

Utilizing ANSI B11 for Machine Safeguarding Risk Assessment: Achieving Acceptable Risk

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Safety Solutions

Topics

- Introduction
 - Why Risk Assessment?
 - ANSI B11 Consensus Standard
- Risk Assessment
 - ANSI B11-TR3
 - ANSI B11-2008



Understanding Risk

- Hazard
 - Potential source of harm
- Risk
 - Combination of severity of harm & probability of occurrence of harm



Risk = Severity of Harm X Likelihood

Why Risk Assessment

- Job Hazard Analysis (JHA)
 - Generally lists the sequence of basic job steps, potential hazards, and recommended hazard controls
- **Risk Assessment**
 - Similar to JHA but contains additional assessment of *Risk* to determine if hazard controls will reduce the risk of potential harm to an acceptable level



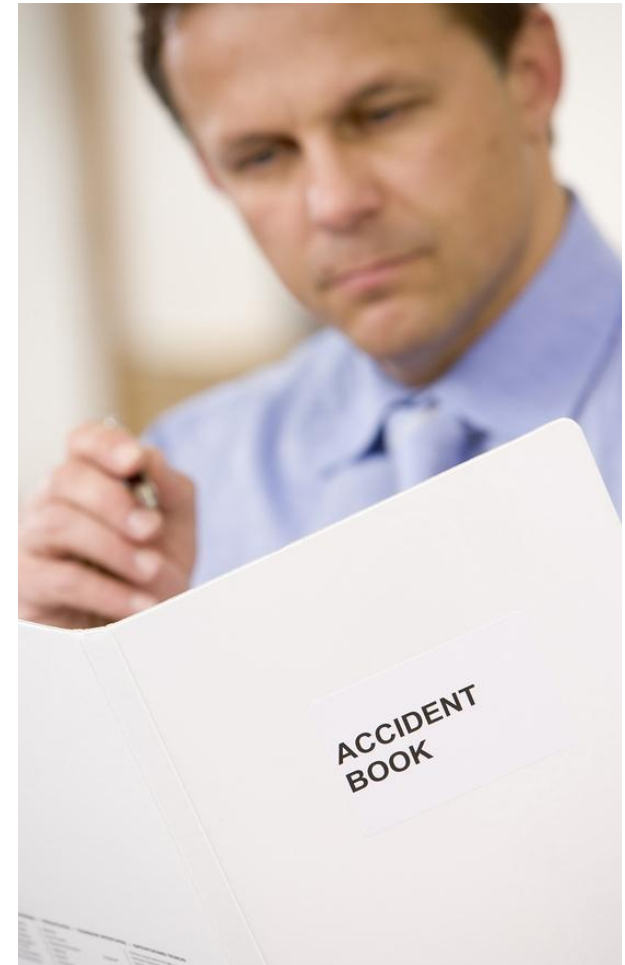
Why Risk Assessment

- A structured process that can discover the cause for the vast majority of workplace injuries.
- Focuses on the relationship between the worker, the task, the tools and the work environment.



Why Risk Assessment?

- Through the use of a Risk Evaluation Form you look at equipment to identify potential problems.
- ANSI TR3 assists in identification of machine hazards & uses a quantitative approach for identification & prioritization



Why Risk Assessment?

- ANSI B11 Series of Standards (set of 31 standards)
 - ANSI B11.6-Manual Turning Machines
 - ANSI B11.15-Bending Machines
 - ANSI B11.24-Transfer Machines
 - **ANSI B11.TR3-Risk Assessment & Risk Reduction**
 - **ANSI B11-2008-General Safety Requirements Common to ANSI B11 Machines (Acceptable Risk)**



Why Risk Assessment?

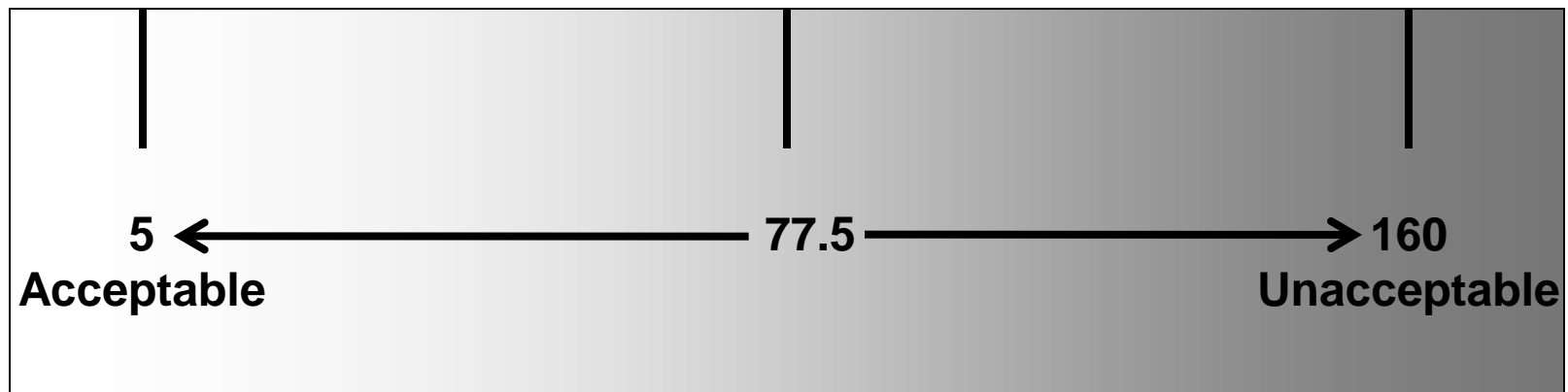
Table 1: Risk Estimation Matrix

Probability of Occurrence of Harm	Severity of Harm			
	Catastrophic	Serious	Moderate	Minor
Very Likely	High	High	High	Medium
Likely	High	High	Medium	Low
Unlikely	Medium	Medium	Low	Negligible
Remote	Low	Low	Negligible	Negligible

