### Risk: The Human Factor Reducing Error & Influencing Behavior



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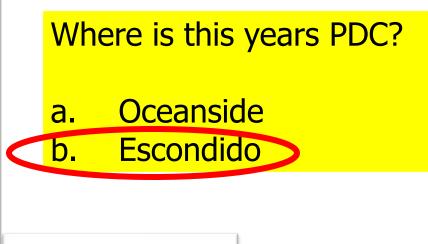
### Agenda

- Review Risk Assessment
   Procedures
- Understanding human factors
- List error precursors
- Reduce error through human performance tools

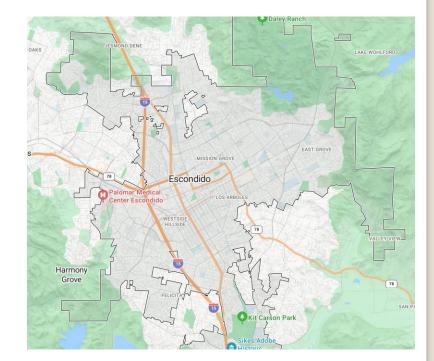


### Agenda

Lecture & Group Questions (example)







### Agenda

• Role Playing (example)

A series of connected vehicles that run along a railway track







"Those who don't know history are doomed to repeat it."

• Edmund Burke, English Philosopher



By learning from past mistakes we can learn to recognize potential hazards and prepare ourselves to provide protection against those hazards in the future.

### Crash of PSA 182

- PSA 182 crash in North Park in 1978
- Mid-air collision resulting from pilot error.
  - Failure to keep visual distance from Cessna aircraft as instructed by ATC.
    - May have resulted from distraction in cockpit.
  - Death of 142 people.
    - Many were PSA employees.



## What variables are used in the definition of risk?

a. Likelihood

С.

- b. Consequences
  - Both Likelihood & Consequences





#### ANSI B11.0 Uses 4X4 Matrix

Likelihood of Occurrence of Harm	Consequences 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

#### NFPA 70E Uses 2X2 Matrix

Likelihood of	Severity of Harm		
Occurrence of Harm	Energy ≤ 1.2 cal/cm <sup>2</sup>	Energy > 1.2 cal/cm <sup>2</sup>	
No	Low	Medium	
Yes	Medium	High	

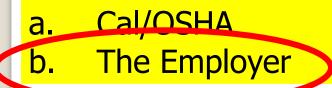
#### ANSI Z10 Uses 4X5 Matrix

	Severity of Injury or Illness					
			Catastrophic (CAT) Death or permanent total disability (Unable to return to work)	<u>Critical (C)</u> Disability in excess of 3 months Hospitalization of at least 3 people per event	<u>Marginal (M)</u> Minor injury, lost workday incident	Negligible (N) First aid or minor medical treatment
likelihood/Probability of Occurrence or Exposure			4	3	2	1
	Frequent (F)	5	High 20 Operation not permissible	High 15 Operation not permissible	Serious 10 High Priority Remedial Action	Medium 5 Take Remedial action at appropriate time
	Probable (P)	4	High 16 Operation not permissible	High 12 Operation not permissible	Serious 8 High Priority Remedial Action	Medium 4 Take Remedial action at appropriate time
	Occavional (O)	3	High 12 Operation not permissible	Serious 9 High Priority Remedial Action	Medium 6 Take Remedial action at appropriate time	Low 3 Risk Acceptable, Remedial action discretionary
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	Improbable (I)	1	Medium 4 Take Remedial action at appropriate time	Low 3 Risk Acceptable, Remedial action discretionary	Low 2 Risk Acceptable, Remedial action discretionary	Low 1 Risk Acceptable, Remedial action discretionary

There is an infinite number of Risk Assessment Procedures but all address Likelihood & Consequences

- Likelihood (Probability): Looks proximity to task, frequency of task, etc.
- **Consequences (Severity):** Looks at injury severity potential (first aid, disabling injury, fatality).
  - Related to energy level.
- Acceptable Risk:
  - Level of human and property loss that can be tolerated by an organization (Risk Appetite).
  - Note there no zero risk unless a hazard is eliminated.
  - Risk can be mitigated through control measures.

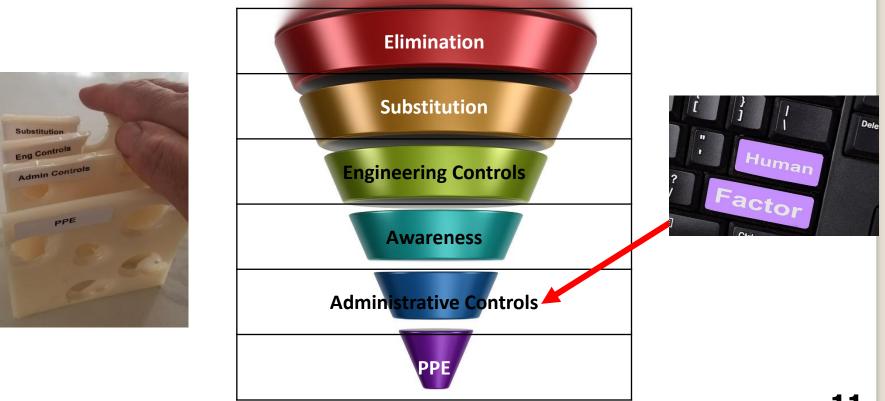
### Acceptable Risk is determined by:



