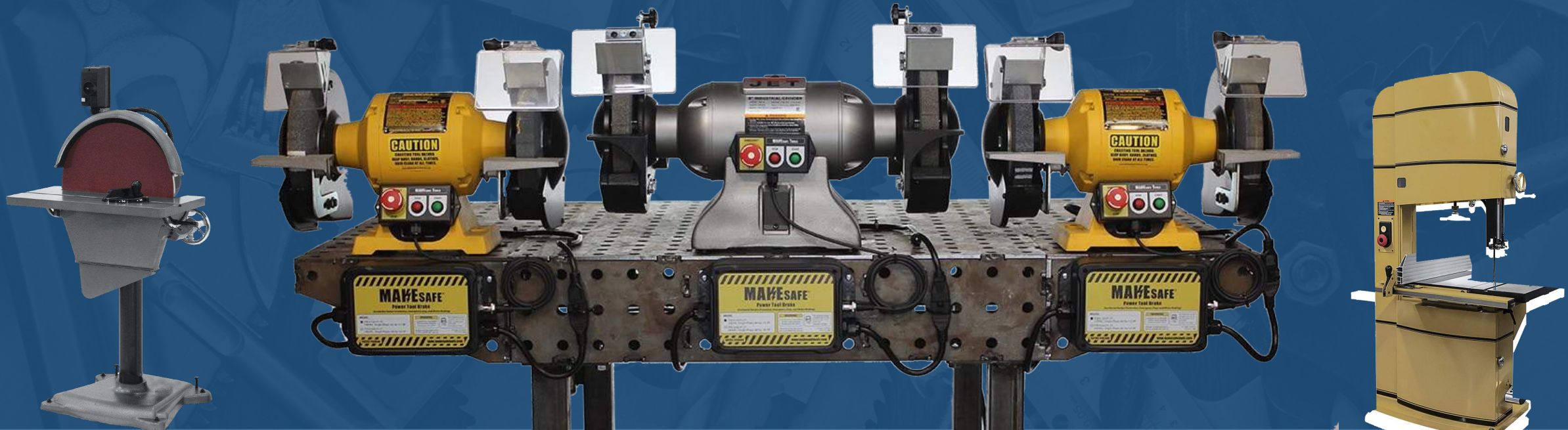


# Machine Risk Assessments

## A Practical Workshop



# Agenda

- Why this topic?
- Does this apply to me?
- Can we afford it?
- Common machine hazards – quick overview
- A practical formula for effective risk assessments
- Now what?

# Why this Topic?

- Because 40,000 people each year suffer from traumatic machinery-related injuries, and it's been the same for over a decade.
- Because machine guarding has been on the top ten list of most commonly citations every year.
- Because many of these injuries and citations are easily avoidable by implementing simple safeguards.
- Because false narratives cause injuries:
  - “This machine doesn’t even cost that much!”
  - “Guards only get in the way!”
  - “It came like that!”
  - “If you get hurt, then you shouldn’t be using machines!”

THE  
TRUE  
COSTS  
OF

## MACHINE GUARDING

FOUR REASONS WHY **DOING NOTHING IS THE MOST EXPENSIVE OPTION.**

### Machine Guarding (29 CFR 1910.212)

One of the 10 most common OSHA citations  
**EVERY YEAR** since the list started in 2002.



### 2019 at a glance...

**1,987** machine guarding citations,  
resulting in **\$13,401,951** in penalties



**OSHA Penalty**  
(for each other-than-serious violation)

**\$13,494**



**Average  
employer cost  
for each injury**

**Laceration:**  
\$53,575  
**Amputation**  
\$186,881



# Assumptions & Disclaimers

- This is not a comprehensive course on machine guarding. It's a summary and overview to encourage early intervention with identified hazards.
- If in doubt, or if you suspect imminent injury, ask an expert for help.
- A comprehensive machine guarding assessment by a certified expert is the gold standard. But in the meantime, intentional work by a generalist (you!) over time can make a significant impact.
- The assessment is step 1 – it doesn't matter unless you make a plan and execute it!
- You want to do what's best for people and what's best for the company. Safety is more than just compliance.
- When doing a risk assessment, write everything down and keep your records!
- In your machine review and conversations, trust but verify.

# Does this apply to me?

- Does your company employ people?
- Do you have a role in safety, supervision, and/or management?
- Do you have machines in a workplace in the USA?

## Production Machinery & Tool Rooms



## Process Machinery



## Everything with a Motor




## Maintenance Closets




# What applies?

## OSH Act of 1970, Duties

*(a)(1) “each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees”;*

- 
- This general clause can stand on its own!
  - The employer bears the responsibility for this, not machine manufacturers.
  - Relevant to all hazards “recognized” by industry, manufacturers, any consensus standard, etc.

