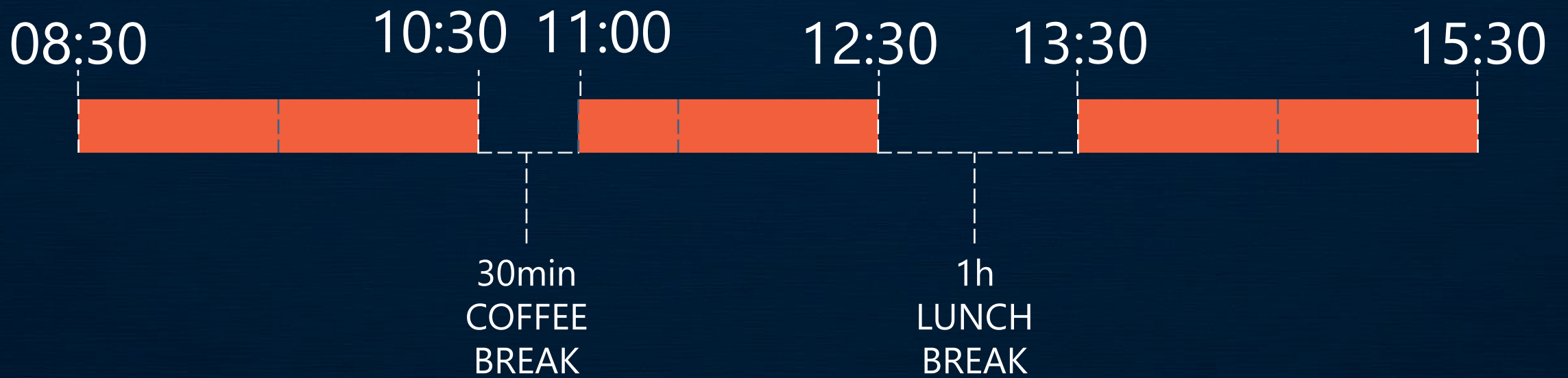


Empowering Frontline Staff to Take the Lead

(Real Process Safety Culture)

William G. Bridges
Dave A. Moore

SCHEDULE



WORKSHOP GROUND RULES



PARTICIPANTS INTRODUCTION

Name: _____

Role in your company: _____

Years of experience: _____

William Bridges

Process Improvement Institute – President & CEO

STUDIES

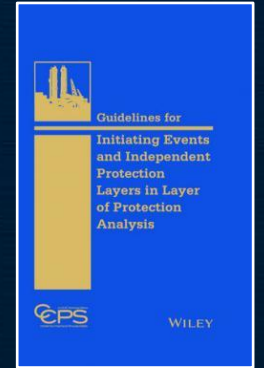
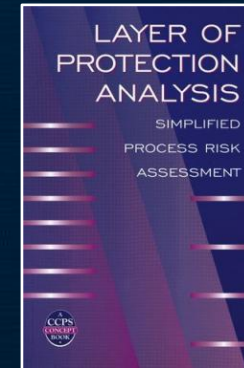
- BS & MS Chemical Engineering
- Co-invented LOPA
- Certified functional safety professional
- Process safety expert
- Human factors expert
- 10 Patents

EXPERIENCE

44 years – *Operator thru Executive*
13 years in plant, 2 as Operator
+250 Unit PHAs
+8000 PHAs managed
+1000 LOPAs
+1000 SIL Verification/Assessments
+3500 trained PHA/LOPA leaders
+100 major accident investigations led
+2000 plant-level workers trained in Human Factors

PUBLICATIONS

Main author of



and 5 other CCPS guideline books – contributing author
+50 Papers presented

David Moore

AcuTech Group, Inc. – President & CEO

STUDIES

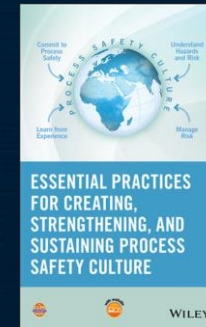
- BS Fire Protection Engineering & MBA
- Professional Engineer
- Process Safety Expert
- Certified Safety Professional
- CCPS Fellow

EXPERIENCE

- +43 years – Oil, Gas, LNG and Chemical Industry Process Safety Engineer
- NFPA – Fire Research Engineer
- Mobil Loss Prevention Engineer - Supported ARAMCO and SABIC (YANPET) for capital project loss prevention, technical service and training 1982-85
- President & CEO of AcuTech Group (29 years of process safety consulting)

PUBLICATIONS

Main author of CCPS Guidelines on PS Culture



and 7 other CCPS guideline books
> 100 Papers presented

Workshop Agenda

- Definitions
- Examples of Poor and Good PS Culture
 - *Business Case for empowering frontline staff)*
- Overview of Process Safety and RBPS
- Overview of human factors
- List of activities for frontline staff to lead
 - *Steps to achieve this empowerment*
- Path forward

DEFINITIONS

- Who are **FRONTLINE STAFF**?
- What does **EMPOWERING FRONTLINE STAFF** Mean?
- How is **EMPOWERING FRONTLINE STAFF** related to Process Safety Culture?

The safety culture perspective does not replace the system perspective, it augments it... the right culture is necessary to make safety systems work

Andrew Hopkins

BUT REALLY THE REVERSE IS TRUE:

Building/maintaining good PS systems results in the right PS culture, which is then robust enough to survive long term to keep PS implementation from faltering, even in the face of change of management

William Bridges

PII GENERAL DEFINITION FOR SAFETY CULTURE

Safety Culture is not what we feel; it is what we as an organization do. The site leaders (management) create the culture by what they do and what they pay attention to. The repetition by leadership of doing the right thing and making the right decision, including investment in the right engineering & hardware, establishes the culture at a site.

The Key to strong PS culture is **EMPOWERMENT of Frontline Staff**

Examples of **Poor** PS Culture

(conclusions from US gov entities)



2005 – BP Texas city, TX, USA

“

Deficiencies in BP's corporate safety **culture**, corporate oversight of process safety, and PSM systems were contributing factors to this and other incidents

”



2010 – Tesoro, Anacortes, WA, USA

“

The refinery process safety **culture** required proof of danger rather than proof of effective safety implementation.

”

CSB Report



2014 – Tesoro, Martinez, CA, USA

“ A weak process safety **culture** created conditions conducive to recurrence of sulfuric acid incidents that caused worker injuries over several years

”
CSB Report



2015 – Chevron, Richmond, CA, USA

“

Weaknesses in the Chevron Richmond Refinery safety **culture** contributed to the August 6, 2012 pipe rupture

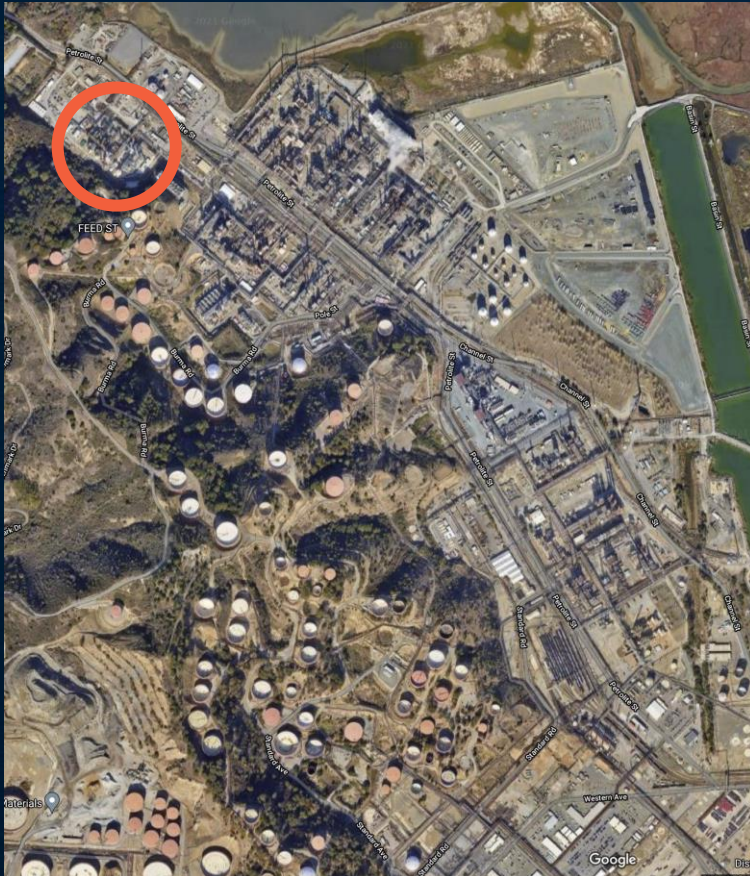
”

CSB Report

Examples of **Good** PS Culture

- *SRU of Chevron Richmond Refinery*
- *BP Cherry Point Refinery*
- *KEMYA (a SABIC affiliate)*

CHEVRON RICHMOND REFINERY – SRU



*Sulphur Recovery Unit
(1 of 38 Units)*

Company engineering & PS standards	Good
Use of verbal communication rules	Excellent
Procedures accuracy	100%
Procedures formatting	Excellent
Trouble-shooting Guides	Excellent
Frequent drills on responses to deviations	Excellent
Procedures authors	Workers
PS Activities leaders	Workers
Superintendent Leadership	Excellent
Overall HF and PS Implementation	EXCELLENT

BP Refinery, CHERRY POINT, WA, USA

BP buys ARCO Refineries in early 1999, including Cherry Point (CP)
~800 direct hire; operating since 1971

CP was great at PSM and PS Culture before buyout

Refinery and department managers refuse to compromise on budgets for maintaining IPLs



This culture has survived because the staff and workers did not bend

Human factors (HF) training and coaching STRONG

Procedures authors Workers

PS Activities leaders

Lead MOC risk reviews

Close MOCs

Workers

Lead PSSR

Lead investigations

Lead most risk assessments

Workers rotating into PSM group

ALL

Overall HF and PS Implementation EXCELLENT

KEMYA (affiliate of SABIC & ExxonMobil), KSA

Kemya (Al-Jubail Petrochemical Company; SABIC affiliate, partnered 50/50 with Exxon)
Jubail, Saudi Arabia, est. 1980 (began ops 1985)

Competency building starts from day 1

Leadership today sustains the same vision as the past
No-one has come in and slashed the programs that sustain competencies and that maintain the equipment



A future leader will not convince the workers to follow anything but best practices

PS design complete; covers human factors

Complete

PS engineering developed from day one

Excellent

PS Competency

Excellent at all levels

Leadership in PS

Excellent for first 30 yrs

PS Competencies development

EXCELLENT

Overview of Process Safety

What is PSM?

