



***Debunking the ‘Injury Pyramid’
Geneva - 2013***

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**...or 30 minutes to challenge
*80 years of
“safety theory” thinking***

**Time is limited... so let's get
STARTED!**

Who The Heck Is This Guy?

- Loaded & Fixed Railway Cars
- Union Safety Representative
- One of the First Government of Alberta OH&S Officers (Enforcement)

3

Who The Heck Is This Guy?

- Largest Employers in Canada
 - 16,000 to 36,000 employees
- Educator, Author, Consultant
- Husband, Father, Grandfather, Brother, Son & Professional Musician

4



Just Some Rules Before We Start

- Avoid Absolutes At...

Almost ALL Costs 😊

- Exception – Are Exceptions
 - *Nothing more – nothing less*
- Agreement Is Not Required
 - *Consideration of Ideas Is Desired*

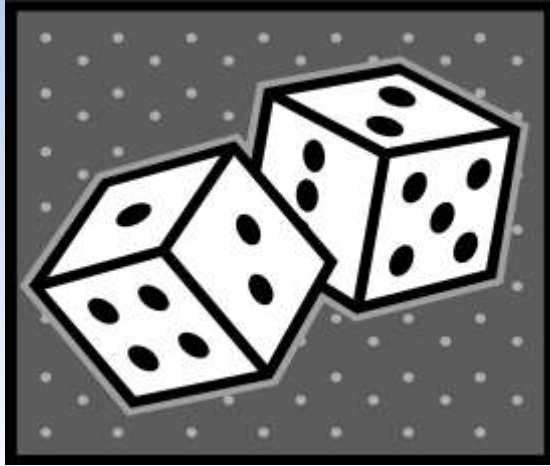
Safety Basically Is...

1. Find the **RISK** for **Harmful Energy** following a path to humans/things
2. Control those **RISKS** Through Risk Management components:
 - a. **Probability**
 - b. **Severity**
 - c. **Exposure**

Safety Basically Is...

3. Ensure the Controls are working through Observation & Inspection
4. When things go wrong investigate and improve the situation to prevent recurrence
5. Repeat as necessary

Risk means...



Page 12
CMPBSC

9

**The FOUR Most Important Words In
Safety Management are...**

- 1. RISK***
- 2. Probability***
- 3. Severity***
- 4. Exposure***

**They Work Together
and are Forever Linked!**

RISK = P x S x E

Probability

Severity

Exposure

**“Performing Safely...
is the performance of work or play
without taking
unnecessary risks.”**



Probability

- A measure of the expectation that an event will produce a **given outcome**
- The higher the **probability** the more certain we are that we will experience the given outcome IF WE ARE EXPOSED TO THE EVENT
- Can Be Expressed as a Percentage or Ratio
 - 5:1 Chance
 - 50% Chance
- **Probability** is DIFFERENT than **Exposure**

Probability

- There is a **100%** chance you will burn your unprotected hand when you touch molten steel
- There is a relatively small chance you will ever receive money from any of the current Lotteries (\$1.00 - \$Millions)
- Neither of these statements discusses the **RISK** of the events...just the **probability** of outcomes should the **exposure** happen

Probability Statement

<u>Toxicity data</u>					
Product/ingredient name	Result	Species	Dose	Exposure	
hydrogen sulphide	LD50 Intraperitoneal	Rat	2300 ug/kg	-	
	LD50 Intravenous	Rat	270 ug/kg	-	
	LC50 Inhalation Vapor	Rat	820 mg/m ³	3 hours	
	LC50 Inhalation Vapor	Rat	700 mg/m ³	4 hours	
	LC50 Inhalation Vapor	Rat	470 mg/m ³	6 hours	
	LC50 Inhalation Gas	Rat	712 ppm	1 hours	
	LC50 Inhalation Gas	Mouse	634 ppm	1 hours	
	LC50 Inhalation Gas	Rat	444 ppm	4 hours	
	IDLH	: 100 ppm			
	Chronic effects on humans	: May cause damage to the following organs: lungs, upper respiratory tract, eyes, central nervous system (CNS)			
Other toxic effects on humans	: No specific information regarding the other toxic effects of this material to humans.				