*(a)(1) “each employer shall comply with occupational safety and health standards promulgated under this Act.”*

- 
- Specific Requirements also apply to specific industries, environments, and machines.

# Can We Afford It?

- Can you afford not to?
- Many effective safeguards can be fabricated and installed in-house in less than an hour!

THE  
TRUE  
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# Machine Hazards – A Quick Review

**These hazards apply to nearly any machine (we'll talk through each):**

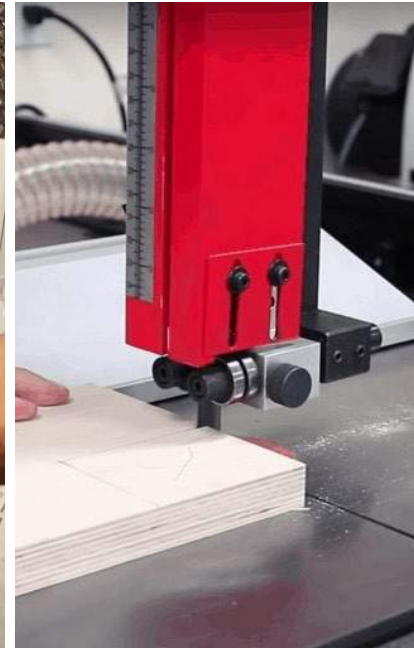
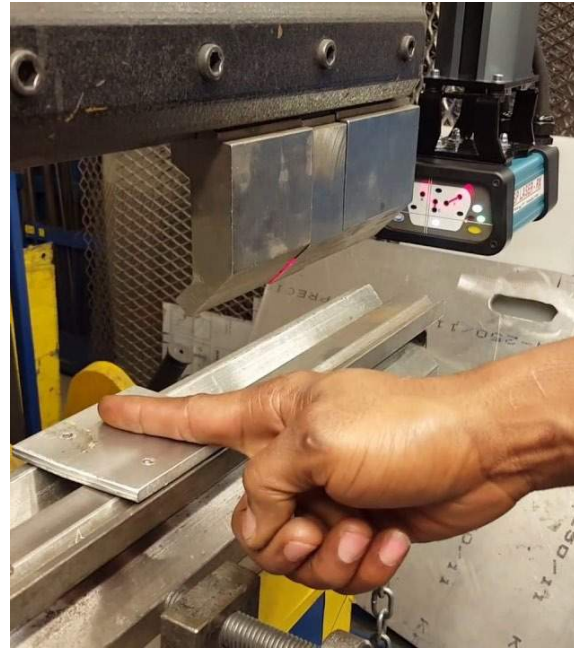
- Point of operation hazards
- Nip points and rotating parts
- Ambiguous, misleading, or ineffective on/off controls
- Compounding hazards



# Quick Review - Point of Operation Hazards

**The What:** The “point of operation” is the business end - where work is performed. It’s often the most considered hazardous point on a machine and gets the most operator focus.

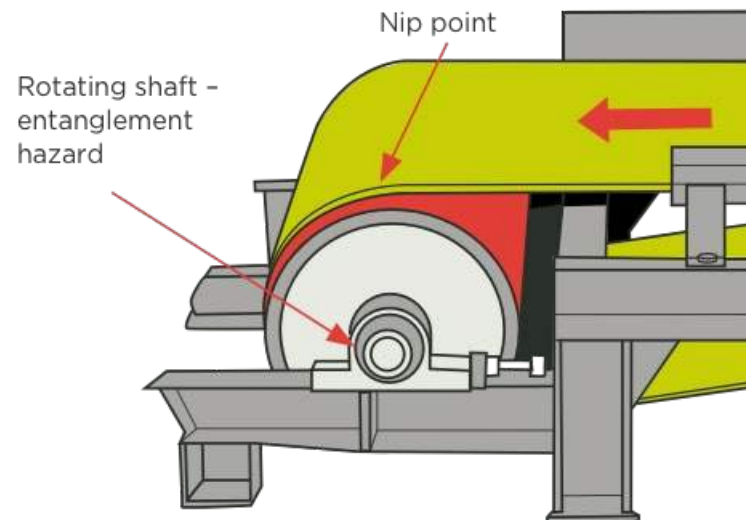
**The Hazard:** The machine will perform its function (e.g. cutting, sanding, crushing) directly onto a body part.



# Quick Review – Nip Points & Rotating Parts

**The What:** Nip points (or pinch points) occur whenever machine parts move toward each other or when one part moves past a stationary object. Rotating parts are anything that may come into contact with skin, clothing, or body parts. Often non-obvious hazards.

**The Hazard:** The nip point or rotating part will pinch, crush, shear or grab then **HOLD AND DRAW-IN**. Body parts, hair, and clothing are often susceptible. Often a compounding hazard.