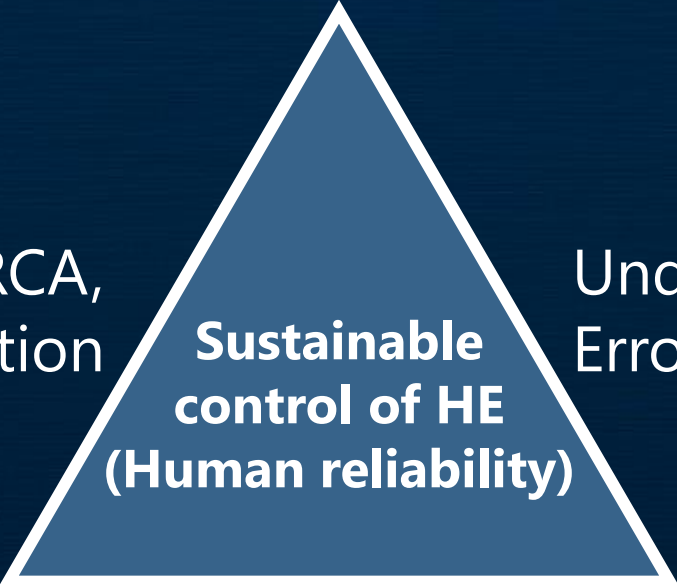
It is a systematic approach to hazard management that is focused on preventing catastrophic accidents due to highly hazardous chemicals

Why was it created?

Several catastrophic accidents in the 1980 in the chemical industry drew attention to the safety of processes involving highly hazardous chemicals

Controlling Risk

Near Miss Reporting, RCA,
Incident Investigation



Understand Risk & Human
Error (PHA, RCM, JSA)

Management systems to
control human error

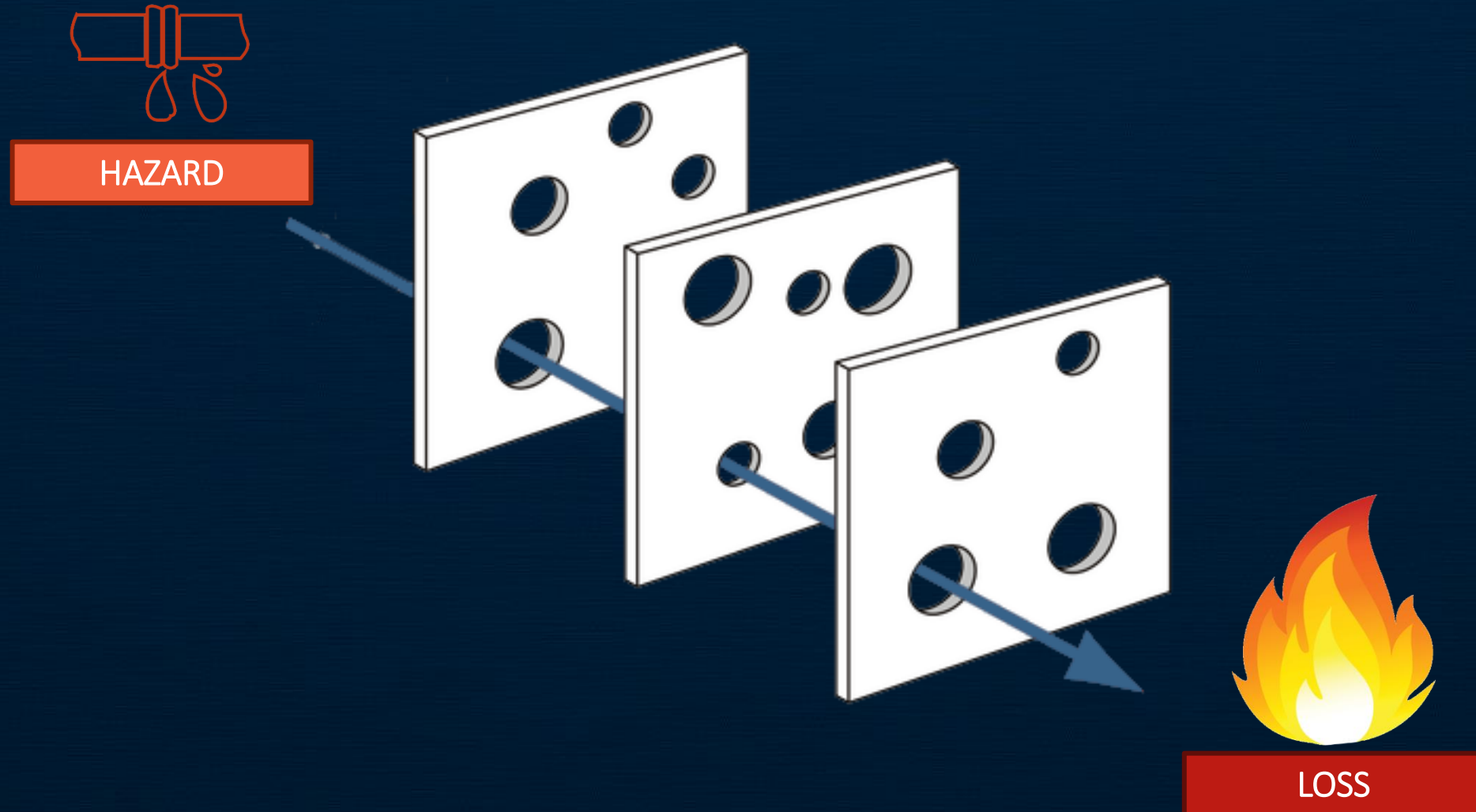
Management
level system

Design standards	Process safety management	Reliability systems	TQM & Production management	Traditional HSE	Behavior management
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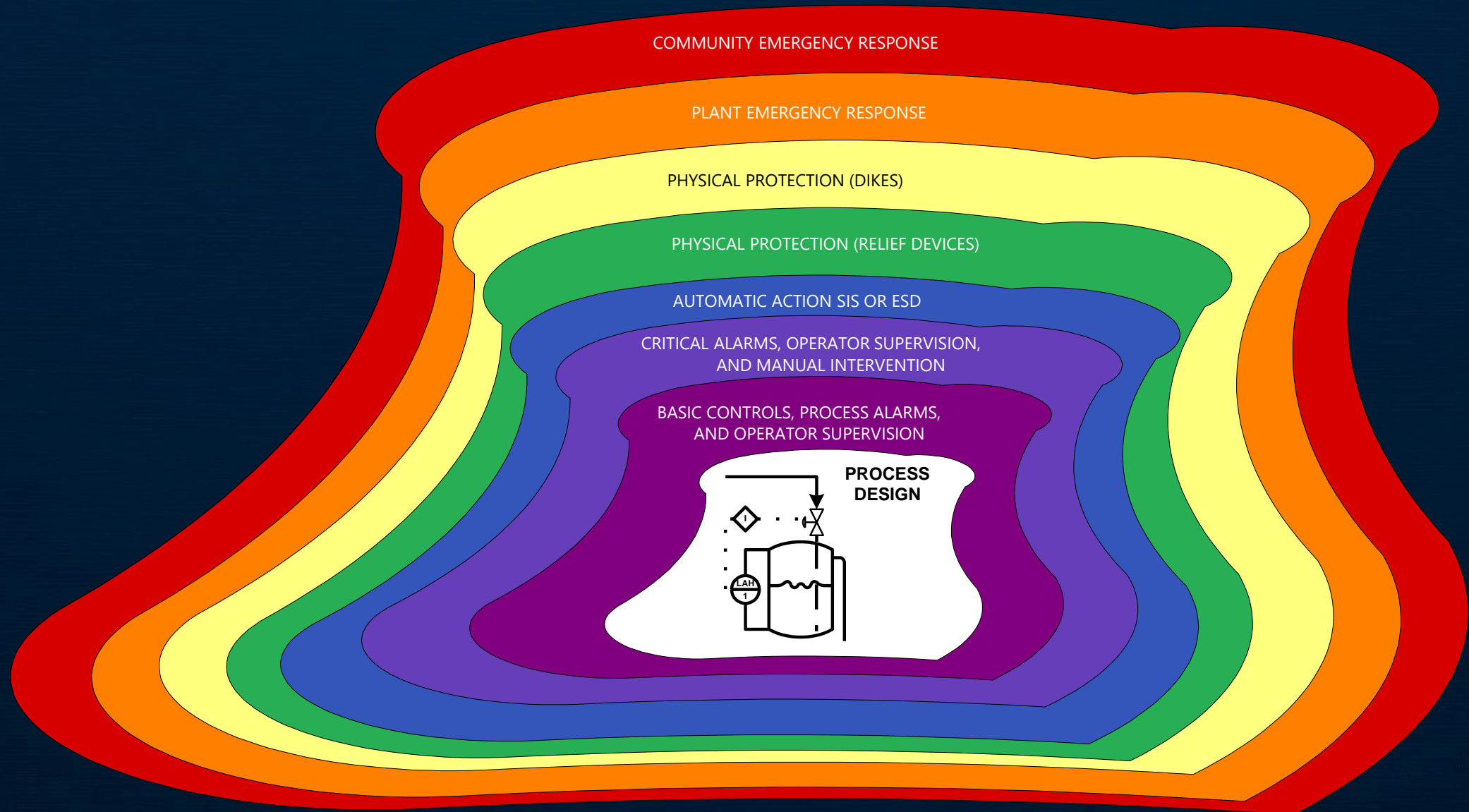
Implementation
level

Process/ System Design	Manage Changes & Analyze Risk	Procedures & Training	Proof Documents	Communication	Behavior/Habit Control	Problem Reporting and RCA
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SWISS CHEESE MODEL



LAYERS OF DEFENSE AGAINST A POSSIBLE ACCIDENT



Risk Based PSM Framework

Commit to Process Safety

- 1. Process Safety Culture *** (*titled Leadership & Accountability in Responsible Care®*)
2. Compliance with Standards
3. Process Safety Competency
- 4. Workforce Involvement ***
5. Stakeholder Outreach

Understand Hazards and Risk

6. Process Safety Information
7. Hazard Identification and Risk Analysis

Manage Risk

8. Operating Procedures
9. Safe Work Practices
- 10. Asset Integrity and Reliability**
11. Contractor Management
12. Training and Performance Assurance
13. Management of Change
14. Operational Readiness
- 15. Conduct of Operations**
16. Emergency Management

Learn from Experience

- 17. Incident Investigation**
18. Measurement and Metrics
19. Auditing
20. Management Review & Continuous Improvement

**PII Guide – Excellent PS
Culture thru Frontline Staff
Empowerment**

Excellent PS
Implementation



TIME



Excellent PS
Culture



**MORE
TIME**



Sustainably
Excellent PS
Implementation



PROCESS IMPROVEMENT INSTITUTE

Risk and Reliability Specialists

*Even in the face of
Poor PS leadership in the
future*

Best Practices for Achieving Process Safety Culture

1.

Ensure this PS Culture Element **focuses on PS Leadership and Accountability**, as these have tangible activities

2.

Invest in the staff, activities, and hard assets needed to control process safety

3.

Ensure only experts in a PS discipline make the decisions for that discipline

4.

Empower and equip hourly workers to drive most of the PS activities:

- **Write work instructions & lead drills on trouble-shooting**
- **Manage verbal communication**
- **Identify Human Factor issues**
- **Find problems while small**
- **Lead RCAs**

5.