Severity

- Usually Expressed by “*How Bad/Good Could the Outcome Be?*”
- Usually Considered Negative in Most Risk Matrix
- Legal/Moral/Financial Consequence
- Remember That There are Two Sides to This Coin!
 - Save Time
 - Less Hassle
 - More Comfortable
 - Injury
 - Damage



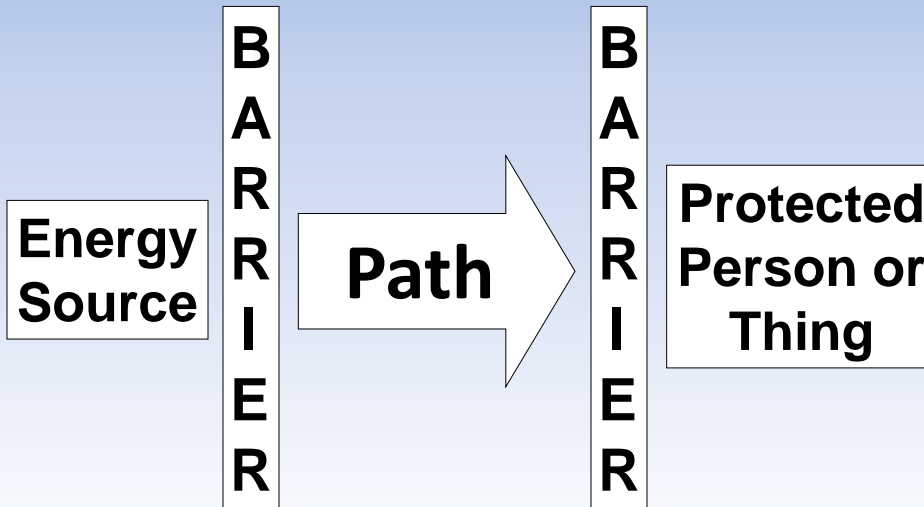
Exposure

- Calculation of how much, many and/or how long the situation exists
- Can be expressed as a % of time or number of the workforce
- Can be expressed as a dose (ppm, mg/m³, dba, etc.)
- Exposure is NOT “Probability” – it is the amount of Exposure TO the Probability in question

In a nutshell we need to manage...

**Hazard Anticipation,
Identification,
Evaluation & Control**

Energy/Barriers Causation Model



**In our sincere attempt
to
“Make Our Lives Safe”
We have tended to...**

Giving Meaning To Things We Don't Understand

- A Flaming Chariots
- Earth is Flat
- Colds are caused by being cold
- Moon is made of Cheese
- There was a time some of us believed in Santa...



... and that there is a
Ratio Connection
with
Minor & Major
events

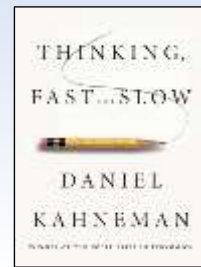


Thinking Fast and Slow

Kahneman describes the two different ways the brain forms thoughts:

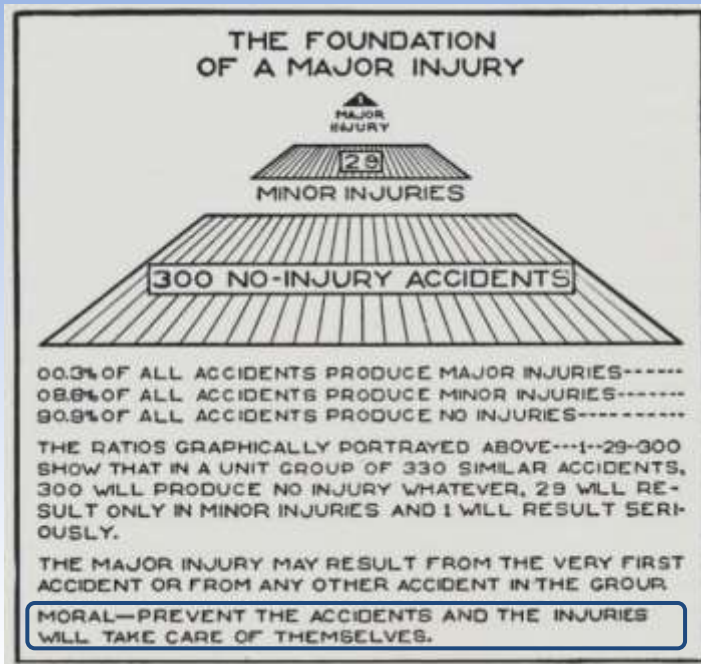
- System 1: Fast, automatic, frequent, emotional, stereotypic, subconscious
- System 2: Slow, effortful, infrequent, logical, calculating, conscious

***“What You See
Is All There Is”***



So with these things in mind let's
look at this

Debunking of the Pyramid!



