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Robotics Safety and Risk Assessment

Presented to: IMEC Plan. Implement. Excel.

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Introduction

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- Multi-disciplinary consulting services:
  - Manufacturing Equipment and Maintenance Support:
    - Maintenance Excellence
    - Total Productive Maintenance
    - Reliability Engineering
  - Health & Safety Support:
    - Machine Guarding
    - Risk Assessment
    - Supplemental EH&S Support
    - Industrial Hygiene

What is an Industrial Robot?

“automatically controlled, reprogrammable multipurpose manipulator, programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications”

– ANSI/RIA R15.06-2012

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Why Care About Robotic Safety?

Further Assess Robotic System Safety:

- Occupational Health and Safety Administration Regulation
- Better understand risks within facility
- Provide a safe work environment for employees
- Comply with Industry best practices

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Standards for Industrial Robot Safety

Current

Photo Credit: Association for Advancing Automation

Future

ISO 10218-1
2006

Edition 1
2006

ISO 10218-1,2
2011

Adopted as ANSI R15.06
in the United States.

ISO 10218-1,2
2025

Expected to be adopted
in the US as an updated
version of ANSI R15.06
later in 2025.

Photo Credit: Inmotion Technology Distribution

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ANSI/RIA Method for Robotic Risk Assessments

ANSI/RIA TR R15.306-2016

- Task Based Risk Assessment
  - Severity of Injury
  - Exposure to Hazard
  - Avoidance of Hazard
- Controlled vs. Uncontrolled Risk

ANSI/RIA TR R15.306-2016 Method

SEQ	Task	Steps	Potential Hazards	Prior to Safeguarding (Initial Risks)				Current Controls for existing systems (Usually N/A)	Risk Reduction Measures	Verification and Validation of Risk Reduction Measures (See Tables)			
				ANSI/RIA TR R15.306-2016 Methodology (See Tables)									
				Severity	Exposure	Avoidance	Risk Level			Severity	Exposure	Avoidance	Risk Level
1	Workpiece loading	Load part on fixture	Struck by robot Hazard	S3	E2	A1	High		Interlocked enclosure	S3	E0	A1	Low
			Struck by robot Hazard	S3	E2	A1	High		Emergency stop(s) accessible	S3	E0		Low
			Inhalation of toxic dust hazard	S2	E2	A1	Medium		Ventilation system	S2	E0		Low

Modified Method F&O Uses

Condition of Use (Task)	Hazard(s) / Failure Mode	People at Risk				INITIAL ASSESSMENT				Control Measure(s) You cannot use risk assessment to lower the degree of protection the standards require!	FINAL ASSESSMENT	
		Operator	Maintenance	Contractors	Any other	Severity Frequency Likelihood Avoidance Number of Persons	Risk Level HRN	ISO 13849-1 S, F, P	ISO 13849-1 PL_r		Severity Frequency Likelihood Avoidance Number of Persons	Risk Level (HRN)
Machine Power-Up Power up machine and engage air and water supply.	Unexpected machine motion or the release of stored energy that could lead to personnel injury.	X	X			Break major bone or major illness Daily Probable, not surprising Possible under specific conditions 1-2 persons	Low But Significant 40	S2 F1 P1	c	See control measures: 1, 2, 3	Break major bone or major illness Daily Unlikely but could occur Possible 1-2 persons	Negligible 2.25
Turn Control Power On Power to robotic control system is turned on.	Unfamiliarity with machine functions or interlocks cause unexpected motion that could lead to personnel injury.	X	X			Break major bone or major illness Daily Probable, not surprising Possible under specific conditions 1-2 persons	Low But Significant 40	S2 F1 P1	c	See control measures: 1, 2, 4	Break major bone or major illness Daily Unlikely but could occur Possible 1-2 persons	Negligible 2.25

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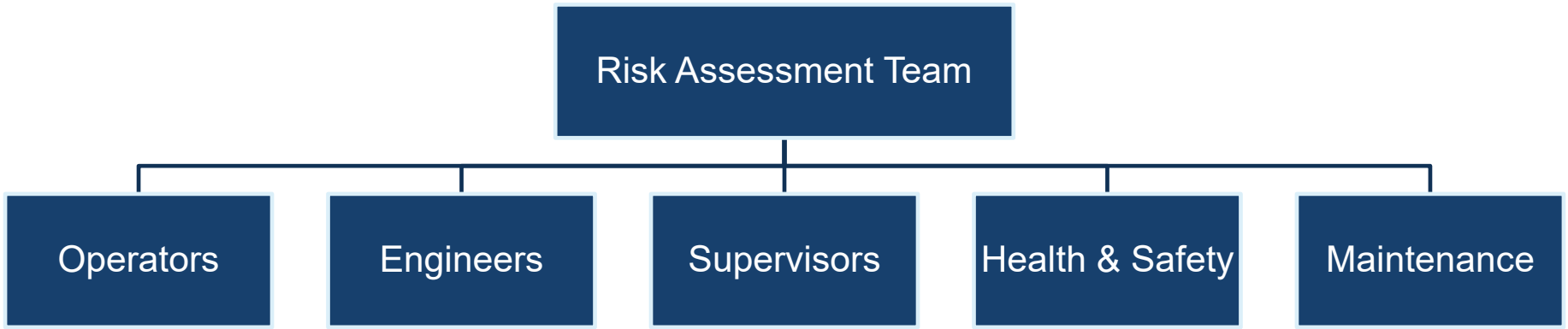
Risk Assessment Process



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Gather Team → **Develop Task / Hazard List** → Assess Uncontrolled Risk → Review Controls → Assess Controlled Risk → Develop Corrective Action Plan

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Photo Credit: MMCI Automation

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Risk Assessment Process

Employee may become trapped inside of the robotic cell.

- Install emergency door releases inside of cell.

Employee may remain in cell with robotic system running in auto mode.

- Install an area scanner inside of the cell.

Two employees may be involved in the robotic teaching process, however only one pendant is available for use.

- Install a secondary non-teach pendant equipped with an emergency stop and 3-position switch.

Teach pendant is equipped with a 2-position switch.

- Upgrade to a new teach pendant equipped with a 3-position switch.

Interior of robotic cell is not equipped with means to stop robotic operation.

- Install emergency stops inside of the cell.

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Questions

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