Risk = Severity of Harm X Likelihood

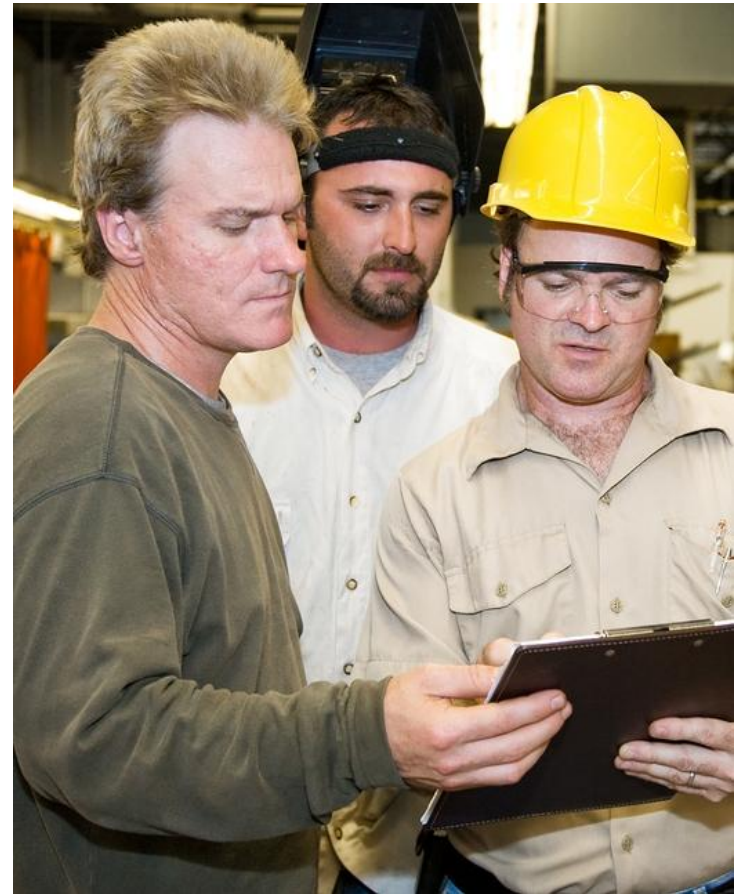
Risk Assessment

- A numeric risk score is generated for each hazard analyzed.
- Scores range from:
 - 5=Low Risk
 - 160=High Risk



Risk Assessment

- Evaluations can be averaged to even out slight differences between observers
- When complete management will have a better picture of which areas need guarding attention



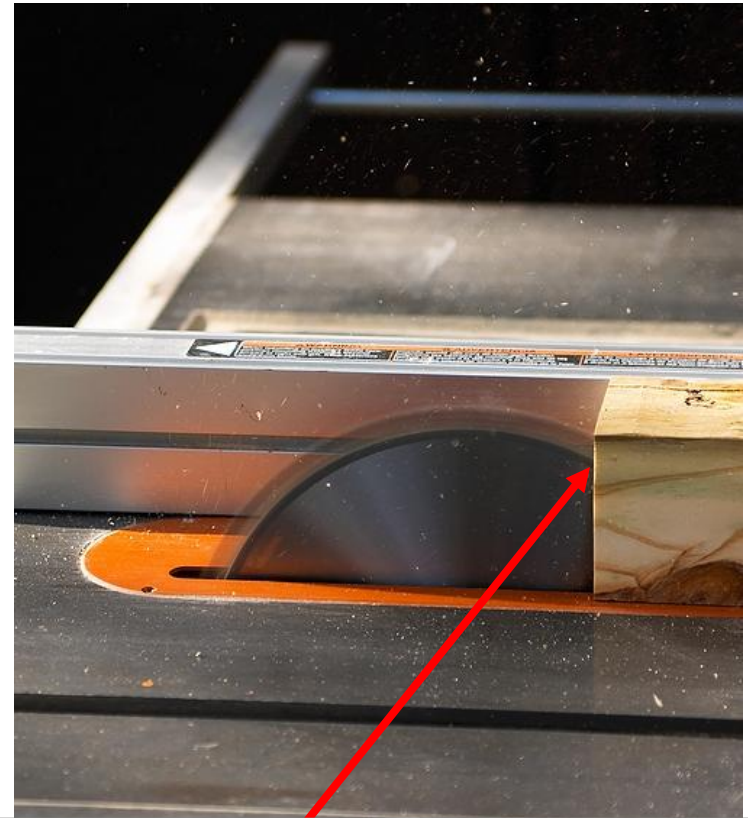
1. Opening Instruction Information
 - Machine
 - Location
 - Department Name
2. Observe & understand how machine operates
 - Watch operators at work paying attention to what they do and how they move
 - Ask questions of operators and crew members
 - Video tape/photograph machine hazards

Risk Assessment

3. Determine which moving parts should be evaluated
 - Assume that if something on a machine moves, it should be evaluated
 - Do not eliminate moving parts because they do not seem dangerous
4. Do not skip moving parts because they are already guarded
 - Evaluate how well those guards work

Risk Assessment

5. Assign a hazard type
 - Type of machine motion
 - Point of operation hazards
 - Miscellaneous hazards
6. Location of evaluation
 - Sketch the location
 - Photographs



Point of operations on a table saw

Risk Assessment

- Probability of Contact (P)
 - 2**=Lesser (likelihood of injury low)
 - 4**=Greater (likelihood of injury high)
 - Consider
 - Do people pass by it frequently?
 - When they go near it, is it at close range?
 - Watch operators as they work and ask questions about their contact with the hazard.
 - If you have any doubts about which probability level to choose, pick the greater probability score.

Machine Safeguarding Risk Assessment Exercise

1. Risk Evaluation

Instructions: check appropriate variable for P, S, and G. Estimate overall risk assessment with each variable.

