Failure Modes and Effects Analysis

Contents

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Chapter 1

Overview

Topics:

Overview of the Failure Modes and Effects Analysis (FMEA) Module

A Reliability Centered Maintenance (RCM) analysis evaluates a system with respect to its individual function to determine how to avoid functional failures. Failure Modes and Effects Analysis (FMEA) focuses on actual equipment and locations and analyzes how each piece of equipment or location can fail and the effect of each failure. In other words, an RCM Analysis is conducted for the purpose of maintaining the function of a system. An FMEA Analysis is conducted for the purpose of maintaining the system itself.

Specifically, FMEA is a method of identifying the potential failures of equipment and locations, describing the possible effect of each failure, and making recommendations for actions that can be taken to prevent the failures from occurring.

In GE Digital APM, an FMEA Analysis consists of the following components:

- **Asset:** To create a FMEA analysis, you must define your assets.
- **Failure Modes:** After you have defined the equipment and locations for an FMEA Analysis, you can define one or more failure modes for each piece of equipment and location. Failure modes describe the ways in which each piece of equipment and location failure is likely to occur and are stored in RCM/FMEA Failure Mode records.
- **Failure Effects:** For each failure mode, you can then define failure effects, which describe the consequences of a failure occurring. Failure effects might describe the safety, environmental, and economic (or production) impact associated with a failure. In GE Digital APM, you can define a Risk Matrix that will be available in the analysis and can help you define the effects of each failure mode.
- **Recommended Actions:** For each failure effect, one or more recommended actions can be defined and stored in an RCM/FMEA Recommendation record. A Recommendation record defines what should be done to avoid the risk defined by the Failure Modes and Failure Effects. Recommended Actions can be determined, in part, using the Decision Tree document that has been set up for use with FMEA Analyses.

  Note: In addition, for each FMEA Analysis, you can define an FMEA team, which is a list of people who are involved in the analysis.

Access the FMEA Overview Page

About This Task

Procedure

In the **Applications** menu, navigate to the **STRATEGY** section, and then select **Failure Modes and Effects Analysis**.

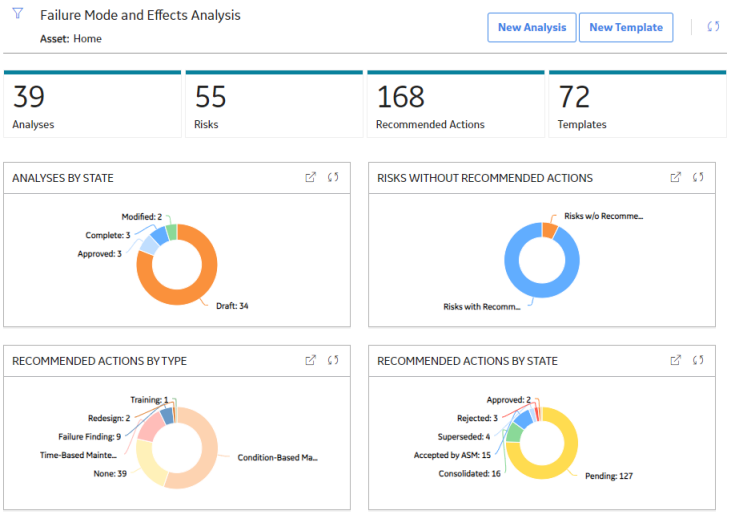
The FMEA Overview page appears, displaying the following tabs:

- **Analyses:** All analyses in the module.
- **Risks:** All the failure modes and effects associated with the analyses in the module.
- **Recommended Actions:** All the recommendations associated with the analyses in the module.
- **Templates:** All templates in the module.

The page contains the following charts:

- **Analyses by State:** Plots the number of analyses in each state.

- **Risks Without Recommended Actions:** Plots the number of failure effects in analyses with and without associated recommended actions.
- **Recommended Actions by Type:** Plots the number of recommended actions of each type in all the analyses.
- **Recommended Actions by State:** Plots the number of recommended actions in each state in all the analyses.



Note: The **Failure Modes and Analysis Overview** page is not updated automatically when you return to the previously opened tab. You can select to update the page.

You can select in the page to filter the information displayed on the **Failure Modes and Effects Analysis Overview** page to a specific time range or asset. When you filter by an asset, the page displays information for the selected asset and the assets under it in the hierarchy. The Home level includes information not related to an asset or related to an asset not in the Asset Hierarchy.

Failure Modes and Effects Analysis (FMEA) Workflow

This workflow provides the basic, high-level steps for using this module. The steps and links in this workflow do not necessarily reference every possible procedure.

1. Create FMEA Analysis record.
2. Create the Analysis team
3. Define the equipment and location list.
4. Define failure modes for each equipment or location.
5. Define failure effect for each failure mode
6. Define Recommended Actions for each failure effect.

GE Digital APM provides various tools that you can use to accomplish these tasks. The tools that you use will depend on your personal preference.

Chapter 2

Workflows

Topics:

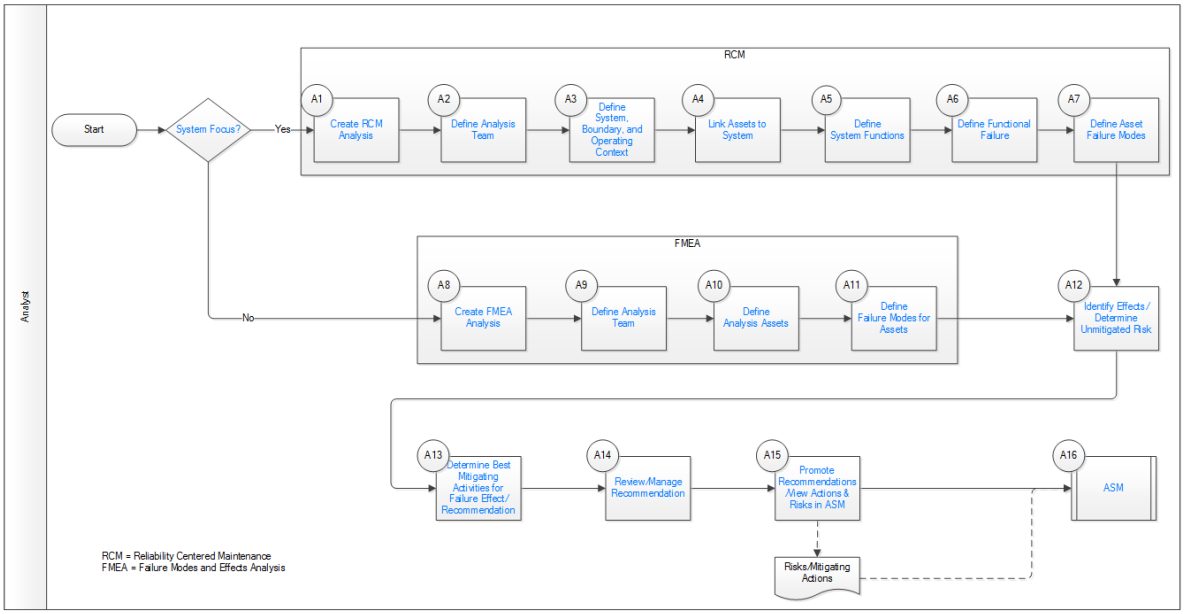
APM Strategy: RCM and FMEA Workflow

The RCM workflow describes the process of determining optimal maintenance and operational strategies based on the probability and consequence of the analyzed failure modes. Reliability Centered Maintenance (RCM) is a process to establish the safe minimum levels of maintenance while ensuring equipment continues to perform to its design function within the current operating context.

The workflow focuses on identifying the potential failures of equipment and locations, describing the possible effect of each failure, and making recommendations for actions that can be taken to prevent the failures from occurring.

In the following workflow diagram, the blue text in a shape indicates that the corresponding description has been provided in the sections that follow the diagram. For more information, refer to the Interpreting the Workflow Diagrams topic in the APM Product Workflows documentation.

Note: For information on the personas associated with a GE Digital APM module, refer to the APM Product Workflows documentation.



15. Promote Recommendations/View Actions & Risks in ASM on page 8
16. Asset Strategy Management (ASM) on page 8
17. Create FMEA Analysis on page 7
18. Determine Best Mitigating Activities for Failure Effect/Recommendation on page 8

System Focus?

Persona: Analyst

Choose RCM if you need an analysis that is conducted at the system level. Choose FMEA if you need the analysis at the asset level.

Create RCM Analysis

Persona: Analyst

Create the RCM analysis and add details, including some high-level attributes such as analysis start date and a re-evaluation date.

Define Analysis Team

Persona: Analyst

Define at least one analysis team member, and probably more, who are subject matter experts from maintenance, operations, and engineering.

Define System, Boundary, and Operating Context

Persona: Analyst

Create the system in this step at a high level, including common identifier(s) relevant to site terminology. Create a boundary to clearly identify the system and system functions being analyzed. Typically, a drawing or drawings, such as P&ID, are referenced in this step with mark-ups showing boundaries for the analysis. It is useful to understand the operating context of the system. An operating context document is assembled and reviewed with the team. The operating context diagram will include system functional flow description, equipment list, operating parameter ranges, and references.

Link Assets to System

Persona: Analyst

Link the assets that comprise the system being analyzed, including all relevant equipment by tag or ID. This is an important step, because Failure Modes and mitigating Recommendations will be defined with respect to the ID.

Define System Functions

Persona: Analyst

Identify and document system functions as a prerequisite to identifying failures and Failure Modes, and to developing effective maintenance strategies. Primary functions are the basic reasons that the system is acquired and installed. Secondary functions are usually less obvious, but can still have serious failure consequences and need to be understood. Define the function with a meaningful name and identify it with a function type of either Primary or Secondary. Quantify the functional performance in order to properly measure it.

Define Functional Failure

Persona: Analyst

Define the Functional Failure based upon the function statement. Functional Failure is the inability to perform the desired function. The Functional Failure can be a total failure or partial failure.

Define Failure Modes

Persona: Analyst

Define Failure Modes to clearly represent how the failures occur. For every failure, there is a least one Failure Mode, and often, there are multiple. Understanding Failure Modes is critical because maintenance activities are selected to address the modes.

Create FMEA Analysis

Persona: Analyst

Create an FMEA Analysis and add details, including some high-level attributes such as analysis start date and a re-evaluation date. Failure Modes and Effects Analysis (FMEA) focuses on actual equipment and locations. It analyzes how each piece of equipment or location can fail and the effect of each failure.

Define Analysis Assets

Persona: Analyst

Define the assets (equipment or functional locations) that make up the system being analyzed. This will include all relevant equipment by tag or ID. This is an important step, because Failure Modes and mitigating Recommendations will be defined with respect to the ID.

Define Failure Modes for Assets

Persona: Analyst

Define Failure Modes for each asset to clearly represent how the failures occur. For every failure, there is a least one Failure Mode, and often, there are multiple. Understanding Failure Modes is critical because maintenance activities are selected to address the modes.

Identify Effects/Determine Unmitigated Risk

Persona: Analyst

Identify the effects of failure and determine the unmitigated risk in order to understand the effects/consequences of failure and the probability of failure. Run decision logic, if necessary. Failure effects and consequences of failure are closely related and are often used interchangeably. Think of effects as the direct outcome of failure and consequences as the safety (health/environment) or economic outcome. Together, consequence and probability define a criticality (or Risk) associated with failure. When assessing consequences of failure, first identify whether they are hidden or evident. Secondly, assess whether there are Safety, Health, and Environmental consequences. Two items, Stored Energy and Toxic Material, are usually key indicators of potential risk to personnel Safety, Health, and/or the Environment. After identifying failure risks to Safety, Health, and the Environment, all other failure risks are identified using economic terms. This identification is not an either/or process. It is highly likely that Safety, Health, and the Environment Failure Modes will also have an economic consequence.

Determine Best Mitigating Activities for Failure Effect/ Recommendation

Persona: Analyst

Decide the mitigating activities for the plan. The Maintenance Strategy is the outcome of the FMEA analysis. It is the plan (activities) to manage an asset. All maintenance actions fall into one of four categories:

- Time- or Cycle-Based (Preventive) maintenance actions
- Condition-Based (Predictive) maintenance actions
- Failure-Finding Tasks (Detective) maintenance actions
- Run-to-failure (Maintenance Inaction)

Review/Manage Recommendation

Persona: Analyst

Review and manage the recommendations that make up asset strategies for each asset in the system. Similar or duplicate recommendations designed to address different Failure Modes can sometimes be consolidated as one activity that requires only one visit (e.g., shutdown) in a given time frame. This clearly reduces the stress on the machine and on the plant operations. For example, the condition-based activity of Vibration Analysis will often be recommended to mitigate the failure modes associated with bearing wear, misalignment, and unbalance. These recommendations may be consolidated into one actionable recommendation to be managed forward, while also maintaining an association to mitigated Failure Modes.

Promote Recommendations/View Actions & Risks in ASM

Persona: Analyst

Promote recommendations so they can be managed as a comprehensive asset strategy. The recommendations will be represented in the asset strategy as actions to be reviewed, approved, and implemented.

Asset Strategy Management (ASM)

Persona: Analyst

RCM and FMEA are GE Digital APM workflows from which you can promote Risks and Mitigating Actions to ASM to create strategies based on those recommendations.

Go to the ASM Workflow.

Chapter 3

FMEA Analyses

Topics:

About FMEA

A Reliability Centered Maintenance (RCM) analysis evaluates a system with respect to its individual function to determine how to avoid functional failures. Failure Modes and Effects Analysis (FMEA) focuses on actual equipment and locations, and analyzes how each piece of equipment or location can fail and the effect of each failure. In other words, an RCM Analysis is conducted for the purpose of maintaining the function of a system. An FMEA Analysis is conducted for the purpose of maintaining the system itself.

Specifically, FMEA is a method used to identify the potential failures of equipment and locations, describing the possible effect of each failure, and implementing recommended actions for actions that can be taken to prevent the failures from occurring.

Access an Analysis

Procedure

1. Access the FMEA Overview page.
2. Select the **Analyses** tab.
   A list of analyses available in the database appears.
3. In the **Analysis Name** column, select the link for the analysis that you want to view.
   In a new page, the **Analysis** workspace for the selected analysis appears.

   The pane contains a hierarchy of assets included in the selected analysis. When you select an asset, you will be able to view the hierarchy of the failure modes within the selected asset.

Create a New FMEA Analysis

About This Task

Procedure

1. Access the FMEA Overview page.
2. In the page, select **Create New Analysis**.
   In a new tab, the **New FMEA Analysis** page appears, displaying the **Analysis Details** section of the datasheet for the new analysis.
3. As needed, enter values in the available fields.
4. Select the **System Definition** tab, and then, as needed, enter values in the available fields.
5. Select .
   The new analysis is saved.

Create an Analysis from a Template

Procedure

1. Access the FMEA Overview page, and then select the **Templates** tab.
   The list of templates appears.

2. Select the line in the grid containing the template from which you want to create an analysis, and then select  .
   The **Apply Template Builder** window appears.
3. Select **Next**.
   The **Review Assets** screen appears.
4. Select **Select Replacements**.
   The **Asset Finder** window appears.
5. Select  beside the assets that you want to add to the template, and then select **Done**.