# Quick Review – Sparks & Chips & Coolant

**The What:** Debris that is thrown or ejected from the machine

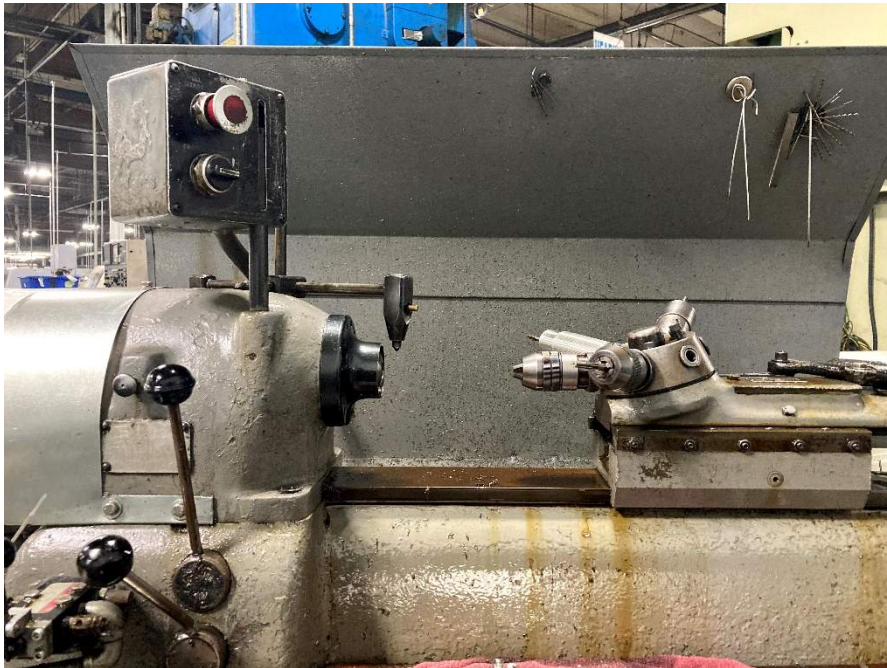
**The Hazard:** Pieces of the debris will cause respiratory distress, burns, eye-injuries, severe lacerations, slips/falls, etc.



# Quick Review – Machine Control

**The What:** Potential for difficulty, ambiguity, or surprise when turning a machine on or off.

**The Hazard:** Exposes operator to all other hazards without warning! A common catalyst that leads to injury and prevents preventable death.





# Quick Review – Compounding Hazards

We're not planning for the perfect world, we're planning for the real world, when situations compound.

*Example: "Employee #1 was using a Giddings and Lewis Horizontal Milling Drilling and Boring Machine, Model 340-T Serial Number 7337, when his clothes caught on the bit lock of a rotating shaft that was operating at 26 RPM. The rotating shaft pulled the employee into the machine preventing him from hitting the emergency stop. The employee was killed."*