Do not allow management to over-ride recommendations from risk assessments (PHAs, MOC risk reviews) or investigations

6.

Ensure the major PS gaps are avoided:

- *PHA of ALL modes of operation*
- *Very high Near Miss Reporting*
- *RCA do not place blame on individuals*
- *Procedures are +95% accurate*

ONE KEY

An organization with strong process safety culture understands it must focus on human factors:

- Human error can be minimized with strong controls of each Human Factor
- Elimination of Human error is not possible so features in the design (other protection layers) will be necessary to compensate for the errors that will occur

Overview of Human Error Prevention

1 99% of accidental losses
begin with a human error*
(except for natural disasters)

2 Root causes of accidents are
management system weaknesses

(Center for Chemical Process Safety, American Institute for Chemical Engineers, "Guidelines for Investigating Chemical Process Incidents", 2003) – OSHA agrees

3 Weak management system
**lead to poor Human Factors, which lead to
Errors & Failures, which lead to Accidents**

Human Error limits

ERROR PROBABILITY FOR RULE-BASED (E.G., INITIATING) ACTIONS

1/100 - process industry; routine tasks performed 1/week to 1/year
This rate assumes excellent control of all human factors

1/200 - pilots in the airline industry; routine tasks performed multiple times a day with excellent control of human factors

1/1000 - for a reflex (hard-wired) action, such as a minor corrective action while driving a car; normally achieved when action is once or multiple times each day

HIGHEST LIMIT OBSERVED DURING ACCIDENTS

1/5 - Highly fatigued work crews or other grossly poor human factor
Like BP Texas City accident

Human Error limits

RESPONSE ACTIONS (TIME DRIVEN) WITHIN THE TIME NECESSARY

1 - 1/10 - if practiced/drilled once per year and there is not sufficient time to accomplish the response task

1/10 - if practiced/drilled once per year and if there is always sufficient time to accomplish the response task

1/100 - if practiced/drilled once per week and there is sufficient time to accomplish response task

HIGHEST LIMIT (TIME DRIVEN OR NOT) WITHIN THE TIME NECESSARY

1/5 - Highly fatigued work crews or other grossly poor human factor

Human Error limits

COUPLED ERROR RATES: THE PROBABILITY OF REPEATING AN ERROR




1/20 - 1/90 - if the same tasks are separated by 3 days but performed by same person, or if a different person does the second and third task, assuming mistake is made on the first task

1/2 - if same two tasks performed back-to-back, by same person, and if a mistake is made on the first task of the two

9/10 - if same two tasks performed back-to-back, by same person, and if strong visual cue is present, and if a mistake is made on the first two steps of the three

Key application: *Maintenance tasks*

Summary of Human Factors

Human Factor Category	Human Factor Issue/Level	Multiplier for Cognitive & Diagnosis Errors
Available Time (includes staffing Issues)	Inadequate time Barely enough time ($\approx 2/3$ x nominal) Nominal time Extra time (at least 2x nominal and > 20 min) → Lots of time (> 4 x nominal and > 20 min)	100% error 10 1 0.1 → 0.01
Stress/Stressors (includes staffing issues)	Extreme (threat stress) High (time pressures such as during a maintenance outage; issues at home, etc.) Normal	5 2 1
Complexity & Task Design	Highly complex Moderately complex (requires more than one staff) Nominal → Obvious diagnosis	5 2 1 → 0.2
Experience/ Training	Low Nominal → High	10 1 → 0.5
Procedures 	Not available in the field as a reference but should be. Or, available but < 75% accurate (<i>industry avg</i>) Incomplete; missing this task or these steps. Or less than 85% accurate Available & > 90% accurate, but does not follow formal rules Good, 95% accurate, follows > 90% of format rules OR Diagnostic / symptom oriented	10 to 20 8 3 1
Human-Machine Interface (includes tools)	Missing/Misleading (violates populational stereotype; e.g, round valve handle facing away from worker) Poor or hard to find the right device; in the head calc Some unclear labels or displays Good	20 10 2 1
Fitness for Duty 	Unfit (high fatigue level [>80 hr/wk or >20 hr/day, no day off in 7-day period; or illness, etc.]) Highly degraded fitness (high fatigue such as >15 hr/day, illness, injury, etc.). Or >60 hr/wk Degraded Fitness (>12 hr/day and > 50 hr/wk) Slight fatigue (>8 hr/day; <i>normal for process industry</i>) Nominal	20 10 5 2 1
Work Processes & Supervision	Poor Nominal Good	2 1 0.8
Work Environment	Extreme Good	5 1
Communication 	No communication or system interference/damage No standard for verbal communication rules (<i>normal value for process industry</i>) Well implemented and practiced standard	10 3 1

Empowering Frontline Staff

(key assignments)

EMPOWERING FRONTLINE STAFF for KEY PS Activities

Empower and equip hourly workers to drive most of the PS activities

- *Lead Incident Investigations & RCAs*
- *Write work instructions & lead drills on trouble-shooting guides*
- *Manage verbal communication*
- *Identify Human Factor issues*
- *Find problems while small*
- *Use Stop Work Authority*

**EMPOWER FRONTLINE STAFF TO
LEAD INCIDENT INVESTIGATIONS
& ROOT CAUSE ANALYSIS**

Teach Frontline Staff Proper Incident Investigation Analysis Methods (target 20% of operators & maintenance craft-persons)

- 1 Gather data to answer questions about who, what, when, where, how, and why
- 2 Use the causal factor charting method to ensure that all **Causal Factors** are identified
- 3 Use the **Root Cause Chart** to identify and characterize all root causes of each causal factor

Causal Factor Charting Method

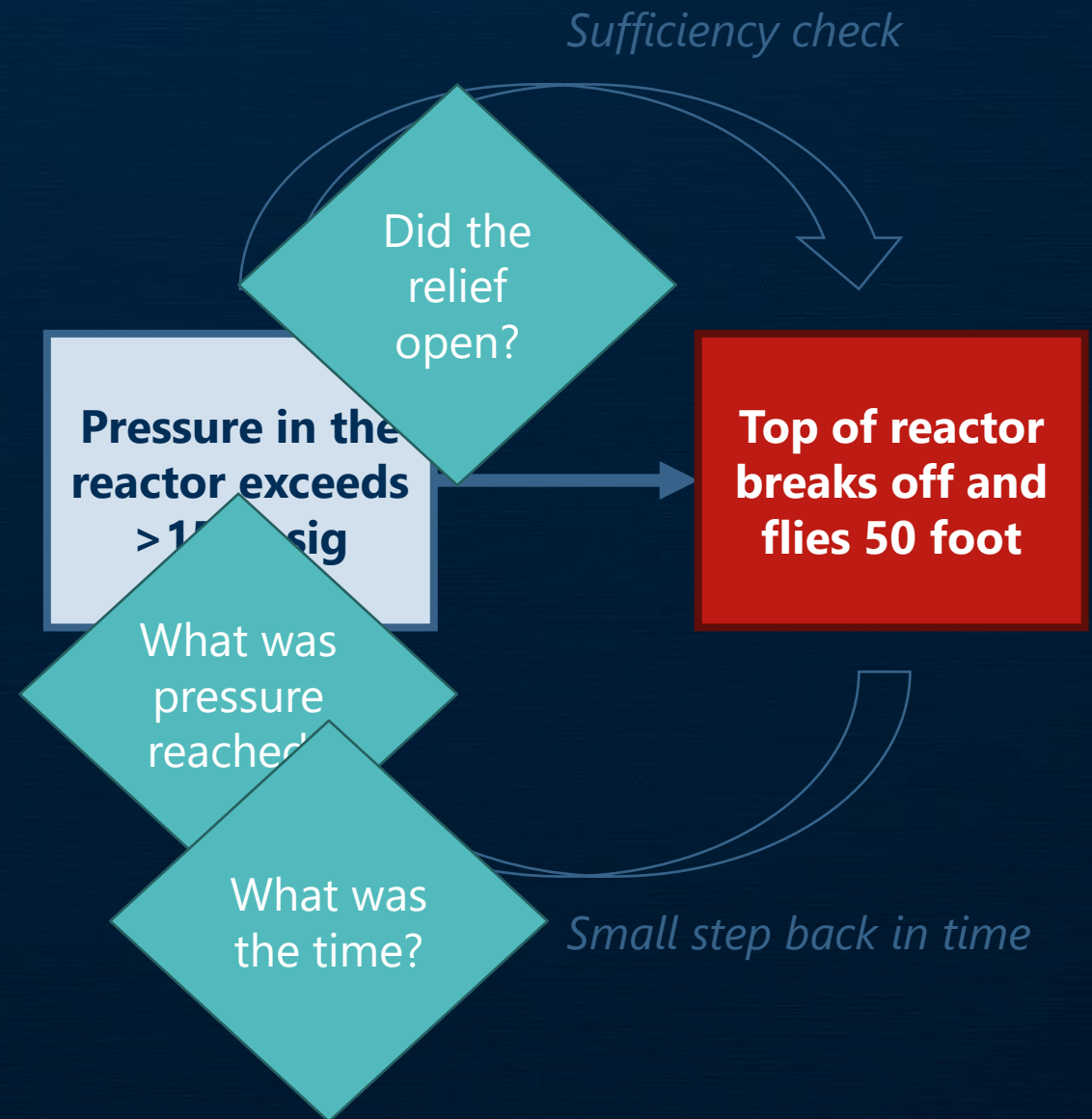
Define the outcomes (all and fully)