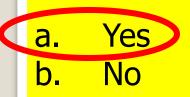




### **Risk Treatment considers Hierarch of controls**



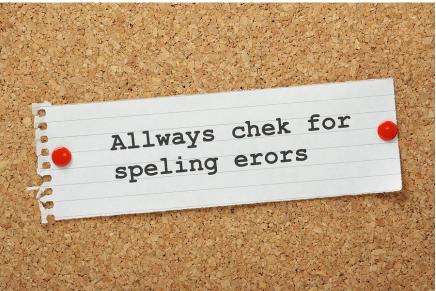
Addressing human error is good risk assessment practice and is mentioned in several safety guidance standards:



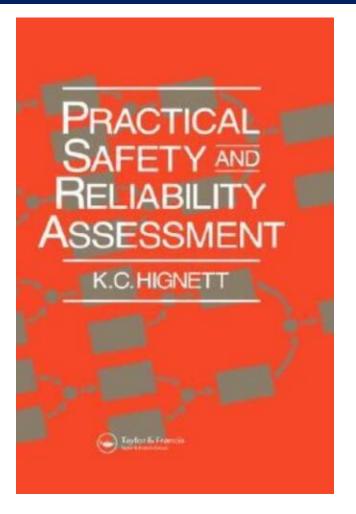




• The risk assessment procedure shall address the potential for *human error* and it's negative consequences on people, processes and the work environment.



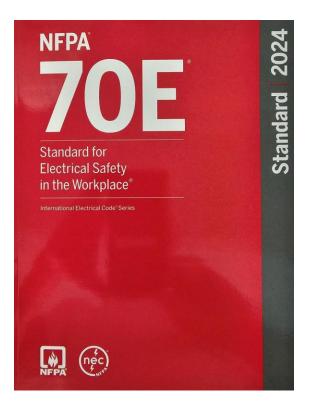
- Human error assessment and reduction technique (HEART) as published A Guide To Practical Human Reliability Assessment
  - Application to ergonomics



 ANSI B11 for machine guarding mentions addressing error as part of risk assessment process.



 NFPA 70E risk assessment process requires addressing human error



#### **Human Factors**

### "If you say that **to error is human**, you mean that it is natural for human beings to make mistakes."

### \* COBUILD Advanced English Dictionary

- People are not perfect.
- Human error is predictable, manageable, and can be prevented.
- Organizational factors greatly influence individual behaviors.
- Positive reinforcement helps people achieve higher levels of performance.
- An understanding of why past errors happened can help us prevent future ones.



### Human Performance & Workplace Electrical Safety (NFPA 70E (2024 Edition), Annex Q)

Error Precursors	Human Performance Tools		
Unfavorable conditions the	Reduce the likelihood of		
increase the probability of	error when applied to error		
error	precursors		

#### **Human Factors**

Supervisor says "Product has to get out quickly to meet customer demand"

# A. Error Precursor? b. Human Performance Tool?





### **ERROR PRECURSORS**

### Unfavorable Conditions which increase the likelihood of error

### Task Demands

- Exceed individual capabilities or challenge the limitations of the individual.
  - Examples:

Time Pressure High Workload Repetitive Actions Interpretation requirements



### Task Demands

Information incomplete= worker needs to interpret information given

### Work Environment

- Influences of the workplace conditions affect individual performance.
  - Examples:

Distractions/interruptions

**Obscure electrical configurations** 

Personality conflicts



### Work Environment

# Distractions or interruptions

### Individual Capabilities

- Individual characteristics do not match the demands of the specific task.
  - Examples:

Unfamiliar with task New task/not used before Lack of knowledge



### Individual Capabilities

A worker is operating a new control panel. It has a lot more buttons and controls than previous

### Human Nature

Limitations common to all persons incline an individual to error under unfavorable conditions. Examples:

- Stress Habits
- Assumptions
- Complacency



### Human Nature

A worker has gone through classroom fall protection training, therefore he knows how to do the task safely

### Let's Role Play!

# "Get product out NOW! We have to meet the production quota!"

### a. Task Demand b. Human Nature





### "I have closed this disconnect 100 times and I have never been hurt."

a. Human nature? b. Individual capabilities?





### "This energy control procedure is complicated!"

a. Task Demand?b. Individual capabilities?



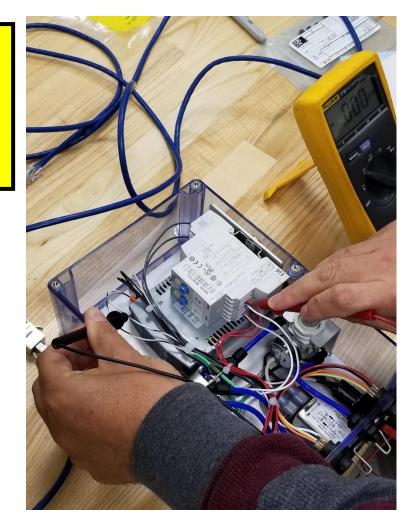
### **Error Precursors**



### What are you doing?

a. Individual capabilities?
b. Work environment?