   Note: You are only able to add assets that have the same site assignment as the analysis you are creating.

   The **Select Asset Replacements** screen appears displaying the assets you newly added.
6. Select **Next**.
   The **Asset Replacement** screen appears, displaying available failure modes for the template.
7. Using the Asset Assignment drop-down lists, select how you want to replace each previous template asset, and then select **Finish**.
   The new analysis is created from the template.

   Note: All Secondary Actions from the template are also applied to the analysis.

Apply Asset Template on Analysis

Procedure

1. Access the analysis to which you want to apply the asset template.
2. In the workspace, select  , and select **Apply Template**.
   The **Template Application** window appears.
3. Select the asset template you want to apply to the analysis, and then select **Next**.
   The **Select Assets** window appears displaying all the assets that belong to the same site as analysis.

   Note: By default, the site for assets is set as the analysis site and you cannot modify this value.
4. Select the assets in the **Select Assets** window, and then select **Next**.
   The **Apply Template** window appears that provides information about the template and the assets to which the template will be applied.
5. Review the template and asset details, and then select **Implement**.
   The template application starts in the background and you can view the progress on the analysis window.

Modify an FMEA Analysis

About This Task

Procedure

1. Access the analysis that you want to modify.
   In a new page, the **Analysis** workspace for the selected analysis appears.
2. Select **Analysis Details** section.
3. Select **Datasheet**.

4. As needed, enter values in the available fields.
5. Select .
   The changes to your analysis have been saved.

Copy and Paste Nodes in an Analysis or Template

Procedure

1. Access an Analysis if you want to copy analysis nodes.

   -or-

   Access a Template if you want to copy template nodes.

   In a new page, the workspace for the selected analysis or template appears.
2. In the pane, select the node that you want to copy.
   The button is enabled.
3. Select .
   A menu appears.
4. Select one of the following options:
   - **Copy Selected Node:** Copies only the selected node without any of the related records attached.
   - **Copy Selected Node and Related Records:** Copies the selected node as well as all related child records of that node.
     A message appears, confirming that the node has been copied.
5. Select the node where you want to place the copied node.
   The button is enabled.
6. Select .
   The copied node is pasted.

Promote an FMEA Analysis to Strategy

About This Task

Promoting an FMEA analysis to an ASM strategy creates risks and actions in a new strategy from corresponding failure effects and Recommended Actions in an FMEA analysis, respectively. Additionally, when you make subsequent changes to the original FMEA analysis, you can also promote those changes to the strategy.

Procedure

1. Access an Analysis on page 11.
2. In the workspace, select .
   A message appears, asking you to confirm that you want to promote all of the pending Recommended Actions to ASM.
3. Select **Yes**.
   A progress indicator appears. Once the process is complete, the date and time of the last promotion appears.

Note: If the process cannot be completed, an error message appears. All the Secondary Actions are also promoted from FMEA to ASM.

Export an FMEA Analysis

Procedure

1. Access the **FMEA Overview** page.
2. Select the **Analyses** tab.
   The **Analyses** section appears, displaying a list of available analyses.
3. Select the check box next to the analyses that you want to export.
   The selected analyses are highlighted.
4. Select , and then select **Export**.
   The **Export to a File** window appears.
5. In the **Please provide a File Name** box, enter a name for the file.
6. Select **Export**.
   The **Jobs Log** page appears, displaying a list of jobs in progress, including the export job that you have initiated just now. After the analyses are exported to an Excel workbook, the job appears in the **Successful** section.

   Note:

   - You can also export an analysis by accessing the analysis.
   - All Secondary Actions associated with the FMEA analysis are also exported.

Use State Controls in FMEA Analyses

About This Task

Procedure

1. Access the analysis that you want to modify.
   In a new page, the **Analysis** workspace for the selected analysis appears.
2. Select .
   The state control menu appears.
3. Select **Complete**.
   The Complete action is highlighted.
4. Select **Done**.
   The analysis is now in the Complete state.

Delete an FMEA Analysis

About This Task

Procedure

1. Access the FMEA Overview page, and then select the **Analyses** tab.

The list of analyses appears.

2. In the list of analyses, highlight the line containing the analysis that you want to delete, and then select  .
   A message appears asking you to confirm that you want to delete the analysis.
3. Select **Yes**.
   The analysis is deleted.

   Note: You can also delete the analysis using the delete button under more options() while viewing the analysis that you want to delete.

Access a Reference Document

Procedure

1. Access the analysis whose reference documents you want to access.
2. In the workspace, select the **Reference Documents** tab.
   The **Reference Documents** section appears, displaying a list of reference documents.

   Tip: For more information, refer to the Manage Reference Documents section of the Record Manager module for additional options when working with reference documents.

Link Reference Documents

Before You Begin

This topic assumes that there are existing documents in FMEA that you want to link to your analysis.

Procedure

1. Access the Reference Documents which you want to link.
2. Select  .
   The **Search** window appears.
3. Select the type of document you want from the **Linked To** drop-down box.

   -or-

   Enter the name that you want to search for in the search box, and then select  .

   The results appear.
4. Select the documents that you want to add, and then select **OK**.
   The selected reference documents are added to the analysis.

   Tip: For more information, refer to the Manage Reference Documents section of the Record Manager module for additional options when working with reference documents.

Delete a Reference Document

Before You Begin

This topic assumes that you have Reference Documents already attached to your FMEA analysis.

Procedure

1. Access the **FMEA Overview** page, and then select the **Analyses** tab.
   The list of analyses appears.
2. Select the analysis for which you want to search reference documents.
   In a new tab, the **Analysis** workspace for the selected analysis appears.
3. Select the **Reference Documents** tab.
   The **Reference Documents** section appears.
4. Select the **Reference Document** that you want to delete, and then select  .
   A window appears, asking if you want to delete the entity.
5. Select **Yes**.
   Your reference document has been deleted.

   Tip: For more information, refer to the Manage Reference Documents section of the Record Manager module for additional options when working with reference documents.

Access an Asset

Procedure

1. Access the analysis whose assets you want to access.
   In a new page, the **Analysis** workspace for the selected analysis appears.
2. Select **Analysis** section.
3. Select **Assets**.
4. In the pane, select the asset that you want to access.
   The list of assets associated with the analysis are listed.
5. In the **Analysis Details** pane, select the asset that you want to access.

   Tip: If needed, modify values in the available fields.

Filter FMEA Analyses by Asset

About This Task

GE Digital APM features asset-centric navigation. To filter strategies by asset, please follow the instructions below.

Procedure

1. Access the FMEA Overview page and then select the **Analyses** tab.
   The list of analyses appears.
2. In the page, select  .

   The **Enter Parameter Values** window appears.
3. In the Asset field, select Home.
   The **Hierarchy** window appears.
4. Filter the assets. You can search through both Hierarchy and Groups by selecting the tabs in the window.
   - Using the **Hierarchy**, you can navigate to the smallest level of asset. You can also select **Search** to find assets not connected to a strategy.

- Using the **Hierarchy**, if you select , it will allow you to filter by Category, Class, and Type.
- Using the **Groups**, if you select , it will allow you to search by Relationship and Hierarchy Filter.

5. When you are finished filtering the assets, select **Done**.
   The **Asset** box is populated with the name of the selected asset.

Link an Asset to an Analysis

Before You Begin

This procedure assumes that there are assets available to link to your analysis.

Procedure

1. In the **Asset** panel, select .
   The **Enter Parameter Values** window appears.
2. In the **Asset** section, select .
   The **Hierarchy** window appears, displaying the asset hierarchy.
3. Select a hierarchy level associated with the asset that you want to link to the analysis, and then select **Done**.

   Note: You can search through both Hierarchy and Groups by selecting the respective tabs in the **Hierarchy** window.

   The assets associated with the hierarchy level appear in the **Add Assets** window.
4. Select the check boxes next to the assets that you want to add to the analysis, and then select **Add**.

   Important: You must select assets that are part of the same site as the current analysis.

   The selected assets are linked to the analysis.

Delete an Asset

Before You Begin

This topic assumes that you have a pre-established FMEA analysis with an asset that needs to be deleted.

Procedure

1. Access the FMEA Overview page, and then select the **Analyses** tab.
   The list of analyses appears.
2. Select the analysis whose asset you want to delete.
   In a new page, the **Analysis** workspace for the selected analysis appears.
3. Select the asset that you want to delete.
   The selected asset is highlighted.
4. In the workspace, select **Delete** button.
   A message appears, confirming that you want to delete the selected item.
5. Select **Yes.**
   The asset is deleted.

Use the Decision Logic Builder in FMEA Failure Effects

Before You Begin

- The Decision Logic Builder guides you step-by-step through answering questions that will result in suggestions for mitigating a given failure effect. After you use the Decision Logic Builder to determine which actions should be taken to mitigate the effects of the failure, you can create Recommended Actions.
- The Decision Logic Builder will pose a series of Yes or No questions. When you complete all steps in the Decision Logic Builder, you will be presented with a recommended action that is based on your responses. You can then view a summary of your responses on the Decision Logic tab of the failure effect.
- The Decision Logic Builder is based upon the concepts and decision diagrams in SAE Standard JA1012, "A Guide to the Reliability-Centered Maintenance (RCM) Standard." The process and terminology used in the Decision Logic Builder are described in more detail in this standards document. To use the Decision Logic Builder effectively, you will need to be familiar with this standard.
- This topic assumes that you have a pre-established FMEA analysis with failure modes.

Procedure

1. Access the **Failure Effect** for which you want to use Decision Logic.
2. Select the **Decision Logic** tab.
3. Select **Yes** or **No** to respond to the question.
   The next question is displayed immediately after you select the **Yes** or **No** button.
4. Continue selecting **Yes** or **No** in response to each question that appears. The number of questions that are presented will depend upon your responses.
   When you have responded to all the questions, a suggested action will appear.
5. Select **Save** button.
   Your responses are now saved.

Run Reports in FMEA

About This Task

Procedure

1. Access the FMEA Overview page, and then select the **Analyses** tab.
   The list of analyses appears.
2. Select the analysis in which you want to run a report.
   In a new page, the **Analysis** workspace for the selected analysis appears.
3. Select the **Analysis Details** tab.
4. Select the **Reports** tab.
   The **Reports** workspace appears.
5. Select the report that you want to run.
   In a new page, the report opens and runs.

Chapter 4

Failure Modes

Topics:

About Failure Modes

After you have defined all the Functional Failures, you can define one or more Failure Modes for each failure. The analysis team should determine which Failure Modes are likely to occur. If the FMEA Analysis is being conducted on a system that does not yet exist physically, the mode(s) will be theoretical, unless other similar types of systems currently exist and historical data for those systems is available. Note that the SAE Standard JA1012, "Evaluation Criteria for Reliability-Centered Maintenance (RCM) Processes," recommends that an FMEA team review all modes in which deterioration, design defects, and human error could cause the failure.

Details

Failure Modes are often closely related to individual pieces of equipment or components of the defined piece of equipment. Values stored at the equipment level allow the team to link a mode to a location, the equipment to that location, and a component to that equipment. Maintenance and reliability statistics for failure modes can be stored at the equipment or component level, and can be analyzed and updated using the GE Digital APM FMEA module.

The SAE Standard JA1012, "Evaluation Criteria for Reliability-Centered Maintenance (RCM) Processes," defines the following requirements for Failure Modes:

- All Failure Modes reasonably likely to cause each Functional Failure shall be identified.
- The method used to decide what constitutes a reasonably likely Failure Mode shall be acceptable to the owner or user of the asset.
- Lists of Failure Modes should include: Failure Modes that have happened before, Failure Modes that are currently being prevented by existing maintenance programs, and Failure Modes that have not yet happened, but that are thought to be reasonably likely (credible) in the operating context.
- Lists of Failure Modes should include any event or process that is likely to cause a Functional Failure, including deterioration, design defects, and human error, whether caused by operators or maintainers (unless human error is being actively addressed by analytical processes apart from FMEA).

Access a Failure Mode

Procedure

1. Access the asset for which you want to access a failure mode.
2. In the pane, select the failure mode that you want to access.
   The datasheet for the selected failure mode appears in the workspace.

Create a Failure Mode

Before You Begin

This topic assumes that you have a pre-established FMEA analysis with assets.

Procedure

1. Access the analysis for which you want to create a Failure mode.
2. Select the **Asset** for which you want to add a **Failure Mode**.

3. In the Failure Mode pane, select + .
   The workspace for the new failure mode appears, displaying the **Failure Mode** section.
4. As needed, enter values in the available fields.
5. Select **Save** .
   The failure mode is saved.

Modify a Failure Mode

Before You Begin

This topic assumes that you have a pre-established FMEA analysis with assets.

Procedure

1. Access the Failure Mode which you want to modify.
2. As needed, modify the values in the available fields.
3. Select **Save** .
   The changes to the failure mode are saved.

Delete a Failure Mode

Before You Begin

This topic assumes that you have a pre-established FMEA analysis with assets.

Procedure

1. Access the FMEA Overview page, and then select the **Analyses** tab.
   The list of analyses appears.
2. Select the analysis containing the asset for which you want to delete a failure mode.
   In a new tab, the **Analysis** workspace for the selected analysis appears.
3. Select the **Asset** where you would like to delete a **Failure Mode**.
   In a new tab, the **Asset** workspace for the selected asset appears.
4. In the pane, select the failure mode that you want to delete.
   The workspace for the selected failure mode appears, displaying the **Failure Mode** section.
5. Select **Delete** .
   A message appears, asking you to confirm that you would like to delete the failure mode.
6. Select **Yes**.
   The failure mode is deleted.

Chapter 5

Failure Effects

Topics:

About Failure Effects

After all the Failure Modes have been defined, one or more Failure Effects can be defined for each Failure Mode. A Failure Effect documents the consequence of a failure occurring. Most FMEA methodologies use Failure Effects to capture the safety, environmental, and economic (or production) impacts associated with a failure.

The SAE Standard JA1012, "Evaluation Criteria for Reliability-Centered Maintenance (RCM) Processes," defines the following requirements for Failure Effects:

- Failure Effects shall describe what would happen if no specific task is done to anticipate, prevent, or detect the failure.
- Failure Effects shall include all the information needed to support the evaluation of the consequences of the failure, including the following data:
  - The evidence (if any) that the failure has occurred (in the case of hidden functions, what would happen if a multiple failure occurred).
  - What the failure does (if anything) to kill or injure someone, or to have an adverse effect on the environment.
  - What the failure does (if anything) to have an adverse effect on production or operations.
  - What physical damage (if any) is caused by the failure.
  - What (if anything) must be done to restore the function of the system after the failure.

Access a Failure Effect

Procedure

1. Access the failure mode for which you want to access a failure effect.
2. In the pane, select the failure effect that you want to access.
   The datasheet and the risk associated with the selected failure effect appears in the workspace. The workspace contains the following tab:
   - **Decision Logic:** Contains a series of questions that will provide you a recommended action based on your responses.

Create a Failure Effect

Before You Begin

This topic assumes that you have a pre-established FMEA analysis with failure modes.