Step backwards in time to what occurred immediately before

Test forward to see if you have missed anything

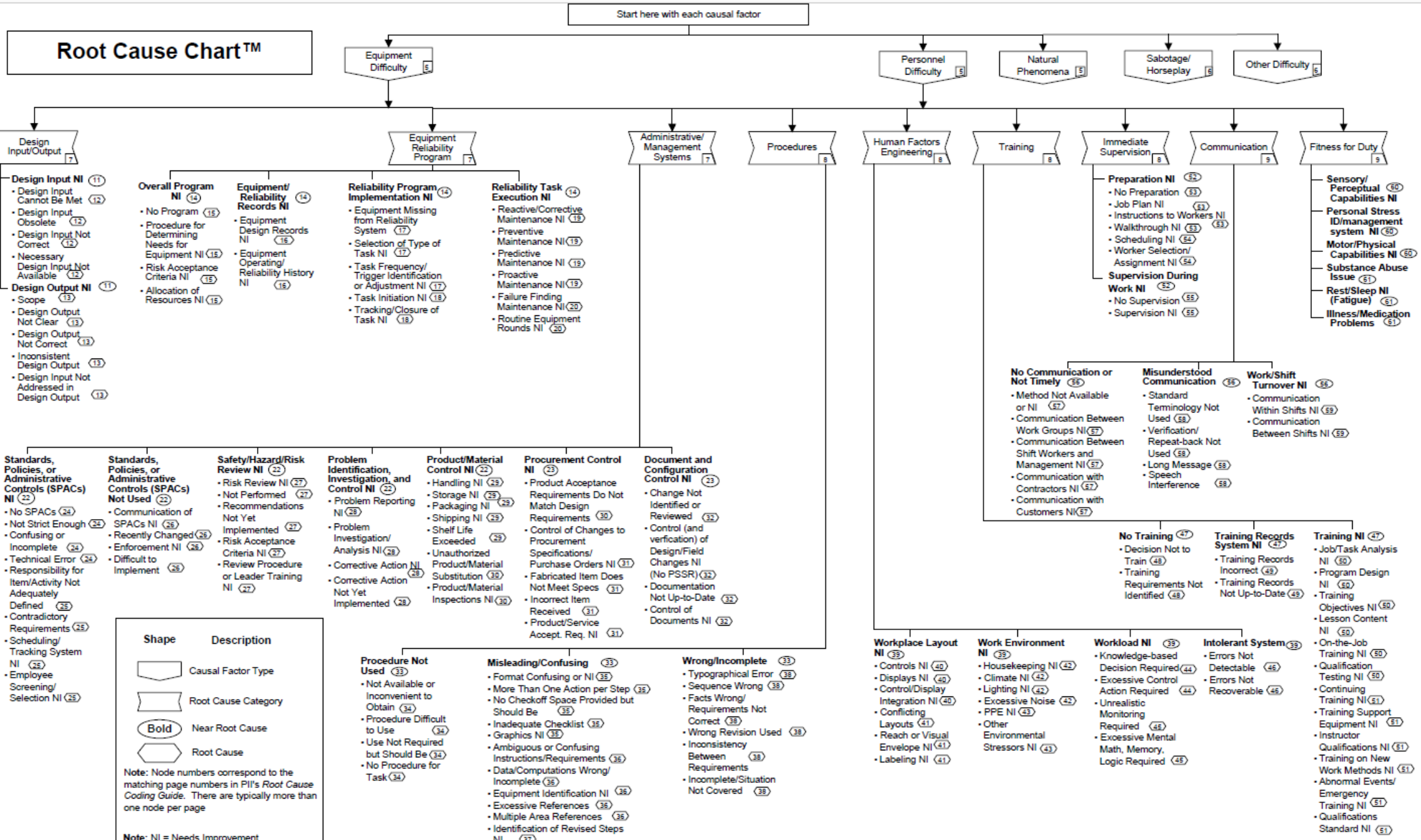
List questions you have to check for issues you missed

Repeat back-step, checking forward, developing new questions



5 Whys Technique *(best if coupled with Root Cause Chart)*

- Select one causal factor – not the entire incident
- Ask why this event occurred
- Get answer(s) to this question
- For each of these answers, ask why they occurred
- Get answers to these questions, and repeat until you reach management system failures (**root causes**)



Shape	Description
	Causal Factor Type
	Root Cause Category
	Near Root Cause
	Root Cause

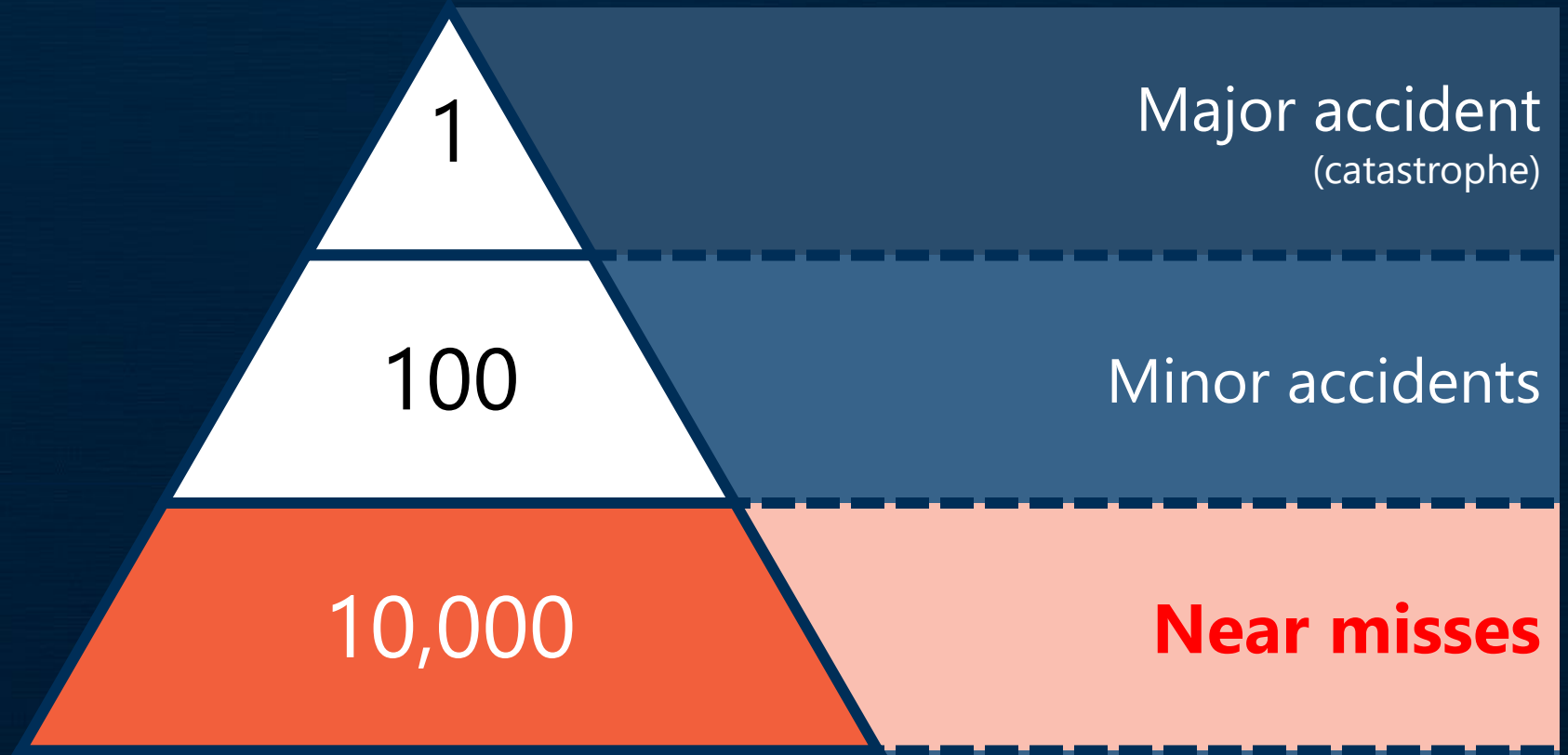
Note: Node numbers correspond to the matching page numbers in PII's Root Cause Coding Guide. There are typically more than one node per page