### HUMAN PERFORMANCE TOOLS

Reduce the likelihood of error

**Human Performance Tools** 

## Systems in place to mitigate worker potential to make a mistake.

a. Error Precursor?
b. Human Performance Tool?



•	<b>Pre-Job</b>	Briefing
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Identify Hazards. Assess Risk. Implement Controls.

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Physical Hazards         Health Hazards           Confind Space         Sitics Exposure Convente/Store Confind Space         Sitics Exposure Convente/Store Conventer/Store Biological Hazards           Electral         Deventand Work         Cold Stress         Biological Hazards         Biological Hazards           Falls from Elevations         Underground Uillies         Healt Stress         Biological Hazards         Biological Hazards           Fire Hazards         Work         Cold Stress         Biological Hazards         Biological Hazards           Fire Hazards         Work         High Noise (-85 dRA)         Abbeston, Led           Heart Stress         Complete Al Prote to Use)         Safety Systems / Training           (5) MAZARD Control MEASURES         PPE and Monitoring Equipment         Complete Al Prote to Use)           (6) Works         Complete Al Protection         Dolob Exponent         Barricades, Pedestrian Shelten, Barner of Notices, PPE, and Warring Signing           (6) Works         Complete Al Protection         Total Lines         Cold Cold-energize, Guard, Identify, Tag or Tag & Lock)           (6) Haad Mail _ Safety Stoes/Bools         Tag Lines         Cold Cold Ingection Shemes, Raging Cause, Identify Beering         Cold Cold Ingection Shemes, Raging Cause, Suspended Personnel Lines           (7) FABdological Monitors         Ground Faul Protection         Prefadological Monitors <td>(4) JOBSITE EXPOSURES, NOTE: ELE</td> <td>CTROMA</td> <td>GNETIC INTERFE</td> <td>RENCE (EMI), RA</td> <td>DIO FREQUENC</td> <td>y (RF)</td> <td></td> <td></td> <td></td> <td></td>	(4) JOBSITE EXPOSURES, NOTE: ELE	CTROMA	GNETIC INTERFE	RENCE (EMI), RA	DIO FREQUENC	y (RF)					
□ Confront Space       Permit Required       □ Struck hyt/Contact With       □ Chemical Exposure       □ Controls         □ Becktoal       □ Control Space       □ Control Space       □ Controls       □ Controls         □ Becktoal       □ Control Space       □ Controls       □ Controls       □ Controls       □ Controls         □ Becktoal       □ Controls       □ Control				titions or may be	a result of site o	perations					
Electrical       Overhead Work       Cold Stress       Colling         Electronic Non Evalutions       Didoground Uillies       EMR/FiRadiological Laser       Biological Heards: Animals, Avia         Fails from Evalutions       Underground Uillies       High Nices (AS GBA)       Didoground Uillies         Heard Stress       Colling       High Nices (AS GBA)       Other:         (5) HAZARD CONTROL MEASURES       PPE and Monitoring Equipment       Complete AI Prior to Uge)       Safety Systems / Training         (Gives       Rigging       Execution & Troncing Dana (Interline)       Cold Execution (Interline)       Cold Stress         (Gives       Rigging       Execution & Troncing PlanLog       Cold Stress       Cold Stress         (Hand Nating)       Tog Lines       Head Nating       Cold Stress       Cold Stress         (Gives       Rigging       Execution & Troncing PlanLog       Cold Stress       Cold Stress         Haard State (Stress Fice Stress)       Hosts       Cold Stress       Cold Stress       Stress Fice Stress Fice Stress Fice Stress         Haard State (Stress Fice Stress)       Cold Stress       Stress Fice Stress											
Elevation / Site Terrain       Eligo, Tr <ul> <li>Complete AI Plant Kome Elevations</li> <li>Underground Billities</li> <li>Heavy Elevations</li> <li>Other:</li> <li>Heavy Elevations</li> <li>Complete AI Pror to Uleit</li> <li>Barricades, Predestran Shettes, Banner of Notces, PPE, and Warning Sign</li> <li>Excavation &amp; Trenching PlanLog</li> <li>Housekeeping</li> <li>Lox-Cu/T Tag-Out (De-emergize, Guard, Identify, Tag or Tag &amp; Lock)</li> <li>Housekeeping</li> <li>Lox-Cu/T Tag-Out (De-emergize, Guard, Identify, Tag or Tag &amp; Lock)</li> <li>Safety Steens for Rigging, Equip, Elevit-al Control</li> <li>Heard Natin Suite, Level: D.C. B. A</li> <li>Safety Vest: Class 1, 2, 3</li> <li>Other:</li> <li>Per Approved Plans (Critical Lifts, Roped-Access, Suspended Personnel Li Safety Guaser-Words (-Tam 15%)</li> <li>Group Enrichment (- Into 15%)</li> <li>Group Enrichment (- Into 15%)</li> <li>Group Enrichment (- Into 15%)</li> <li>Dorgon Enrichment (- Into 15%)</li> <li>Groups Channel (- Into 15%)</li> <li>Groups Channel (- Into 15%)</li> <li>Baerrai Required?</li> <li>Yes Ontoine:</li> <li>Peres-Approved Press Regrited?</li> <li>Yes Ontained</li> <li>Press-Sproxite Annoback-Marcet as PermiR Required?</li> <li>Yes Ontained</li> <li>Press Stroker, Heart Breaker?</li> <li>Yes Ontained</li> <li>Press Proceker Annoback-Marcet as PermiReguired?</li> <li>Yes Ontained</li> <li>Pr</li></ul>				ct With	Chemical Exposure Silica Exposure (Concrete/Stone Cution)						