*[OSHA Accident # 202343430]*

Hazard 1: rotating shaft

Hazard 2: machine difficult to turn-off in an emergency

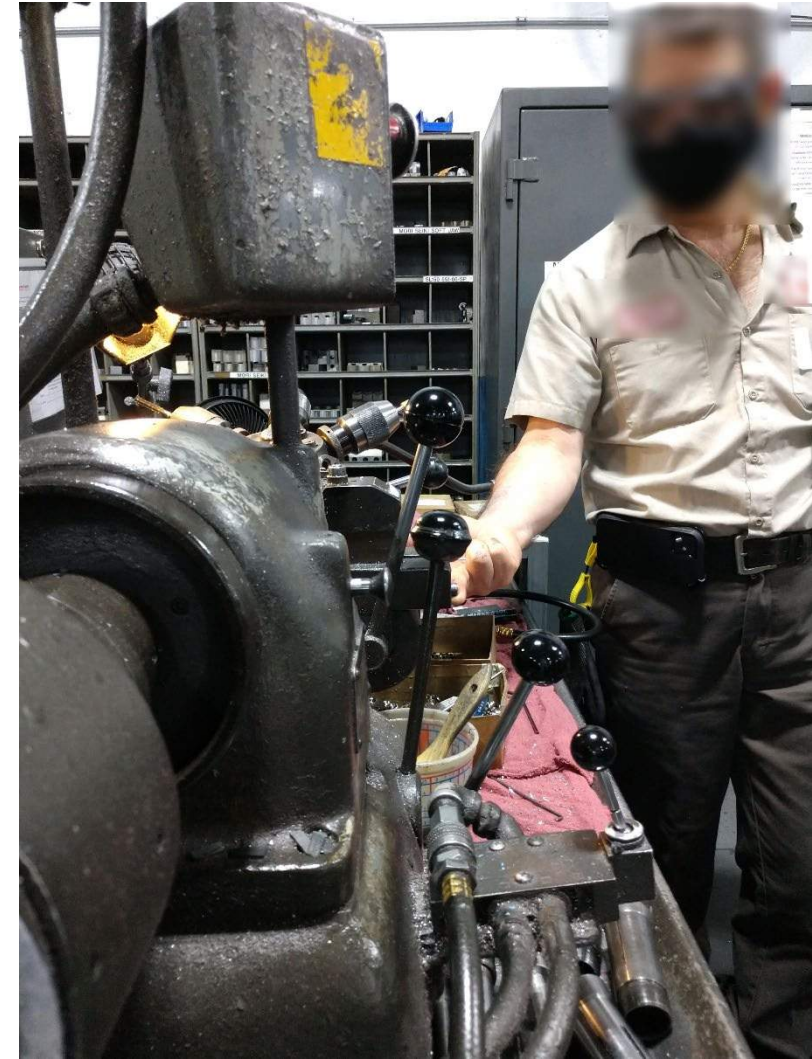
Hazard 3: crushing/entanglement hazard

# Machine Risk Assessments - Where to Start?

- Set reasonable expectations – this is a first pass and they'll be lots of learning.
- Start with a small group of 5 - 10 machines and take them all the way through to completion.
- Plan to iterate over time.
- Form a team, with emphasis on including machine operators.
- Expect your time to be split roughly into thirds:
  - In the shop observing and asking questions.
  - Researching, thinking, and evaluating.
  - Figuring out what to do next.

# Step 1 – Collect Basic Machine Info

- This should be done in-person on the shop floor.
- Collect this info through in-person conversation while at the machine:
  - Type of machine (common name, any relevant adjectives)
  - Who uses and/or has access to the machine?
  - What is being done with the machine?
  - Why is this done?
  - Where is the machine?
- Use your camera phone – take photos and video (useful for later)
- Just hang around and watch for a while



# Step 1 – Collect Basic Machine Info

At the end of Step 1, you should be able to complete this statement for each machine:

**Goal:** After [ previous operator/group ] finishes [ previous process ], [ operator name(s) ] uses the [ type of tool ] in [ the area ] to [ do a specific action ] to the [ workpiece ].

**Example:** After purchasing finishes receiving the materials, Jorge uses the vertical bandsaw by the employee lounge entrance to cut a long metal bar into 4" lengths.



# Step 2 – Research

- Remember our universal hazards from earlier!
- Look for machine-specific “recognized” hazards and requirements
- Good resources include:
  - Visual safety guides
  - Machines that look like your machine
  - What safeguards are people selling
  - Repeating themes/trends/mentions
  - References to specific standards
  - Videos of machines being used
  - Photos of ‘new’ machines for sale
  - Injury data and statistics



band saw safety



band saw **safety guide**

band saw **osha**

band saw **ansi**

band saw **safeguards**

band saw **safety checklist**

band saw **safety visual guide**

band saw **injuries**

**vertical** band saw **safety**

**powermatic** band saw **user manual**

# Step 2 – Research

It's google time.

# Step 3(a) – Hazard Hunting

- This should be done in-person on the shop floor in a 1-on-1 setting
- Get used asking “I still don’t understand. Can you show me?”
- Step 3(a) - Check your machines against the list of common hazards and requirements you generated
  - Note any safeguards already in place (but document the hazard anyways).
  - Note all other hazards from your list if they’re present in your application (even if they’re minor)
- Identify and report any imminent threats to safety
- Look for stories, anecdotes, and mentions of machine or process history
- Take more pictures!

# Step 3(b) – Hazard Hunting

- Look for the universal hazards
- Look for the machine specific hazards and requirements from your research





## Step 3(b) – Hazard Hunting

Reading between the lines ...

*“We don’t really use that machine anymore but like to keep it around for deburring, just in case.”*

## Step 3(b) – Hazard Hunting

Reading between the lines ...

*“Only Jack and Debbie are allowed to operate machinery in the tool room and they are experienced enough to not hurt themselves.”*

## Step 3(b) – Hazard Hunting

Reading between the lines ...

*“I think that band saw is the oldest tool on the floor, but it still works! Just make sure you flip the switch all the way up. Can’t beat old cast iron!”*

## Step 3(b) – Hazard Hunting

Reading between the lines ...

*“I think OSHA got us for that bench grinder last year but that was when Jimmy was running the floor.”*



## Step 3(b) – Hazard Hunting

Reading between the lines ...

*“We tried to get rid of that bench grinder when we switched to all carbide but Debbie insisted we keep it.”*

# Step 3(b) – Hazard Hunting

- Pause, linger, and be aware of the stories being told by the environment.
- Ask lots of questions and follow-ups
- The operator isn't the only one exposed to hazards.