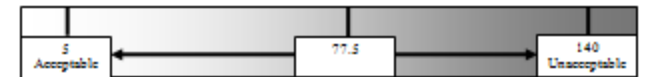
Probability of Contact (P)	
Greater=4	Does lack of guarding put operator at close range to point of operation?
Lesser=2	Is guarding in place or operator is not at close range to point of operation?

Severity of Injury if Contact with Hazard (S)	
High=4	Will injury result in death or disabling injury?
Medium=2	Will injury result in an OSHA recordable not including death or disabling injury?
Low=1	Will injury result in a non-OSHA recordable first aid injury?

Guarding Factor (G): Is contact with hazard	
Not Exposed=0.5	Is complete guarding in place?
Unlikely but may occur=0.5	Do safety guards permit slight chance of contact? / Chance of operator removal?
Exposed=0.5	Can the guards restrain or be overridden? / Can operator contact point of op?
Imminent=0.1	Has there been an injury? / Are safeguards properly used and varied properly?

Risk Assessment: Circle risk variable and calculate overall risk.

Probability of Contact (P)	4 of 2
Severity of Injury if Contact with Hazard (S)	4 of 2
Guarding Factor (G)	0.5 of 0.5 of 0.5 of 0.1
Risk=(P x S) x G	



2. Acceptable risk

One of the following MUST be checked

Process orientation
Engineering control

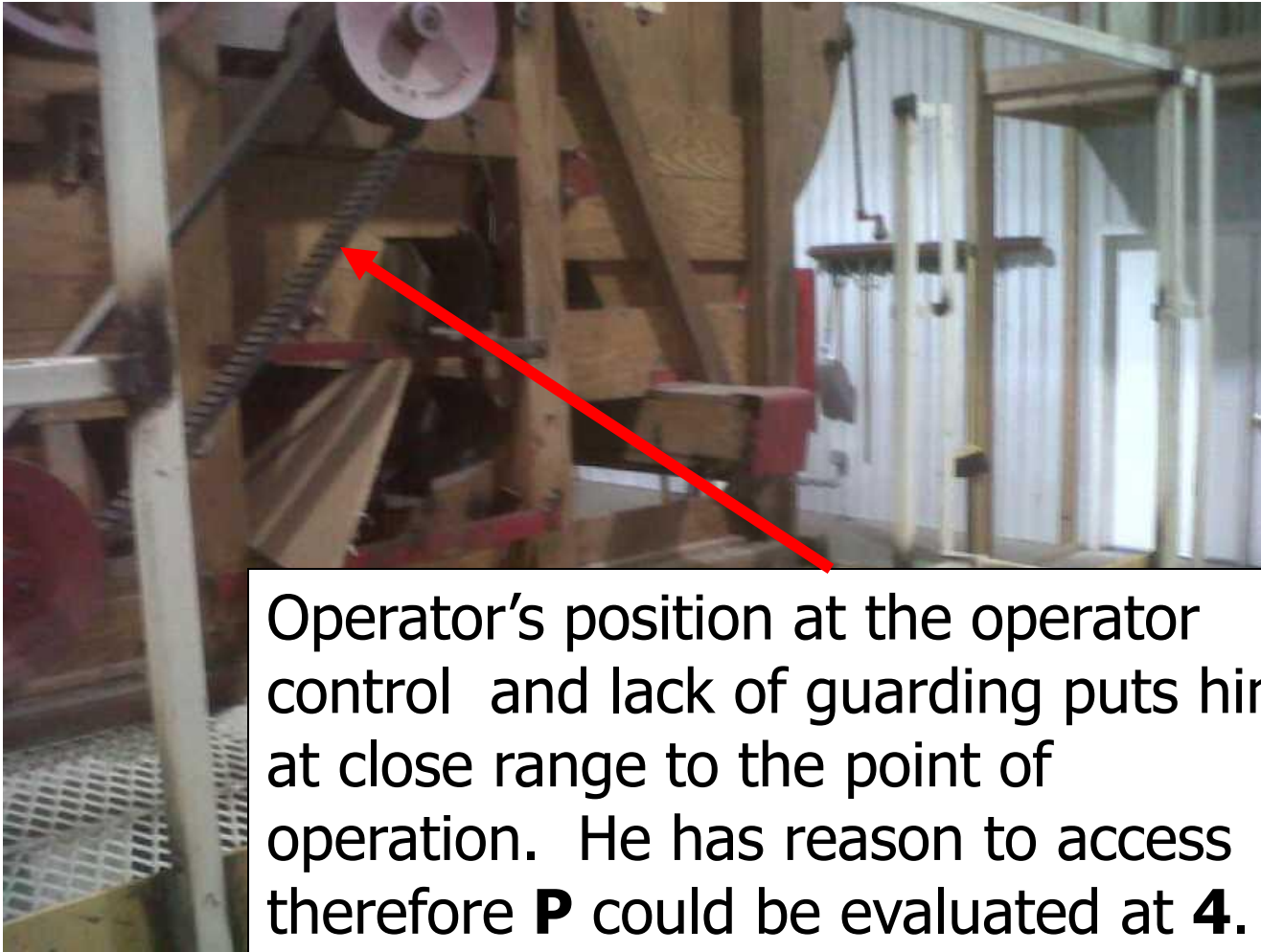
At least two of the following MUST be checked

