencing Assets 88
 - Reviewing Reliability Programs 289
 - Risk Analysis Options 77
 - Run-To-Failure 43
 - SAP Plant Maintenance, Setting up 38
 - Scheduled Restoration 43
 - Secondary Action Plans 184
 - Secondary Functions 43
 - Sending Analysis for Approval 280
 - Setting Smart Mapping Options 36
 - Site Ownership 34
 - Updating Hierarchy Snapshot 307
 - Viewing History 284
 - Viewing Standard Tasks and Jobs 310
 - Viewing Status 284
 - Viewing Template Hierarchies 332
- MTA2 Templates 317
 - Creating 318
 - Creating MTA2 With 54
 - Hierarchies 327, 332
 - Moving 333
 - Overview 33
 - Selecting Asset Type 318
 - Site Ownership 34
 - Sites 326
 - Top Analysis in Hierarchy 34
- O**
 - Operating Contexts
 - MTA2 100
 - Operating State, MTA2 100
- P**
 - Primary Asset, MTA2 305
 - Printing
 - MTA2 Reports 296
 - Projects
 - Links to MTA2 Action Plans 301
 - Removing Links to MTA2 Action Plans 303

R

RCA

- Failure Modes, Source of [207](#)

- Reliability Program Review Requests

- MTA2 [289](#)

- Reports, MTA2 [296](#)

S

- Secondary Action Plans, MTA2 [184](#)

- Severity of Usage Values, Assigning to Failure Modes

- MTA2 [207](#)

- Standard Documents

- Adding to MTA2 Action Plans [205](#)

- Standard Jobs

- Adding to MTA2 Action Plans [192](#)

- Viewing Failure Modes [310](#)

- Standard Tasks

- Adding to MTA2 Action Plans [192](#)

- Viewing Failure Modes [310](#)

- Status

- Changing MTA2 [276](#)

- Strategy Development View, MTA2 [31](#)

- Susceptibility to Failure Evaluations

- MTA2 [124](#)

- Symptoms, Assigning to Failure Modes

- MTA2 [210](#)

T

- Template Hierarchies, MTA2 [327](#)