

## Flexibility and Support for ISO 14971 Implementation in Medical Device Product Development

### SITUATION

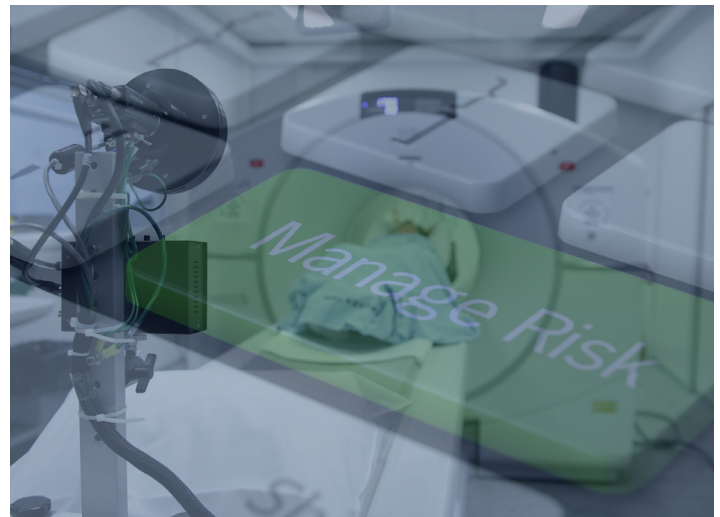
Medical device development is a complex process, with a critical element focusing on risk management. The consequences of not managing risk properly can be catastrophic. For many countries, ISO 14971 “Application of risk management to medical devices” is a consensus standard for complying with the regulation for medical device design, development, manufacture, and distribution. This standard helps companies provide evidence of risk management and is a required activity for medical device creation. The European Union recognizes this standard as a method to comply with the requirements to assess risk and has gone a step farther with the implementation of the EU MDR (Medical Device Regulation) which governs, by law, the production and manufacturing of medical devices in Europe.

Currently, risk management (and overall product) data is often managed in Excel and/or Word, which can quickly become overwhelming with the sheer amount and complexity of data. Not only do medical device manufacturers have to manage this data, they also need to ensure they are meeting applicable standards and laws. How can medical device manufacturers better align to applicable standards and regulations in their risk management process?

### SOLUTION

At Cognition, we have developed a new risk module for our Cockpit Enterprise solution to support ISO 14971 implementation with the flexibility to align with existing processes at individual medical device companies, making it easier to address risk and deliver products to market.

The Risk Module extends the base-risk functionality included in Cockpit Enterprise, specifically to provide enhanced support for the array of ISO 14971:2019 risk management processes. It is designed to “plug in” to existing Cockpit Enterprise implementations, delivering new risk functionality without affecting existing requirement/test data. This gives users the control to specify data sources and object filters where required in order to connect the risk data to existing project data.



The Risk Module is an optional subscription add-on delivering new, supported functionality and UI elements for implementing risk/reliability analysis tools using the Safety Risk and FMEA Row classes, allowing users to start utilizing the risk functionality with minimal configuration needs.

# FEATURES

## Risk Management Plan

- Easy access to change acceptability criteria
- Define at project level

## Product Risk Analysis

- Analyzes risks associated with the device as a result of side effects, failures, or use errors

### 1.0 Risk Analysis

Description here...

ID	Sequence of Events	Hazardous Situation	Pre Risk Control							Risk	Risk Controls	Type	Implementation	Post Risk Control					
			P1	Hazard	Harm	P2	Overall P	Severity	Residual P1					Residual P2	Overall Residual P	Residual Severity	Residual Risk		
RSK0003	(1) The sequence of a possible side effect... Intended Use	A Hazardous Situation that is a side effect of intended use	Remote	Library Hazard 3	Library Serious (S=3)	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Broadly Acceptable
RSK0001	(1) A sequence leading to Local Effect 1  Some additional information about this sequence... Causes: • Device Failure Mode 1 (Possible) - DEVFMEA0001, DEVFMEA0009	Local Effect 1	Occasional	Library Hazard 1	Library Minor (S=2)	Remote	Occasional	Minor	Minor	Broadly Acceptable	Risk Control 1	Inherent Safety by Design	DO0011: Design Output 3 DO0010: Design Output 2	Remote	Remote	Remote	Remote	Minor	Broadly Acceptable
RSK0004	(1) A sequence leading to Local Effect 1  Some additional information about this sequence... Causes: • Device Failure Mode 1 (Possible) - DEVFMEA0001, DEVFMEA0009	Local Effect 1	Occasional	Library Hazard 1	Library Negligible (S=1)	Probable	Probable	Negligible	Negligible	Broadly Acceptable	Risk Control 1	Inherent Safety by Design	DO0011: Design Output 3 DO0010: Design Output 2	Remote	Probable	Probable	Negligible	Negligible	Broadly Acceptable
RSK0005	(1) A sequence leading to Local Effect 1  Some additional information about this sequence... Causes: • Device Failure Mode 1 (Possible) - DEVFMEA0001, DEVFMEA0009	Local Effect 1	Occasional	Library Hazard 1	Library Serious (S=3)	Remote	Occasional	Serious	Serious	Investigate Further	Risk Control 1	Inherent Safety by Design	DO0011: Design Output 3 DO0010: Design Output 2	Remote	Remote	Remote	Serious	Serious	Broadly Acceptable
RSK0008	(1) A sequence leading to Local Effect 2 Causes: • Use Error 1 (Possible) - APFMEA0003 • Device Failure Mode 2 (Unlikely) - DEVFMEA0007  (2) Another possible sequence leading to Local Effect 2 Causes: • Device Failure Mode 1 (Possible) - DEVFMEA0001, DEVFMEA0009	Local Effect 2	Occasional	Library Hazard 2	Library Catastrophic (S=5)	Improbable	Occasional	Catastrophic	Catastrophic	Requires Benefit - Risk Justification	Risk Control 3	Protective Measure	DO0009: Design Output 1	Remote	Improbable	Remote	Catastrophic	Catastrophic	Requires Benefit - Risk Justification
											Risk Control 2	Inherent Safety by Design	DO0009: Design Output 1 DO0010: Design Output 2						