Awareness Devices
Personal Protective Equipment
Procedures & training

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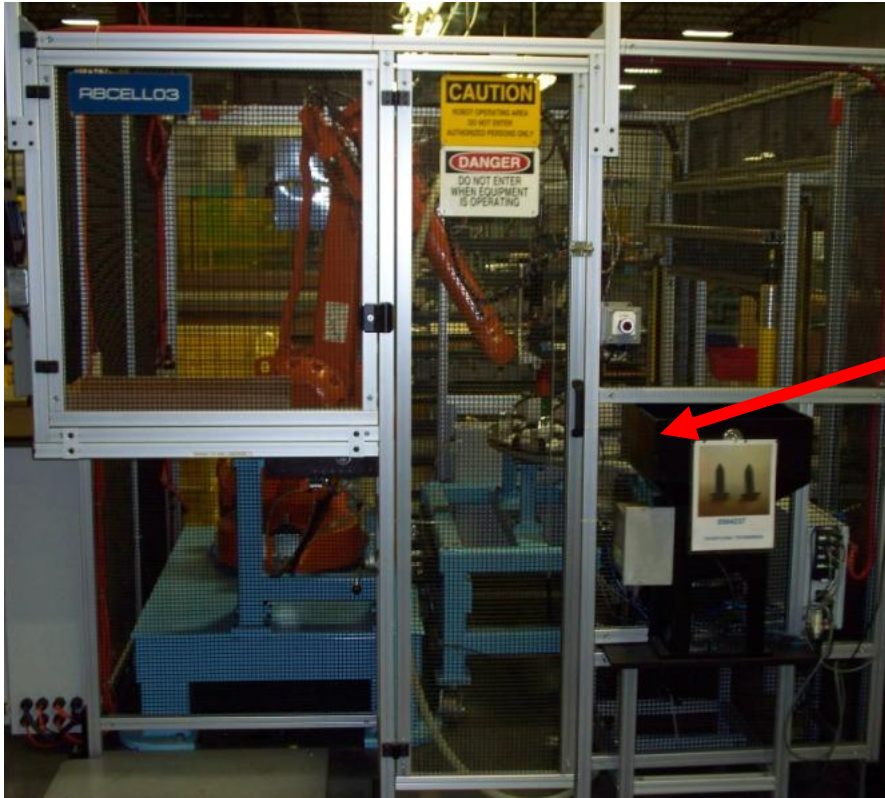
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Risk Assessment



Operator's position at the operator control and lack of guarding puts him at close range to the point of operation. He has reason to access therefore **P** could be evaluated at **4**.

Risk Assessment



Operator's position at the operator control does not put him at close range to the point of operation during normal operations. He has little/no reason to access therefore **P** could be evaluated at **2**.

Risk Assessment

- Severity (S)
 - High=4**: Involves death from injury or injuries involving permanent disability.
 - Medium=3**:
 - Involves injuries resulting in hospitalization or variable but limited period of disability
 - OSHA recordable injury not resulting in fatality or permanent disability
 - Low=2**:
 - Involves injuries not resulting in hospitalization and requiring only minor supportive treatment.
 - Non-OSHA recordable injury resulting in first aid treatment

Machine Safeguarding Risk Assessment Exercise

1. Risk Evaluation

Instructions: check appropriate variable for P, S, and G. Estimate overall risk assessment with each variable.

Probability of Contact (P)

Greater=4	Does lack of guarding put operator at close range to point of operation?
Lesser=2	Is guarding in place or operator is not at close range to point of operation?

Severity of injury if Contact with Hazard (S)

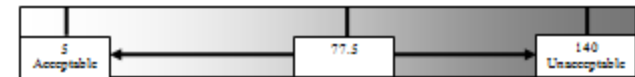
High=4	Will injury result in death or disabling injury?
Medium=3	Will injury result in an OSHA recordable not including death or disabling injury?
Low=2	Will injury result in a non-OSHA recordable first aid injury?

Probability of Contact (P) if Contact with Hazard (S)

Not Exposed=0.5	Is complete guarding in place?
Unlikely but may occur=0.5	Do safety guards permit slight chance of contact? / Chance of operator removal?
Exposed=0.5	Can the guards restrain or be overridden? / Can operator contact point of op?
Imminent=0.1	Has there been an injury? Are safeguards properly used and used properly?

Risk Assessment. Circle risk variable and calculate overall risk

Probability of Contact (P)	4 of 2
Severity of injury if Contact with Hazard (S)	4 of 2
Guarding Factor (G)	0.5 of 0.5 of 0.5 of 0.1
Risk=(P X S) / G	



2. Acceptable risk

One of the following MUST be checked

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Risk Assessment

- Guarding Factor (G)
 - Contact with the hazard is not expected=0.9
 - Complete guarding in place, little chance of operator removal of guards during normal operation; little chance of guards being over-ridden during operation.
 - Contact with hazard is unlikely but conceivable=0.6
 - Guards permit slight chance of contact; slight chance of operator removal of guards during normal operations; slight chance of guards being over-ridden during operation.

Machine Safeguarding Risk Assessment Exercise

1. Risk Evaluation

Instructions: check appropriate variable for P, S, and G. Estimate overall risk assessment with each variable.

Probability of Contact (P)

Greater=4	Does lack of guarding put operator at close range to point of operation?
Lesser=2	Is guarding in place or operator is not at close range to point of operation?

Severity of injury if Contact with Hazard (S)

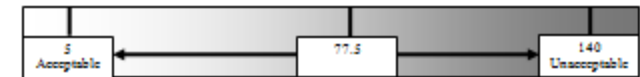
High=4	Will injury result in death or disabling injury?
Medium=2	Will injury result in an OSHA recordable not including death or disabling injury?
Low=1	Will injury result in a non-OSHA recordable first aid injury?

Guarding Factor (G) Is contact with hazard

Not Exposed=0.9	Is complete guarding in place?
Unlikely but may occur=0.6	Do safeguards permit slight chance of contact? / Chance of operator removal?
Exposed=0.3	Can the guards be overridden? / Can operator contact point of op?
Imminent=0.1	Has there been an injury? Are safeguards properly used & varied properly?