Procedure

1. Access the analysis for which you want to create a **Failure Effect**.
2. Select the **Failure Mode** for which you want to add a failure effect.
3. In the Failure Effect pane, select + .
4. As needed, enter values in the available fields.
5. Select **Save** .
   The failure effect is saved.

Modify a Failure Effect

Before You Begin

This topic assumes that you have a pre-established FMEA analysis with failure modes.

Procedure

1. Access the failure mode for which you want to modify a failure effect.
2. In the pane, select the failure effect that you want to access.
   The datasheet and risk associated with the selected failure effect appears in the workspace. The workspace contains the following tab:
   - **Decision Logic :** Contains a series of questions that will provide you a recommended action based on your responses.
3. As needed, modify the values in the available fields.
4. Select **Save** .
   The modifications to the failure effect are saved.

Delete a Failure Effect

Before You Begin

This topic assumes that you have a pre-established FMEA analysis with failure modes.

Procedure

1. Access the FMEA Overview page, and then select the **Analyses** tab.
   The list of analyses appears.
2. Select the analysis containing the Asset whose Failure Effect you want to delete.
   In a new tab, the **Analysis** workspace for the selected analysis appears.
3. In the pane, select the asset whose Failure Effect you want to delete.
   In the pane, the Failure Modes for the selected asset appears.
4. In the pane, select the Failure Mode whose Failure Effect you want to delete.
   The workspace for the selected Failure Mode appears, displaying the **Failure Mode** section.
5. In the pane, select the **Failure Effect** that you want to delete.
   The workspace for the selected **Failure Effect** appears.
6. Select **Delete** .
   A message appears, asking you to confirm that you want to delete your failure effect.
7. Select **Yes**.
   Your Failure Effect is deleted.

Chapter 6

FMEA Templates

Topics:

About Values Mapped from an FMEA Template to Asset Strategy Template

When you promote an FMEA template to an ASM template, several fields in the Asset Strategy Template family are populated with the fields that are mapped from RCM FMEA Template family.

Note: Some of the fields listed in the table are not available on any of the datasheets that are configured for the RCM FMEA Template and Asset Strategy Template family.

The following table lists the field mappings:

This field in RCM FMEA Template family:	...populates this field in Asset Strategy Template family
Template Long Description	Description
Template Notes	Template Notes
Template Short Description	Template Name
Template Category	Template Category
Criticality	Criticality
Duty	Duty
Service	Service

Save an FMEA Analysis as a Template

About This Task

Procedure

1. Access the analysis which you want to save as a template.
2. In the workspace, select , and select **Save as Template**.
   The **RCM FMEA Template** window appears.
3. As needed, modify the values in the available fields.
4. Select .
   The analysis is saved as a template.

Access a Template

Procedure

1. Access the FMEA Overview page.
2. In the workspace, select the **Templates** tab.
   The **Templates** section appears, displaying a list of Templates.
3. Select the Template that you want to access.
4. Select **Template Details** tab.

The datasheet for the selected template appears.

Tip: If needed, modify values in the available fields.

Create a Template

Procedure

1. Access the FMEA Overview page.
2. In the page, select **New Template**.
   The **Template Builder** window appears.
3. Select **Next**.
   The **Select Template Type** screen appears.
4. Select the template type you want to apply, and then select **Next**.
   The **Define Root Node** screen appears.
5. As needed, enter values in the available fields, and then select **Next**.
   The **Define Template** screen appears.
6. As needed, enter values in the available fields, and then select **Finish**.
   The new Template is added.

Use the Apply Template Builder

Before You Begin

The template with which you are creating a new Analysis must be associated with at least one RCM FMEA Asset record.

Procedure

1. Access the analysis.
2. In the workspace, select  and then select **Apply Template**.
   The **Apply Template Builder** window appears.
3. Select **Next**.

   Note: For Asset templates, you can apply a template to multiple assets at a single instance. To apply asset template to multiple assets, select **Would you like to apply this Asset Template to one or many Assets?**. For more information, see Apply Asset Template to Multiple Assets.

   The **Select Template** screen appears.
4. Select the template that you want to apply, and then select **Next**.
   The **Asset Assignment** screen appears.
5. Select **Select Replacements**.
   The **Asset Finder** window appears.
6. Select the asset that you want to use, and then select **Done**.
   The **Asset Assignment** screen appears, displaying the selected asset.
7. Select **Finish**.
   The selected template is applied to the analysis and will be listed in the **Analysis** pane at the analysis level (Asset or Failure Mode) that you selected.

Apply Asset Template to Multiple Assets

Procedure

1. Access the **FMEA Overview** page.
2. Select the **Templates** tab.
   The **Templates** section appears, displaying a list of available analysis templates.
3. Select an asset template that you want to apply on one or many assets and then select the **Apply Template** button ().
   The **Enter Parameter Values** window appears.
4. Select the asset site and asset in hierarchy, and then select **Done**.
   The **Template Application** window appears.

   Note: The risk matrix for the selected site should be same as the risk matrix for the template you selected in Step 3.
5. Select the check boxes next to the assets to which you want to apply the template in the **Select Assets** tab, and then select **Next**.
6. In the **Select Analysis** tab, select one of the following options:
   - Link Existing: Links an existing analysis with the selected asset.
   - Create New: Creates a new analysis, and then links the selected asset.
7. Select **Next**.
   The **Apply Template** window appears that provides information about the template and the assets to which the template will be applied.
8. Review the template and asset details, and then select **Implement**.
   The template application starts in the background and you can view the progress on the Overview page.

Promote an FMEA Template to ASM

About This Task

Promoting an FMEA analysis and asset template to an ASM template creates risks and actions in a new strategy template from corresponding failure effects and Recommended Actions in an FMEA template, respectively. Additionally, when you make subsequent changes to the original FMEA template, you can also promote those changes to the strategy template.

Procedure

1. Access a Template on page 26 that you want to promote to ASM.

   Note: You can promote only Global templates to ASM.
2. In the workspace, select  .
   A message appears, asking you to confirm that you want to promote all of the pending Recommended Actions to ASM.
3. Select **Yes**.

   A progress indicator appears. Once the process is complete, the date and time of the last promotion appears.

   Note: If the process cannot be completed, an error message appears.

Export an FMEA Template

Procedure

1. Access the **FMEA Overview** page.
2. Select the **Templates** tab.
   The **Templates** section appears, displaying a list of available analysis templates.
3. Select the check box next to the templates that you want to export.
   The selected templates are highlighted.
4. Select , and then select **Export**.
   The **Export to a File** window appears.
5. In the **Please provide a File Name** box, enter a name for the file.
6. Select **Export**.
   The **Jobs Log** page appears, displaying a list of jobs in progress, including the export job that you have initiated just now. After the templates are exported to an Excel workbook, the job appears in the **Successful** section.

   Note:

   - You can also export a template by accessing the template.

Chapter 7

Team Members

Topics:

Manage Team Members

A team is a group of individuals who will complete a specified task. You can add both GE Digital APM users and non-GE Digital APM users to a team.

You can access Team Members from an FMEA analysis, as detailed in the Access Team Members topic.

Tip: For details about working with teams and the **Team Members** section, refer to the Teams section of the documentation.

Access the FMEA Team Members Section

About This Task

Procedure

1. Access the analysis in which you want to access team members.
   In a new page, the **Analysis** workspace for the selected analysis appears, displaying the **Analysis** section.
2. Select the **Team Members** tab.
   The **Team Members** section appears.
3. In the section, select  .

Next Steps

Search Team Members

Search FMEA Team Members

About This Task

Procedure

1. Access **Team Members** .
2. In the list of available team members, select  .
   A search box appears.
3. Enter your search criteria.
   The results appear.

Chapter 8

Recommendations

Topics:

Manage Recommended Actions

Once an analysis is completed, Recommended Actions can be managed through the **Recommended Actions** pane. After Recommended Actions are successfully managed, the consolidated collection of Recommended Actions can be promoted to Asset Strategy Management.

You can access the **Recommended Actions** by selecting Recommended tab from the RCM or FMEA analysis.

Tip: For information about additional options available when working with the Recommendation records, refer to the Action Management section of the documentation.

Consolidate Recommended Actions

Before You Begin

Note: This documentation assumes that you are working with Recommended Actions with subfamilies that include Consolidate.

Procedure

1. Access the **Recommended Actions** section.
2. Next to each Recommended Action that will be involved in the Consolidate operation, select the check box.

   Note: The Recommended Actions must be in the same family and same state.
3. In the page, select .
   The state control menu appears.
4. Select **Consolidate**, and then select **Done**.
   The **Consolidate Recommendations** window appears.
5. In the **Consolidate Recommendations** window, you can select either of the following options:
   - Select the dominant elements of the Recommended Actions that you are consolidating.

     -or-
   - Select **Merge Remaining Unselected**.
6. Select **Consolidate**.
   The selected Recommended Actions have been consolidated.

   Note: Any Secondary Actions that were linked to the recommendations and consolidated will be linked to the new consolidated target recommendation.

Access Recommendations in FMEA

About This Task

Procedure

1. Access the **Failure Effect** for which you want to access recommendations.
2. Select the recommendation that you want to access.
   The datasheet of the recommendation appears.

Tip: For information about additional options available when working with recommendation records, refer to the Recommended Actions section of the documentation.

Add a Recommendation

Procedure

1. Access the **Failure Effect** for which you want to add recommendations.
2. Select + .
   The new recommendation datasheet appears.
3. As needed, enter values in the available fields.
4. Optionally, to include action information in the recommendation, select the **Action Information** tab, and then, as needed, enter values in the available fields.
5. Select **Save**.
   The Recommendation is saved.

Chapter 9

Secondary Actions

Topics:

About Secondary Actions

A Secondary action is associated with a primary action. It defines the corrective actions that should be performed to mitigate an undesirable condition that is found while performing primary maintenance, monitoring, or data collection activity.

Access Secondary Actions

Procedure

1. Access the **Recommendation** whose secondary actions you want to view.
2. Select the **Secondary Actions** tab.
   The **Secondary Actions** workspace appears displaying a list of associated secondary actions.
3. In the **Secondary Actions** section, select the action that you want to access.
   The datasheet for the selected secondary action appears.

Create a Secondary Action

Procedure

1. Access **Secondary Actions**.
   The **Secondary Actions** workspace appears.
2. In the **Secondary Actions** section, select .
   A blank datasheet appears for the new secondary action record.
3. As needed, enter values in the available fields. For more information, refer to the RCM FMEA Recommendation Records section of the documentation.
4. Select **Save**.
   The record is saved.

Delete a Secondary Action

Procedure

1. Access **Secondary Actions**.
   The **Secondary Actions** workspace appears.
2. In the **Secondary Actions** section, select the row containing the secondary action that you want to delete, and then select .
   The secondary action is deleted.

Promote a Secondary Action to Strategy

Procedure

1. Access an Analysis on page 11.

2. In the workspace, select  .
   A message appears, asking you to confirm that you want to promote all of the pending Secondary Actions to ASM.
3. Select **Yes**.
   A progress indicator appears. Once the process is complete, all the Secondary Actions are promoted from FMEA to ASM, and the date and time of the last promotion appears.

   Note: If the process cannot be completed, an error message appears.

Chapter 10

Admin

Topics:

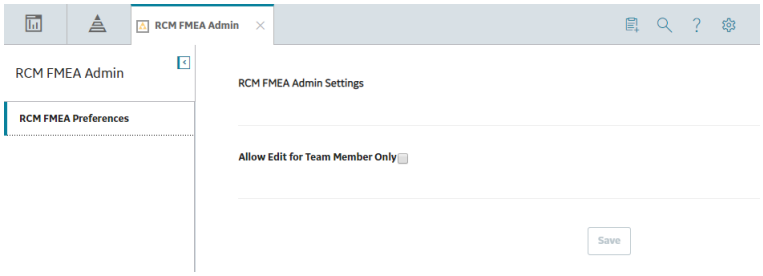
Access the RCM FMEA Admin Page

Before You Begin

- Ensure that your Reliability Centered Maintenance (RCM) license is active.
- Ensure that you are either a member of the MI RCM Administrator Security Group or a Super User.

Procedure

In the module navigation menu, select **Admin** > **Application Settings** > **RCM/FMEA**.
The **RCM FMEA Admin** page appears, displaying the **RCM FMEA Preferences** workspace.



Restrict Modifying the FMEA Analysis and Child Records to Team Members Only

Procedure

1. Access the **RCM FMEA Admin** page.
2. Select the **Allow Edit For Team Member Only** check box, and then select **Save**.

Results

Only the Team Members can now modify the FMEA Analysis and child records.

Chapter 11

Data Loaders

Topics:

About the Failure Modes and Effects Analysis (FMEA) Data Loaders

The Failure Modes and Effects Analysis (FMEA) Data Loader, Failure Modes and Effects Analysis (FMEA) Asset Templates Data Loader, and Failure Modes and Effects Analysis (FMEA) Analysis Templates Data Loader allow a user to load full FMEA analyses, analysis templates, and asset templates from data in fixed format Excel workbooks. The Excel workbooks contain worksheets that contain data to populate various nodes/records in the populated data model.

About the Failure Modes and Effects Analysis (FMEA) Data Loaders Requirements

The following data must be present prior to loading FMEA data:

1. Equipment Taxonomy
2. Equipment and Functional Location records

Note: There is no requisite data that must be present in order to load FMEA Asset Template or FMEA Analysis Template records.

Mapping

The Failure Modes and Effects Analysis (FMEA) Data Loaders map the datasheet columns in the Excel workbook to fields in GE Digital APM families by position. The captions may be changed as needed, but the column positions should not be moved.