Bits mon Elevations       Inderground Utilities       Index Stress       Index Stress       Index Stress         Prior Hazards       Vehicle Traffic       High Noise (>55 GAA)       Other:         I Mark Stress       Index Stress       Index Stress       Index Stress         PEE and Monitoring Equipment       Inspections       Safety Systems / Training         [ Complete Al Prior to Use)       Safety Systems / Training         [ Gives       Rigging       Excavation & Trenching Plan1.og         [ Haurd Hain Could Device (Signement)       Togging       Excavation & Trenching Plan1.og         [ Haurd Hain Could Device (Signement)       Color Code Inspections       Color Code Inspections         [ Haurd Hain Colors, Items, & Frequency       Genum Fault Protection       Color Code Inspections (Ical Lifts, Roped-Access, Suspended Personnel I L)         [ Haurd Site (Sisses, Goggies, Face Shield       Ground Fault Protection       Color Code Inspection Stress (Trago Lifts, Sisses)         [ Ald Monitoring:       Color Code Inspection Stress       Color Code Inspections (Ical Lifts, Roped-Access, Suspended Personnel I L)         [ Ald Monitoring:       Ground Fault Protection       Color Code Inspections (Ical Lifts, Roped-Access, Suspended Personnel I L)         [ Ald Monitoring:       Ground Fault Protection       Color Code Inspections (Ical Lifts, Roped-Access, Suspended Personnel I L)         [ A	Elevation / Site Terrain Slips. Trip. or Falls			alls	EMI/RF/Radiological/Laser Biological Hazards: Animals, Avian,						
Implement	Falls from Elevations Underground Utiliti			ilities	Heat Stress Insects, Microbiological, etc.						
Image Contract         Image Contract           Image Contract         Entry           Image Contract         Image Contract           Image Contract         Entry           Image Contract         Image Contract           Image Con	Fire Hazards Vehicle Traffic										
PPE and Monitoring Equipment         Inspections (Complete AI Prote Use)         Safety Systems / Training           P PE and Monitoring Equipment         Complete AI Prote Use)         Barricades, Pedestrian Shelters, Barmer of Notices, PPE, and Warning Sig Diverse           Gloves         Rigging         Barricades, Pedestrian Shelters, Barmer of Notices, PPE, and Warning Sig Diverse           Haurd Nating         Rigging         Diverse         Barricades, Pedestrian Shelters, Barmer of Notices, PPE, and Warning Sig Diverse           Haurd Nating         Tog Lines         Diverse         Diverse         Diverse           Haurd Sultz, Level: D, C, B, A         Ground Fault Proteion         Dob Heling Meeting         Dob Heling Meeting           Safety Vet Classes, Gogglies, Face Shield         Hoists         Color Coded Inspection Schemes Rigging, Equip., Elevin., Elevintal Control         Demetry Systems:           Orgona Dictorium (t): Fina 15/h)         Other:         Preder of Towards Andeu, or Channes Required?         Yes           Planmatk Obschom (t): Fina 15/h)         Other:         Fina, Shoke, Heat Alemest Doach, etc. Aleman Baquied?         Yes         Otaland           Planmatk Obschom (t): Fina 15/h)         Differe         Fina, Shoke, Heat Alemest Doach, etc. Aleman Required?         Yes         Otaland           Planmatk Obschom (t): Fina 15/h)         Differe         Fina, Shoke, Heat Alemest Doach, etc. Aleman Required?			Other:		Lifting F	lazards		L Other	;		
Complete All Prior to Use)         Enable Protection           Fall Protection         CondexEngineent           Barricades, Pedestrian Shelters, Barner of Notices, PPE, and Warning Signation Structure Plant (Grind Lifts, Roped-Access, Suspended Personnel Lift, Padological Monitors)           Head Had         Sately Stoes/Boots           Hadring         Ground Fault Protection           Pre-Approved Plans (Circla Lifts, Roped-Access, Suspended Personnel Lift, Padological Monitors)         Ground Fault Protection           Pre-Approved Plans (Circla Lifts, Roped-Access, Suspended Personnel Lift, Padological Monitors)         Ground Fault Protection           Stately States (Sasse, Goggies, Face Sheld)         Hoiss         Colir Coded Inspection Shemas           Stately