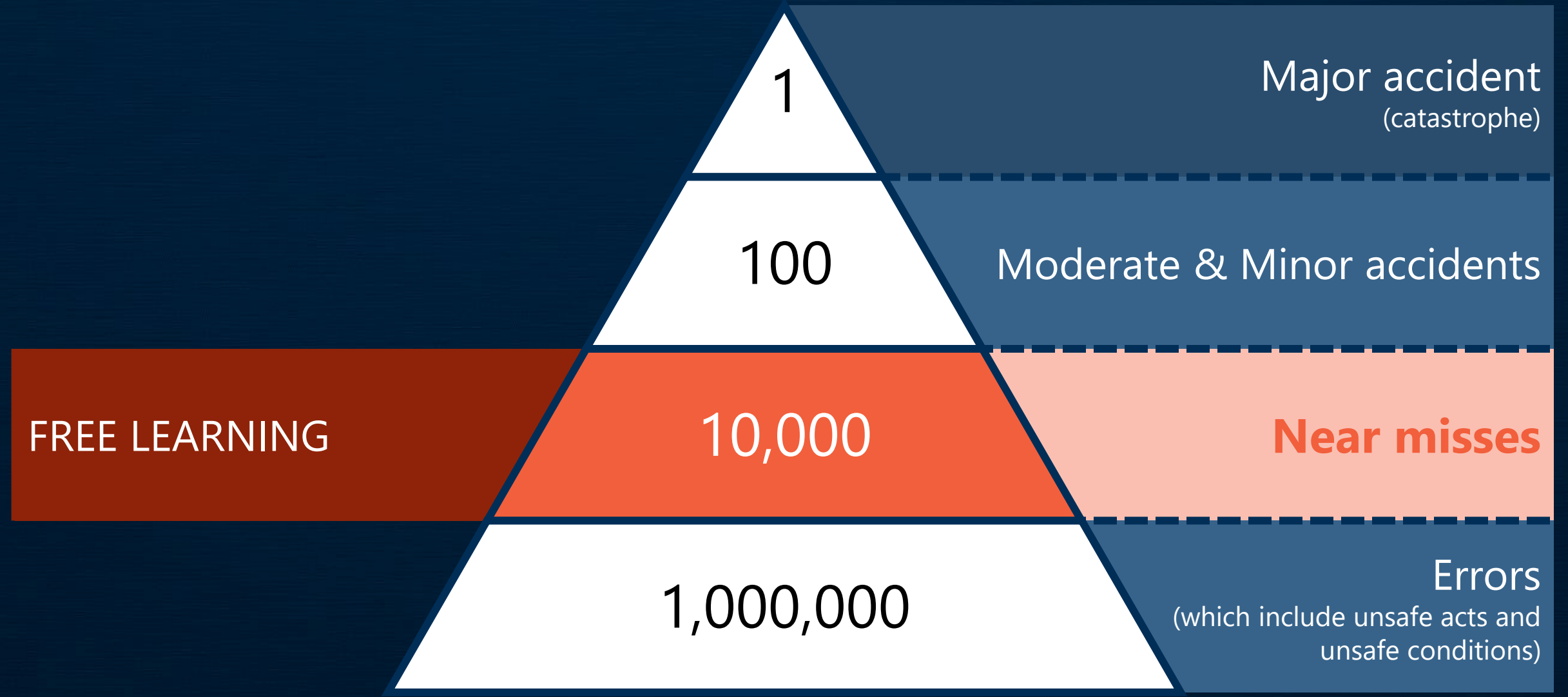
Note: NI = Needs Improvement

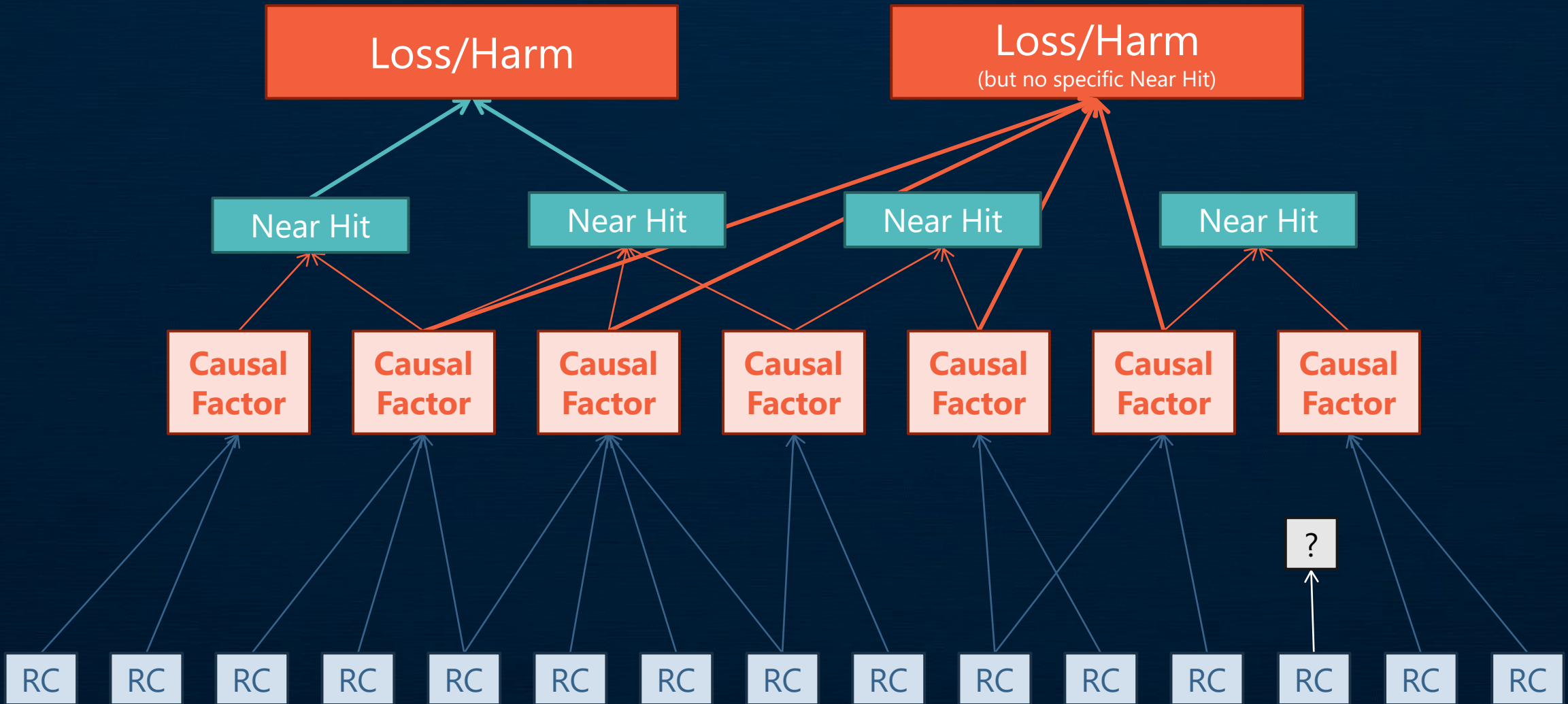


Major accident
(catastrophe)









Reason Near Misses are Not Reported

Fear of punishment (or even just fear of blame)

Embarrassment

Lack of management commitment or follow-thru

Apparently high level of effort required

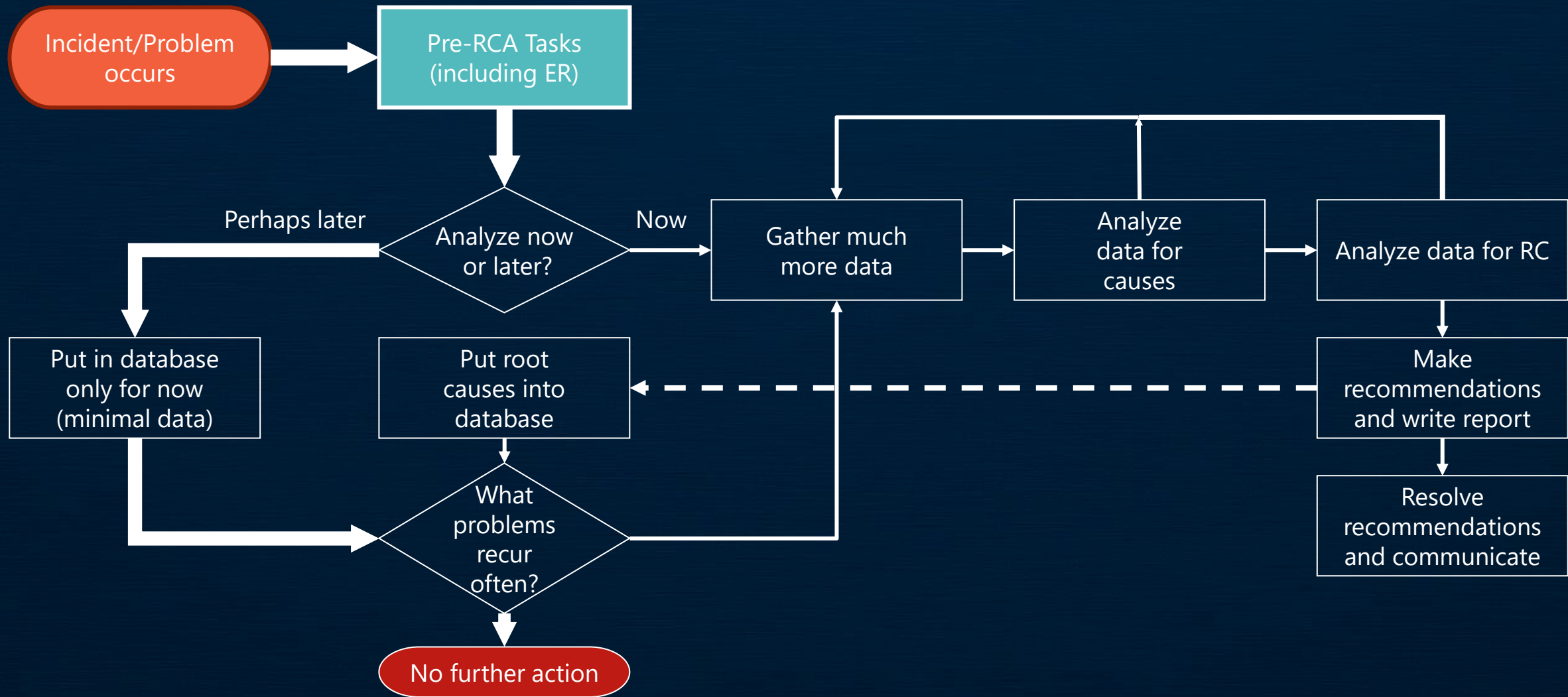
No Way to investigate thousands of near misses per year

Not knowing what is a near miss

Will hurt department's performance appraisal

Not knowing which reporting system to use (or main system is difficult to use)

Company discourages near-miss reporting



ENHANCING ROOT CAUSE ANALYSIS SYSTEM by

- 1 Ensure operators / specialists and maintenance staff are capable of leading investigations for incidents (and near misses) and finding valid root causes
 - *15-20% of staff, with 2 per shift*
 - *Target completion within 1 hour on shift*

OBTAIN 50 NEAR MISS REPORTS PER FRONTLINE STAFF, PER YEAR

- 1 Clarify and address all remaining barriers to near miss reporting
- 2 Equip staff to work on these highest priority issues

EXERCISE: Identify Causes and Root Causes of an Accident

BAYER CROP SCIENCES WORKSHOP

1. Form groups of 3 - 5 people
2. Watch video re-enactment of the incident
3. As a group, complete the workshop handout



Workshop – Bayer CropScience (2009) Accident – Human Errors			
#	Cause	Human Factor or Management System Weakness	Ways to Compensate for or Reduce Human Error
1			
2			
3			

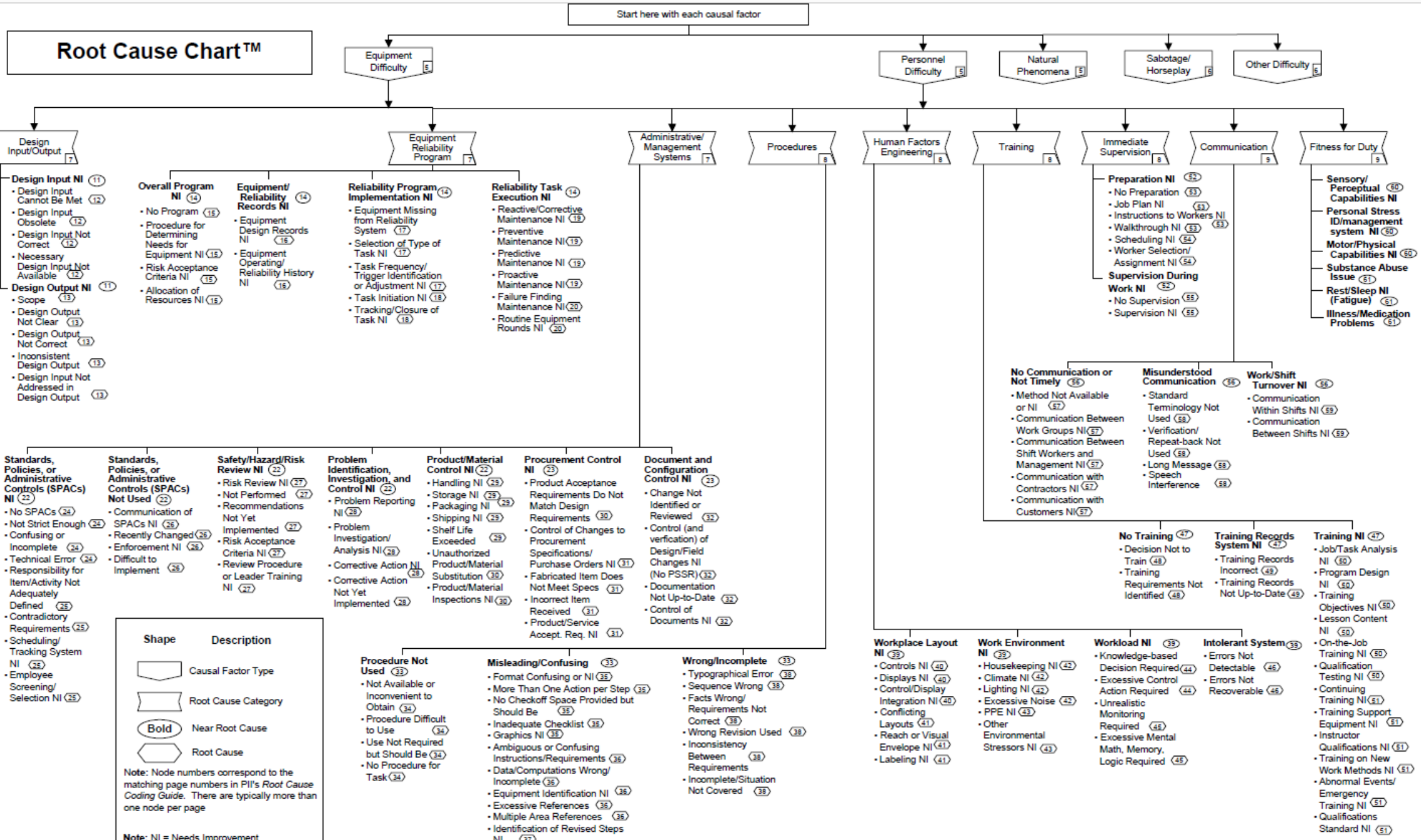
Identify the Causes that led to the incident