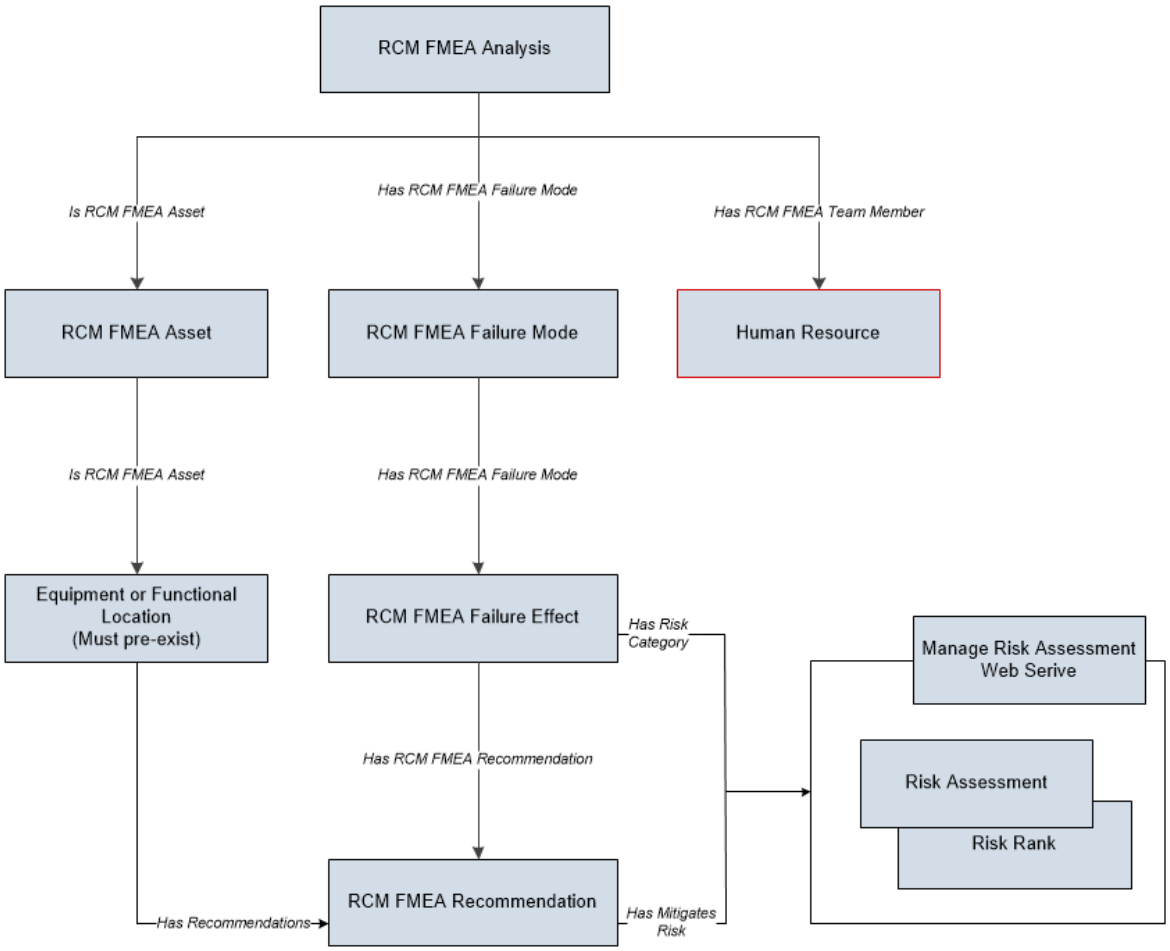
Security Settings

The Security User performing the data load operation must be associated with either the MI Data Loader User or MI Data Loader Admin Security Role as well as the MI Strategy Admin role or MI Strategy User role.

About the Failure Modes and Effects Analysis (FMEA) Data Loaders Data Model

The data for FMEA families is loaded from Excel workbooks containing multiple worksheets each. This includes Analysis, Team Members, Assets, Failure Modes, Failure Effects, and Recommendations.

Note: Elements outlined in red are not loaded by the data loaders.



About the Failure Modes and Effects Analysis (FMEA) Data Loaders General Loading Strategy

This section describes any prerequisites to loading the data and the order in which the data will be loaded.

Load Sequence

The FMEA data loads must be performed in a specific sequence to successfully populate fields, create records, and link them to the predecessor and/or successor records:

Failure Modes and Effects Analysis (FMEA) Data Loader

1. Create or update RCM FMEA Analysis of type FMEA.
2. Link the Existing Team Members to the Analysis. Team members exist in the Human Resource family and must exist prior to the load.
3. Create or update an RCM FMEA Asset and link it to the analysis.
    a. Locate the physical asset (Equipment or FLOC) and link it to the RCM FMEA Asset.
4. Create or update a Failure Mode and link it to the Analysis.
5. Create or update a Failure Effect and link it to the Failure Mode.

    a. Create the Unmitigated Risk Assessment and Risk Rank records and link to the Failure Effect.
6. Create or update the RCM FMEA Recommendation and link it to the associated Failure Effect.
7. Create the Mitigated Risk Assessment and Risk Rank records and link to the Failure Effect.
8. Create or update the RCM FMEA Secondary Actions and link it to the associated Recommendation.

Failure Modes and Effects Analysis (FMEA) Asset Templates Data Loader

1. Create or update an RCM FMEA Template and link it to an asset.
2. Create or update an RCM FMEA Asset.
3. Create or update a Failure Mode and link it to the asset.
4. Create or update a Failure Effect and link it to the Failure Mode.
5. Create or update the RCM FMEA Recommendation and link it to the associated Failure Effect.
6. Create or update the RCM FMEA Secondary Actions and link it to the associated Recommendation.

Failure Modes and Effects Analysis (FMEA) Analysis Templates Data Loader

1. Create or update an RCM FMEA Template and link it to an analysis.
2. Create or update RCM FMEA Analysis of type FMEA.
3. Link the Existing Team Members to the Analysis. Team members exist in the Human Resource family and must exist prior to the load.
4. Create or update an RCM FMEA Asset and link it to the analysis.
5. Create or update a Failure Mode and link it to the Analysis.
6. Create or update a Failure Effect and link it to the Failure Mode.
7. Create or update the RCM FMEA Recommendation and link it to the associated Failure Effect.
8. Create or update the RCM FMEA Secondary Actions and link it to the associated Recommendation.

Risk Assessment Management and Web Service

FMEA and RCM have mitigated and unmitigated risk assessments for Failure Effects and Recommendations respectively. Each Risk Assessment has related Risk Rank records which is in essence a sub-model. The FMEA loaders use the Risk Assessment service to manage the Risk Assessment and underlying Risk Rank records.

Note: Any changes here should be reflected in the Strategy RCM Mappings Document.

Special Note on Failure Effect

The Failure Effect also acts as the Risk Assessment record. Review the Failure Effect web service and you will see that the manage operation creates a Risk Rank collection. There is no need to create an additional Risk Assessment record linked to the Failure Effect.

Special Note on RCM FMEA Recommendation

The Recommendation will need to have a linked Risk Assessment record if there are mitigated values in the worksheet. The loader should locate the Risk Assessment record linked to the Recommendation. If one exists, then update it.

If one does not exist, then use the Risk Assessment web service to create it and use the relationship Mitigates Risk [MIR_MITRISK] to relate it to the Recommendation.

Special Note on Risk Assessment ID Field

You can use any combination of fields to uniquely identify the record, you are not limited to ID. The ID on the Risk Assessment record has no purpose but the Web Service requires it.

If the service requires an ID, then auto-generate is used with the understanding that it will not be used to perform a lookup.

There are two entities and each has two scenarios with regards to the Risk Assessment. None of them require an ID since no attempt is being made to find a risk assessment by ID.

Entity	Scenario	Processing Assumptions	Additional Validation and Integrity Logic
Failure Effect	Unmitigated (Create new assessment)	Since the Failure Effect is the Risk Assessment, there is no need to create a Risk Assessment record.	The unmitigated fields on the Failure Effect Record should not be null if the user is loading RCM FMEA recommendations that have a mitigated risk rank. When created through the UI, the recommendation always inherits the unmitigated Risk Assessment from the failure effect and thus we could be creating a situation where there are mitigated Risks without corresponding Unmitigated Risks. Conversely, a recommendation cannot have a Risk Assessment whose Failure Effect does not have one Risk Assessment, or else an out of sync condition will be created.
Failure Effect	Unmitigated (Update assessment)	Update the unmitigated risk fields on the failure effect	
RCM FMEA Recommendation	Mitigated (Create new assessment)	Check if there is an existing mitigated risk assessment linked to the Recommendation. There can only be one. If none exists, then we create it.	
RCM FMEA Recommendation	Mitigated (Update assessment)	Check if there is an existing mitigated risk assessment linked to the Failure Effect. If one does exist then update the risk assessment.	

About the Failure Modes and Effects Analysis (FMEA) Data Loader Workbooks Layout and Use

This section provides a high-level overview and explanation of how the FMEA data loader workbooks are constructed.

In order to import data using the Failure Modes and Effects Analysis (FMEA) Data Loaders, GE Digital APM provides Excel workbooks, , **FMEA_Asset_Template_Data_Loader.xlsx**, and **FMEA_Analysis_Template_Data_Loader.xlsx**, which support baseline data loading of FMEA analyses, FMEA asset templates, and FMEA analysis templates, in GE Digital APM. These workbooks must be used to perform the data load.

The following table lists the worksheets that are included in the Failure Modes and Effects Analysis (FMEA) Data Loader workbook.

Failure Modes and Effects Analysis (FMEA) Data Loader

Worksheet	Description
Analysis	The analysis is the root record in the data model and is created first. Links to other records are established after the child record is created.
Team Members	This worksheet is used to load team members data for the analysis. Team members are linked to the FMEA Analysis through the Has RCM FMEA Team Member relationship. **Note:** If the user wants to add team members, the individuals must already have an entry in GE Digital APM.
Assets	This worksheet is used to load data into the various assets linked to the Analysis record. The FMEA Asset is a virtual asset that links the actual equipment or functional location to the analysis. This node must be created and linked to the analysis using information from the asset ID.
Failure Modes	This worksheet is used to load data into the Failure Mode family node. The FMEA Failure Mode is linked directly to the virtual asset.
Failure Effects	This worksheet is used to load data into the Failure Effect family node. The Failure Effect is linked to both the Failure Mode and the associated Recommendation record. See the Recommendations section for its relationship.
Recommendations	This worksheet is used to load data into the Recommendations. FMEA Recommendations are linked to the associated Failure Effects. Failure Effect can have multiple recommendations, but each one must be unique.
Secondary Actions	This worksheet is used to load data into the Secondary Actions. Secondary Actions are linked to the associated Recommendations.

Analysis Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Analysis Long Description	MI_AN_LONG_DESCR_TX	Text	None
Start Date	MI_AN_ANALY_START_DATE_DT	Date	None
End Date	MI_AN_ANALY_END_DATE_DT	Date	None
Re-Evaluation Date	MI_RCMANALY_ANALY_REEV_D	Date	None

Team Members Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
User ID	SEUS_ID	Character (255)	This is a key field.

Relationship:

Predecessor	Relationship	Successor
MI_RCMANALY	MIR_HRCMTMMEM	MI Human Resource

Assets Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	Used to locate Analysis.
Asset ID Value	ASSET_ID_CHR	Character (255)	This is a key field.
Asset ID Field	ASSET_FIELD_ID	Character (255)	This is a key field.
Asset Family ID	ASSET_FAMILY_ID	Character (255)	Used to determine which MI family to create, by identifying whether the Asset is an Equipment or Functional Location. The valid values are: • MI_EQUIP000 • MI_FNCLOC00
CMMS ID	ASSET_CMMS_ID	Character (255)	None
CMMS Value	ASSET_CMMS_VALUE	Character (255)	None

Relationships:

Predecessor	Relationship	Successor
MI_RCMANALY	MIR_HRCMEQP	MI_RCMEQPMT

Predecessor	Relationship	Successor
MI_EQUIP000	MIR_IRCMEQP	MI_RCMEQPMT
MI_FNCLOC00	MIR_IRCMEQP	MI_RCMEQPMT

Failure Mode Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Asset ID Value	ASSET_ID_CHR	Character (255)	This is a key field.
Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
Long Description	MI_RCMFMODE_LNG_DESC_T	Text	None
Maintainable Item	MI_RCMFMODE_MAINT_ITEM_C	Character (50)	None
Damage Code	MI_RCMFMODE_CONDI_DAMA_C	Character (50)	None
Failure Pattern	MI_RCMFMODE_FAIL_SHP_FACT_C	Character (40)	None
PF Interval	MI_RCMFMODE_PF_INTER_N	Numeric	None
PF Interval Units	MI_RCMFMODE_PF_INTER_UNITS_C	Character (40)	None

Relationships:

Predecessor	Relationship	Successor
MI_RCMEQPMT	MIR_HRCMFMD	MI_RCMFMODE

Failure Effects Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Asset ID Field	ASSET_ID_FIELD	Character (255)	This is a key field.
Asset Family ID	ASSET_FAMILY_ID	Character (255)	This is a key field.
Effect Name	MI_RCMFEFFT_NAME_C	Character (255)	None
Effect Long Description	MI_RCMFEFFT_LNG_DESC_T	Text	None
Effect Impact	MI_RCMFEFFT_EFF_IMPACT_C	Character (40)	None
(ENVIRONMENT) Consequence	ENVIRONMENT|MI_CONSE_N	Numeric	None
(ENVIRONMENT) Probability	ENVIRONMENT|MI_PROB_N	Numeric	None
Failure Mode Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
(FINANCIAL) Consequence	FINANCIAL|MI_CONSE_N	Numeric	None

Field Caption	Field ID	Data Type (Length)	Comments
(FINANCIAL) Maintenance Cost	FINANCIAL|MI_RISK_MAIN_COST_N	Numeric	None
(FINANCIAL) Probability	FINANCIAL|MI_PROB_N	Numeric	None
(FINANCIAL) Production Loss	FINANCIAL|MI_RISK_PROD_LOSS_N	Numeric	None
(OPERATIONS) Consequence	OPERATIONS|MI_CONSE_N	Numeric	None
(OPERATIONS) Probability	OPERATIONS|MI_PROB_N	Numeric	None
(SAFETY) Consequence	SAFETY|MI_CONSE_N	Numeric	None
(SAFETY) Probability	SAFETY|MI_PROB_N	Numeric	None
Basis for Assessment	MI_RCMFEFFT_BASIS_T	Text	None

Relationships:

Predecessor	Relationship	Successor
MI_RCMFMODE	MIR_HRCMFEF	MI_RCMFEFFT

Recommendations Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Effect Name	MI_RCMFEFFT_NAME_C	Character (255)	This is a key field.
Headline	MI_REC_SHORT_DESCR_CHR	Character (255)	None
Description	MI_REC_LONG_DESCR_TX	Text	None
Business Impact	MI_REC_IMPAC_CHR	Character (100)	None
Shutdown Required?	MI_RECRCM_SYS_SHUTDN_REQ_L	Boolean	None
Target Completion Date	MI_REC_TARGE_COMPL_DATE_DT	Date	None
Action Type	MI_RECRCM_ACTIO_TYPE_C	Character (5)	None
Interval	MI_RECRCM_INTER_N	Numeric	None
Interval Units	MI_RECRCM_INTER_UNITS_C	Character (50)	None
Nonrecurring	MI_RECRCM_NONRE_L	Logical	Defaults to False when no value.
Performance Interval	MI_RECRCM_PERFO_INTER_N	Numeric	None

Field Caption	Field ID	Data Type (Length)	Comments
Performance Interval Units	MI_RECRCM_PERFO_INTER_UNITS_C	Character (50)	None
Estimated Cost	MI_RECRCM_ESTIM_COST_N	Numeric	None
Estimated Cost Basis	MI_RECRCM_COST_BASIS_C	Character (255)	None
Recommended Resource	MI_RECRCM_RECOMM_RSRC_C	Character	Must match a resource configured in the system picklist for this field.
(ENVIRONMENT) Consequence	ENVIRONMENT|MI_CONSE_N	Numeric	None
(ENVIRONMENT) Probability	ENVIRONMENT|MI_PROB_N	Numeric	None
(FINANCIAL) Consequence	FINANCIAL|MI_CONSE_N	Numeric	None
(FINANCIAL) Maintenance Cost	FINANCIAL| MI_RISK_MAIN_COST_N	Numeric	None
(FINANCIAL) Probability	FINANCIAL|MI_PROB_N	Numeric	None
(FINANCIAL) Production Loss	FINANCIAL| MI_RISK_PROD_LOSS_N	Numeric	None
(OPERATIONS) Consequence	OPERATIONS|MI_CONSE_N	Numeric	None
(OPERATIONS) Probability	OPERATIONS|MI_PROB_N	Numeric	None
(SAFETY) Consequence	SAFETY|MI_CONSE_N	Numeric	None
(SAFETY) Probability	SAFETY|MI_PROB_N	Numeric	None
Basis for Assessment	MI_RCMFEFFT_BASIS_T	Text	None

Relationships:

Predecessor	Relationship	Successor
MI_RCMFEFFT	MIR_HRCMREC	MI_RECRCM

Secondary Actions Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Asset ID Value	ASSET_ID_CHR	Character (255)	This is a key field.
Asset ID Field	ASSET_ID_FIELD	Character (255)	This is a key field.
Asset Family ID	ASSET_FAMILY_ID	Character (255)	This is a key field.
Failure Mode Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
Effect Name	MI_RCMFEFFT_NAME_C	Character (255)	This is a key field.