States (Sasse, Goggies, Face Sheld)         Hoiss         Federal of Treas Manual on Unitorn Taffic Control           Orgong Detichemy (- Inta 15%)         Cohrol States (Sasse, Sassew/Soro) (- Inta 15%)         Cohrol States (Sassew/Soro) (- Inta 15%)           Plansmith Glassew/Soro) (- Inta 15%)         Files Smoite, Head Administric, Pre-Braginerd' (- Yes)         Obtained           Filemante Glassew/Soro) (- Inta 15%)         Files Smoite, Head Administric, Is a Permit Required' (- Yes)         Obtained           Laker Satiety, Circle and Plans, Control States (- Permit Required')         Yes         Obtained           Filemante Glassew/Soro) (- Inta 15%)         Filemanthe Glassew/Soro) (- Inta 15%)         Ye		t	Inene	ations			Safaty Syst	ome / Tr	aining		
Gloves       Rgging         Hard Had       Safety Shoes/Boots         Had Had       Carevation & Trenching PlanLidg         Had Had       Carevation & Trenching PlanLidg         Hadring       Tag Lines         Hard Nation       Ground Fault Protection         PF / Radiotiopid Monitors       Ground Fault Protection         Attamat Subte, Level: D, C, B, A       Ground Fault Protection         Safety (Stasses, Goggies, Face Shield       Hoiss         Attamat Subte, Level: D, C, B, A       Ground Fault Protection         Color Coded Inspection Shmears       Ground Fault Protection         Orogon Encidency (- than 19:5%)       Cohnol States I: A: 3         Orogon Encidency (- than 19:5%)       Cohnol States I: B Primit Required?       Yes         Planmath Glossev/Dato (- than 19:5%)       Cohnol States I: B Primit Required?       Yes         Planmath Glossev/Dato (- than 19:5%)       Cohnol States I: B Primit Required?       Yes         Planmath Cohnorit (- than 19:5%)       Cohnor States I: B Primit Required?       Yes       Obtained         Introduction (- than 19:5%)       Cohnor States I: B Primit Required?       Yes       Obtained         Introduction (- than 19:5%)       Cohnor States I: B Primit Required?       Yes       Obtained         Introduction (- than 19:5%)	PPE and Monitoring Equipment		(Complete All Prior to Use)		Salety Systems / Training						
Hard Hall Safety Shoes/Bools       Howakeeping       Lock Out / Tag Out (De-energize, Guard, Identify, Tag or Tag & Lock)         Hearing       Job Briefing Meening       Lock Out / Tag Out (De-energize, Guard, Identify, Tag or Tag & Lock)         Hearing       Guorund Fault Protection       Do Briefing Meening       Howakeeping         Stafety Glasses, Oogles, Face Sheld       Gin Poles       Pre-Approved Plans (Ontical Lifts, Roped-Access, Suspended Personnel LI         Safety Vest: Class 1, 2, 3       Other:       Perse-Approved Plans (Ontical Lifts, Roped-Access, Suspended Personnel LI         Organ Definitions (I than 15.%)       Other:       Perse-Approved Plans (Ontical Lifts, Roped-Access, Suspended Personnel LI         Planmable Guardwords (I than 15.%)       Other:       Permit Reguired?       Yes       Othered         Planmable Guardwords (I than 15.%)       Electrical Work: Is a Permit Reguired?       Yes       Othered         Planmable Guardwords (I than 15.%)       Electrical Work: Is a Permit Reguired?       Yes       Othered         Planmable Guardwords (I than 15.%)       Electrical Work: Is a Permit Reguired?       Yes       Othered         Planmable Guardwords (I than 15.%)       Electrical Work: Is a Permit Reguired?       Yes       Othered         Planmable Guardwords (I than 15.%)       Electrical Work: Is a Permit Reguired?       Yes       Othered         Later Stafe <td>Fall Protection</td> <td colspan="3"></td> <td colspan="6"></td>	Fall Protection										
Harring       Tag Lines       Bit Pier Adadiogical Monitors         Harring Br / Radiological Monitors       Ground Fault Protecton       Pre-Approved Press (Critical Lifts, Ropet-Access, Suspended Pressonnel Li         Harmat Suits, Level: D, C, B, A       Gin Poles       Annotatal Colors, Items, & Frequency,       Safety Vist Classes, Goglies, Face Sheid       Hoats         Safety Vist Classes, Goglies, Face Sheid       Hoats       Federal or Texas Manual on Unform Taffic Control       Peremit Systems:         Orugen Environet (: hun 15.%)       Other:       Peremit Systems:       Outlind Safety Vist Classes, Goglies, Face Access, Suspended Personnel Li         Patematic Sease Vispon (: han 110; // LEL)       File, Sheidy Vist Classes, Goglies, Face Access, Suspended Personnel Li       Peremit Systems:       Outlind Spaces:         Patematic Sease Vispon (: han 110; // LEL)       File, Shoid, Hat Alamma Dacchadar, Are Permits Required?       Yes       Otaland         Hater Stafety, Chan ER, Life, Chan ER,											