Risk Assessment. Circle risk variable and calculate overall risk

Probability of Contact (P)	4 of 2
Severity of injury if Contact with Hazard (S)	4 of 2
Guarding Factor (G)	0.9 0.6 0.3 0.1
Risk=(P x S)G	



2. Acceptable risk

One of the following MUST be checked

Process orientation
Engineering control

At least two of the following MUST be checked

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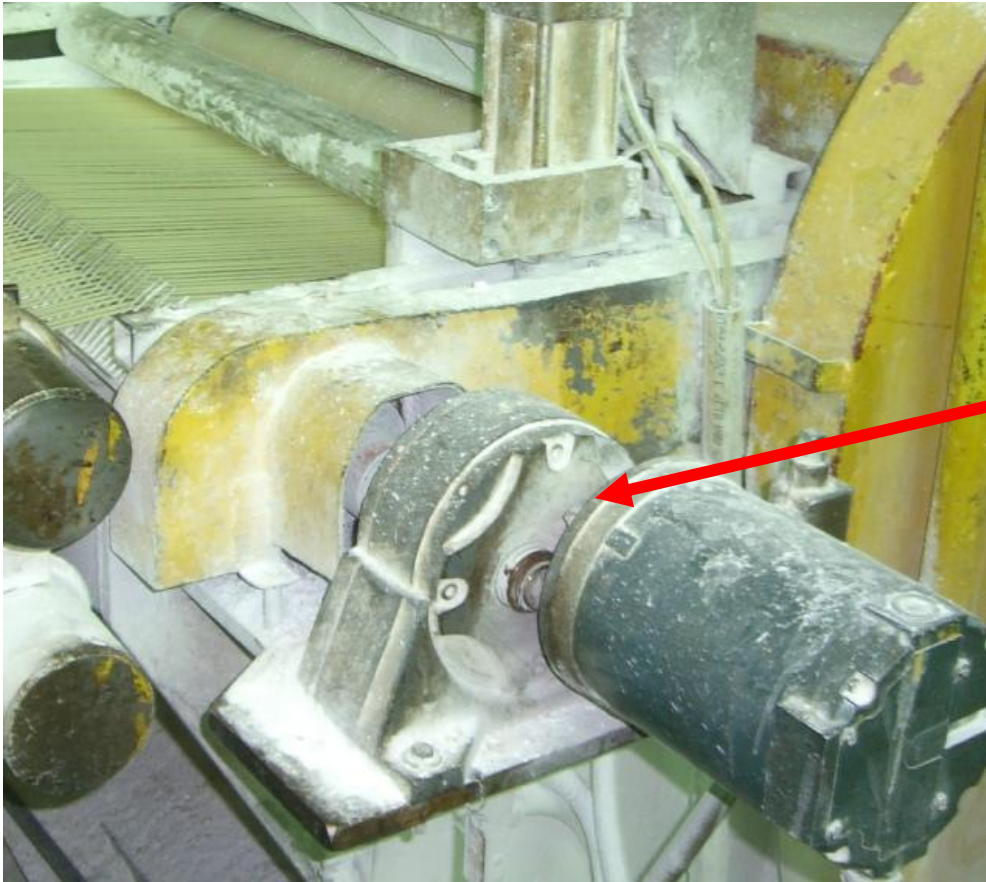
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Risk Assessment



Complete enclosure of process & operator controls outside the point of operation making inaccessible. Therefore **G** could be evaluated at **0.9**.

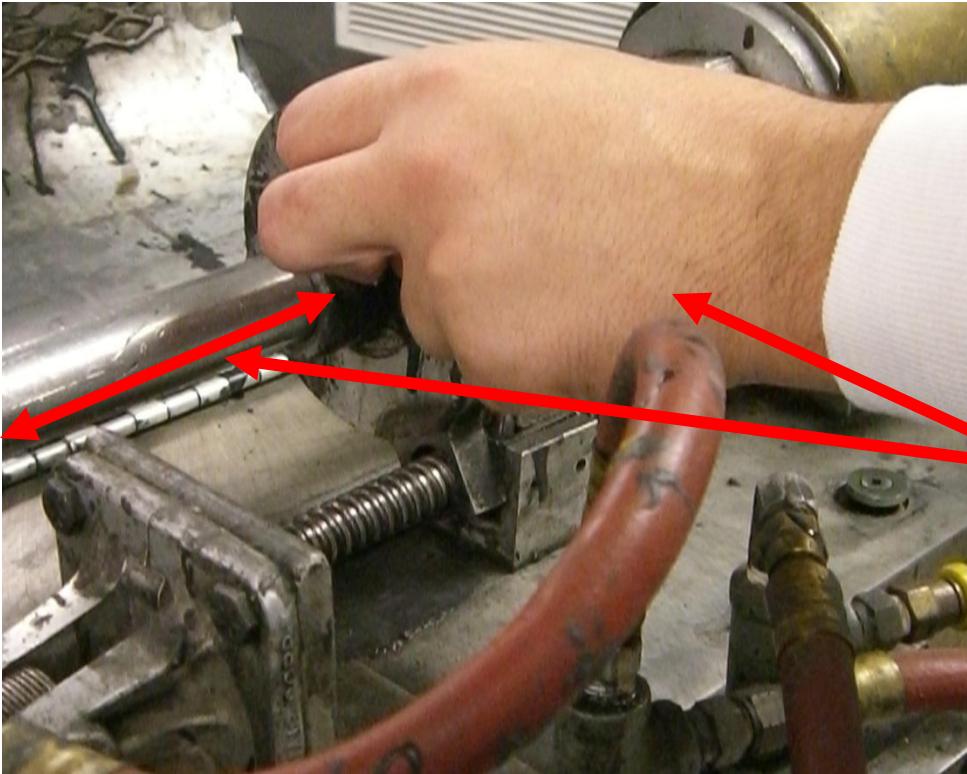
Risk Assessment



Operator has slight chance of accessing point of operation if he left operator control because of lack of guarding on sides. Therefore **G** could be evaluated at **0.6**.