Field Caption	Field ID	Data Type (Length)	Comments
Recommendation Headline	MI_REC_SHORT_DESCR_CHR	Character (255)	None
Name	MI_ACTION_SHORT_DESC_C	Character (255)	None
Description	MI_ACTION_DESCRIPTION_T	Character (255)	None
Basis	MI_ACTION_BASIS_C	Character (255)	None
Type	MI_ACTION_TYPE_C	Character (255)	None
Condition Monitoring Type	MI_ACTION_CM_TYPE_C	Character(50)	None
Interval	MI_ACTION_INTV_N	Numeric	None
Interval Units	MI_ACTION_INTV_UNITS_C	Character(50)	None
Resource Cost	MI_ACTION_RESOURCE_COST_N	Numeric	None
Shutdown Required	MI_ACTION_SHUTDOWN_L	Boolean	None

Failure Modes and Effects Analysis (FMEA) Asset Templates Data Loader

Worksheet	Description
Assets	This worksheet is used to load data into the various assets linked to the Analysis record. The FMEA Asset is a virtual asset that links the actual equipment or functional location to the analysis. This node must be created and linked to the analysis using information from the asset ID.
Failure Modes	This worksheet is used to load data into the Failure Mode family node. The FMEA Failure Mode is linked directly to the virtual asset.
Failure Effects	This worksheet is used to load data into the Failure Effect family node. The Failure Effect is linked to both the Failure Mode and the associated Recommendation record. See the Recommendations section for its relationship.
Recommendations	This worksheet is used to load data into the Recommendations. FMEA Recommendations are linked to the associated Failure Effects. Failure Effect can have multiple recommendations, but each one must be unique.
Templates	This worksheet is used to load data into the Templates. FMEA Templates are linked to the associated virtual assets, as well as a specific site.
Secondary Actions	This worksheet is used to load data into the Secondary Actions. Secondary Actions are linked to the associated Recommendations.

Templates Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Site Reference Name	MI_SITEREF_NAME_C	Character (255)	This is a key field.
Template Short Description	MI_TM000000_SHRT_DSC_C	Character (255)	None
Template Long Description	MI_TM000000_LNG_DSC_T	Text	None

Assets Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.
Asset Description	MI_RCMEQPMT_DESC_C	Text	None

Failure Modes Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.
Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
Long Description	MI_RCMFMODE_LNG_DESC_T	Text	None
Maintainable Item	MI_RCMFMODE_MAINT_ITEM_C	Character (50)	None
Damage Code	MI_RCMFMODE_CONDI_DAMA_C	Character (50)	
Failure Pattern	MI_RCMFMODE_FAIL_SHP_FACT_C	Character (40)	None
PF Interval	MI_RCMFMODE_PF_INTER_N	Numeric	None
PF Interval Units	MI_RCMFMODE_PF_INTER_UNITS_C	Character (40)	None

Failure Effects Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.

Field Caption	Field ID	Data Type (Length)	Comments
Mode Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
Effect Name	MI_RCMFEFFT_NAME_C	Character (255)	This is a key field.
Effect Long Description	MI_RCMFEFFT_LNG_DESC_T	Text	None
Effect Impact	MI_RCMFEFFT_EFF_IMPACT_C	Character (40)	None
(ENVIRONMENT) Consequence	ENVIRONMENT|MI_CONSE_N	Numeric	None
(ENVIRONMENT) Probability	ENVIRONMENT|MI_PROB_N	Numeric	None
(FINANCIAL) Consequence	FINANCIAL|MI_CONSE_N	Numeric	None
(FINANCIAL) Maintenance Cost	FINANCIAL| MI_RISK_MAIN_COST_N	Numeric	None
(FINANCIAL) Probability	FINANCIAL|MI_PROB_N	Numeric	None
(FINANCIAL) Production Loss	FINANCIAL| MI_RISK_PROD_LOSS_N	Numeric	None
(OPERATIONS) Consequence	OPERATIONS|MI_CONSE_N	Numeric	None
(OPERATIONS) Probability	OPERATIONS|MI_PROB_N	Numeric	None
(SAFETY) Consequence	SAFETY|MI_CONSE_N	Numeric	None
(SAFETY) Probability	SAFETY|MI_PROB_N	Numeric	None
Basis for Assessment	MI_RCMFEFFT_BASIS_T	Text	None

Recommendations Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.
Mode Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
Effect Name	MI_RCMFEFFT_NAME_C	Character (255)	This is a key field.
Headline	MI_REC_SHORT_DESCR_CHR	Character (255)	This is a key field.
Description	MI_REC_LONG_DESCR_TX	Text	None
Business Impact	MI_REC_IMPAC_CHR	Character (100)	None
Shutdown Required?	MI_RECRCM_SYS_SHUTDN_REQ_L	Boolean	None
Target Completion Date	MI_REC_TARGE_COMPL_DATE_DT	Date	None

Field Caption	Field ID	Data Type (Length)	Comments
Action Type	MI_RECRCM_ACTIO_TYPE_C	Character (5)	None
Interval	MI_RECRCM_INTER_N	Numeric	None
Interval Units	MI_RECRCM_INTER_UNITS_C	Character (50)	None
Nonrecurring	MI_RECRCM_NONRE_L	Logical	Defaults to False when no value.
Performance Interval	MI_RECRCM_PERFO_INTER_N	Numeric	None
Performance Interval Units	MI_RECRCM_PERFO_INTER_UNITS_C	Character (50)	None
Estimated Cost	MI_RECRCM_ESTIM_COST_N	Numeric	None
Estimated Cost Basis	MI_RECRCM_COST_BASIS_C	Character (255)	None
Recommended Resource	MI_RECRCM_RECOMM_RSRC_C	Character	Must match a resource configured in the system picklist for this field.
(ENVIRONMENT) Consequence	ENVIRONMENT|MI_CONSE_N	Numeric	None
(ENVIRONMENT) Probability	ENVIRONMENT|MI_PROB_N	Numeric	None
(FINANCIAL) Consequence	FINANCIAL|MI_CONSE_N	Numeric	None
(FINANCIAL) Maintenance Cost	FINANCIAL|MI_RISK_MAIN_COST_N	Numeric	None
(FINANCIAL) Probability	FINANCIAL|MI_PROB_N	Numeric	None
(FINANCIAL) Production Loss	FINANCIAL|MI_RISK_PROD_LOSS_N	Numeric	None
(OPERATIONS) Consequence	OPERATIONS|MI_CONSE_N	Numeric	None
(OPERATIONS) Probability	OPERATIONS|MI_PROB_N	Numeric	None
(SAFETY) Consequence	SAFETY|MI_CONSE_N	Numeric	None
(SAFETY) Probability	SAFETY|MI_PROB_N	Numeric	None
Basis for Assessment	MI_RCMFEFFT_BASIS_T	Text	None

Secondary Actions Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	This is used to identify the template.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.
Mode Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.

Field Caption	Field ID	Data Type (Length)	Comments
Effect Name	MI_RCMFEFFT_NAME_C	Character (255)	This is a key field.
Recommendation Headline	MI_REC_SHORT_DESCR_CHR	Character (255)	None
Name	MI_ACTION_SHORT_DESC_C	Character (255)	None
Description	MI_ACTION_DESCRIPTION_T	Character (255)	None
Basis	MI_ACTION_BASIS_C	Character (255)	None
Type	MI_ACTION_TYPE_C	Character (255)	None
Condition Monitoring Type	MI_ACTION_CM_TYPE_C	Character(50)	None
Interval	MI_ACTION_INTV_N	Numeric	None
Interval Units	MI_ACTION_INTV_UNITS_C	Character(50)	None
Resource Cost	MI_ACTION_RESOURCE_COST_N	Numeric	None
Shutdown Required	MI_ACTION_SHUTDOWN_L	Boolean	None

Failure Modes and Effects Analysis (FMEA) Analysis Templates Data Loader

Worksheet	Description
Templates	This worksheet is used to load data into the Templates. FMEA Templates are linked to the associated virtual assets, which are linked to specific sites.
Analysis	The analysis is the root record in the data model and is created first. Links to other records are established after the child record is created.
Team Members	This worksheet is used to load team members data for the analysis. Team members are linked to the FMEA Analysis through the Has RCM FMEA Team Member relationship. **Note:** If the user wants to add team members, the individuals must already have an entry in GE Digital APM.
Assets	This worksheet is used to load data into the various assets linked to the Analysis record. The FMEA Asset is a virtual asset that links the actual equipment or functional location to the analysis. This node must be created and linked to the analysis using information from the asset ID.
Failure Modes	This worksheet is used to load data into the Failure Mode family node. The FMEA Failure Mode is linked directly to the virtual asset.

Worksheet	Description
Failure Effects	This worksheet is used to load data into the Failure Effect family node. The Failure Effect is linked to both the Failure Mode and the associated Recommendation record. See the Recommendations section for its relationship.
Recommendations	This worksheet is used to load data into the Recommendations. FMEA Recommendations are linked to the associated Failure Effects. Failure Effect can have multiple recommendations, but each one must be unique.
Secondary Actions	This worksheet is used to load data into the Secondary Actions. Secondary Actions are linked to the associated Recommendations.

Templates Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Site Reference Name	MI_SITEREF_NAME_C	Character (255)	This is a key field.
Template Short Description	MI_TM000000_SHRT_DSC_C	Character (255)	None
Template Long Description	MI_TM000000_LNG_DSC_T	Text	None

Analyses Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Analysis Long Description	MI_AN_LONG_DESCR_TX	Text	None
Start Date	MI_AN_ANALY_START_DATE_DT	Date	None
End Date	MI_AN_ANALY_END_DATE_DT	Date	None
Re-Evaluation Date	MI_RCMANALY_ANALY_REEV_D	Date	None

Team Members Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
User ID	SEUS_ID	Character (255)	This is a key field.

Assets Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.
Asset Description	MI_RCMEQPMT_DESC_C	Character (255)	None

Failure Modes Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.
Mode Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
Long Description	MI_RCMFMODE_LNG_DESC_T	Text	None
Maintainable Item	MI_RCMFMODE_MAINT_ITEM_C	Character (50)	None
Damage Code	MI_RCMFMODE_CONDI_DAMA_C	Character (50)	
Failure Pattern	MI_RCMFMODE_FAIL_SHP_FACT_C	Character (40)	None
PF Interval	MI_RCMFMODE_PF_INTER_N	Numeric	None
PF Interval Units	MI_RCMFMODE_PF_INTER_UNITS_C	Character (40)	None

Failure Effects Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.
Mode Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
Effect Name	MI_RCMFEFFT_NAME_C	Character (255)	This is a key field.
Effect Long Description	MI_RCMFEFFT_LNG_DESC_T	Text	None

Field Caption	Field ID	Data Type (Length)	Comments
Effect Impact	MI_RCMFEFFT_EFF_IMPACT_C	Character (40)	None
(ENVIRONMENT) Consequence	ENVIRONMENT|MI_CONSE_N	Numeric	None
(ENVIRONMENT) Probability	ENVIRONMENT|MI_PROB_N	Numeric	None
(FINANCIAL) Consequence	FINANCIAL|MI_CONSE_N	Numeric	None
(FINANCIAL) Maintenance Cost	FINANCIAL| MI_RISK_MAIN_COST_N	Numeric	None
(FINANCIAL) Probability	FINANCIAL|MI_PROB_N	Numeric	None
(FINANCIAL) Production Loss	FINANCIAL| MI_RISK_PROD_LOSS_N	Numeric	None
(OPERATIONS) Consequence	OPERATIONS|MI_CONSE_N	Numeric	None
(OPERATIONS) Probability	OPERATIONS|MI_PROB_N	Numeric	None
(SAFETY) Consequence	SAFETY|MI_CONSE_N	Numeric	None
(SAFETY) Probability	SAFETY|MI_PROB_N	Numeric	None
Basis for Assessment	MI_RCMFEFFT_BASIS_T	Text	None

Recommendations Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	Used to locate template.
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.
Mode Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
Effect Name	MI_RCMFEFFT_NAME_C	Character (255)	This is a key field.
Headline	MI_REC_SHORT_DESCR_CHR	Character (255)	This is a key field.
Description	MI_REC_LONG_DESCR_TX	Text	None
Business Impact	MI_REC_IMPAC_CHR	Character (100)	None
Shutdown Required?	MI_RECRCM_SYS_SHUTDN_REQ_L	Boolean	None
Target Completion Date	MI_REC_TARGE_COMPL_DATE_DT	Date	None
Action Type	MI_RECRCM_ACTIO_TYPE_C	Character (5)	None
Interval	MI_RECRCM_INTER_N	Numeric	None

Field Caption	Field ID	Data Type (Length)	Comments
Interval Units	MI_RECRCM_INTER_UNITS_C	Character (50)	None
Nonrecurring	MI_RECRCM_NONRE_L	Logical	Defaults to False when no value.
Performance Interval	MI_RECRCM_PERFO_INTER_N	Numeric	None
Performance Interval Units	MI_RECRCM_PERFO_INTER_UNITS_C	Character (50)	None
Estimated Cost	MI_RECRCM_ESTIM_COST_N	Numeric	None
Estimated Cost Basis	MI_RECRCM_COST_BASIS_C	Character (255)	None
Recommended Resource	MI_RECRCM_RECOMM_RSRC_C	Character	Must match a resource configured in the system picklist for this field.
(ENVIRONMENT) Consequence	ENVIRONMENT|MI_CONSE_N	Numeric	None
(ENVIRONMENT) Probability	ENVIRONMENT|MI_PROB_N	Numeric	None
(FINANCIAL) Consequence	FINANCIAL|MI_CONSE_N	Numeric	None
(FINANCIAL) Maintenance Cost	FINANCIAL| MI_RISK_MAIN_COST_N	Numeric	None
(FINANCIAL) Probability	FINANCIAL|MI_PROB_N	Numeric	None
(FINANCIAL) Production Loss	FINANCIAL| MI_RISK_PROD_LOSS_N	Numeric	None
(OPERATIONS) Consequence	OPERATIONS|MI_CONSE_N	Numeric	None
(OPERATIONS) Probability	OPERATIONS|MI_PROB_N	Numeric	None
(SAFETY) Consequence	SAFETY|MI_CONSE_N	Numeric	None
(SAFETY) Probability	SAFETY|MI_PROB_N	Numeric	None
Basis for Assessment	MI_RCMFEFFT_BASIS_T	Text	None

Secondary Actions Worksheet

Field Caption	Field ID	Data Type (Length)	Comments
Template ID	MI_TM000000_ID	Character (255)	This is used to identify the template.
Analysis Short Description	MI_AN_SHORT_DESCR_CHR	Character (255)	This is a key field.
Asset ID	MI_RCMEQPMT_EQUIP_ID_C	Character (255)	This is a key field.
Mode Name	MI_RCMFMODE_NAME_C	Character (255)	This is a key field.
Effect Name	MI_RCMFEFFT_NAME_C	Character (255)	This is a key field.