The Injury Pyramid Proposed Premise

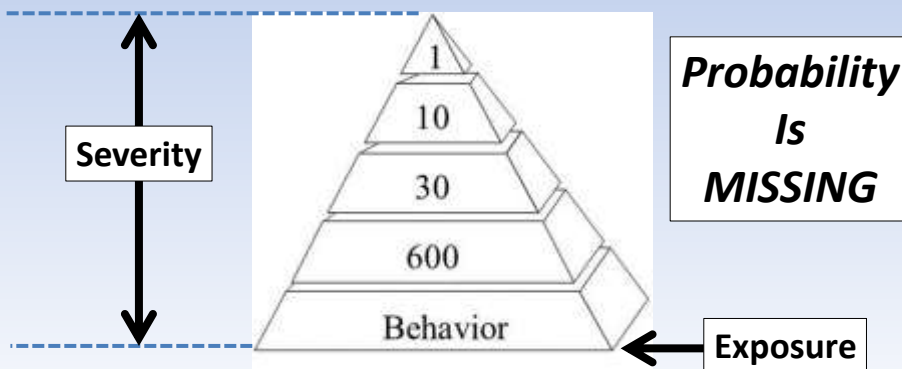
1. There are common causes to incidents
2. Serious injury incidents are averted by reducing/avoiding minor/no injury incidents



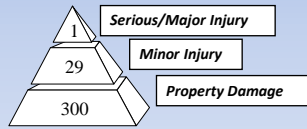
The Injury Pyramid Proposed Logical Premise

3. There's a randomness to outcomes (ranging from minor to major)
4. The less minor/no injury incidents we have the less major injury incidents we will have in a ratio relationship (many to few).

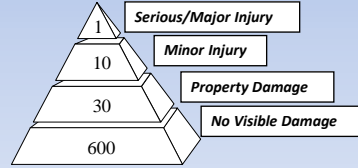
“Moral – Prevent the Accidents and the injuries will take care of themselves”



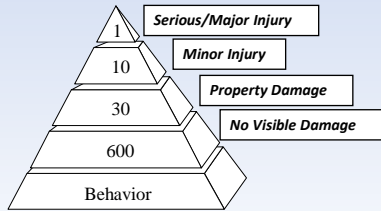
Historic Accident Ratio Studies



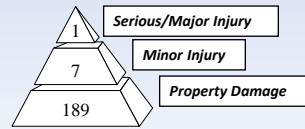
H. W. Heinrich 1931



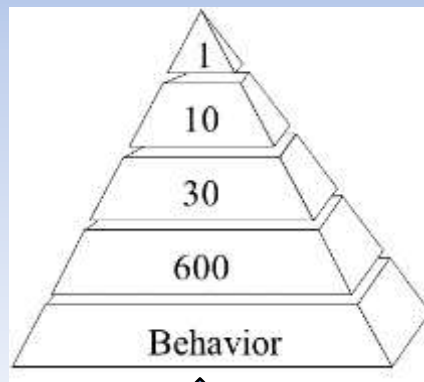
Frank Bird Jr. 1969



1969 - Modified By P&G

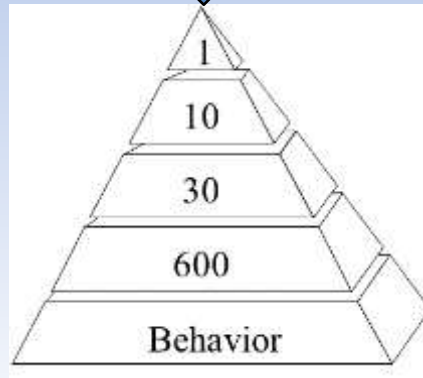


1993 UK Study

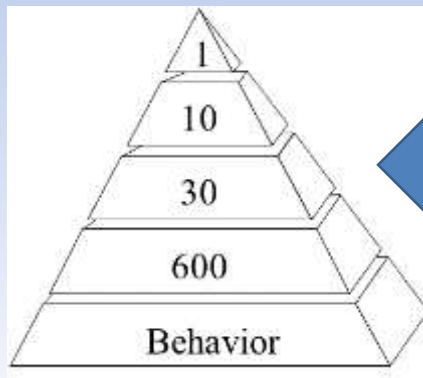


The assumption is that if you reduce THESE

That these will be reduced



- **Used as a Risk Management Tool it is flawed**
- **Errors in base data/assumptions lead to errors in the resulting conclusions**