Key events or conditions that, if eliminated, would prevent a loss event or reduce its effects

Human error / Equipment failure / Safeguard failure

For each cause, identify the Human Factor or Management System Weakness

For each cause, identify ways to compensate for or reduce Human Error



Shape	Description
	Causal Factor Type
	Root Cause Category
	Near Root Cause
	Root Cause

Note: Node numbers correspond to the matching page numbers in PII's Root Cause Coding Guide. There are typically more than one node per page

Note: NI = Needs Improvement

AFTER LUNCH

REMINDER: EMPOWERING FRONTLINE STAFF for KEY PS Activities

Empower and equip
hourly workers to drive
most of the PS
activities

- *Lead Incident Investigations & RCAs*
- *Write work instructions & lead drills on trouble-shooting guides*
- *Manage verbal communication*
- *Identify Human Factor issues*
- *Find problems while small*
- *Use Stop Work Authority*

**EMPOWER FRONTLINE WORKERS
TO AUTHOR AND OWN
PROCEDURES**

Reasons Why Procedures are Not Used in Field

- **Procedures are Low accuracy**
- Procedures are out of date
- No procedure has been written for the task
- Users cannot find the procedure they want to use
- Users don't need a procedure because the task is simple
- Users need more information than the procedures contain
- Users see procedures as an affront (insult) to their skill
- **Procedures are difficult to use in the work environment**
- Procedures are difficult to understand, or too little / too much details (**not written by end users**)

Approach to Getting the Content Right


Draft – Have a User Write the First Draft of the set of Instructions




Validation – Have Another User Walk-down the First Draft in the Field; make Revised Draft



Verification – Have A Technical Expert (senior engineer, chemist, etc.) Walk-down the Revised Draft in the Field



Presentation Rules – If not already done, make sure the Revised Draft meets the Rules Presented on pages 3-37 and 3-38 of this course for format of the page and writing of steps. Issue Final Draft



Risk Review – Before Using the Final Procedure in Training and in Practice, Perform a Review to Determine and Control the Risk of *Performing a Step Wrong or Skipping a Step*. This is necessary even if the procedure is perfect because humans do not follow procedures perfectly

OPERATING MANUAL vs WORK INSTRUCTION

Unit Operations Manual

Process Overview	Process Chemistry	Safety & Health & Environment	Safety Systems & Functions	Operating Limits	List of Modes
<ul style="list-style-type: none"> Purpose of Unit Process Flow and Major Equipment 	<ul style="list-style-type: none"> Chemicals Reactions & rates 			<ul style="list-style-type: none"> Table of limits Link to trouble-shooting guides 	

Routine Modes of Operations

Abnormal Modes of Operations

Startup	Shutdown	Online Maintenance	Normal	Response to Critical Alarm	Temporary Operations	Emergency (emergency op and emergency SD)
<ul style="list-style-type: none"> Multiple WI for a complete unit SU WI specific to case (after maintenance, after power dip ...) 	<ul style="list-style-type: none"> Multiple WI for a complete unit SD WI specific to case 	<ul style="list-style-type: none"> WI specific to case of performing work while the unit operates References SWP 	<ul style="list-style-type: none"> Dailey tasks, rounds Target ranges for day/ week/ month Link to trouble-shooting guides 	<ul style="list-style-type: none"> Identified in PHA as necessary for risk target Trouble-shooting guide 	<ul style="list-style-type: none"> Control flow with a bypass valve, Time limit (with tracking of same) 	<ul style="list-style-type: none"> Case specific to keep operating in emergency state

Standard Operating Procedure Work Instruction

Work Instruction Name: Test Run of Lab Reactor (to validate new catalyst)

Step	Actions	Responsible
Preparations & Purge		
1	Make sure the reactor was cleaned at the end of the last test run.	Lab Tech
2	Open vent valve from reactor to roof.	Lab Tech
3	Open hydrogen valve to reactor at a rate of 0.5 l/hr.	Lab Tech
4	AFTER purging for 15 min, CLOSE hydrogen.	Lab Tech
CAUTION: If you do NOT close the valve, THEN the catalyst can be blown into the top portion of the reactor where it will not react, leading to poor yield and requiring a costly shutdown to clean out the reactor		
Add Isobutane		
5	OPEN the isobutane gate valve.	Lab Tech
6	OPEN the isobutane needle valve at the reactor and adjust the isobutene flow to 300 on the counter.	Lab Tech
7	WHEN totalizer count reaches 60, TURN ON the agitator	Lab Tech
8	SET temperature controller to automatic (to AUTO??)	Lab Tech

Work Instructions for EACH Task for that Mode (field document)

Work Instruction Name

Test Run of Lab Reactor D (to validate new catalyst)

Step	Actions	Responsible
Preparations & Purge		
1	Make sure the reactor was cleaned at the end of the last text run.	Lab Tech
2	Open vent valve from reactor to roof.	Lab Tech
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4	AFTER purging for 15 min, CLOSE hydrogen.	Lab Tech
	CAUTION: IF you do NOT close the valve, THEN the catalyst can be blown into the top portion of the reactor where it will not react, leading to poor yield and requiring a costly shutdown to clean out the reactor	

Add Isobutane		
5	OPEN the isobutane gate valve.	
6	OPEN the isobutane needle valve at the reactor and adjust to 300 on the counter.	
7	WHEN totalizer count reaches 60, TURN ON the agitator.	
8	SET temperature controller to automatic (to AUTO??).	
9	WHEN totalizer count reaches 120, CLOSE the isobutane needle valve.	
10	CLOSE the isobutane gate valve.	

Add Ethylene and Hydrogen (produce PE)

Work Instructions (which list the written steps for each action) are the focus of this course because this level controls HUMAN ERROR

Process Overview	Process Chemistry
<ul style="list-style-type: none"> Purpose of Unit Process Flow and Major Equipment 	<ul style="list-style-type: none"> Chemical Reactions Reaction Conditions

Routine Operations

Startup	Shutdown
<ul style="list-style-type: none"> Multiple WI for a complete unit SU WI specific to case (after maintenance, after power dip ...) 	<ul style="list-style-type: none"> Multiple WI for a complete unit SU WI specific to case (after maintenance, after power dip ...)

Operating Modes	List of Modes

Emergency Operations

Temporary Operations	Emergency (emergency op and emergency SD)
Flow with a valve, permit (with tracking)	<ul style="list-style-type: none"> Case specific to keep operating in emergency state

Code (field document)

Unloading Monomer from Tanker to Storage

STEPS	DETAILS
1. Wear standard PPE, plus rubber gloves and full-face organic respirator.	Standard PPE includes hard hat, safety glasses with side shields, and steel-toe shoes.
2. Weigh in the tanker.	Record weight on GROSS line of form.
3. Check bill of lading.	... to verify correct type of material is in tanker.
4. Sign in tanker driver.	Driver must sign in as a visitor and be escorted at all times.
5. Take Certificate of Analysis to QC.	<i>CAUTION: To avoid contamination, DO NOT unload until you receive approval from QC.</i>
6. Spot tanker.	A) Direct driver to location. B) Verify brake is set. C) Chock the wheels on at least one side between the two rear axles. D) Ground the tanker (attach grounding strap to an unpainted metal surface).
7. Have the storage area operator make sure the storage tank can hold contents of tanker.	<i>WARNING: Failure to perform this step can result in an overflow and spill of hazardous Monomer.</i> Perform Tank Gauging Procedure (SOP-01-804) or check the storage tank load cell readout. Storage tank operating limits are stenciled on the control panel.
8. Place 5-psig nitrogen pad on tanker.	A) Connect from local 5-psig nitrogen drop to aft bottom nitrogen connection on tanker. B) Open nitrogen supply valve. C) Then open valve at tanker.
9. Connect Monomer unloading hoses.	A) Verify hoses and gaskets are in good condition. (Hoses are normally stored on hose rack at unloading spot.) B) Connect from tanker to air pump. (Use aft bottom connection on tanker. Remove cap.) C) Connect from air pump to storage tank. (Connect to storage tank line labeled "from TW.")

