Practical Method to Assess Hazards in Industry

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About me

- Mechanical Engineer, Purdue University
- Three decades with a $18B consumer products company
- Expert: Web handling, Winding, Unwinds, Converting, Process design, Troubleshooting and Optimization
- Led Corporate open innovation efforts at the Web Handling Research Center hat provided over $100M savings
- Developed Corporate Machine Guarding standard
- Principal, Converting Expert, LLC

Assess – Troubleshoot – Optimize - Train

Web Handling - Converting - Unwinds - Winders

Nonwovens - Elastics - Film - Tissue - Laminates

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Why is Safety Important?

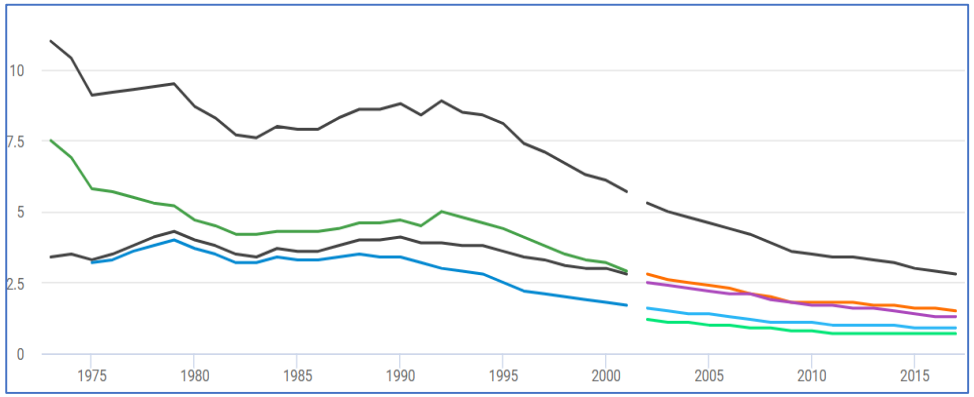
OSHA created 1970

Section 5(a) - General Duty Clause

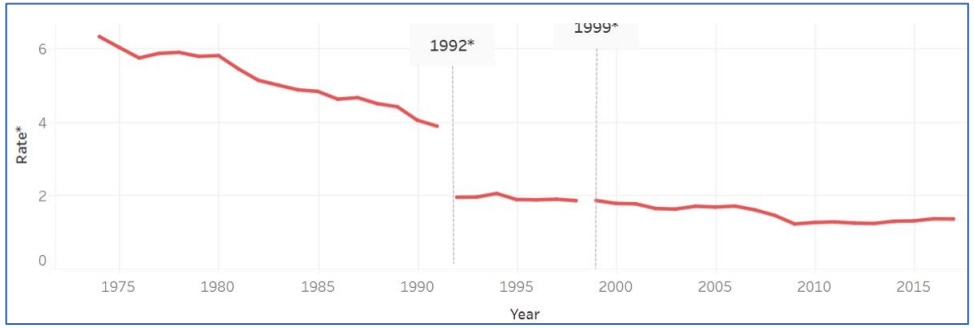
"Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees;"

- Work injuries fell dramatically after 1948 through 1992, and since that time have leveled out
- Fatalities decreased 28% from 1999 to 2009
- **Fatalities increased 18% from 2009 to 2017**

Injuries & Illnesses / 100 full-time workers



Fatalities / 100 full-time workers



Year	Fatalities per 100,000 people	Total Fatalities	% Change
1999	1.8580	5185	Baseline
2009	1.2195	3744	-27.8
2016	1.3614	4399	+17.5
2017	1.3552	4414	+0.34

https://injuryfacts.nsc.org/

Types of Machine Hazards

POINT OF OPERATION HAZARD

The Occupational Safety and Hazard Association (OSHA) defines a "point of operation hazard" as the place where work is performed on the material. This includes cutting, slitting, compacting, forming, calendaring and conveying.