# Step 3(b) – Hazard Hunting

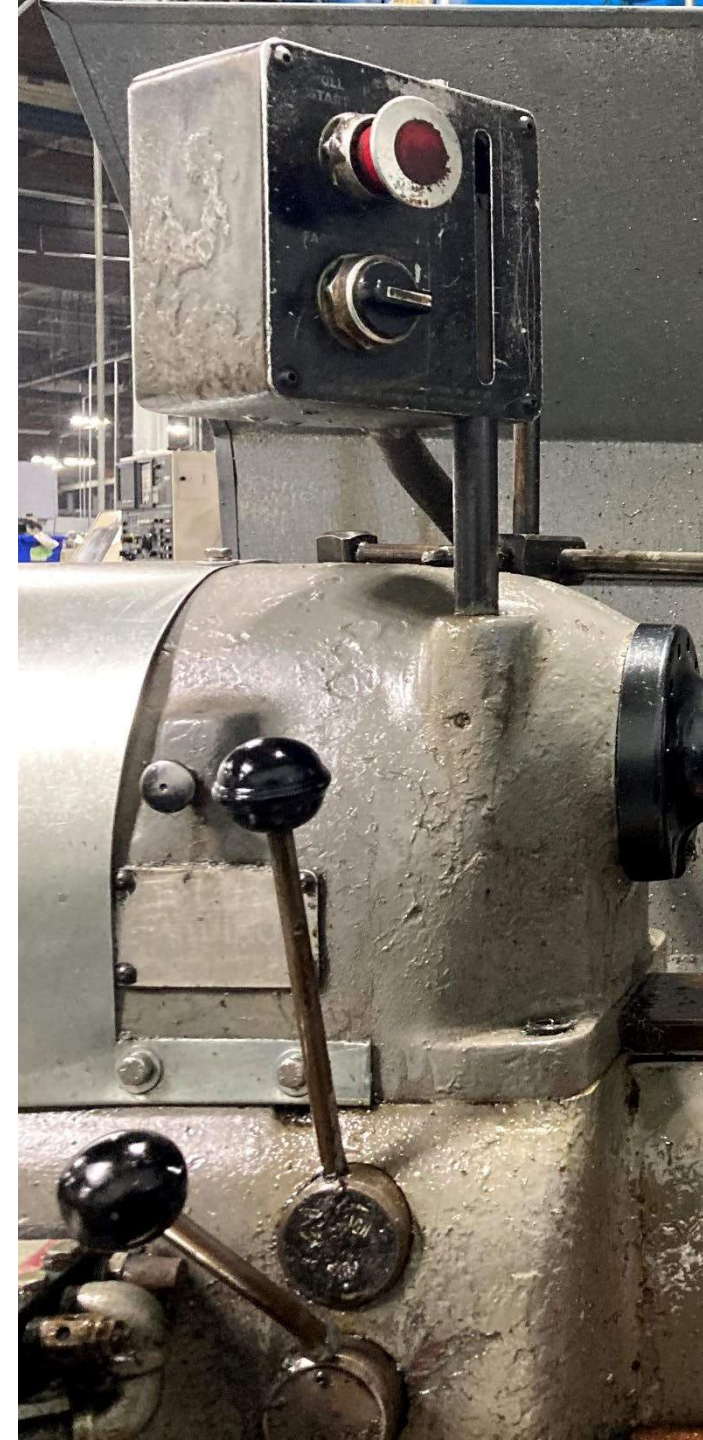
- What other compounding hazards are present?
- Think about ‘potential’ hazards, most of which have nothing to do with the operator.
- What are common maintenance, adjustment, or cleaning operations?





# Step 3(b) – Hazard Hunting

- Take note of what's “just known” vs. what's posted, typical, or obvious.
- How do different operators do it differently?
- Beware of “it should” or “it used to”
- Take note of non-standard or DIY mods
- “What's that for?”
- “What else is this used for?”