Figure 1: Example of Capabilities for Product Risk Analysis

## Preliminary Hazard Analysis

- Ability to define questions similar to those from ISO 24971:2020 to assist in identifying Hazards
- Uncovers Situations, Justification for not applicable questions, Safety Characteristics, Initial Hazards, Side Effects

## Design FMEA

- Analyzes failures associated with the device

### 1.0 Device FMEA

Description here...

ID	Requirement	Failure Mode	Failure Mode Type	Potential Local Effect	Severity of Local Effect	Potential to Lead to Harm	Associated Safety Risks	Potential Cause(s)/Mechanism(s) of Failure	Existing Detection and Prevention Methods	Likelihood of Occurrence	Detectability	RPN	Recommended Action(s)	Residual Severity	Residual Likelihood of Occurrence	Residual Detectability	Residual RPN
DEVFMEA001	Design Input 1	Device Failure Mode 1	Partial Function	Local Effect 1	Serious	Yes	RSK0001 RSK0004 RSK0005	Device Cause 1	Detection: NONE Prevention: NONE	Possible	Not entirely obvious	Investigate Further	Action: Type: Implementation Prevention DO0009: Design Output 1	Serious	Very Unlikely	Not entirely obvious	Acceptable
DEVFMEA006	Design Input 3	Device Failure Mode 3	Unintended Function	Local Effect 4	Critical	No	NONE IDENTIFIED	Device Cause 3	Detection: NONE Prevention: NONE	Unlikely	Not entirely obvious	Investigate Further	NONE	Critical	Unlikely	Not entirely obvious	Investigate Further
DEVFMEA007	Design Input 2	Device Failure Mode 2	Intermittent Function	Local Effect 2	Serious	Yes	RSK0002 RSK0006 RSK0007 RSK0008 RSK0009	Use Error 2	Detection: NONE Prevention: NONE	Unlikely	Not too hard to find	Investigate Further	NONE	Catastrophic	Unlikely	Not too hard to find	Investigate Further
DEVFMEA009	Design Output 4	Device Failure Mode 1	Partial Function	Local Effect 2	Serious	Yes	RSK0002 RSK0006 RSK0007 RSK0008 RSK0009	Device Cause 1	Detection: NONE Prevention: NONE	Possible	Really obscure	Need Corrective Action	NONE	Catastrophic	Possible	Really obscure	Need Corrective Action

Figure 2: Example of Capabilities for Design FMEA

## aFMEA / Use Risk Analysis

- Analyzes use errors associated with the use of the device

## Data Libraries

- Harms (with severities) are only sourced from a library
- New Hazards (local to the project) can be created or Hazards can be sourced from a library