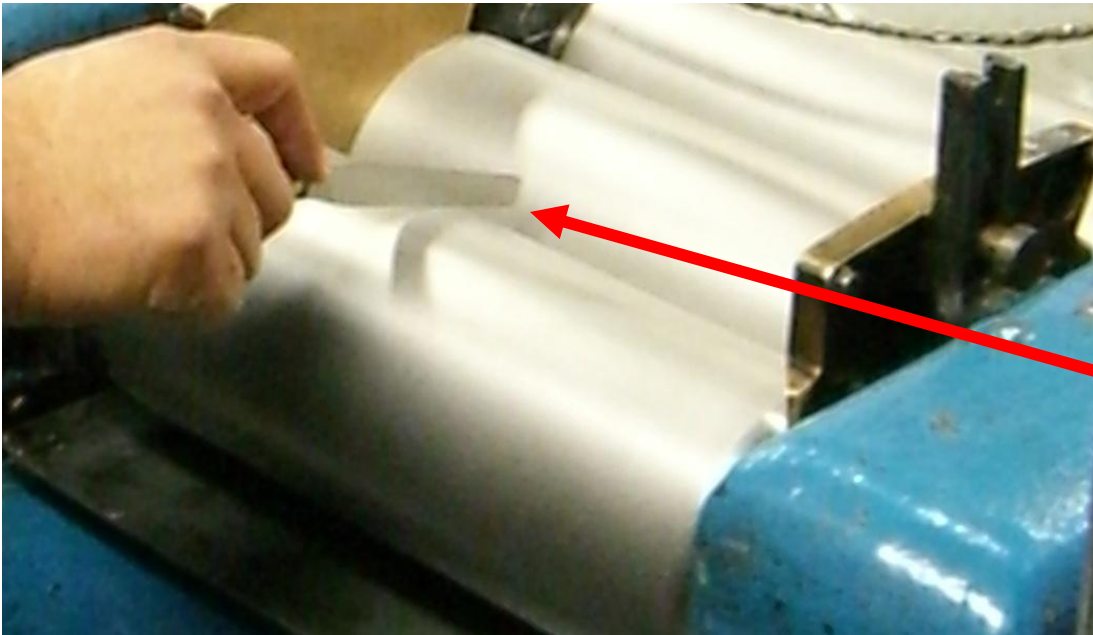
- Guarding Factor (G)
 - *Contact with hazard is possible*=**0.3**
 - Can/are safeguards missing or be overridden?
 - Can operator contact point of operation?
 - *Contact with hazard is imminent*=**0.1**
 - Has there been an injury?
 - Are safeguards properly used/adjusted properly?

Risk Assessment



Operator needs access to piston periodically throughout the shift. Guarding over piston is interlocks, however the interlock is a limit switch which can be easily overridden. Therefore **G** could be evaluated at **0.3**.

Risk Assessment



Lack of guarding and operational controls puts operator at risk of contact with in-running nip point since he has to access the point of operation with a tool at close range. Therefore **G** could be evaluated at **0.1**.

Risk Assessment

- Probability (P)
- Severity (S)
- Guarding Factor (G)
- Risk = $(P \times S) / G$
 - Scores range from:
 - 5 = Low Risk
 - 160 = High Risk

Machine Safeguarding Risk Assessment Exercise

1. Risk Evaluation

Instructions: check appropriate variable for P, S, and G. Estimate overall risk assessment with each variable.

Probability of Contact (P)

Critical=4	Does lack of guarding put operator at close range to point of operation?
Lesser=2	Is guarding in place or operator is not at close range to point of operation?

Severity of injury if Contact with Hazard (S)

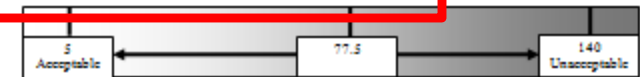
High=4	Will injury result in death or disabling injury?
Medium=2	Will injury result in an OSHA recordable not including death or disabling injury?
Low=1	Will injury result in a non-OSHA recordable first aid injury?

Guarding Factor (G) Is contact with hazard

Not Exposed=0.9	Is complete guarding in place?
Unlikely but may occur=0.6	Do safety guards permit slight chance of contact? / Chance of operator removal?
Exposed=0.3	Can the guard's raising or be overridden? / Can operator contact point of op?
Imminent=0.1	Has there been an injury? / Are safeguards properly used and used properly?

Risk Assessment. Circle risk variable and calculate overall risk.

Probability of Contact (P)	4 or 2
Severity of injury if Contact with Hazard (S)	4 3 2
Guarding Factor (G)	0.9 0.6 0.3 0.1
Risk = $(P \times S) / G$	