# Step 3(b) – Hazard Hunting

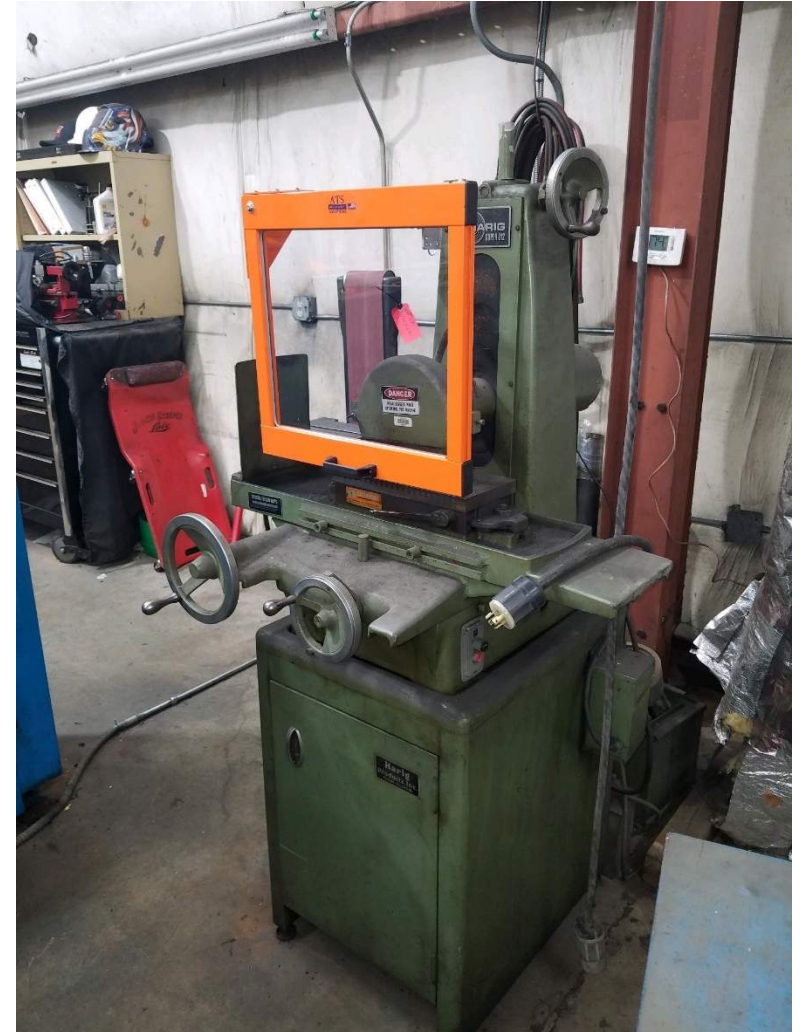
- What happens if ...
  - The machine is plugged-in while the machine switch is in the 'on' position?
  - You hit the emergency stop?