Question	Answer(s)	Perspective	Potential Hazard(s)
(C.2.1) What is the intended use and how is the medical device to be used?	my answer <input type="checkbox"/> <a href="#">Details</a>	Patient <input type="checkbox"/>	+
Factors that should be considered include:			
<ul style="list-style-type: none"> <li>• what is the medical device used for?</li> <li>• what are the indications and contraindications?</li> <li>• what are the intended uses and conditions of use?</li> <li>• does the medical device have any special intended uses or conditions of use?</li> </ul>	<div style="border: 1px solid gray; padding: 5px;"> <p>Choose Items to link:</p> <p><input type="checkbox"/> HAZ0007: Electromagnetic energy - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0006: Radiation energy - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0001: Thermal energy - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0005: Mechanical energy - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0002: Biological - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0004: Chemical - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0003: Biocompatibility - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0008: Function - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0009: Use error - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0010: Labeling - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0011: Operating instructions - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0012: Warnings - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0013: Specification of service and maintenance - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0026: Symbols - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0027: Delete - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0029: Some new Ben one - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0030: Another one - PHA Generic Hazards Library</p> <p><input type="checkbox"/> HAZ0032: Test one right here - PHA Generic Hazards Library</p> </div>		
(C.2.2) Is the medical device safe for use?			
Factors that should be considered include:			
<ul style="list-style-type: none"> <li>• what are the intended uses and conditions of use?</li> <li>• what are the safety features and how do they function?</li> <li>• what are the safety critical functions and how do they function?</li> <li>• what are the safety critical parameters and how do they function?</li> <li>• what are the safety critical components and how do they function?</li> <li>• what are the safety critical interfaces and how do they function?</li> <li>• what are the safety critical software and how do they function?</li> <li>• what are the safety critical hardware and how do they function?</li> <li>• what are the safety critical electrical and how do they function?</li> <li>• what are the safety critical mechanical and how do they function?</li> <li>• what are the safety critical thermal and how do they function?</li> <li>• what are the safety critical chemical and how do they function?</li> <li>• what are the safety critical biological and how do they function?</li> <li>• what are the safety critical electromagnetic and how do they function?</li> <li>• what are the safety critical radiation and how do they function?</li> <li>• what are the safety critical mechanical and how do they function?</li> <li>• what are the safety critical electrical and how do they function?</li> <li>• what are the safety critical thermal and how do they function?</li> <li>• what are the safety critical chemical and how do they function?</li> <li>• what are the safety critical biological and how do they function?</li> <li>• what are the safety critical electromagnetic and how do they function?</li> <li>• what are the safety critical radiation and how do they function?</li> </ul>			
(C.2.3) Is the medical device safe for use by the patient or other persons?			
Factors that should be considered include:			
<ul style="list-style-type: none"> <li>• what are the safety features and how do they function?</li> <li>• what are the safety critical functions and how do they function?</li> <li>• what are the safety critical parameters and how do they function?</li> <li>• what are the safety critical components and how do they function?</li> <li>• what are the safety critical interfaces and how do they function?</li> <li>• what are the safety critical software and how do they function?</li> <li>• what are the safety critical hardware and how do they function?</li> <li>• what are the safety critical electrical and how do they function?</li> <li>• what are the safety critical mechanical and how do they function?</li> <li>• what are the safety critical thermal and how do they function?</li> <li>• what are the safety critical chemical and how do they function?</li> <li>• what are the safety critical biological and how do they function?</li> <li>• what are the safety critical electromagnetic and how do they function?</li> <li>• what are the safety critical radiation and how do they function?</li> </ul>			
(C.2.4) What materials or components are used in the medical device?			
Factors that should be considered include:			

Figure 3: Example of Harms Library

## BENEFITS

### Configurability

- Offers document tables/section formats that can be used to create, manage, and report on risk data while working alongside existing requirements/test data
- Uses included tables as starting points and configure the layout. It allows configuration to be done at the engineering level rather than needing developers.
- User configurable document layouts
- Standard table definitions and library of reusable snippets

### Process Independence

- Does not force data connections so in most cases processes can be updated without affecting the integrity of the overall data
- The module expects that the customers will configure their implementation to integrate and connect with existing requirement, test, and library data

### Maintainability

- Increases use of off-the-shelf functionality, maintained/supported by Cognition; decreases customer-unique configurations, maintained by the customer

### Faster Deployment

- Leverages a starting place for configurability; simplified configuration means that aligning the system to customer's processes is faster and less burdensome
- Configuration can be done quickly by Cognition application engineers and customer's users can start using the implementation within a few hours

### Flexible Risk Environment

- Formalized Risk Acceptability criteria, reflects and enforces customer's QMS procedures
- Separate setups for Hazard Analysis and FMEA
- Wide range of options to support existing processes

### Reusability

- Utilizes centrally managed libraries for Hazards and Harms
- On-the-fly libraries of reusable items created during analysis, such as Mitigations, Hazardous Situations etc.
- Items reusable between different analysis tools such as FMEAs, Use Error Analysis, and Hazard Analysis

### Integrated Reporting and Analysis

- Built-in analysis tools look at different risk aspects such as use errors, design failures, etc.
- Easy custom report creation (including risk control implementation, sources of highest-risk items, risk control sources of new risks, etc.)
- Simple identification of critical elements, such single Design Input or Output controlling multiple risks

### Workflow Availability

- Integrates with existing Cockpit Enterprise workflows, allowing for review and approval of outputs

## NEXT STEPS

To learn more about our Risk Module for Cockpit Enterprise, [request a demo](#).

## ABOUT COGNITION

For more than 20 years, Cognition Corporation has designed its product development solutions specifically for the life sciences industry including medical device, pharmaceutical, laboratory equipment, and combination products. Cognition software uses a unique technology of generating structured data items, dynamic links between items, reusable templates, and structured documents and reports to support the generation of both internal technical reports and submission deliverables to global health authorities.