Field Caption	Field ID	Data Type (Length)	Comments
Recommendation Headline	MI_REC_SHORT_DESCR_CHR	Character (255)	None
Name	MI_ACTION_SHORT_DESC_C	Character (255)	None
Description	MI_ACTION_DESCRIPTION_T	Character (255)	None
Basis	MI_ACTION_BASIS_C	Character (255)	None
Type	MI_ACTION_TYPE_C	Character (255)	None
Condition Monitoring Type	MI_ACTION_CM_TYPE_C	Character(50)	None
Interval	MI_ACTION_INTV_N	Numeric	None
Interval Units	MI_ACTION_INTV_UNITS_C	Character(50)	None
Resource Cost	MI_ACTION_RESOURCE_COST_N	Numeric	None
Shutdown Required	MI_ACTION_SHUTDOWN_L	Boolean	None

Chapter 12

Deployment and Upgrade

Topics:

Deployment

Deployment

Refer to the deployment information here Deploy FMEA for the First Time.

Upgrade

Upgrade

Refer to the upgrade information here Upgrade or Update FMEA to V5.1.0.0.0.

Chapter 13

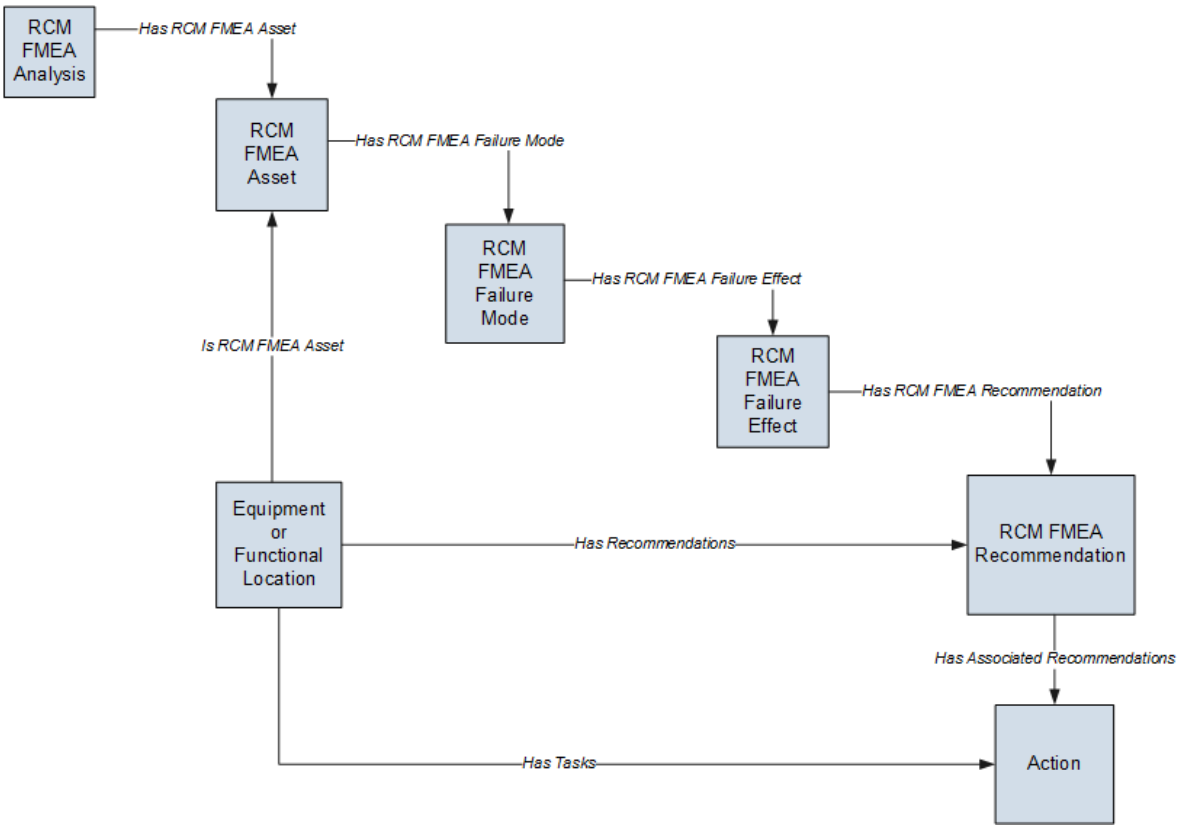
Reference

Topics:

General Reference

FMEA Data Model

The following diagram shows how the families used in FMEA are related to one another.



Note: In the diagram, boxes represent entity families and arrows represent relationship families that are configured in the baseline database. You can determine the direction of each relationship definition from the direction of the arrow head: the box from which the arrow originates is the predecessor, and the box to which the arrow head points is the successor.

In the preceding diagram:

- The RCM FMEA Asset box represents a single RCM FMEA Asset record within an analysis. The RCM FMEA Analysis record can be linked to multiple RCM FMEA Asset records, each of which can optionally be linked to an Equipment or Functional Location record.
- The Equipment or Functional Location box represents the Equipment or Functional Location family for which the Is RCM FMEA Asset, Has Recommendations, and Has Tasks have been defined between that family and the specified predecessor or successor.
- When an RCM FMEA Recommendation record is created for the analysis, the Recommendation record is linked to the Equipment or Functional Location record to which the RCM FMEA Asset record is linked.
- When an RCM FMEA Recommendation record is promoted to an Action record, the Action record will be linked to a Proposed Strategy record and associated with the Equipment or Functional Location record. For details, see the ASM help.

In addition to the families included in the preceding image, the following families are used by the Decision Logic Builder in FMEA:

- Decision Tree Consequence
- Decision Tree Response
- Decision Tree Structure

Within the baseline GE Digital APM family hierarchy, these families are subfamilies of the GE Digital APM Reference Tables family. Baseline records are provided in each of these families to support the Decision Logic Builder functionality.

Entity and Relationship Families used in FMEA

The following table provides a summary of the entity families and relationship families that are used to develop an FMEA Analysis.

Records in this entity family:	...Can be linked to records in this entity family:	...Through a relationship definition on this relationship family:
RCM FMEA Analysis	RCM FMEA Asset	Has RCM FMEA Asset
RCM FMEA Asset	RCM FMEA Failure Mode	Has RCM FMEA Failure Mode
RCM FMEA Failure Effect	RCM FMEA Recommendation	Has RCM FMEA Recommendation
RCM FMEA Failure Mode	RCM FMEA Failure Effect	Has RCM FMEA Failure Effect

The following families and relationships are also used by FMEA but not within the analysis itself.

Records in this entity family:	...Can be linked to records in this entity family:	...Through this relationship:	Purpose
RCM FMEA Analysis	Human Resource	Has RCM FMEA Team Member	Facilitates the construction of the RCM Analysis Team Members list. Through this relationship, Human Resource records are linked directly to the RCM FMEA Analysis record.
RCM FMEA Analysis	RCM FMEA Task	Has Tasks	Allows Task records generated from Recommendation records to be linked to the RCM FMEA Analysis record for which the recommendation was created. Note that in the current version of GE Digital APM, RCM FMEA Task records cannot be created from RCM FMEA Recommendation records. Instead, RCM FMEA Recommendation records can be used to create Action records in ASM. This relationship still exists, however, to support legacy RCM FMEA Task records.
RCM FMEA Analysis	RCM FMEA Template	Has Templates	Facilitates the creation of FMEA Templates.
RCM FMEA Asset	Asset Strategy	Has Strategy	Facilitates the promotion of RCM FMEA Asset records to Asset Strategy records via Recommendation Management. This link is established when an RCM FMEA Analysis is linked to a physical or "virtual" piece of equipment or location for which you have defined Recommendation records.
RCM FMEA Asset	Asset Strategy Template	Has Strategy	Facilitates the promotion of RCM FMEA Asset records to Asset Strategy Template records via Recommendation Management. This link is established when an RCM FMEA Analysis is linked to a "virtual" piece of equipment or location for which you have defined Recommendation records.

Records in this entity family:	...Can be linked to records in this entity family:	...Through this relationship:	Purpose
RCM FMEA Asset	RCM FMEA Task	Has Tasks	Allows RCM FMEA Asset records to be linked to RCM FMEA Task records. This link is established only when a Task record is generated from a recommendation where the related RCM FMEA Asset record (i.e., the RCM FMEA Asset record that is linked to the RCM FMEA Analysis record) is not linked to an Equipment or Functional Location record. Note that in the current version GE Digital APM, RCM FMEA Task records cannot be created from RCM FMEA Recommendation records. Instead, RCM FMEA Recommendation records can be used to create Action records in ASM. This relationship still exists, however, to support legacy RCM FMEA Task records.
RCM FMEA Asset	RCM FMEA Template	Has Templates	Facilitates the creation of FMEA Templates.
RCM FMEA Asset	Task History	Has Task History	Facilitates the rejection of RCM FMEA Task records that are linked to RCM FMEA Asset records. When you reject an RCM FMEA Task record, a Task History record is created and linked to the RCM FMEA Asset record through the Has Task History relationship.
RCM FMEA Failure Effect	RCM FMEA Template	Has Templates	Facilitates the creation of FMEA Templates.
RCM FMEA Failure Mode	RCM FMEA Template	Has Templates	Facilitates the creation of FMEA Templates.
RCM FMEA Recommendation	Mitigates Risk	Risk Assessment	Allows you to determine how a recommendation mitigates a risk.

Records in this entity family:	...Can be linked to records in this entity family:	...Through this relationship:	Purpose
RCM FMEA Recommendation	RCM FMEA Task	Has Tasks	Allows RCM FMEA Recommendation records to be linked to RCM FMEA Task records that are generated from those recommendations. Note that in the current version of GE Digital APM, RCM FMEA Task records cannot be created from RCM FMEA Recommendation records. Instead, RCM FMEA Recommendation records can be used to create Action records in ASM. This relationship still exists, however, to support legacy RCM FMEA Task records.
RCM FMEA Recommendation	RCM FMEA Template	Has Templates	Facilitates the creation of FMEA Templates.

FMEA Security Groups

The following table lists the baseline Security Groups available for users within this module, as well as the baseline Roles to which those Security Groups are assigned.

Important: Assigning a Security User to a Role grants that user the privileges associated with all of the Security Groups that are assigned to that Role. To avoid granting a Security User unintended privileges, before assigning a Security User to a Role, be sure to review all of the privileges associated with the Security Groups assigned to that Role. Also, be aware that additional Roles, as well as Security Groups assigned to existing Roles, can be added via Security Manager.

Security Group	Roles
MI ASI Administrator	MI Strategy Admin
MI RCM User	MI Strategy Admin MI Strategy Power MI Strategy User
MI RCM Viewer	MI APM Viewer MI Strategy Admin MI Strategy Power MI Strategy User

The baseline family-level privileges that exist for these Security Groups are summarized in the following table.

Family Caption	MI RCM User	MI RCM Viewer
Entity families		
Action	View	View
Asset Criticality Analysis System	View	None
Consequence Definition	View	View
Decision Tree Consequence	View	View
Decision Tree Response	View	View
Decision Tree Structure	View	View
Human Resource	View, Update, Insert, Delete	View
Mitigates Risk	View, Update, Insert, Delete	View
Probability Definition	View	View
Protection Level	View	View
RCM FMEA Analysis	View, Update, Insert, Delete	View
RCM FMEA Asset	View, Update, Insert, Delete	View
RCM Function	View, Update, Insert, Delete	View
RCM Functional Failure	View, Update, Insert, Delete	View
RCM FMEA Failure Mode	View, Update, Insert, Delete	View
RCM FMEA Failure Effect	View, Update, Insert, Delete	View
RCM FMEA Recommendation	View, Update, Insert, Delete	View
RCM FMEA Template	View, Update, Insert, Delete	View
RCM FMEA Task	View, Update, Insert, Delete	View
Reference Documents	View, Update, Insert, Delete	View
Risk Assessment	View, Update, Insert, Delete	View
Risk Category	View	View
Risk Matrix	View	View
Risk Rank	View, Update, Insert, Delete	View
Risk Threshold	View	View
Site Reference	View	View
Task History **Note:** The Task History relationship family is inactive in the baseline GE Digital APM database.	View, Update, Insert, Delete	View

Family Caption	MI RCM User	MI RCM Viewer
Relationship Families		
Has Associated Recommendation	View	View
Has Consolidated Recommendations	View	View
Has Driving Recommendation	View	View
Has RCM FMEA Team Member	View, Update, Insert, Delete	View
Has RCM FMEA Analysis	View, Insert, Delete	None
Has RCM FMEA Asset	View, Update, Insert, Delete	View
Has RCM Function	View, Update, Insert, Delete	View
Has RCM Functional Failure	View, Update, Insert, Delete	View
Has RCM FMEA Failure Mode	View, Update, Insert, Delete	View
Has RCM FMEA Failure Effect	View, Update, Insert, Delete	View
Has RCM FMEA Recommendation	View, Update, Insert, Delete	View
Has Reference Values	View	View
Has Recommendations	View, Update, Insert, Delete	View
Has Reference Documents	View, Update, Insert, Delete	View
Has Risk	View	None
Has Risk Category	View, Update, Insert, Delete	View
Has Site Reference	View	View
Has Superseded Recommendations	View	View
Has Task History **Note:** The Has Task History relationship family is inactive in the baseline GE Digital APM database.	View, Update, Insert, Delete	View
Has Tasks	View, Update, Insert, Delete	View
Has Templates	View, Update, Insert, Delete	View
Is Based on RCM FMEA Failure Effect	View	View
Is RCM FMEA Asset	View, Update, Insert, Delete	View

With these privileges, any user who is a member of the MI RCM User Security Group will have access to ALL records involved in FMEA Analyses. In addition to these baseline privileges, which you can grant by assigning users to the MI RCM User Security Group, you will need to grant FMEA users permission to the Equipment or Functional Location family if it is related to the RCM FMEA Asset family through the Is RCM FMEA Asset relationship.

Note: You may also want to grant some users permission to modify the items in the following Catalog folders: \\Public\Meridium\Modules\RCM.

- The current page on your desktop (create shortcut), in an email message, or on a Home Page.
- Help: Displays the context-sensitive Help topic for the FMEA Team Members page for FMEA Templates.

FMEA System Code Tables

The following System Code Table is used by FMEA.

Table ID	Table Description	Function
SC_RECOM_RESOURCE	Recommended Resource	Use to populate the Recommended Resource list in RCM FMEA Recommendation records.