2. Acceptable risk

One of the following MUST be checked

Process orientation
Engineering control

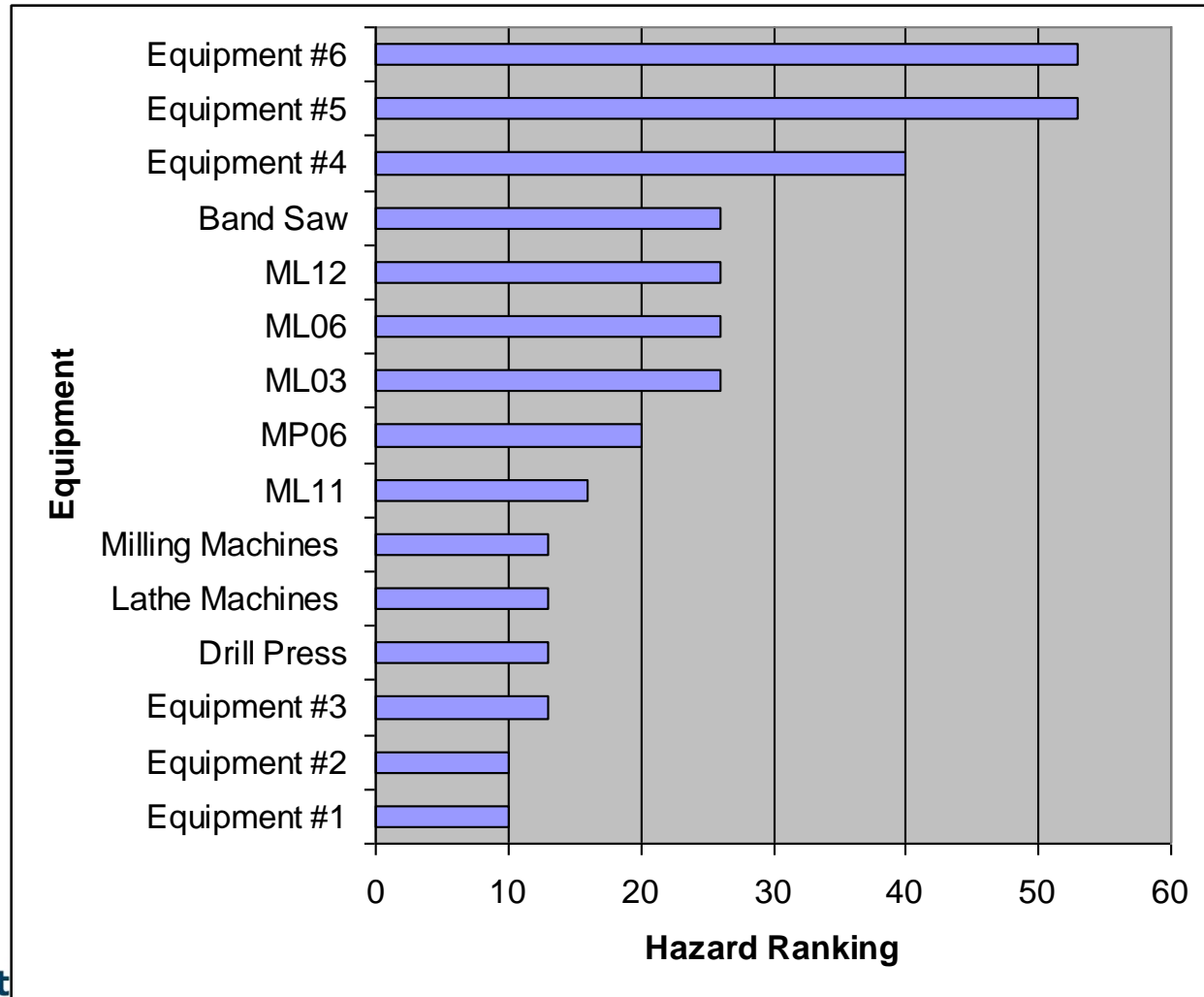
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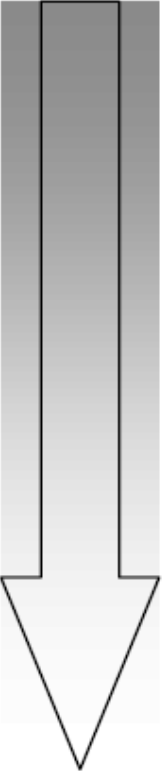
Risk Assessment



Risk Assessment Exercise



Guarding Requirements

	Protective Measure	Examples
<p>Most Effective</p>  <p>Least Effective</p>	Elimination or Substitution	<ul style="list-style-type: none"> • Eliminate human interaction in the process • Eliminate pinch points (increase clearance) • Automated material handling (robots, conveyors, etc.)
	Engineering Controls (Safeguarding Technology/ Protective Devices)	<ul style="list-style-type: none"> • Barriers • Interlocks • Presence sensing devices (light curtains, safety mats, area scanners, etc.) • Two hand control and two hand trip devices
	Awareness Means	<ul style="list-style-type: none"> • Lights, beacons, and strobes • Computer warnings • Signs and labels • Beepers, horns, and sirens
	Training and Procedures (Administrative Controls)	<ul style="list-style-type: none"> • Safe work procedures • Safety equipment inspections • Training • Lockout/Tagout/Tryout
	Personal Protective Equipment (PPE)	<ul style="list-style-type: none"> • Safety glasses and face shields • Ear plugs • Gloves • Protective footwear • Respirators

- Suggested Engineering Controls
 - Two Hand Control
 - Light Curtain
 - Adjustable Guard
 - Robot