IP F / Radiodjožd Monitors       Gruund Fault Protecton       IP-Approved Parisr (Critical Lifts, RoperAccess, Supervided Personnel Lights, Level; D, C, B, A         Hazmat Suits, Level; D, C, B, A       Gin Poles       Color Coded Inspection Schemes for Rigging, Equip., Electrical Corts & Te         Safety Glasses, Vasc Cases 1, 2, 3       Hoids       Folderal or Texas Manual on Uniform Traffic Control       Annotati Colors, Items, & Frequency;         Daypon Dateinory (-the 19,7%)       Other:       Folderal or Texas Manual on Uniform Traffic Control       Permit Negurery;         Parisr Distributions (-the 19,7%)       Other:       Folderal or Texas Manual on Uniform Traffic Control       Permit Negurery;       Other         Parisr Distribution (-the 19,7%)       Control of Decr.       Folderal or Texas Manual on Uniform Traffic Control       Permit Negurery;       Ves       Obtained         Parisr Distribution (-the 19,7%)       Control of Decr.       Folderal or Texas Manual on Uniform Traffic Control       Ves       Obtained         Plannable Baser-Valors (-than 17,8)       Folderal or Texas Manual on Uniform Traffic Control       Ves       Obtained       Ves       Obtained         Plannable Baser-Valors (-than 17,8)       Folderal or Texas Manual on Uniform (-the 19,7%)       Ves       Obtained       Ves       Obtained       Pressure/Chemical Pice Opening: Is a Permit Required?       Ves       Obtained       Pressure/Chemical Pice Opening: Is			ping								
Humat Static, Level: D. C. B. A         Gin Poles         Color Coded Inspection Schemes for Rigging, Equip., Electrical Cords & To Annotate Condition, Electrical Cords & To           Sately Glasses, Gogles, Face Shield         Hoids         Folderal or Texas Manual on Uniform Traffic Control           Sately Vest: Class 1, 2, 3         Other:         Permit Systems:         Point           Organ Erichnen († Fina 18.7%)         Other:         Permit Systems:         Other           Parmatic Glasses/Woors († han 19.7%)         Electrical Work: Is a Permit Required?         Yes         Otained           Parmatic Glasses/Woors († han 10%)         Electrical Work: Is a Permit Required?         Yes         Otained           Planmatic Glasses/Woors († han 10%)         Electrical Work: Is a Permit Required?         Yes         Otained           Planmatic Glasses/Woors († han 10%)         Electrical Work: Is a Permit Required?         Yes         Otained           Traic Staces of Woors († han FL)         Files Should Mork: Is a Permit Required?         Yes         Otained           Laser Safely:         Electrical Work: Is a Permit Required?         Yes         Otained           Laser Safely:         Electrical Work: Is a Permit Required?         Yes         Otained           Laser Safely:         Electrical Work: Is a Permit Required?         Yes         Otained           Areage Monthining											
Satety Giasses, Goggies, Face Shield         Hoids         Annotate Colors, Items, & Frequency,           Air Monitoring:         Dother:         Federal or Texas Manual on Uniform Traffic Control           Air Monitoring:         Dother:         Federal or Texas Manual on Uniform Traffic Control           Drugo Delicinony (chan 19.%)         Contined Spaces: Is a Permit Required?         Ves           Orugon Delicinony (chan 19.%)         Exercised Vacors (brance Required?         Ves           Planmable Gasse/Vacors (- han 10% of LEL)         Fire, Smoke, Heat Atams Deachadron: Are Permits Required?         Ves           I Anton Combustible Dut (- han LFL)         WeidrightAbbring: Is a Permit Required?         Ves         Obtained           I and Statey Vacors (- han ELL)         Pressure/Demicial Poe Opening: Is a Permit Required?         Ves         Obtained           Laser Statey:         Areas micro Required?         Ves         Obtained         Egress/Exaction Charles Attend Is a Permit Required?         Ves         Obtained           Respirator:         APR Monitoring:         Is Area Micro Required?         Ves         Obtained           Respirator:         Half-Facoe         No Alam: Toxico, Nes or Nonke, Head Detector and Sprinker, Fire Watch Required         No Alam: Toxico, Head Detector and Sprinker, Fire Match Required				ault Protection							
Safety Vest: Class 1, 2, 3       □ Other:       □ Federal or Toxas Manual on Uniform Traffic Control         ↓ If Minitoring:       □ Other:       □ Permit Systems:       □ Permit Required?       ↓ Yes       Obtained         □ Organo Existences (Fature 15%)       □ Confined Sposes: Is a Permit Required?       ↓ Yes       Obtained         □ Organo Existences (Fature 15%)       □ Existences (Fature 15%)       □ Existences (Fature 15%)       Obtained         □ Permit Regulared?       ↓ Yes       Obtained       □       Obtained       □         □ Permit Regulared?       ↓ Yes       Obtained       □       Obtained       □       □       Obtained       □											
