OSC|12
Ohio Safety Congress & Expo

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114 Safety and Risk Assessment in the Agriculture Industry

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Thursday, March 29, 1:15 to 2:15 p.m.

Ohio | Bureau of Workers' Compensation

Closing the loop
Safety the Right Way!

Risk Assessment and Safety in Agriculture

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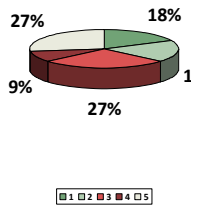
Objectives

- Explore the Concepts of Risk Assessment and How it Functions in Agriculture
- Discuss how to Track and Trend
- Expand the Concepts Whenever Possible

Closing the loop
Safety the Right Way!

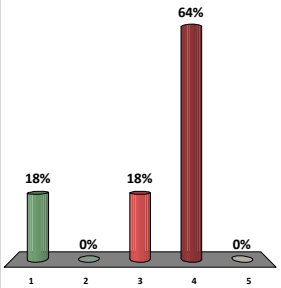
Who has used Risk Assessments Before?

1. Never
2. As a Stand-Alone Process
3. As part of JSA/TSA
4. Part of RCA
5. Pre-and-Post Event



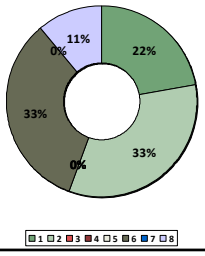
What is Risk Assessment?

1. A means of evaluating the chances of an accident or incident?
2. A type of assessment that looks at how bad things could be if something unplanned occurs?
3. A logical means of evaluating and ranking hazards?
4. A quantified and precise means of assessing both the likelihood and potential severity of an unplanned event?
5. A financial technique for evaluating the potential for loss to a portfolio or financial instrument



WHAT RISK ASSESSMENT METHODOLOGIES HAVE YOU USED?

1. FAULT TREE
2. FISH-BONE
3. FMEA
4. HAZ-OP
5. MARKOV ANALYSIS
6. PARETO ANALYSIS
7. R3
8. ANSI B-111



Uses of Risk Assessments

- Safety
- Military
- Financial
- Market Conditions
- Business Planning

Risk Assessment Standards

- ANSI/ASSE Z-690.2 Risk Assessment
- ISO 31000 Risk Management – Principles and Guidelines (Section 5.4 Risk Assessment)
- ANSI B-11 Machine Safety
- MIL STD 882D (DOD Standard Practices for System's Safety)

Risk Assessment Methodologies

- Qualitative
  - Relatively Simple
  - Can be done by an Individual or a Group
  - May Serve as the Starting Point for Quantitative Risk Assessments
  - Often Somewhat Subjective
- Quantitative
  - More Difficult
  - Can be Done Most Effectively by a Group
  - MUST BE PRECISE, ACCURATE, and RELIABLE
  - NEED TO BE VALIDATED

THERE CAN BE SOME OVERLAP BETWEEN WHAT IS QUANTIATIVE AND WHAT IS QUALITATIVE

Risk Assessment Techniques

- Either Inductive or Deductive
  - Deductive – Based on the premise that true statements build toward a logical conclusion. If all dogs are animals and this is a dog, then it must be an animal.
  - Inductive – Based on knowledge and not certainty of statements. All police carry guns and there is a policeman, he must have a gun. Broader and potentially less precise than deductive Risk Assessment Techniques.
- Examples of Deductive – Fault Tree Analysis, Fish Bone Diagram
- Examples of Inductive – HazOP, FMEA etc…

Military Risk Assessment

- Military Standard MIL-STD-882
- Qualitative Risk Assessment uses a combination of Severity and Probability

Severity	*Probability*
1. Catastrophic	A. Frequent
2. Critical	B. Probable
3. Marginal	C. Occasional
4. Negligible	D. Remote
	E. Improbable

Military Risk Assessment

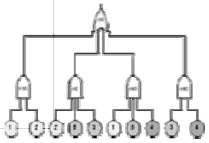
Example of a Military Risk Assessment Results Page

	Frequency				
Severity	1	2	3	4	5
V	1-V	2-V	3-V	4-V	5-V
IV	1-IV	2-IV	3-IV	4-IV	5-IV
III	1-III	2-III	3-III	4-III	5-III
II	1-II	2-II	3-II	4-II	5-II
I	1-I	2-I	3-I	4-I	5-I

High Risk
Medium Risk
Low Risk

Fault Tree Analysis (Fault Hazard Analysis)

- **Developed by Boeing in 1965 for the Minute Man project**
- Deductive
- Uses Boolean Logic
- Fault trees are built using gates and events (blocks). The two most commonly used gates in a fault tree are the **AND** and **OR** gates.