These numbers
represent the
SEVERITY
Component...
NOT
RISK

A Minor Leads To Major Is Not Valid

Errors in Logic

- It's not that the Pyramid is totally wrong
- It inappropriately tries to explain a complex subject like **RISK**
- **Severity** is **NOT** a function of repetitions in **Exposure**
- Let's look at a simple **EXAMPLE...**



Juggling



Chainsaws VS. Eggs



Juggling Eggs

- Severity of Dropping an Egg while juggling them is impacted by?
 - Energy exerted (gravity/velocity)
 - Strength of the Egg
 - Qualities of the landing surface (ring)
 - How the Egg lands
 - Many Repetitions would not significantly change the experienced outcome severity!
 - Extreme exceptions are possible

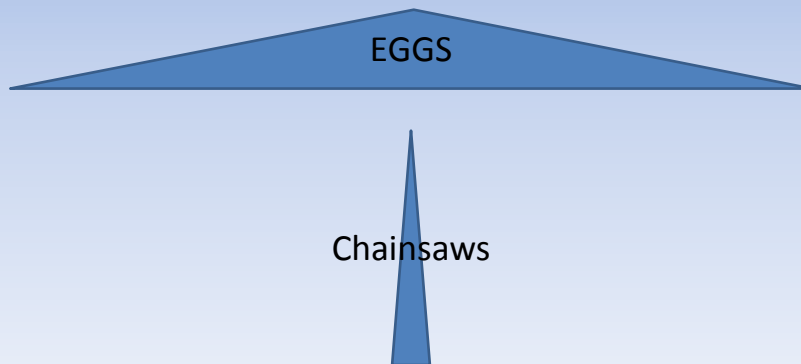


Juggling Chainsaws

Severity of Dropping a Chainsaw while juggling them is impacted by?

- Energy exerted (gravity/velocity)
- Strength of the Chainsaw
- Qualities of the landing
- How the Chainsaw lands
- Many repetitions would not significantly change the experienced severity outcome!

Eggs VS Chainsaws



**Reducing Egg Incidents will have
NO Logical Impact
on Chainsaw Incidents**

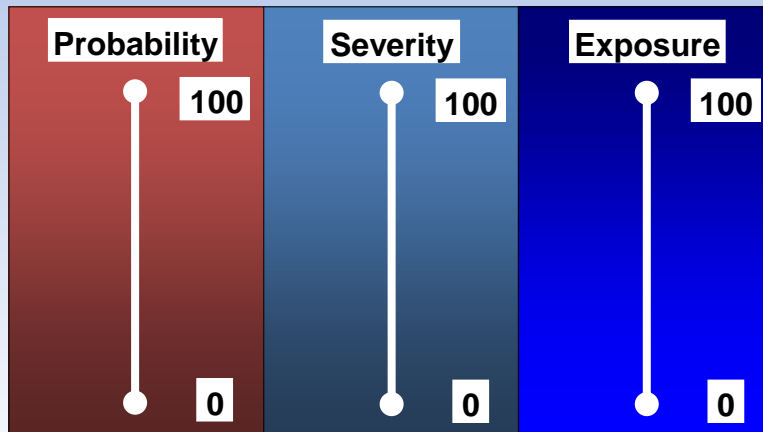
Worst First

- As Heinrich suggested reducing ALL Juggling Incidents would indeed reduce all injuries (perhaps) but at what cost (Careful of Absolutes)
- Problem - Low payback on investment
- High Payback comes from reducing WORST FIRST!

Risk Analysis

Page 12
CMPBSC

$$P \times S \times E = \text{Risk}$$



Winning a EuroMillions Lottery?

Errors in Logic Explained

- **Probability** does **NOT** increase with frequency of **Exposure**
- The amount of **Energy** relative to the damaged item/person is the key difference in **major and minor** events (**Severity** of Outcome)
- **Large energy missing the "target" is a MAJOR RISK because of the Potential for a Severe Outcome**

Exception?