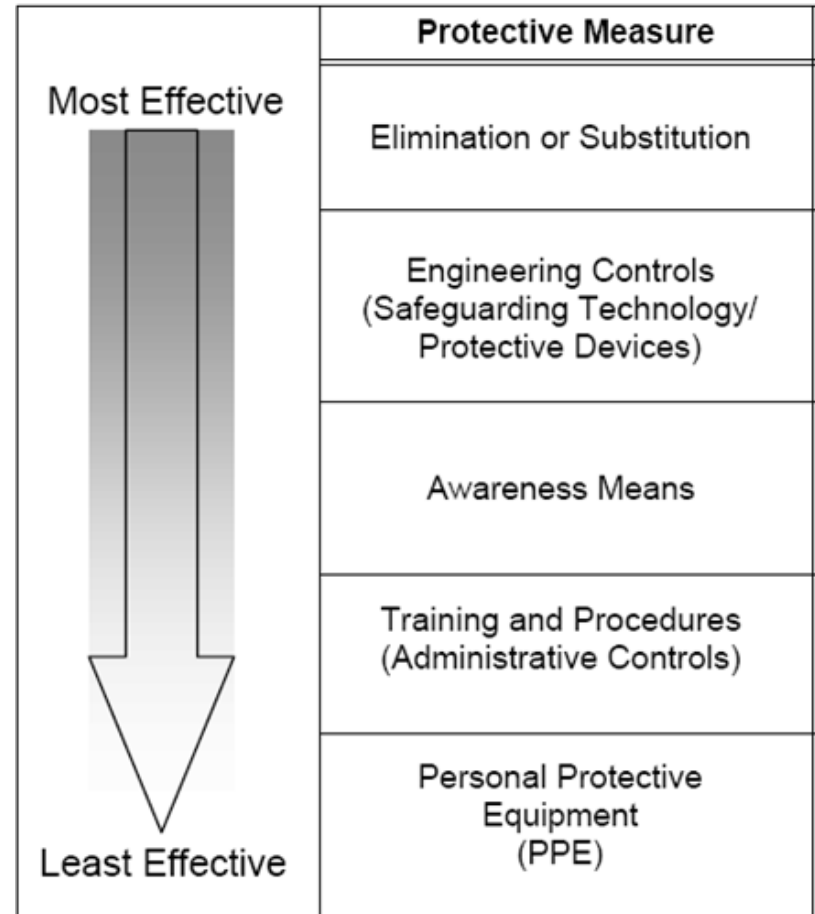


- Acceptable Risk
 - Refers to the level at which further risk reduction will not result in significant reduction in risk
 - Risk reduction is considered complete when protective measures are applied and acceptable risk had been achieved for the identified hazards



Risk Assessment

- Achieving Acceptable Risk
 - Use the hazard control hierarchy.
 - Use of engineering controls (guards/devices) mandatory but not sufficient in reducing risk to an acceptable level.



Risk Assessment

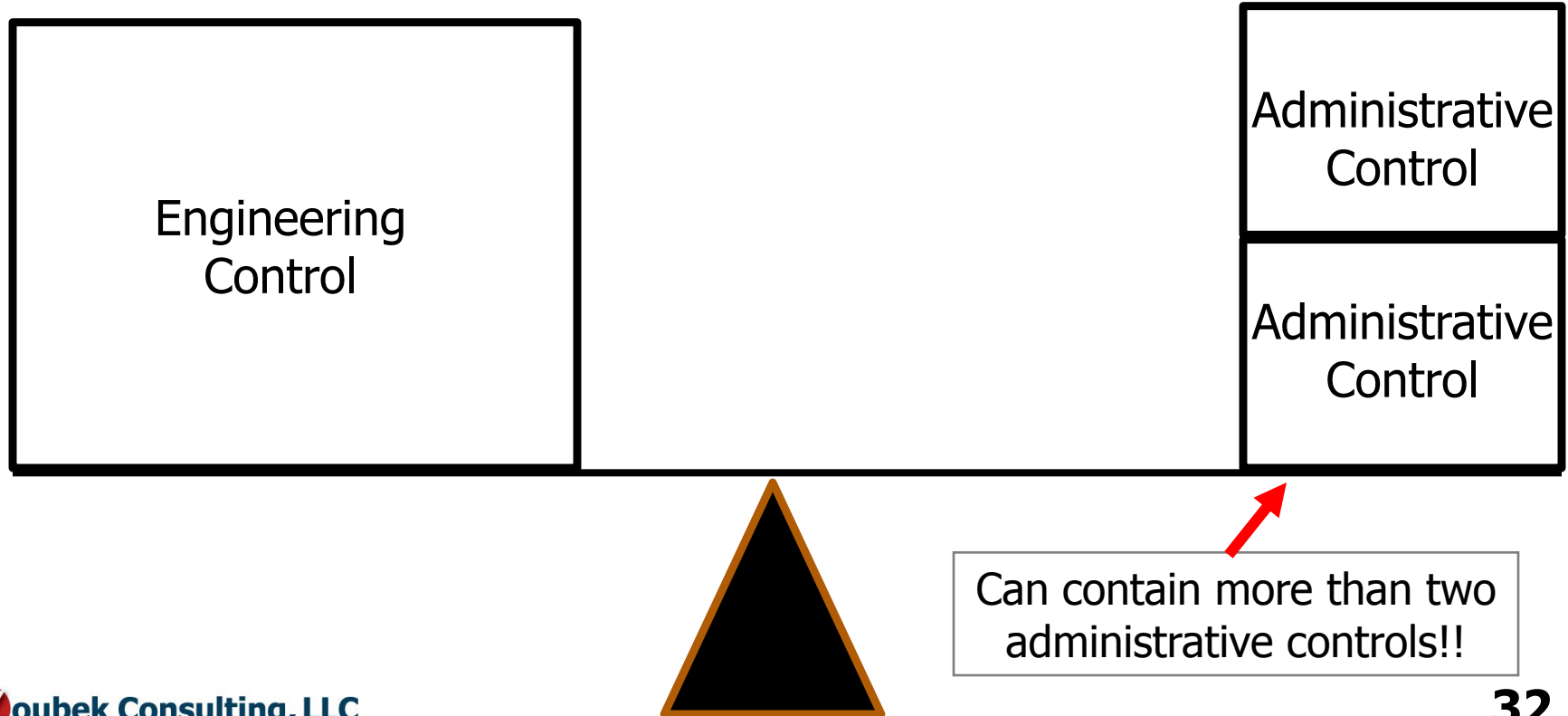
Required element to achieve Acceptable Risk.

More Effective	1. Eliminate by design	Engineering Controls
⇓	2. Guards and Safeguarding Devices	
⇓	3. Awareness Devices	Administrative Controls
⇓	4. Procedures and Training	
Less Effective	5. Personal Protective Equipment	

Need culture driven combination to balance to achieve Acceptable Risk. Requires at least a combination of two or more administrative controls in addition to engineering controls.

Risk Assessment

Required Balance to achieve Acceptable Risk.



Risk Assessment

- Suggested for achieving acceptable risk **after** engineering controls are in place:
 - Signage
 - Training of proper use of equipment
 - Energy control procedures
 - PPE



Questions or Comments??