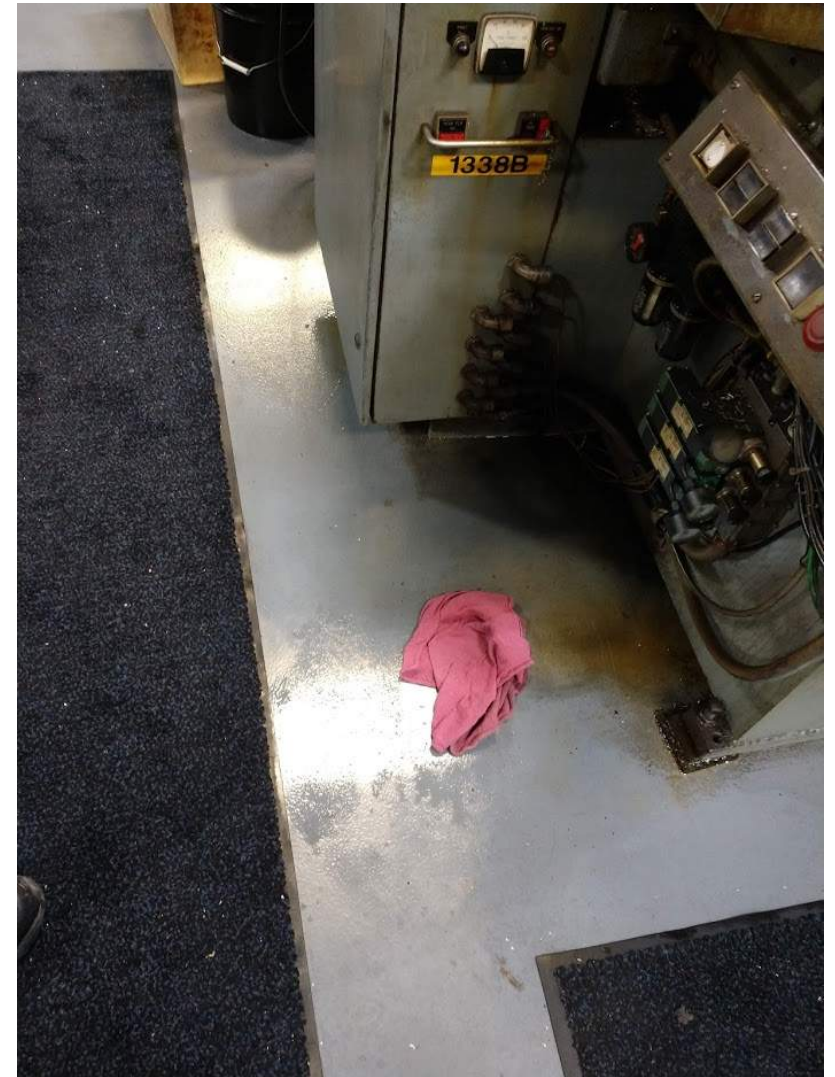
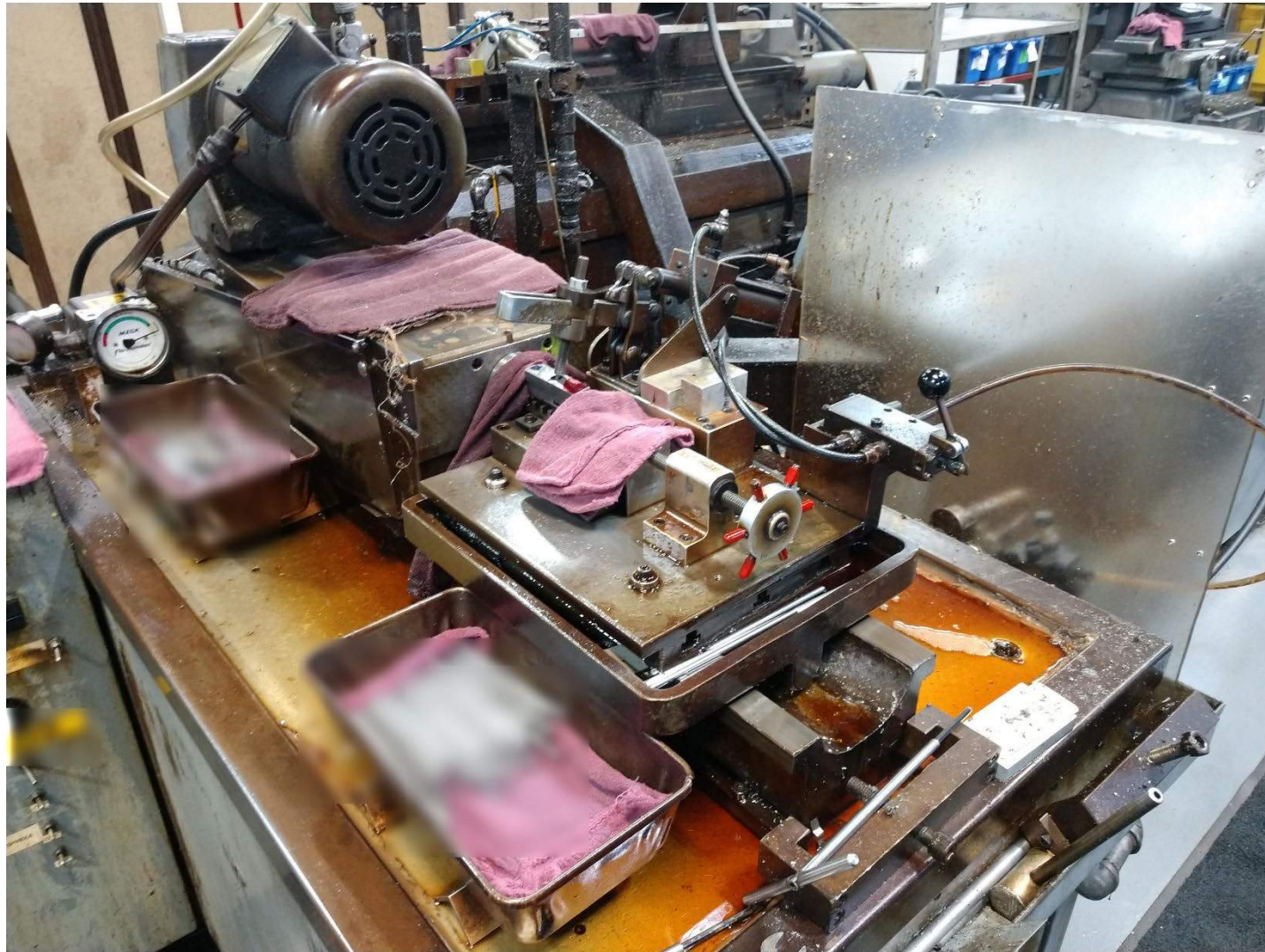
# Step 3(b) – Hazard Hunting

- Role play





## Step 3(b) – Hazard Hunting



# Step 4(a) – Prioritize Identified Hazards

Task #	Task	Affected Persons	Hazard Type	Risk Level Estimate						Est. Risk Level
				Frequency of Exposure 1,2,4	Probability of Injury 1,2,4,6	Severity of Injury 1,3,6,10	Number of People Exposed	Protracted time in Danger Zone		
	<b>Normal Operation</b>									
										0
										0
										0
										0
										0
	<b>Maintenance Activities</b>									
										0
										0
										0
										0
										0
	<b>Commissioning/Other</b>									
										0
										0
										0
										0
										0

This assessment tool was developed by UL, and is available here:

<https://www.ul.com/resources/understanding-importance-machine-risk-assessment>

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# Step 4(b) – Document Existing Reductions

Task #	Task	Method of Reduction						Final Risk Estimate						Tolerable?
		Design	Safe-guarding	Admin. Controls	Method description	Date Final Follow-up Assessment	Owner	Frequency of Exposure 1,2,4	Probability of Injury 1,2,4,6	Severity of Injury 1,3,6,10	Number of People Exposed	Protracted time in Danger Zone	Final Risk Level	
	<b>Normal Operation</b>													
													0	Yes
													0	Yes
													0	Yes
													0	Yes
													0	Yes
	<b>Maintenance Activities</b>													
													0	Yes
													0	Yes
													0	Yes
													0	Yes
													0	Yes
	<b>Commissioning/Other</b>													
													0	Yes
													0	Yes
													0	Yes
													0	Yes
													0	Yes

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# Step 4(b) – Document Existing Reductions

- Demo

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# Next Steps?