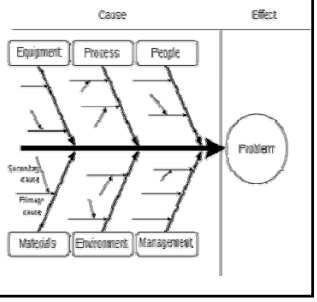


Fault Tree Continued

AND		The output event occurs if all input events occur.	
OR		The output event occurs if at least one of the input events occurs.	
Voting OR (k-out-of-n)		The output event occurs if k or more of the input events occur.	
Inhibit		The input event occurs if all input events occur and an additional conditional event occurs.	
Priority AND		The output event occurs if all input events occur in a specific sequence.	
Dependency AND		The output event occurs if all input events occur, however the events are dependent,*i.e.* the occurrence of each event affects the probability of occurrence of the other events.	
XOR		The output event occurs if exactly one input event occurs.	

Fish Bone Diagram

- Also known as Ishikawa Diagram
- Often Combined with the 6 M's
  - Machine (technology)
  - Method (process)
  - Material (Includes Raw Material, Consumables and Information.)
  - Man Power (physical work)/Mind Power (brain work): Kaizens, Suggestions
  - Measurement (Inspection)
  - Milieu/Mother Nature (Environment)



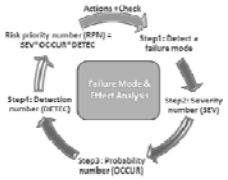
HazOp

- Developed in the 1970's by the Institute of Chemical Industry, in the UK.
- Involves evaluating every part of a process and determining where there is a possibility deviations from the designed intent
- Generally run by a cross-functional team
- The Steps of the HazOP are:
  - Define the System
  - Select the Team
  - Acquire Data
  - Conduct the HazOP
  - Recommend Corrective Actions
  - Monitor and Trend
  - Document the entire process

HAZOP STUDY RECORD SHEET			PROJECT:			DATE:	
SYSTEM: FLOWSHEET: LINE:			PRESENT: CHAIRED: SECRETARY:			PAGE: TOTAL PAGES:	
NO.	GUIDE	POSSIBLE CAUSES	CONSEQUENCES	EXISTING SAFEGUARDS	ACTION REQUIRED	PERSON	DONE
1	HIGH FLOW HIGH LEVEL						
2	LOW FLOW LOW LEVEL						
3	ZERO FLOW EMPTY						
4	REVERSE FLOW						
5	HIGH PRESSURE						
6	LOW PRESSURE						
7	HIGH TEMPERATURE						
8	LOW TEMPERATURE						
9	IMPURITIES						
10	CHANGE IN COMPOSITION						
11	TESTING						
12	PLANT ITEMS						
13	ELECTRICAL						
14	INSTRUMENTS						

FMEA

- Developed by the US Military in the 1940's
- Evaluates the likelihood of failures and the effect that failures may have on the system
- Can aggregate failure rates to create a probabilistic analysis for all aspects of the system
- Usually done at the outset of a project or design of a system or when changes are made to a process

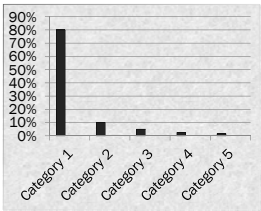


Terms for FMEA

- **Failure** - The loss of an intended function of a device under stated conditions.
- **Failure mode** - The manner by which a failure is observed; it generally describes the way the failure occurs.
- **Failure effect** - Immediate consequences of a failure on operation, function or functionality, or status of some item
- **Indenture levels** - An identifier for item complexity. Complexity increases as levels are closer to one.
- **Local effect** - The failure effect as it applies to the item under analysis.
- **Next higher level effect** - The failure effect as it applies at the next higher indenture level.
- **End effect** - The failure effect at the highest indenture level or total system.
- **Failure cause** - Defects in design, process, quality, or part application, which are the underlying cause of the failure or which initiate a process which leads to failure.
- **Severity** - The consequences of a failure mode. Severity considers the worst potential consequence of a failure, determined by the degree of injury, property damage, or system damage that could ultimately occur.

Pareto Analysis

- Inductive form of Analysis
- Also Known as the 80/20 "rule"
- The 80% is not statistically valid, but the generality of this methodology has been proven to be highly effective in the fields of economics, business management, biology, psychology, and safety!



So How do you Fit Risk Assessment into Agriculture???

- 1) As a stand-alone approach to System's Safety
- 2) As Part of a Behavioral Safety Process
- 3) In Accident Investigation
- 4) In Job Safety Analysis/Task Analysis
- 5) As part of the larger Risk Management Process

Do we need Risk Assessment in Agriculture?

- **Bartlett Grain (2011) - Atchison Kansas (6)**
- **Indiana State Fair Collapse (2011) – Indianapolis, IN (7)**
- **Imperial Sugar (2008) – Port Wentworth, GA (15)**
- **Imperial Foods Chicken Processing Plant (1993) – Hamlet, NC (25)**
- **Other workplace fatalities**
- http://www2a.cdc.gov/NIOSH-FACE/state.asp?Category=0000&Category2=ALL&State=IA&Submit=Submit
- http://www.cdc.gov/niosh/face/stateface.html

What is the future of Safety in Agriculture?

- Better OSHA Compliance?
- Improvement of Safety Management Systems?
- Integration of safety in the larger business practice?
- A focus on a culture of safety?
- Better usage of Behavior Based Safety?
- Formalization of policies and procedures?

A movement away from any Production over Safety mentality!

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