Failure Modes, Effects, and Criticality Analysis

Operational Sustainability, LLC® (OS) developed the **OESuite™ Failure Modes and Effects Analysis (FMEA) and Failure Modes, Effects, and Criticality Analysis (FMECA)** functionalities to streamline these proven analysis methods and automatically integrate findings, tasks, and information into our **Process Risk** and **Corrective And Preventive Actions** modules. Failure to address potential failures to mitigate risk can lead to severe malfunctions, product or process problems, and incidents. The results can be expensive repairs, warranty costs, production delays, catastrophic failures, or even loss of life. FMEA / FMECA analyses can be employed to support design, development, manufacturing, service and other activities to improve reliability and increase efficiency.

FMEA / FMECA are flexible processes designed to identify potential failure modes for a product or process and to assess the risk associated with those failure modes. Different industries utilize industry-specific templates to address their needs.

Standards we follow include

- U.S. Department of Defense's MIL-STD-1629A
- SAE International's J1739 and ARP5580 documents (for automotive and non-automotive applications, respectively)
- IEC 61508
- ISO 9000 / QS 9000
- ISO 26262 BS5670 Part 5
- Automotive Industry Action Group's (AIAG) FMEA-4

During an FMECA procedure, identifying the failure modes and their effects is often only the beginning. The Criticality Analysis portion of the process is where the failure modes are ranked according to a combination of the severity of the consequences of failure and the probability of that failure mode actually occurring. Another way of determining the priority of an identified issue is to use Risk Priority Numbers. Our FMECA Module also provides a phrase library containing commonly used descriptions of component parts, failure modes, and effects to speed data entry. An apportionment library, derived from MIL-HDBK-338 is also included.

Risk Priority Numbers (RPN): The risk priority number system is a relative rating system that assigns a numerical value to the issue for each of three different categories: Severity (S), Occurrence (O) and Detection (D). The three ratings are multiplied to determine the overall RPN.

Criticality Analysis: Criticality Analysis takes into account the probability of failure for the item, the severity of the consequences of failure, and the portion of the failure probability that can be attributed to a particular failure mode. These factors determine the Criticality Value.

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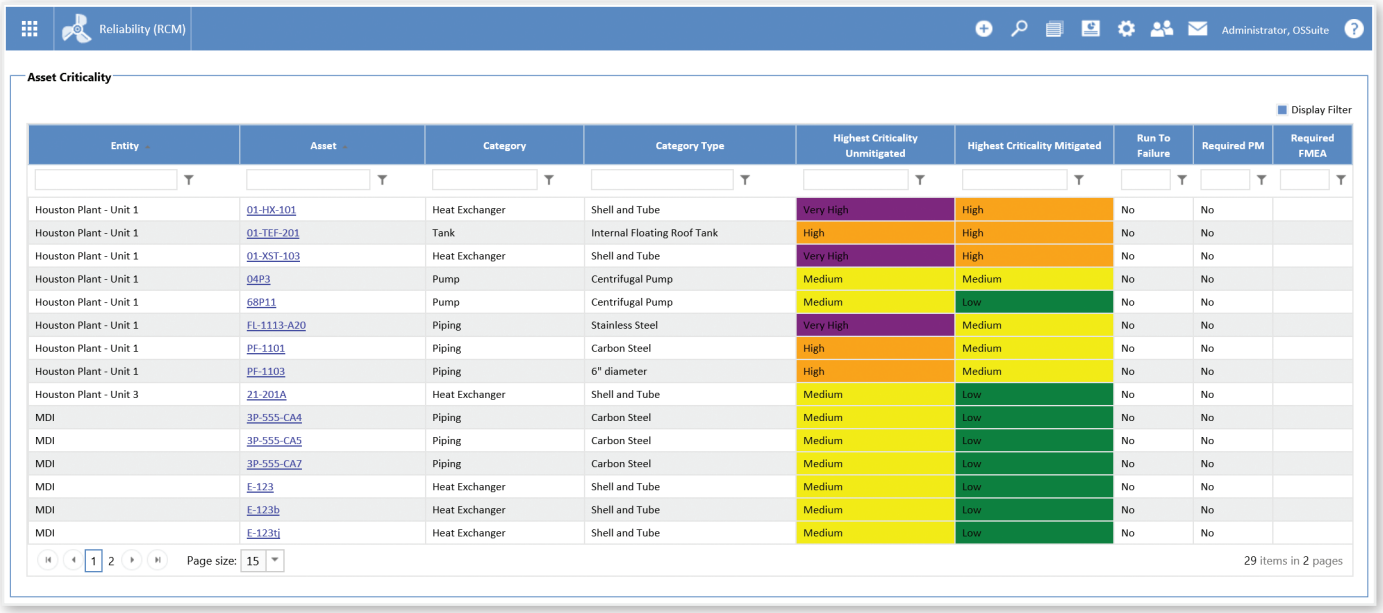
As with the RPN method, this criticality value can be compared with the criticalities for other failure modes to help rank the issues that must be addressed.