FMEA URLs

There are two URL routes associated with FMEA: **fmea/overview** and **strategy/fmea**. The following table describes the various paths that build on the routes, and the elements that you can specify for each.

Element	Description	Accepted Value(s)	Notes
fmea/overview: Displays the FMEA Overview page. **strategy/fmea/analysis/<EntityKey>: Displays a specific analysis based on the entity key.**			
<EntityKey>	Specifies the analysis that you want to access.	Any numeric Entity Key that corresponds to an existing analysis.	Displays the specified analysis in a new tab.
strategy/fmea/template/<EntityKey>: Displays a specific template based on the entity key.			
<EntityKey>	Specifies the template that you want to access.	Any numeric Entity Key that corresponds to an existing template.	Displays the specified template in a new tab.

Example URLs

Example URL	Destination
fmea/overview	The **FMEA Overview** page.
strategy/fmea/**analysis/64251758233**	The FMEA analysis record with Entity Key 64251758233.
strategy/fmea/**template/64251549394**	The FMEA template record with Entity Key 64251549394.

About the FMEA Data Structure

Within the FMEA module, families are used to represent the various components of an FMEA Analysis. GE Digital APM leverages its fundamental entity and relationship family infrastructure to store data related to an FMEA Analysis.

Each FMEA Analysis is represented at the root level by an RCM FMEA Analysis family record. FMEA Analyses use the same root analysis family, and they are distinguished from RCM Analyses via the

Analysis Type field in the RCM FMEA Analysis record. The Analysis Type can be either RCM or FMEA. For an RCM FMEA Analysis that will be used for an FMEA Analysis, the Analysis Type is FMEA.

Note: Because both RCM and FMEA Analysis records belong to the same family, a query on the RCM FMEA Analysis family will return results that include all analyses of any type. To limit your results to include only one analysis type, you must include the Analysis Type field in your query and define criteria to filter on either RCM or FMEA.

For an FMEA Analysis (a record in which the Analysis Type is FMEA), the RCM FMEA Analysis record can be linked to RCM FMEA Asset records through the Has RCM FMEA Asset relationship. RCM FMEA Asset records can, in turn, be linked to RCM FMEA Failure Mode records through the Has RCM FMEA Failure Mode relationship, and so on, for all components of the analysis. Together, the root RCM FMEA Analysis record and all the records that are linked to it, either directly or indirectly, make up the FMEA Analysis.

Failure Finding Activity in FMEA Recommended Actions

When you define an FMEA recommendation and specify the Action Type as Failure Finding, you can use the Failure Finding Activity cells to calculate the failure finding task interval (FFI).

The following equation is used to calculate FFI:

FFI = MTIVE x [(n + 1)(MTED)/MMF]1/n

Note that the information used for the FFI calculation is based upon the concepts in SAE Standard JA1012, "A Guide to the Reliability-Centered Maintenance (RCM) Standard." The process and terminology used in the FFI calculation are described in more detail in this standards document. To use the Failure Finding Activity cells effectively, you will need to be familiar with this standard.

In addition, the FFI calculation is based upon information in the book "Reliability-Centered Maintenance" by John Moubray.

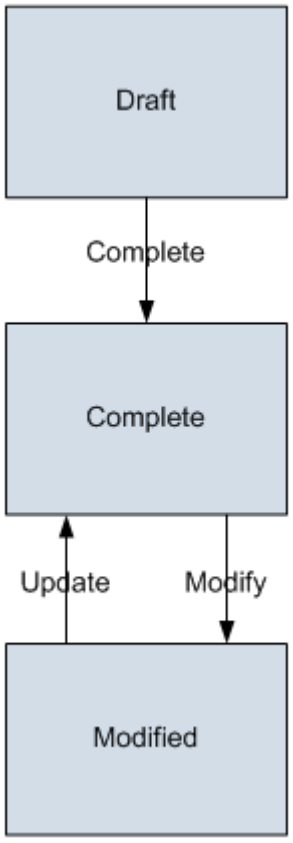
The following table describes the Failure Finding Activity cells in the GE Digital APM Framework.

Cell	Description
MMF	Stores the mean time between multiple failures. For example, a 1 in 1,000,000 probability of a multiple failure in one year implies a mean time between failures of 1,000,000 years. The probability of multiple failures occurring in any one year is 1/MMF.
MTIVE	Stores the mean time between failures of the protective device.
MTED	Stores the mean time between failures of the protected function. For example, if the demand rate of the protected function is once in 200 years, this equals a probability of failure for the protected function of 1 in 200 in any one year, or a mean time between failures of the protected function of 200 years. The probability of failure of the protected function in any one year is 1/MTED.
n	The number of protective devices.

FMEA State Configuration

This topic describes the different analysis states in a Failure Modes and Effects Analysis analysis configuration.

By default, the following baseline State Configuration exists for the FMEA Analysis family.



Initial State

The Draft state is the initial state of all new FMEA Analysis records.

Datasheet Configuration

By default, no states and operations will appear on the datasheet when you are viewing an RCM FMEA Analysis record in RCM, FMEA, the Record Manager, or the Bulk Data Form.

Reserved States and Operations

By default, no states or operations displayed in the preceding diagram are reserved. This means that you can remove or modify any of these states or operations. You can also add your own states and operations to the State Configuration.

FMEA Site Filtering

FMEA Analyses

Site filtering is applied to FMEA analysis records by setting the site on the datasheet or by linking an asset with an existing site assignment to a global analysis. If you assign a site to an FMEA analysis by linking an existing asset, then all of the records associated with the analysis inherit the same site. After the site is set for an analysis, you can only link assets with that same site assignment.

FMEA Analysis Templates

When you create a new analysis template, you can use the **Site** control to set the site for the template, which then gets populated through all of the records associated with an analysis. You can apply any viewable template to any viewable analysis, regardless of the site assignment, as long as the risk matrices match.

Examples

Consider an organization that has two sites, Site X and Site Y, and then consider the following scenarios:

Scenario 1: User assigned to Site X and Site Y applies a template to an analysis

Template A is assigned to Site X. Analysis 1 is assigned to Site Y. The user applies Template A to Analysis 1, even though they have separate site assignments, as long as there are no conflicts between the risk matrices.

Scenario 2: User assigned to Site X and Site Y links an asset to an analysis

Equipment 1 is assigned to Site X and Equipment 2 is assigned to Site Y. Analysis 1 is assigned to Site Y. The user links Equipment 2 to Analysis 1, because they share the same site (Site Y).

The user is unable to link Equipment 1 to Analysis 1, because Equipment 1 would not appear in the list of available assets to link there due to site incompatibility. So, even though this multi-site user can view both Equipment 1 and Equipment 2, they cannot link an equipment to an analysis with an incompatible site assignment.

Promotion to ASM Field Mapping

When promoting an Analysis or Template to Asset Strategy Management (ASM), the field mapping is controlled using a module workflow Policy. You can modify this Policy by accessing the **RCM FMEA Admin** page.

About Values Mapped from FMEA Analysis to Asset Strategy

When you promote FMEA analysis to an ASM analysis, several fields in the Asset Strategy family are populated with the fields that are mapped from RCM FMEA Analysis family.

The following table lists the field mapped for Risk family:

This field in RCM FMEA Failure Effect and RCM FMEA Failure Mode family:	...populates this field in Risk family
Basis for Assessment	Basis for Assessment
Failure Mode Name,Effect Name	Name

This field in RCM FMEA Failure Effect and RCM FMEA Failure Mode family:	...populates this field in Risk family
Failure Mode Long Description, Effect Long Description	Description
Failure Mode Name	Failure Mode
Maintainable Item	Maintainable Item
Damage Code	Condition
PF Interval	PF Interval
PF Interval Units	PF Interval Units

The following table lists the field mapped for Action family:

This field in RCM FMEA Recommendation family:	...populates this field in Action family
Recommendation Headline	Name
Recommendation Description	Description
Action Type	Action Type
Interval	Interval
Interval Units	Interval Units
Estimated Cost	Cost
Asset Shutdown Required?	Shutdown Required
Estimated Cost Basis	Cost Basis
Nonrecurring	Nonrecurring
Performance Interval	Performance Interval
Performance Interval Units	Performance Interval Units
Recommended Resource	Recommended Resource
Target Completion Date	Target Completion Date

Family Field Descriptions

RCM FMEA Analysis Records

This topic provides an alphabetical list and description of the fields that exist for the RCM FMEA Analysis family and appear on its datasheet. The information in the table reflects the baseline state and behavior of these fields. This list is not comprehensive.

This family is enabled for site filtering, which means that records in this family can be assigned to a specific site and will only be accessible to users who are assigned to the same site and have the appropriate license and family privileges. For more information, refer to the Sites section of the documentation.

Field	Data Type	Description	Behavior and Usage
Analysis Identification			
Analysis End Date	Date/Time	The end date for the analysis.	You can use the Calendar feature to select the date on which the analysis should end.
Analysis ID	Character	The ID of the analysis.	Generated automatically by the system. Cannot be modified.
Analysis Long Description	Text	A more detailed description of the analysis.	You can enter a description manually.
Analysis Re-Evaluation Date	Date/Time	The date scheduled between the start and end dates to re-evaluate analysis parameters.	This date cannot be before the Analysis Start Date.
Analysis Short Description	Text	A brief description of the analysis.	This is a required field.
Analysis Start Date	Date/Time	The start date for the analysis.	You can use the Calendar feature to select the date on which the analysis should begin.
Analysis Type	List	The type of analysis.	Generated automatically by the system. Cannot be modified.
System Definition			
System Boundary Description	Text	Details for the system boundary.	You can enter a description manually.
System Criticality	Character	The level of criticality for the system being analyzed.	This value is based on criticality evaluation outside of GE Digital APM, and therefore must be entered manually.
System Criticality Basis	List	The criticality basis for a system.	This field will contain one of the following values: • Calculated • Economic Analysis • Safety and Health Analysis • System Criticality Analysis • System Reliability Analysis
System ID	Character	The ID for the system.	Enter a value manually in the text box.
System Long Description	Text	Details for the system.	You can enter a description manually.
System Name	Character	The name of the system.	Enter a value manually in the text box.

Field	Data Type	Description	Behavior and Usage
System Notes	Text	Any notes necessary for the system.	You can enter your notes manually.
System Primary Drawing Number	Numeric	The number that references a drawing or diagram of the system.	This value is based on an indexing system outside of GE Digital APM, and therefore must be entered manually.

RCM FMEA Template Records

This topic provides an alphabetical list and description of the fields that exist for the RCM FMEA Template family and appear on its datasheet. The information in the table reflects the baseline state and behavior of these fields. This list is not comprehensive.

This family is enabled for site filtering, which means that records in this family can be assigned to a specific site and will only be accessible to users who are assigned to the same site and have the appropriate license and family privileges. For more information, refer to the Sites section of the documentation.

Field	Data Type	Description	Behavior and Usage
Analysis Type	List	The type of analysis the template is based on.	This field is populated automatically with FMEA and cannot be modified.
Approved Date	Date/Time	The date on which the template was approved.	You can use the Calendar feature to select the date on which the template was approved.
Approver	Character	The person who approved the template.	Enter the name and/or title of the approver.
Author	List	The user that created the template.	This field is generated automatically and cannot be modified.
Created On	Date/Time	The date on which the template was created.	This field is generated automatically and cannot be modified.
Criticality	Character	The degree to which an asset is functionally or economically important.	This field is read-only and populated automatically.
Description	Text	Details for the template.	You can enter a description manually.
Duty	Character	The duty cycle context under which the asset is operating (i.e., continuous or standby).	This field is read-only and the value is populated by the APT template data load.

Field	Data Type	Description	Behavior and Usage
ID	Character	The ID of the template.	This is a required field. It can be modified, but each template ID must remain unique.
Service	Character	The process and environmental conditions under which the asset is operating.	This field is read-only and the value is populated by the APT template data load.
Status	List	The status of the template.	This field will contain on of the following values: • Development • Approved • Obsolete
Template Category	Character	Any category name you want to assign to the template.	Enter a category in the field.
Template Notes	Text	Any additional information you want to provide about the analysis template.	Enter additional notes in the field.
Type	Text	The family of the record from which the template was created.	This field is generated automatically and cannot be modified.

RCM FMEA Asset Records

This topic provides an alphabetical list and description of the fields that exist for the RCM FMEA Asset family and appear on its datasheet. The information in the table reflects the baseline state and behavior of these fields. This list is not comprehensive.

This family is enabled for site filtering, which means that records in this family can be assigned to a specific site and will only be accessible to users who are assigned to the same site and have the appropriate license and family privileges. For more information, refer to the Sites section of the documentation.

Field	Data Type	Description	Behavior and Usage
Asset Description	Text	Description of the asset.	You can enter a description manually.
Asset ID	Character	The original Equipment ID for the asset.	Populated automatically when you select an asset from the **Asset Finder**. This is a required field.
Asset Type	List	The type of asset.	Generated automatically by the system. Can be modified, if needed. This is a required field.

Field	Data Type	Description	Behavior and Usage
Purpose Statement	Text	Purpose of the asset.	You can enter a description manually.
FMEA Asset ID	Character	The ID for the asset specific to the FMEA module.	Generated automatically by the system. Cannot be modified.

RCM FMEA Failure Effect Records

This topic provides an alphabetical list and description of the fields that exist for the RCM FMEA Failure Effect family and appear on its datasheet. The information in the table reflects the baseline state and behavior of these fields. This list is not comprehensive.

This family is enabled for site filtering, which means that records in this family can be assigned to a specific site and will only be accessible to users who are assigned to the same site and have the appropriate license and family privileges. For more information, refer to the Sites section of the documentation.

Field	Data Type	Description	Behavior and Usage
Effect ID	Character	The ID of the failure effect.	Generated automatically by the system. Cannot be modified.
Effect Impact	List	The level at which the failure effect has an impact.	The field will contain one of the following values: • Unit • Plant • System • Equipment
Effect Long Description	Text	Description of the failure effect.	You can enter a description manually.
Effect Name	Character	The name of the failure effect.	Enter a value manually in the text box. This is a required field.
Unmitigated Driving Risk Category	List	Unmitigated risk category from failure mode **Risk** section.	Generated automatically by the system. Cannot be modified.
Unmitigated Driving Risk Rank	Numeric	Unmitigated risk rank value assigned from failure mode **Risk** section.	Generated automatically by the system. Cannot be modified.
Unmitigated Financial Risk	Numeric	Unmitigated risk value assigned from failure mode **Risk** section.	Generated automatically by the system. Cannot be modified.
Unmitigated Risk	Numeric	Unmitigated risk value assigned from failure mode **Risk** section.	Generated automatically by the system. Cannot be modified.

RCM FMEA Failure Mode Records

This topic provides an alphabetical list and description of the fields that exist for the RCM FMEA Failure Mode family and appear on its datasheet. The information in the table reflects the baseline state and behavior of these fields. This list is not comprehensive.

This family is enabled for site filtering, which means that records in this family can be assigned to a specific site and will only be accessible to users who are assigned to the same site and have the appropriate license and family privileges. For more information, refer to the Sites section of the documentation.