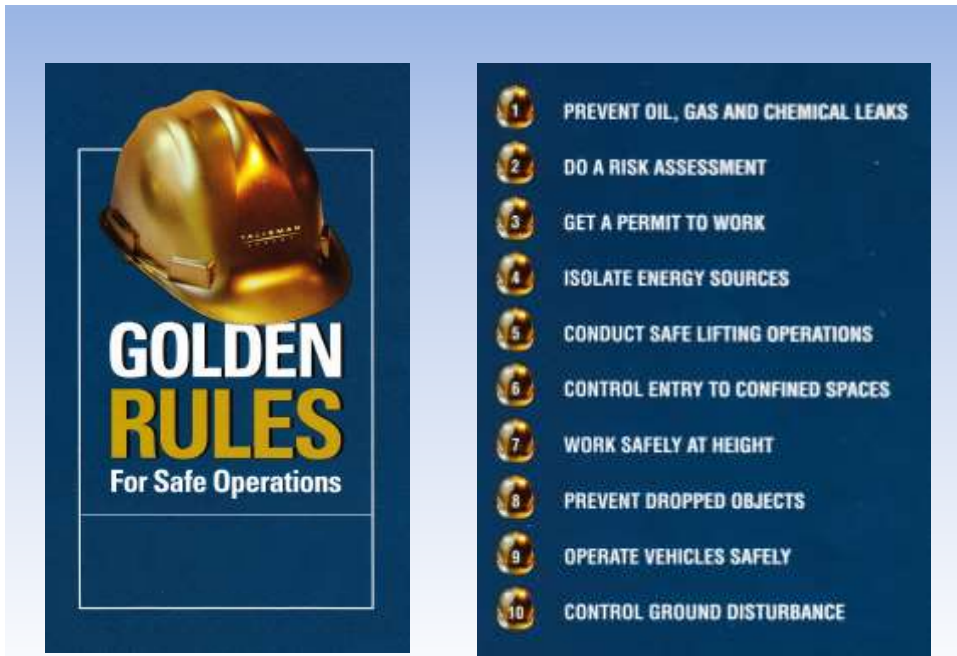
- The factors that impact severity are not usually impacted by probability nor exposure
- Note: Repetitive Motion Injuries can be an exception

Attacking Catastrophic Loss

The Solution:

- Find High Energy
- Extreme Outcome Probability
- Logic #101 tells us that:

$$\mathbf{A+B=C \text{ then } C-B=A \text{ and } C-A=B}$$



45

Defining Critical Safe & Unsafe Behaviours

- **The Golden Rule Approach**
 - Statement of Intent – **“We will work at heights safely and legally”**
- **What are the Golden Rules in your Industry?**

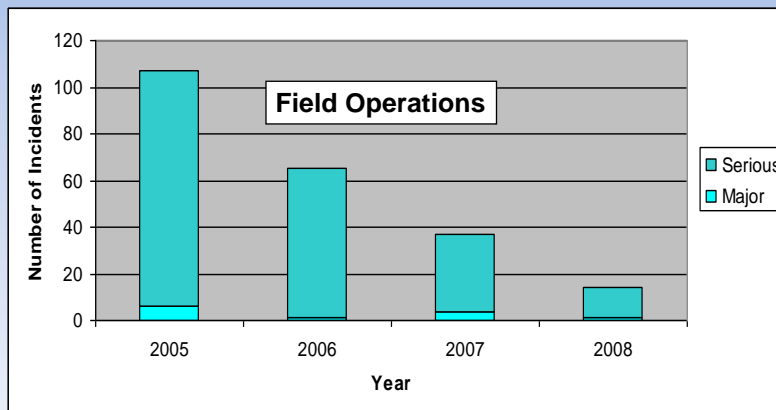
46

Where the Rubber Hits The Road

1. Prioritize the Golden Rules for Local Conditions
2. Identify the Energy/Barriers Situations
3. Identify the Critical Behaviours & Procedures
4. Identify the Activators and Consequences
5. Identify the Measurements & Processes
6. Identify the Management of Change Issues
7. Develop and Implementation the Plan
8. Implement – Measure Activities and Outcomes as Defined
9. Celebrate or Correct

47

Trailing Indicators



Year	2005	2006	2007	2008
Major	6	1	4	1
Serious	101	64	33	13
Percentage Reduction		-37%	-48%	-61%

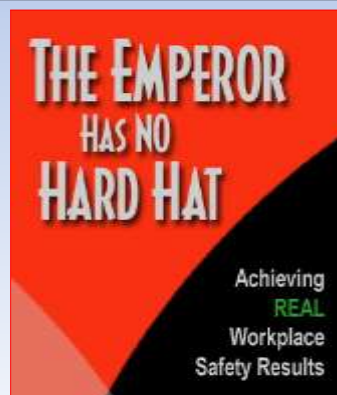
Putting It Together

- **Probability** without **Exposure** = **Zero Risk**
- Low **Probability** does not increase with higher **Exposure**
- **Probability** requires **Exposure** to create a **Risk Event** (incident)
- Without sufficient **Energy** there is little or no **Severity**
- Without significant **Severity** there is little **Risk**

Available

www.safetyresults.ca

<http://safetyresults.wordpress.com/>



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51