POWER TRANSMISSION APPARATUS

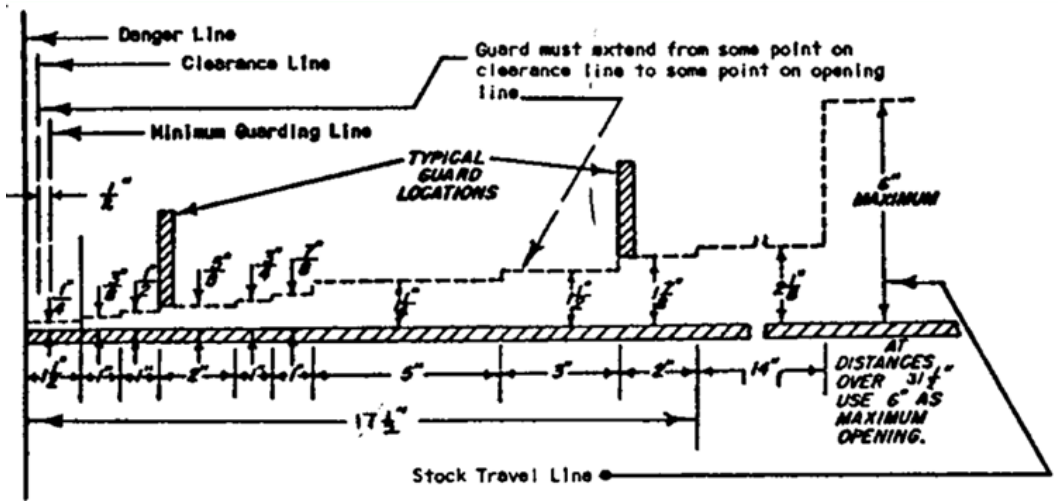
OSHA defines a power transmission apparatus as mechanical systems that transmit energy to the machine parts doing the work. Examples include: shafts, gears, couplings, belts, chains and cams.

OTHER HAZARDS

Examples include electrical energy, flying debris, chemical splashes and hot surfaces

www.osha.gov/SLTC/etools/woodworking/pointofoperation.html

Machine Guarding

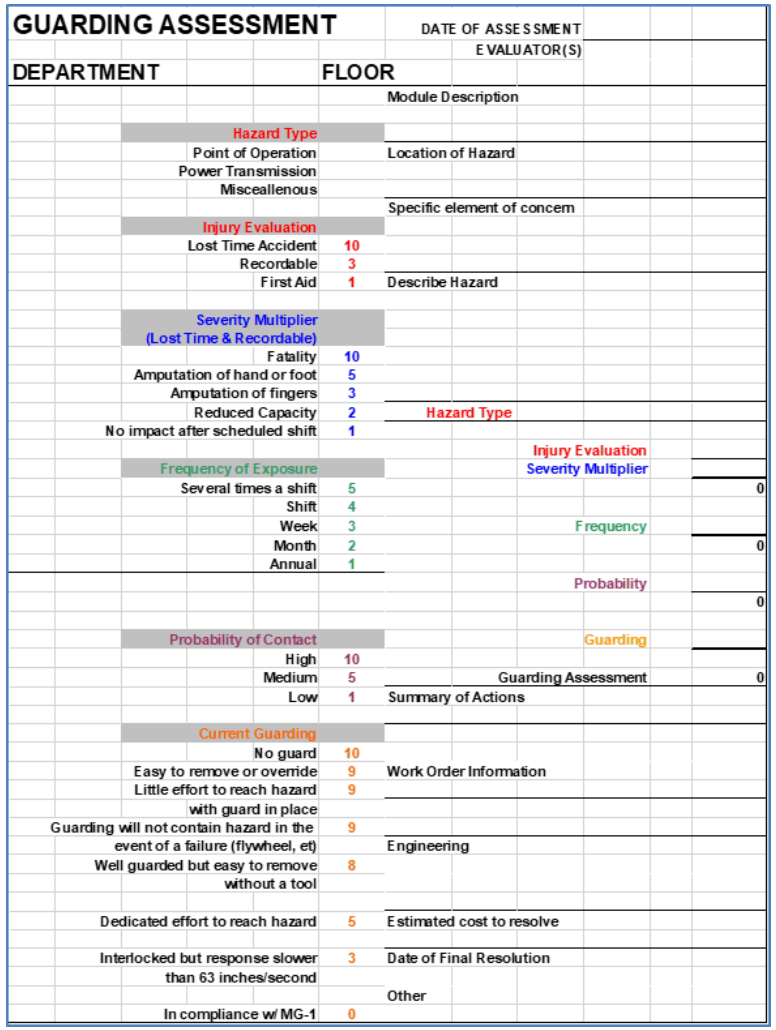


Distance of opening from point of operation hazard	Maximum width of opening
1/2 to 1 1/2	1/4
1 1/2 to 2 1/2	3/8
2 1/2 to 3 1/2	1/2
3 1/2 to 5 1/2	5/8
5 1/2 to 6 1/2	3/4
6 1/2 to 7 1/2	7/8
7 1/2 to 12 1/2	1 1/4
12 1/2 to 15 1/2	1 1/2
15 1/2 to 17 1/2	1 7/8
17 1/2 to 31 1/2	2 1/8