Example
T-Bar
Format

Procedure quality checklist

PII's

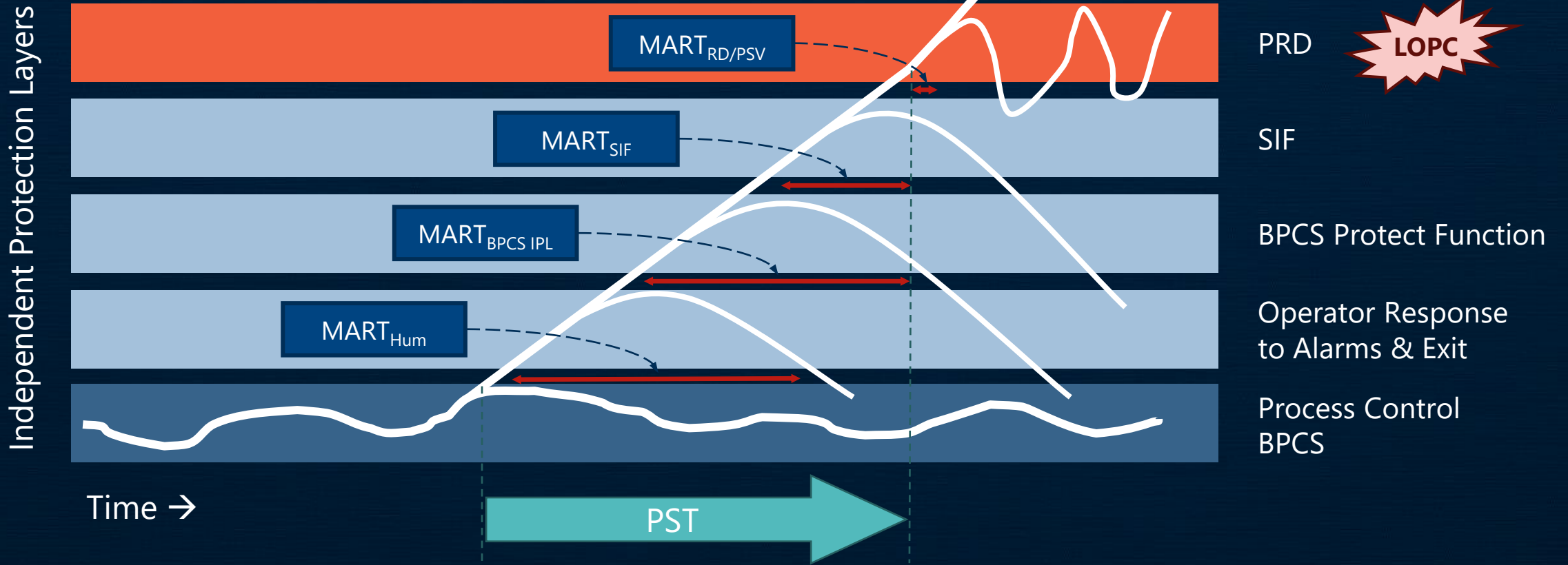
#	Issue	Response
Procedure Content Checklist		
1	Is the procedure drafted by a future user of the written procedure? (Engineers should not author procedures to be used by operators or maintenance staff.)	
2	Is the procedure validated by a walk-down in the field by another future user of the procedures?	
3	Is the procedure reviewed and commented on by technical staff (engineers or vendors)?	
4	Is the procedure checked versus the Page and Step format rules below?	
5	Is a hazard review of step-by-step procedures performed to make sure there are sufficient safeguards (IPLs) against the errors that will occur eventually (when a step is skipped or performed wrong)?	
6	Is the content measured using "newly trained operators" to judge the % of steps that are missing, steps that are confusing or wrong, and steps that are out-of-sequence? (A score of 95% accuracy of content is good.)	
Page Format Checklist		
1	Is the title of the procedure the largest item on the page?	
2	Is the procedure title clear and consistent with other titles, and does it uniquely describes the topic?	
3	Are the document control features the smallest items on the page?	
4	Are temporary procedures clearly identified?	
5	Is white space used effectively? <ul style="list-style-type: none"> • Is there one blank line between each step? • Does indentation help the user keep their place? • Are the margins large enough to reduce page congestion? 	
6	Is type size is 12 pt font or larger?	
7	Is serif type is used (rather than sans-serif)?	
8	Is mixed case used for words of steps, with ALL CAPS used only for special cases (such as IF, THEN, AUTO, and WARNING)?	
9	Is the step number very simple (single level of number used)? Only an integer?	
10	Have sections or information not necessary to performing the steps been moved to the back or to another part of the manual or training guide?	
11	Are section titles bold or larger than the text font? Do sections have clear endings (noted with the word "End")?	
12	Is the decision on electronic presentation versus hard copy correct? Are electronic linkages to procedures clear and accurate and easy to use? If paper is chosen, is the color of the paper appropriate?	
13	Is the overall page format (such as Outline format or T-Bar format) appropriate to the use of the procedure?	

IMPROVING OPERATING and MAINTENANCE PROCEDURES

- 1 Ensure operators/specialists and maintenance staff become capable of writing procedures and begin doing so
TARGET: 20% of staff
- 2 Enable supervisors to manage the procedure writing process

PROCEDURES ALSO NEEDED FOR RESPONSE TO CRITICAL ALARMS:

The time budgeted for each IPL is based on the MART that the LOPA team selects



Emergency Response

LOPC

Components of a Trouble-Shooting Guide

- Alarm ID, Action Limit, Consequence

Source of information is PHA/HAZOP

- Guidance as bulleted information

➤ *IMMEDIATE ACTION (by system or operator)*

➤ *DECIDE IF ALARM IS REAL*

➤ *FINDING and FIXING the CAUSE*

➤ *FIX or BYPASS PROBLEM*

Example Trouble- Shooting Guide

Alarm or Indicator:	PAL 4446 – Low Pressure Alarm for Suction of Organic Feed Pump 40-PM-18.445		
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Action Limit:	5 kPa		
Consequence:	Possible pump seal failure, releasing or spraying organic waste into the berm.		
Process Area:	FB&D Incinerator; Liquid Organic Liquid Feed	Oper. Mode:	Normal
Drawing #s:	D-400-PI-013		

IMMEDIATE ACTION (by system or by operator)

- DCS should shutdown the organic feed pump (40-PM-18.445).
- From the DCS display, MAKE SURE the organic feed pump is shut down.
- HAVE the field operator check for leaks near the organic feed pump.
- IF there is a large leak/release, THEN use the ESD switch to shutdown the unit and then follow/complete the shutdown and isolation procedure, OPS.....
- IF there is a minor leak or no leak, THEN:
 - COMPLETE the rest of the trouble-shooting,
 - and DECIDE how to contain the leak for now,
 - and DECIDE when to repair the leaking seal.

DECIDE IF ALARM is REAL

- From the DCS, CHECK the pressure and feed tank level trends. IF the trends indicate the alarm is valid, THEN continue with finding the cause or fixing or bypassing the problem.

FINDING and FIXING the CAUSE

- MAKE SURE valves upstream of the organic feed pump to see if any are closed too far, including checking ESD valves.
- CHECK, by feel with hand, if the heat tracing is on; if not, TURN ON or open heat trace valves
- MAKE SURE nitrogen to the pump seal is at the normal operating pressure.

EXERCISE: Using the rules for Page format and Step format to evaluate a Procedure

**EMPOWER FRONTLINE STAFF TO
“FIND SMALL, FIX SMALL”**

SIPCHEM's Culture pillars

Performance

Strengthening company and employee performance management through various levers

Collaboration

Actively promoting collaboration and teamwork between all areas of the organization

Empowerment

Empowering employees to take ownership to deliver their objectives while recognizing their contribution

Empowerment - SIPCHEM's Beliefs

Target Culture

"EMPOWERMENT"

Pillar



We trust others to deliver

What does it mean?

- We, as leaders, ensure we have enough time to focus on core company/function decisions
- We set principles that guide our employees in their roles while giving them appropriate level of autonomy to manage their day-to-day and make decisions on their work
- We do not incentivize micro-management, giving space and freedom for our employees to finalize their tasks



Target Culture

"PERFORMANCE"

Pillar



We are mentors and coaches

What does it mean?

- We, as leaders, dedicate enough time to mentor and coach our direct reports to help them grow in the company
- We, as leaders, proactively offer our availability and support to our employees
- We, as employees, proactively reach out for support and advice from our management



Initiatives for Empowering Frontline Staff

- Frontline Staff Author Work Instructions for Operations and Maintenance Staff
- Risk / Release Containment – identification and control
 - *Every leak is preventable (RC program)*
 - *Find small, Fix small (Frontline staff Line walks)*
- Others

Initiatives Related to “find small” – Line walks

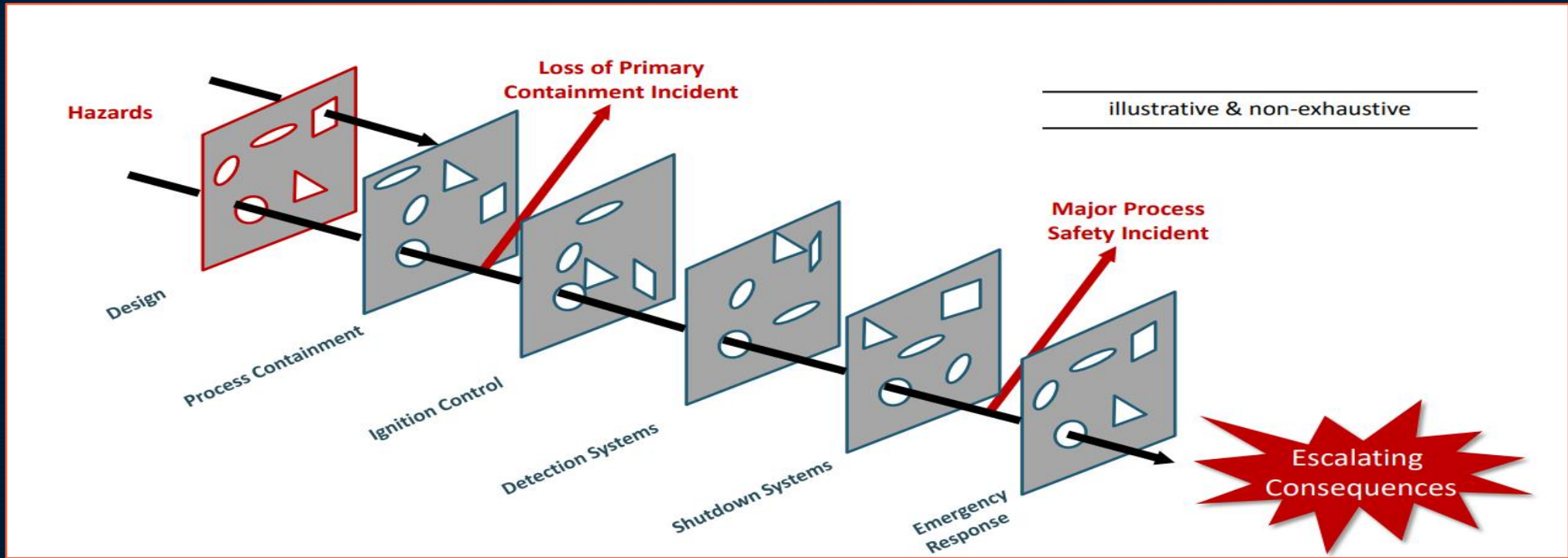
Benefits	Designation	Frequency
Identify hazards that compromise technical or management system integrity	CEO	1 / Quarter
	Manager	2 / Month
	Section Head	4 / Month
Take corrective action and strengthen PSM system to mitigate risk	Engineers	4 / Month
	Loss Prevention Specialist	4 / Month
Engage in conversations. Understand consequences of actions.	RC frontline team	4 / Month
	<i>(90% of effort)</i>	
Share learning and build awareness		

RISK CONTAINMENT STRUCTURE



Usually in the field and utilize their presence to raise release / risk observations through this program

Front-line staff



Risk Evaluation – Categorization of the risk

Environmental findings

Any observation on equipment, surroundings, chemical handling areas, storage areas that has the potential to impact the environment



Occupational safety

Any observation on equipment, surroundings, facilities, or human activities that has the potential to injure the well-being or impact the health



PSM Findings

Any observation on equipment, surroundings facilities or human activities that has the potential to lead to a process hazards, e.g. fire & explosion, toxic release, runaway reaction, etc.