- Work with a vendor (or your own internal team) to get budgetary quotes and ideas to safeguard against the highest priority hazards.
- A great time for the production team to co-lead the effort.
- Aftermarket safeguard 'kits' are definitely worth a look, even if it's just for inspiration.
- Share your hazard assessment with a vendor or shop for solutions
- Remember the hierarchy

# Commercial Options

\* In some cases, OSHA considers momentary foot switches to meet basic anti-restart and e-stop requirements.

Magnetic Switches  
(anti-restart only)



In-Line Protection Devices  
(anti-restart only)



Momentary Foot Switches  
(anti-restart & e-stop\*)



UL508A Control Boxes  
(anti-restart + e-stop)



MAKESafe One-Stop  
(anti-restart + e-stop + motor braking)



Custom Control Cabinets  
(anything you want ...)



\$20

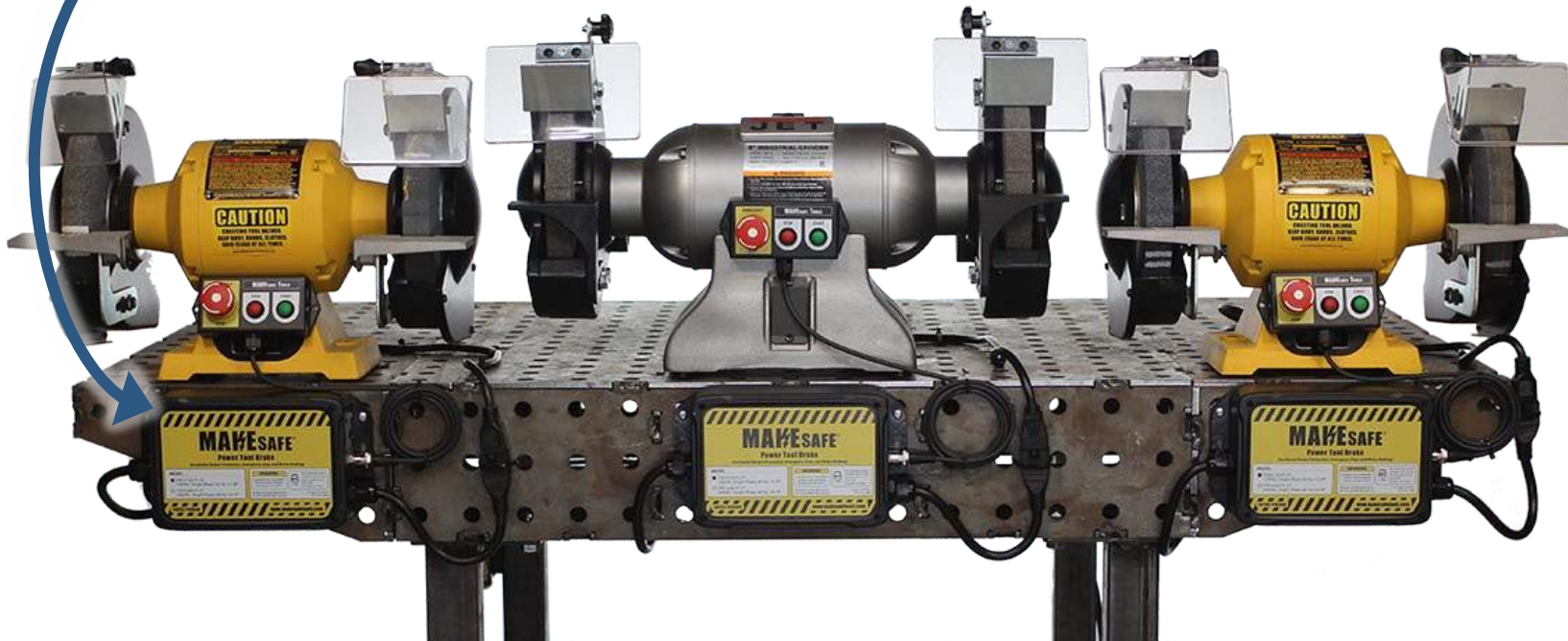
\$40-\$150

\$400-\$1,000

\$3000+

# Contact me anytime!

We make easy to install safeguards for any machine tool.



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