29 CFR 1910-217 Mechanical Power Presses

Table O-10

Guarding Assessment



GUARDING ASSESSMENT

DATE OF ASSESSMENT

EVALUATOR(S)

DEPARTMENT FLOOR

Module Description

Hazard Type
Point of Operation
Power Transmission
Miscellenous

Location of Hazard

Specific element of concern

Injury Evaluation
Lost Time Accident 10
Recordable 3
First Aid 1

Describe Hazard

Severity Multiplier (Lost Time & Recordable)
Fatality 10
Amputation of hand or foot 5
Amputation of fingers 3
Reduced Capacity 2
No impact after scheduled shift 1

Hazard Type

Injury Evaluation
Severity Multiplier

Frequency of Exposure
Several times a shift 5
Shift 4
Week 3
Month 2
Annual 1

0

Frequency

0

Probability

0

Probability of Contact
High 10
Medium 5
Low 1

Guarding

Guarding Assessment 0

Summary of Actions

Current Guarding
No guard 10
Easy to remove or override 9
Little effort to reach hazard with guard in place 9
Guarding will not contain hazard in the event of a failure (flywheel, et) 9
Well guarded but easy to remove without a tool 8

Work Order Information

Engineering

Dedicated effort to reach hazard 5

Estimated cost to resolve

Interlocked but response slower than 63 inches/second 3

Date of Final Resolution

Other

In compliance w/ MG-1 0

Categories

Hazard Type	Admin
Injury Evaluation	[1-10]
Severity Multiplier	[1-10]
Frequency of Exposure	[1-5]
Probability of Contact	[1-10]
Current Guarding	[1-10]

A rating of 50,000 is the worst-case scenario which would be a

- Lost time accident [10]
- Potential fatality [10]
- Operator is exposed to several times a shift [5]
- Operator has a high incentive to reach into [10]
- No guarding in place [10]

Example Slitting

Module Description
Two drum rewinder
Location of Hazard
Slitter
Specific element of concern
Cut point of slitter
Describe Hazard
During routine operation of the rewinder one could reach into the cut point of the shear slitter.
Lost edge trim has been an issue lately which would give an operator incentive to reach in.
The slitters are easy to reach.
They are guarded on the outside but not at the cut point.

Hazard Type	Point of Operation
Injury Evaluation	10
Severity Multiplier	3
	30
Frequency	5
	150
Probability	10
	1,500
Guarding	10
Guarding Assessment	15,000