Ar Monttoring:     Are Monttoring:     Area Monttoring:     Mont											
☐ Ongen Daticiency (< than 19.5%)											
Origon Enclorment (> hand 25%)         Exected Work: Is a Permet, Alaga, or Charmone Required () ' Here Otelained           Filamante Gassave Valora (> han 10% of EL)         File: Smole, Heat Atems Deschuellor: Are Permet Required () ' Here         Obtained           I docting Heat Marking: Is a Permet Required () ' Here         Obtained ()         Obtained ()           I docting Heat Marking: Is a Permet Required () ' Here         Obtained ()         Obtained ()           I docting Heat Marking: Is a Permet Required () ' Here         Obtained ()         Obtained ()           Laker Safety         Egress Evolution Roots Atends Is a Permet Required () ' Here         Obtained ()           \Laker Safety         Egress Evolution Roots Atends Is a Permet Required () ' Here         Obtained ()           \Laker Safety         Egress Evolution Roots Atends Is a Permet Required () ' Here         Obtained ()           \Laker Safety         Egress Evolution Roots Atends Is a Permet Required () ' Here         Obtained ()           \Laker Safety         Egress Evolution Roots Atends Is a Permet Required () '											
Firmsthe Gases/Vapore (r bina 10% of (EL)     Arborne Combustible Duti (r bina 10% of (EL)     Arborne Combustible Duti (r bina 1CH)     WeidryHt&Burnity: Is a Permit Required? Urse Obtained     Toric Gases of Vapore (r bina 1CH)     WeidryHt&Burnity: Is a Permit Required? Urse Obtained     Lares Stately:     Arborne Combustible Duti (r bina 1CH)     PressureChamical Pergeophing: Is a Permit Required? Urse Obtained     Lares Stately:     Arborne Combustible Duti (r bina 1CH)     Berginator:     Arborne Combustible Duti (r bina 1CH)     PressureChamical Pergeophing: Is a Permit Required? Urse Obtained     Lares Stately:     Arborne Combustible Duti (r bina 1CH)     Arborne Combustible Duti	Oxygen Enrichment (> than 23.5%) Flammable Gases/Vapors (> than 10% of LEL)										
□ Arbone Combutible Dati (- han ER)         Welding-HotBurning: Is a Permit Required? □ Yes         Obtained           □ Tonic Gases or Vipcos (- han PEL)         Pressure/Demicial Pec Opening: Is a Permit Required? □ Yes         Obtained           □ Laser Safety:         Egrees Envasion Roots Alenot: Is a Permit Required? □ Yes         Obtained           ∴ XRay Montholing:         □ Arbine Tipe Alenoting:         □ Arbine Tipe Alenoting:         □ Arbine Tipe Alenoting:           □ Arbine Tipe Alenoting:         □ Arbine Tipe Alenoting:         □ Arbine Tipe Alenoting:         □ Arbine Tipe Alenoting:         □ Arbine Tipe Alenoting:           □ Arbine Tipe Alenoting:         □ Arbine Alenoting:         □ Arbine Tipe Alenoting:											
Veol Synchrobining: a servini mequited? If its      Veol Synchrobining: a servini mequited? If its      Veol Synchrobining: a servini mequited? If its      Veol Synchrobining:      Pespirator:      Area Monitoring:     Pespirator:      APP [     Supplied Air:     Hati-Face     Veol Synchrobining:     Mathematical Synchrobining:     Media Synchrobining:     Media Synchrobining:     Media Synchrobining:     Mathematical Synchoining:     Ma											
Laser Stellyr     Tesseuccentral rep Cpaning: is a remin required regime re											
X-Ray Monitoring:         Egress Evacuation Routes Attends is a Permit Required 1 yes         Obtained           Respirator:         APR         Supplied Air:         Area Fire Alarm Disable, Area Sprinkler Disable         Ves         Obtained           Half-Faco         Half-Faco         Smoke to Heat Detect, Smoke or Heat Disable         Smoke or Heat Disable					Pressure/Chemical Pipe Opening: Is a Permit Required? Yes Obtained						
Respirator:      APR _ Supplied Air:     Area = ire Alam Disable, Area Sprinker Disable     And Alam, Disable, Head Detector and Sprinker, File Watch Required     Hati-Face     And Alam, Disable     Smoke to Head Detect, Smoke or Head Disable					Egress Evacua	tion Routes	Altered: Is a Perm	it Required?	Yes	Obtained 🗖	
Hespirator: \_APH \_Suppleo Ar: \_No Alarm, Smoke, Heat Detector and Sprinkle; Fire Watch Required Hall-Face \_Smoke to Heat Detect, \_Smoke or Heat Disable											
Hain-Face Full-Face											
Note Any Other Hazards or Safety Controls Here:	Han-hace Full-Face										
	Note Any Other Hazards or Safety Co	ntrols H	lere:								