Field	Data Type	Description	Behavior and Usage
Damage Code	Character	The code associated with the damage type.	This value is based on an indexing system outside of GE Digital APM, and therefore must be entered manually.
Failure Mechanism	Character	The physical, electrical, chemical, and mechanical factors which cause a failure individually or in combination with other factors.	Enter factors which have induced the failure.
Failure Mechanism Description	Text	Description of the failure mechanism.	Enter a description for the failure mechanism.
Failure Mode ID	Character	The ID of the failure mode.	Generated automatically by the system. Cannot be modified.
Failure Mode Long Description	Text	Description of the failure mode.	Enter a description for the failure mode.
Failure Mode Name	Character	The name of the failure mode.	This is a required field.
Failure Pattern	List	The type of failure pattern exhibited by the asset.	The field will contain one of the following values: • Bathtub • Wearout • Increasing (zero early/ random) • Constant/random • Infant Mortality • Rapid Wearout
Maintainable Item	Character	An item from an EAM system, failure codes, etc.	This value is based on an indexing system outside of GE Digital APM, and therefore must be entered manually.
PF Interval	Numeric	The interval value for potential to failure of the asset.	Enter the number of the interval to be combined with the PF Interval Units.

Field	Data Type	Description	Behavior and Usage
PF Interval Units	List	Unit of measurement for the potential to failure of the asset.	The field will contain one of the following values: • Minutes • Hours • Days • Weeks • Months • Years
Related Asset ID	Character	The ID for the asset related to the failure mode.	This field contains a list of assets that are linked to the analysis. You can select any ID in the list. The selected asset will be linked to subsequent recommendation records. This is a required field.
Related Asset Type	List	The type of the asset that is related to the failure mode.	The Related Asset Type field is automatically populated with the Asset Type value from the associated Asset record. **Note:** If you modify the value in the Related Asset ID field of an existing Failure Mode record, the links to any recommendations will also be updated. Note, however, that if RCM FMEA Task records have been linked to the Recommendation record, changing the Related Asset ID in the Failure Mode record will not update the link to the Task record. The RCM FMEA Task record will continue to be linked to the RCM FMEA Asset or Asset record to which the Recommendation record was linked when the Task record was originally created.

RCM FMEA Recommendation Records

This topic provides an alphabetical list and description of the fields that exist for the RCM FMEA Recommendation family and appear on its datasheet. The information in the table reflects the baseline state and behavior of these fields. This list is not comprehensive.

This family is enabled for site filtering, which means that records in this family can be assigned to a specific site and will only be accessible to users who are assigned to the same site and have the appropriate license and family privileges. For more information, refer to the Sites section of the documentation.

Field	Data Type	Description	Behavior and Usage
Recommendation			
Asset ID	Character	The ID for the asset associated with the recommendation.	This field's value is automatically populated.
Asset Shutdown Required?	Boolean	Indicates whether or not the asset must be physically shut down after implementing the action.	Select the check box to flag for an equipment shutdown after the action is applied.
Business Impact	List	Indicates the scope of impact for carrying out the recommendation.	This field contains a list of the following values: • Plant • Unit • System • Equipment Select the value that defines the level of impact to carry out the recommendation.
Comments	Text	Any additional information pertaining to the recommendation.	N/A
Create Work Request?	Boolean	Indicates whether or not a work request should be generated for this recommendation.	Select the check box if you want a work request to be automatically generated for this recommendation.
Recommendation Description	Text	A description for the recommendation.	N/A
Recommendation Headline	Character	The title of the recommendation record.	This is a required field.
Recommendation ID	Character	A unique ID for the recommendation.	This field's value is automatically populated.
Target Completion Date	Date/Time	Target date for the recommendation's action to be executed.	Use the date/time selectors to select the date and time by which the action must be executed.
Technical Number	Character	The technical number for the associated asset of the recommendation.	This field's value is automatically populated.
Work Request Equipment	Text	The specific equipment associated with the work request.	This field's value is automatically populated.
Work Request Functional Location	Text	The specific functional location associated with the work request.	This field's value is automatically populated.

Field	Data Type	Description	Behavior and Usage
Work Request Reference	Text	The reference ID for the work request.	This field's value is automatically populated.
Action Information			
Failure Finding Activity	See an explanation of the Failure Finding Activity cell values.		
Action Type	List	The type of action associated with the recommendation.	This field contains a list of the following values: • Time-Based Maintenance (Preventative) (PM) • Condition-Based Maintenance (Predictive) (CM) • Redesign (DSN) • Procedure (PROC) • Training (TRN) • Failure Finding (FF) Select the action type from the corresponding action. The values are driven by system code table MI_ACTION_TYPE.
Display FFI Units As	List	The unit used to indicate the FFI value.	N/A
Estimated Cost	Numeric	The estimated cost for carrying out the action.	Enter the numeric value for the estimate cost of implementing the recommendation.
Estimated Cost Basis	Text	An explanation for the estimated cost of carrying out the action.	N/A
FFI	Numeric	Indicates frequency of failure finding tasks.	N/A
Interval	Numeric	The number of the interval unit corresponding to how often the action should be performed.	This value corresponds with Interval Units to give the complete frequency with which the action should be performed.
Interval Units	List	The unit of the interval corresponding to how often the action should be performed.	This value corresponds with Interval to give the complete frequency with which the action should be performed.
Nonrecurring	Boolean	Indicates whether the action should be on a recurring basis or only once.	Select the check box if you only want the action performed once instead of on a recurring basis.

Field	Data Type	Description	Behavior and Usage
Performance Interval	Numeric	Reference value for the interval of the performance of the action.	The values in the Performance Interval field are not used in any calculations in ASM. You can use them as reference values, but no logic is executed based on the values. All calculations that require an interval are based on the values in the Interval field and the Interval Units field.
Performance Interval Units	List	Reference value for the interval units of the performance of the action.	The values in the Performance Interval Units field are not used in any calculations in ASM. You can use them as reference values, but no logic is executed based on the values. All calculations that require an interval are based on the values in the Interval field and the Interval Units field.
Recommended Resource	Text/List	A custom entry for a resource to execute action.	Use the drop-down list and enter text into the **add caption** box that corresponds to the custom resource.
Use Calculated FFI Results	Boolean	Indicates whether or not you want to use the calculated FFI results.	N/A

Catalog Items

Queries Folder

The Catalog folder `\\Public\Meridium\Modules\FMEA` contains subfolders which contain baseline queries that are used by default in FMEA. The following table identifies the folder locations and results of these queries.

Query	Behavior and Usage
Baseline queries for FMEA in folder `\\Public\Meridium\Modules\FMEA`	
FMEA AnalysisTeam	Returns all team members for an analysis. The query is also used to support the **FMEA Analysis TeamSub Report** report.
RCM FMEA Risks Without Recommendations Query	Returns the list of risks without any recommendations.
Template List	Returns all FMEA templates of the selected template type. The query is used to support the **Select Template** window of the **Apply Template Builder** for FMEA.

Query	Behavior and Usage
Baseline queries for FMEA in folder `\\Public\Meridium\Modules\FMEA\Analysis`	
Criticality of RCM FMEA Assets	Returns number of RCM FMEA assets at very high, high, medium, and low criticality.
FMEA Equipment By System	Returns select equipment records based on Analysis System ID. The query is also used to support the **FMEA Analysis Description** report.
FMEA FailureModeEffects	Returns analysis details based on function, failure mode, and failure effects. This query is also used to support the **FMEA Failure Mode Effects Analysis** report.
FMEA Overview Filter Query	Defines the parameters to be used to filter the FMEA Overview page.
FMEA Recommendations by System	Returns recommendations based on the Analysis System ID. The query is also used to support the **FMEA Recommendations** report.
Overview Page - FMEA Analyses	Returns all FMEA analyses for the Overview page list.
Overview Page - Template	Returns all FMEA templates for the Overview page list.

Graphs Folder

The Catalog folder `\\Public\Meridium\Modules\FMEA` contains the baseline graphs that are used by default in FMEA. The following table contains the graph names and details.

Graph	Behavior and Usage
Percentage of Critical Assets with an Analysis	Displays a graph representing the percentages of critical assets that have an analysis.
Percentage of Critical Assets an Analysis - LowMedium	Displays a graph representing the percentages of critical assets at low and medium that have an analysis.
RCM FMEA Risks Without Recommendations	Displays a graph representing the number of risks without recommendations compared to the total number of risks.

Reports Folder

The Catalog folder `\\Public\Meridium\Modules\FMEA` contains subfolders which contain baseline reports that are used by default in FMEA. The following table identifies the folder locations and descriptions of those reports.

Report	Behavior and Usage
Baseline reports for FMEA in folder `\\Public\Meridium\Modules\FMEA`	
FMEA AnalysisTeamSubReport	SSRS report that is used by the **FMEA Analysis Description** report.
Baseline reports for FMEA in folder `\\Public\Meridium\Modules\FMEA\Analysis`	

Report	Behavior and Usage
FMEA Analysis Description	SSRS report that displays general information for an FMEA analysis, including the associated asset and team members.
FMEA FailureModeEffectsAnalysis	SSRS report that displays detailed information of the FMEA analysis, including functions, failures, failure modes, and failure effects.
FMEA Recommendations	SSRS report that displays detailed information of the FMEA recommendations for a system.
Baseline reports for FMEA in folder `\\Public\Meridium\Modules\FMEA\SSRS`	
FMEA Analysis Description	SSRS report that displays general information for an FMEA analysis, including the associated asset and team members.
FMEA AnalysisTeamSubReport	SSRS report that is used by the **FMEA Analysis Description** report.
FMEA FailureModeEffectsAnalysis	SSRS report that displays detailed information of the FMEA analysis, including functions, failures, failure modes, and failure effects.
FMEA Recommendations	SSRS report that displays detailed information of the FMEA recommendations for a system.

Dashboards Folder

The Catalog folder `\\Public\Meridium\Modules\FMEA` contains the baseline dashboard that is used for the **FMEA Overview** page. The following table contains the name of the dashboard and its usage.

Dashboard	Behavior and Usage
FMEA Dashboard	Displays the dashboard for the FMEA module, which contains the **All RCM FMEA Risks Without Recommendations** and **Criticality Distribution of All Assets** graphs.

Chapter 14

Troubleshooting

Topics:

Troubleshooting Scenarios

Troubleshooting Scenarios

The following topics can help you troubleshoot issues that you may have with the *Failure Modes and Effects Analysis* module:

Dashboard Tile Count Does not Appear or Takes Longer Time to Load the Count in the RCM/FMEA Overview Screen

Description

In the **Applications** menu, navigate to the **STRATEGY** section, and then select **Failure Modes and Effects Analysis**. The dashboard tile count takes longer time to load or it does not appear in the module overview page.

Cause

This issue may occur if any of the database indexes are missing.

Solution

Perform the following step:

Run the following script for the RCM/FMEA equipment, recommendation, and the RCM/FMEA recommendation families. This improves the loading performance of the **Failure Modes and Analysis Overview** page.

```
CREATE NONCLUSTERED INDEX [<N_MI_RCMEQPMT_ID_NK>]
ON [dbo].[MI_RCMEQPMT] ([MI_RCMEQPMT_EQUIP_ID_C])
INCLUDE ([ENTY_KEY])
```

```
CREATE NONCLUSTERED INDEX [<N_MI_REC_ANALY_KEY_FK>]
ON [dbo].[MI_REC] ([MI_REC_ANALY_KEY_NBR])
INCLUDE ([ENTY_KEY])
```

```
CREATE NONCLUSTERED INDEX [<N_MI_RECRCM_ACTIO_TYPE_FK>]
ON [dbo].[MI_RECRCM] ([MI_RECRCM_ACTIO_TYPE_C])
INCLUDE ([ENTY_KEY])
```

These indexes have been added to the baseline product, in version 4.4. This step is applicable to Version 4.x and earlier versions.

Note: Run the script directly in the database.

Data Loader Does not Load Recommendations Instead a Warning Message Check for Possible Orphaned Records

Description

In the **Applications** menu, navigate to **Tools** > **Data Loader** > **APM Strategy** > **Failure Modes and Effect Analysis (FMEA)** and then import the attached file.

When you load the data loader, the following warning messages appear:

- <Date/Time>|Batch [0001]| Warn - The Assets table contains 1 records but only 0 were loaded. Check for possible orphaned records.
- <Date/Time>|Batch [0001]| Warn - The Recommendations table contains 7 records but only 3 were loaded. Check for possible orphaned records.

Cause

The failure effect names may not be unique.

Solution

Procedure

Ensure the failure effect name is unique, so that the data loads without errors.

RCM Data Loader Gives an Error After Loading the RCM Data

Description

The following error appeared when loading the RCM/FMEA data loader:

2021-11-02 10:19:44.0206|Batch [0015]|ERROR| RCM FMEA Recommendation '<Recommendation name ...> ' was processed more than once due to ambiguity in reference column information.

2021-11-02 10:19:44.0215|Batch [0015]|DEBUG| Finished processing Batch [0015]

Or

2019-11-25 11:47:47.635412|Batch [0001]| Error - RCM FMEA Failure Mode '<Failure Mode name...>' was processed more than once due to ambiguity in reference column information.

2019-11-25 11:47:49.104147|Batch [0001]| Debug - Finished processing Batch [0001]

Cause

The dataloader file contains duplicate names in the Failure Effect, Failure Modes, Recommendations, and Secondary Action sheet as there is no option to differentiate the duplicate names in the datasheet.

Solution

Perform one of the following options:

1. Do not have same Failure effect or Failure mode or Recommendation or Secondary action names.
2. If you cannot implement the first option, then the column **Related Asset** ID must be added in the Failure Mode, Failure Effect, Recommendations, and Secondary action sheet.

FMEA Analysis Templates Data Loader Error

Description

Importing a Failure Modes and Effects Analysis (FMEA) templates data loader triggers an Internal Server error if length of the field input file exceeds 200 character. This error occurs with specific users and templates.

Cause

The length of the data loader template file name exceeds 200 characters.

Solution

The data loader template file name must be reduced to a maximum length of 200 characters to mitigate this error.

Frequently Asked Questions

About Frequently Asked Questions

The following topics cover the frequently asked questions (FAQs) for Failure Modes and Effects Analysis organized by common categories. Select one of the categories to view the list of FAQs.

- Can I remove virtual assets in the RCM/FMEA?
- Can I create a URL directly to the Failure Mode or Failure Effect levels in the RCM/FMEA?

Frequently Asked Questions

This topic covers the frequently asked questions (FAQs) for Failure Modes and Effects Analysis (FMEA) module.

1. Can I remove virtual assets in the RCM/FMEA?
   In APM version 4.3.0, the ability to add "virtual assets" (RCM FMEA Asset) within an Analysis is removed. In 4.3.0 and latest versions, the concept of virtual assets using the RCM FMEA Asset family is now limited to the Template functionality. Hence, you can only add real assets that exist in the database via the Asset Hierarchy to an RCM or FMEA Analysis.
2. Can I create a URL directly to the Failure Mode or Failure Effect levels in the RCM/FMEA?
   There is no option to create a URL directly to the Failure Mode or Failure Effect levels in the RCM/FMEA. The only option is to create URLs to the analysis or the template. For more information on the URLs, see the **Available FMEA URLs** section of the document.