Entity	Asset	Category	Category Type	Highest Criticality Unmitigated	Highest Criticality Mitigated	Run To Failure	Required PM	Required FMEA
Houston Plant - Unit 1	01-HX-101	Heat Exchanger	Shell and Tube	Very High	High	No	No	
Houston Plant - Unit 1	01-TEF-201	Tank	Internal Floating Roof Tank	High	High	No	No	
Houston Plant - Unit 1	01-XST-103	Heat Exchanger	Shell and Tube	Very High	High	No	No	
Houston Plant - Unit 1	04P3	Pump	Centrifugal Pump	Medium	Medium	No	No	
Houston Plant - Unit 1	68P11	Pump	Centrifugal Pump	Medium	Low	No	No	
Houston Plant - Unit 1	FL-1113-A20	Piping	Stainless Steel	Very High	Medium	No	No	
Houston Plant - Unit 1	PF-1101	Piping	Carbon Steel	High	Medium	No	No	
Houston Plant - Unit 1	PF-1103	Piping	6" diameter	High	Medium	No	No	
Houston Plant - Unit 3	21-201A	Heat Exchanger	Shell and Tube	Medium	Low	No	No	
MDI	3P-555-CA4	Piping	Carbon Steel	Medium	Low	No	No	
MDI	3P-555-CA5	Piping	Carbon Steel	Medium	Low	No	No	
MDI	3P-555-CA7	Piping	Carbon Steel	Medium	Low	No	No	
MDI	E-123	Heat Exchanger	Shell and Tube	Medium	Low	No	No	
MDI	E-123b	Heat Exchanger	Shell and Tube	Medium	Low	No	No	
MDI	E-123ti	Heat Exchanger	Shell and Tube	Medium	Low	No	No	

1 2 Page size: 15 29 items in 2 pages

Figure 1 – OESuite™ analytics showing asset criticality

OS's **Reliability Centered Maintenance (RCM)** module leverages FMEA as a primary component of the analysis. In addition, our **Process Risk Management** module includes an FMECA methodology.

The following features are included in FMEA:

- Track completion of recommended actions
- Record and manage data for current FMEAs
- Find and reuse relevant information from existing FMEAs
- Evaluate risk via RPN or Criticality Analysis
- Access ad hoc and template reports, queries, and dashboards
- Integrates with Reliability Centered Maintenance (RCM) module
- Adjust maintenance intervals as FMEA analysis changes
- Integrates with CAPA module

The following features are included in FMECA:

- Automatically assigned severity values
- User-definable severity category and matrix
- Assignment of RPN as needed
- Effects may be defined on any higher-level sub-system
- User-definable data fields and sort facilities
- Failure effects and severities traced through to system hierarchy
- Integrates with CAPA Module
- Multiple failure effects permitted for a single failure mode
- Libraries of components with pre-defined modes and apportionment
- Optimization of design to meet acceptable failure modes and severity

For more information email us at info@DrivingOE.com or call (713) 355-2900.

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