Rev: 2, 02/02/10

#### Job Site Review

Risk analysis. Barriers. Delays.



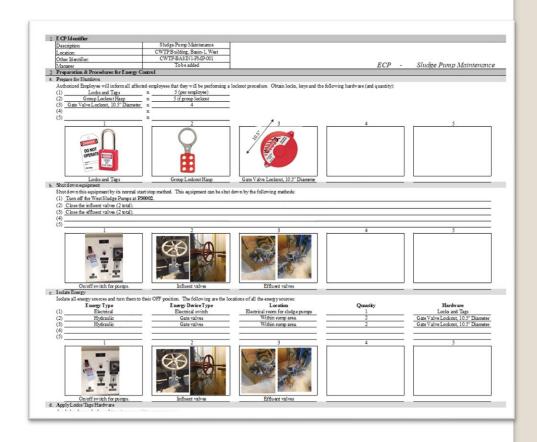
#### Post Job Review

- Feedback.
- Lessons learned.
- Incorporation of human performance tools.



## • Procedure use & adherence

- Step by step procedure read.
- Such as:
  - Production SOP.
  - Energy control procedure.

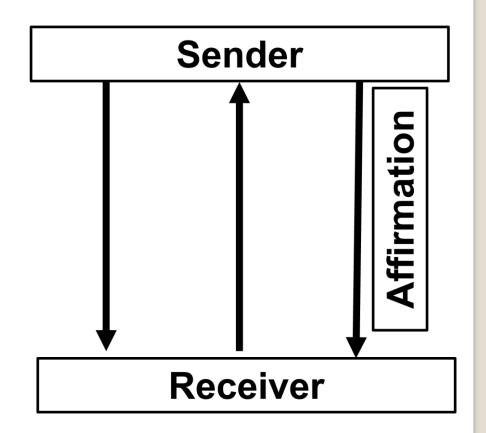


- Self check with verbalization
  - Verbalize intent before, during, and after task.

# Stop Think -Act Review

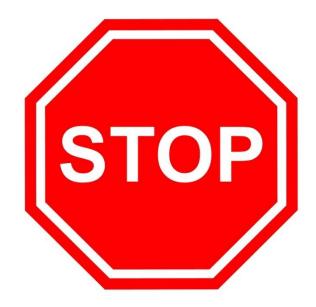
#### • 3-Way Communication

- Directives are repeated by receiver back to sender.
- Receiver is acknowledged by sender.



#### $\cdot$ Stop when unsure

• Maintain a questioning attitude.



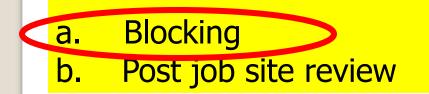
#### Flagging & Blocking

- Prevent access to equipment.
- Marker or label.



## Let's Role Play Again!

#### This is:

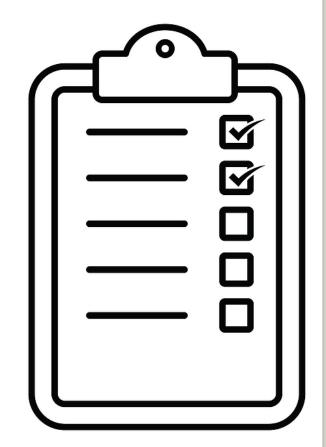






"I need to obtain my checklist to see what PPE and safety procedures are necessary for transporting this chemical"

### a. Pre-Job Briefina b. Flagging & Blocking





"I will review the arc flash label in order to determine consequence levels for a risk assessment"







#### Arc Flash and Shock Hazards Appropriate PPE Required

**REVIEW SAFE WORK PRACTICES PRIOR TO WORK** 8 Arc Flash Protection Boundary 3 ft Incident Energy @ Working Distance 1ft, 6 in Cal/cm<sup>2</sup> Recommended (minimum) PPE Protective clothing, Nonmelting (ASTM F 1506) or Untreated Fiber (e.g. untreated cotton), Long sleeve shirt and long pants or coverall, Safety glasses/goggles, Hearing protection, Heavy-duty leather gloves or Rubber insulating gloves w/ Leather protectors, Face shield (as needed) 480 VAC Shock Hazard Glove Class 00 3 ft 6 in Limited Approach 1ft **Restricted Approach** ocation: LINE 15 EXT

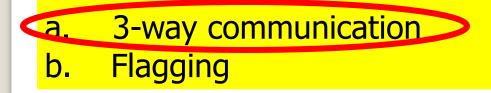
"I am at Panel 12 Bravo (12B)."

- "I will close circuit breaker 4 Bravo (4B)
- a. 3-way communicationb. Self check with Verbalization

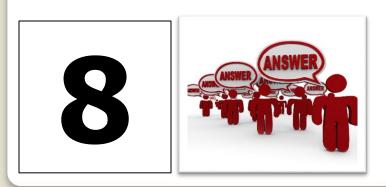




8A-"Close Disconnect 4 Bravo"8B-"I understand, closedisconnect 4 Bravo"8A-"That is correct"







#### "I think"

- "I am pretty sure"
- a. 3-way communicationb. Stop when unsure





"I have obtained my locks and tags and will locate energy sources per procedure"

a. Job Site Reviewb. Procedure use & adherence





"After performance of overhead crane operations, danger tape would be a better awareness barrier to keep people outside of operation areas"

a. Job Site Reviewb. Post job site review





## "To error is human; to forgive, divine."\*

#### \*18<sup>th</sup> Century Poet: Alexander Pope



#### Summary

#### **Error Precursors**

- Task Demands
- Work Environment
- Individual Capabilities
- Human Nature

#### **Human Performance Tools**

- Pre-Job Briefing
- Job Site Review
- Post Job Review
- Procedure Use & Adherence
- Self Check with Verbalization
- 3-Way Communication
- Stop When Unsure
- Flagging & Blocking