Example Nip Point

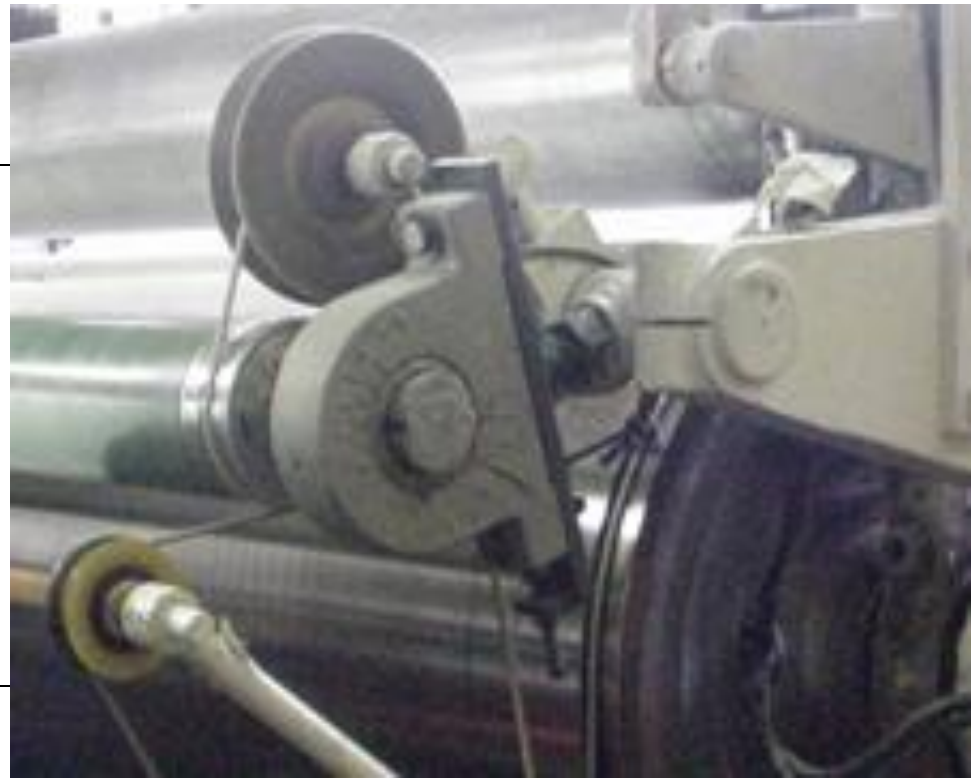
Module Description
Two drum rewinder
Location of Hazard
Operator and Drive side of the Rewinder
Specific element of concern
Nip point between the roll and the winder drum
Describe Hazard
One could reach past the guards to reach the nip between the building roll and the front winding drum
There has been ongoing issues with lost trim that would give an operator incentive to reach in past the guards
It is a long reach to even touch the guard because of the adjacent equipment

Hazard Type	Point of Operation
Injury Evaluation	10
Severity Multiplier	10
	100
Frequency	5
	500
Probability	5
	2,500
Guarding	9
Guarding Assessment	22,500

Example Rope Thread Up

Module Description
Rope Thread Up
Location of Hazard
Paper Machine #2 Reel
Specific element of concern
Potential pinch point between rope and pulleys
Describe Hazard
The roll thread up is driven and runs at line speed with the equipment.
It is out of the way on the drive side but it is not guarded.
The operators use this system more than once a shift

Hazard Type	Point of Operation
Injury Evaluation	10
Severity Multiplier	5
	50
Frequency	5
	250
Probability	10
	2,500
Guarding	10
Guarding Assessment	25,000



Example Point Guards

Module Description
Drive system
Location of Hazard
Drive side of Paper Machine #2
Specific element of concern
Drive shaft and coupling are guarded but not completely
Describe Hazard
One could reach under the guard about the coupling
Only a maintenance person would be back there
There is little incentive to reach under the guard

Hazard Type	Power Transmission
Injury Evaluation	10
Severity Multiplier	2
	20
Frequency	1
	20
Probability	1
	20
Guarding	5
Guarding Assessment	100

Guarding Assessment Process

GUARDING INSPECTION - TIMING AND RESPONSIBILITIES	
Inspection Team Efforts	**DATE**
First meeting to provide training, schedule & establish teams	Day 1
Inspection Team meeting to develop strategy	14 days
Department Inspection Complete	30 days
Summarize Department Inspection	42 days
Follow-up Meeting with Department Core Team	45 days
Department Efforts	
Determine Key Contact	60 days
Continue to develop Excel Spreadsheet	Ongoing
Implement guarding improvements	Ongoing
Plant Manager Responsibility	
Follow-up with Team Leaders & Key Contacts	90 days
Begin cadence meetings with Department leaders	Ongoing

INSPECTION TEAM

- Cross section of technical resources and senior operators
- Receive training on guarding and how to assess hazards
- Volunteers sign up to inspect a department
- Complete department assessment within 30 days
- Summarize results

DEPARTMENT HAND OVER

- Inspection team reviews results with Department team leader within 45 days
- Department now takes ownership to reduce hazards

PLANT MANAGER RESPONSIBILITY

- First follow up meeting with Department leaders within 90 days

Common Hazards in Web Processes

Refer to the white paper for additional information

- Slitting
- Winding
- Unwinds
- Accumulators
- Lift truck traffic
- Hoists
- Nips
- S-Wraps
- Idlers
- Driven rollers
- Laminator, embosser, calendar rolls
- Power transmission
- Lineshaft, driveshaft
- Fixed guards
- Interlocked guards

Questions?

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