RISK CONTAINMENT PROGRAM



Actions Plan Tracking Board

Safe Work Practices



Identified Risks	Findings Studied	Underlying Causes Identified	Actions Plan Developed	Actions Closure Verified	Learnings from Findings Shared
<p>Handwritten notes on yellow sticky notes, including 'Slip' and circled numbers 6 and 7.</p>	<p>Two columns of blue sticky notes, numbered 1 through 5.</p>	<p>Two columns of red sticky notes, numbered 1 through 5.</p>	<p>Two columns of yellow sticky notes, numbered 1 through 5.</p>	<p>Two columns of green sticky notes, numbered 1 through 5.</p>	<p>Five teal sticky notes, numbered 1 through 5.</p>
<p>Handwritten note on yellow sticky paper: 'Handwritten note on yellow sticky paper' with circled number 3.</p>	<p>One blue sticky note, numbered 3.</p>	<p>One red sticky note, numbered 3.</p>	<p>One yellow sticky note, numbered 3.</p>	<p>None</p>	<p>None</p>
<p>Handwritten note on yellow sticky paper: 'Handwritten note on yellow sticky paper' with circled number 4.</p>	<p>One blue sticky note, numbered 4.</p>	<p>One red sticky note, numbered 4.</p>	<p>One yellow sticky note, numbered 4.</p>	<p>None</p>	<p>None</p>



Linewalk Observation Card

Unsafe act

Unsafe condition

	Date:	Location:
	Plant:	Unit:
	Identified Observation:	
	Immediate Corrective Action:	
	Additional Recommended Mitigation/Preventive Actions:	
<p>Do not forget to log observation in SAP and the area Risk Containment Sheet if it is a medium/high level risk!</p>		

Identifying and reporting risks aim at providing a safe work environment for all

Identifying and reporting risks is everyone's concern

FLANGES	1 - Short bolting (3 thread minimum)	
	2 - Missing bolts	
	3 - Bent or distorted flanges	
	4 - Heavy corrosion	
	5 - Damaged or incorrect gaskets	
SMALL BORE DRAINS (<2")	1 - Open or leaking drains (no caps or flanges)	
	2 - Damaged block valves (no handles or bent stems)	
PUMPS	1 - Leaking seals	
	2 - Vibration	
	3 - Missing e-stops	
	4 - Damaged or inoperable filters	
PANELS/ATEX	1 - Incorrect / damaged glands or switches	
	2 - Open apertures	
	3 - Missing bolts / labels	
	4 - Damaged cables / enclosures (holes / corrosion)	
CIVILS & STEELS	1 - Damaged or cracked plinths	
	2 - Beams corroded	
	3 - Damaged / missing fire protection	
	4 - Missing bolts	
	5 - Poor or damaged welds	
FIELD INSTRUMENTS	1 - Damaged / missing field instruments (including cables & impulse lines on transmitters)	
	2 - Missing or damaged alarm klaxons / lamps	
	3 - Instrument isolated / impaired / impossible to read	
ISOLATIONS	1 - Inadequate isolation (Valve only—no blind or spade)	
	2 - No locks or tags	
PSV	1 - Isolated in error	
	2 - Installed incorrectly	
	3 - Missing tags	
GENERAL (FIELD WORK INCLUDING CONFINED SPACE)	1 - Missing or inappropriate barricading	
	2 - Inappropriate/missing/damaged tools (e.g. no air mover & rescue tripod in case of C.S.)	
	3 - Generator or welding sets damaged / inappropriate location / not grounded	
	4 - Incorrect lifting gear or uncertified	
	5 - Inappropriate access / egress	
	6 - Field PTW missing / incorrect	
	7 - Missing or malfunctioning gas detector (Personal or Field)	
	8 - Incorrect / missing PPE	
	9 - Missing standby person / back-up man with breathing apparatus	
	10 - Confined space created but not recognized	
	11 - Failing to follow correct procedure (e.g. No tag-in/tag-out board in case of C.S.)	
	12 - Inappropriate / Inadequate lighting	
	13 - Space not isolated or purged	
OTHER		

Risk Containment Program Realized Benefits

- Having more engaged workforce at all levels, especially from the frontline.
- Capitalizing on the time spent by frontline staff at site by providing them with a systematic approach guiding their area surveillance and valuing their input
- Process safety walkdown card helped a lot as an eye opener for frontline staff
- Enhancing the communication and sharing of the lesson learned
- Building the culture of **find small , fix small**
- Adapting the Risk-based approach
- Improved the early risk discovery (One month after launch RC program, a 43% increase in LOPC reporting was observed)
- Well structured governance for the RC program sustain the efforts & ensure continues improvement
- VFL is one of the main enablers for the success of the RC program

**EMPOWER FRONTLINE STAFF
TO CONTROL VERBAL
COMMUNICATION SYSTEM**

Key Communication Tool: Shift Turnover Log

- Use of a specific form provides structure
- Components include:
 - *Equipment out of service*
 - *Routine, transition and non-routine operations*
- Review shift log verbally with relief personnel

Checklist Communication rules

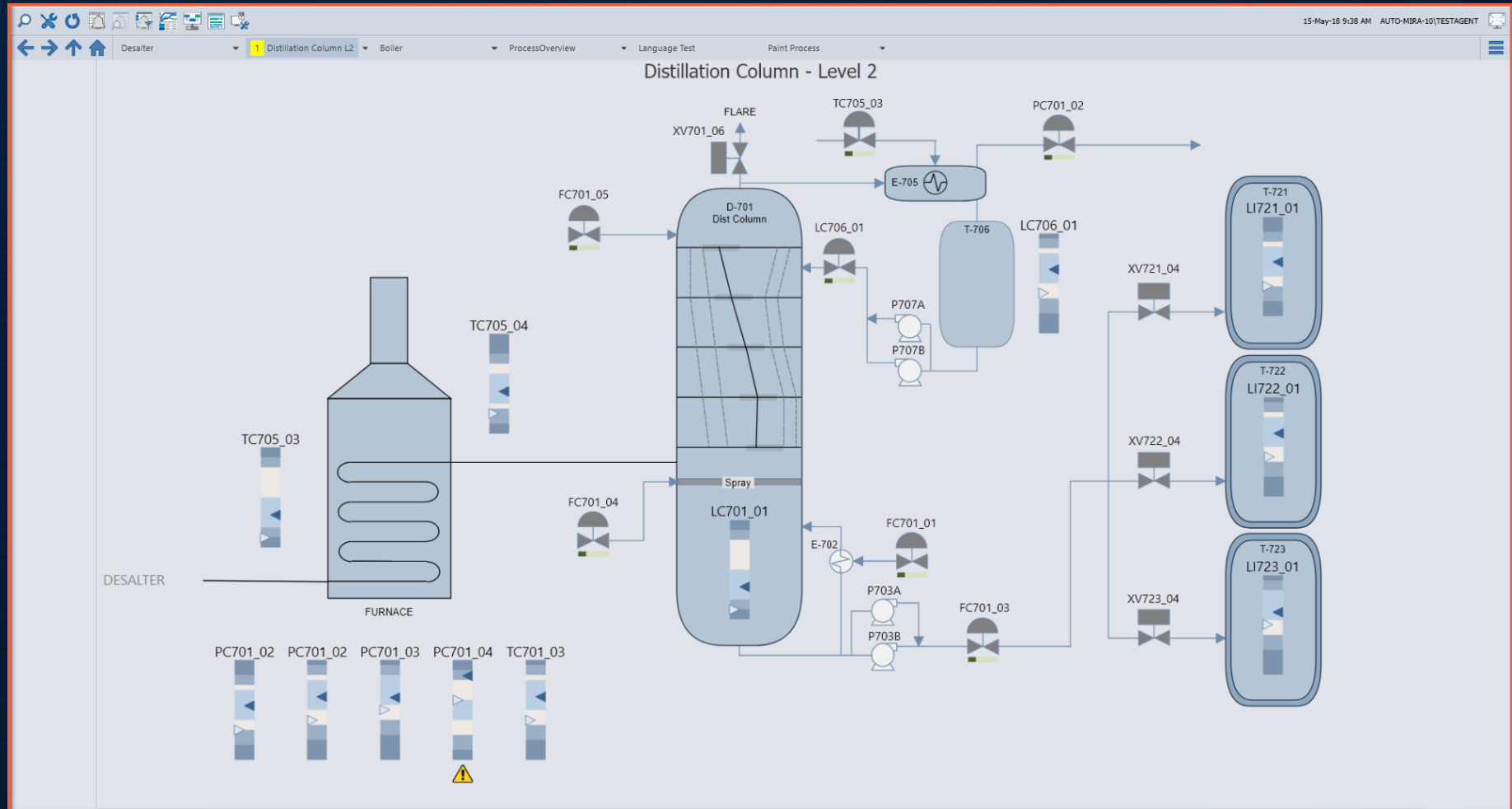
#	Communication Rules
1	Senders MUST require repeat back by the receiver; ask questions to make sure of understanding.
2	Receivers of messages MUST repeat a message they receive.
3	Communicate one task at a time.
4	Sender & receiver must use the standard name and component number (and building name and number) and/or for related reference material (drawing, procedure name/number) in each message.
5	Sender must require receiver to give feedback of foreseeable conflicts. Sender (if message is to subordinate) should follow-up in the field if possible, to make sure message was understood.
6	Receiver must request clarification anytime they believe the message is confusing.
7	Do NOT give verbal instructions to workers who do not have the demonstrated skills to correctly understand and perform the task assignment (unless you plan to supervise/coach the task yourself)
8	Communicate to the most senior member on the work crew.
9	Know your audience & change message accordingly to compensate for lack of knowledge (when appropriate; see other related rules).
10	Use units (and use approved units, such as SI) for process parameters.
11	Spell out letters phonetically of an acronym (A = Alpha; B = Baker; C = Charlie, ...)
12	Always count from left to right when giving instructions related to multiple choices of equipment.
13	Use approved jargon only.
14	Use the words check , make sure , and actions consistently (see procedure writing rules).
15	When possible, write out the task (use a special procedure or work order) rather than communicating verbally. Use formalized templates for consistency and make sure the receiver is provided all information (such as work orders and drawings) necessary for the task.
16	Perform pre-job meeting with work crew (including with contractors or construction company).
17	Perform walkthrough at the location where the work will be completed.
18	Have a backup communication method. Don't rely on one mode of communication. In emergency situations have hand signals as backup to loss of verbal communication.
19	Talk to the operator or technician who is doing the work (no delegation of work); but see Rule 8.
20	Receiver (worker or group) must report back when work is complete.
21	If confusion exists in implementing a task, the shift supervisor (and higher, if supervisor is unavailable) must be contacted to make sure he/she understands the problem.
22	Do NOT use a PA (public address system) for process instructions, since this method of communication does not allow repeat-back.
23	Use Open questions and non-confrontational questioning methods when requesting clarification.
24	When communicating remotely (by phone or radio), if the message is not understood on the second attempt at clarification the Sender must find the Receiver and communicate face-to-face.
25	For large or complicated jobs, in addition to repeat back, the sender must ask the receiver for an assessment of the pre-job briefing to ensure the workers are not confused.
26	Workers and supervisors must keep a shift log to aid in turnover between shifts. Workers and supervisors and support staff (if necessary) must have a minimum of 15 minutes overlap with a relieving shift. See <i>shift turnover standard</i> for more details.

ENHANCING VERBAL COMMUNICATION

- 1 Ensure all field staff (field / engineers, management) use best practices for control of verbal communication
- 2 Follow best practices for work / shift handovers

**EMPOWER FRONTLINE STAFF TO
DETECT HUMAN SYSTEM
INTERFACE DEFICIENCIES**

Newer
Screen Design
Uses best practice rules
for colors and for
mimic displays



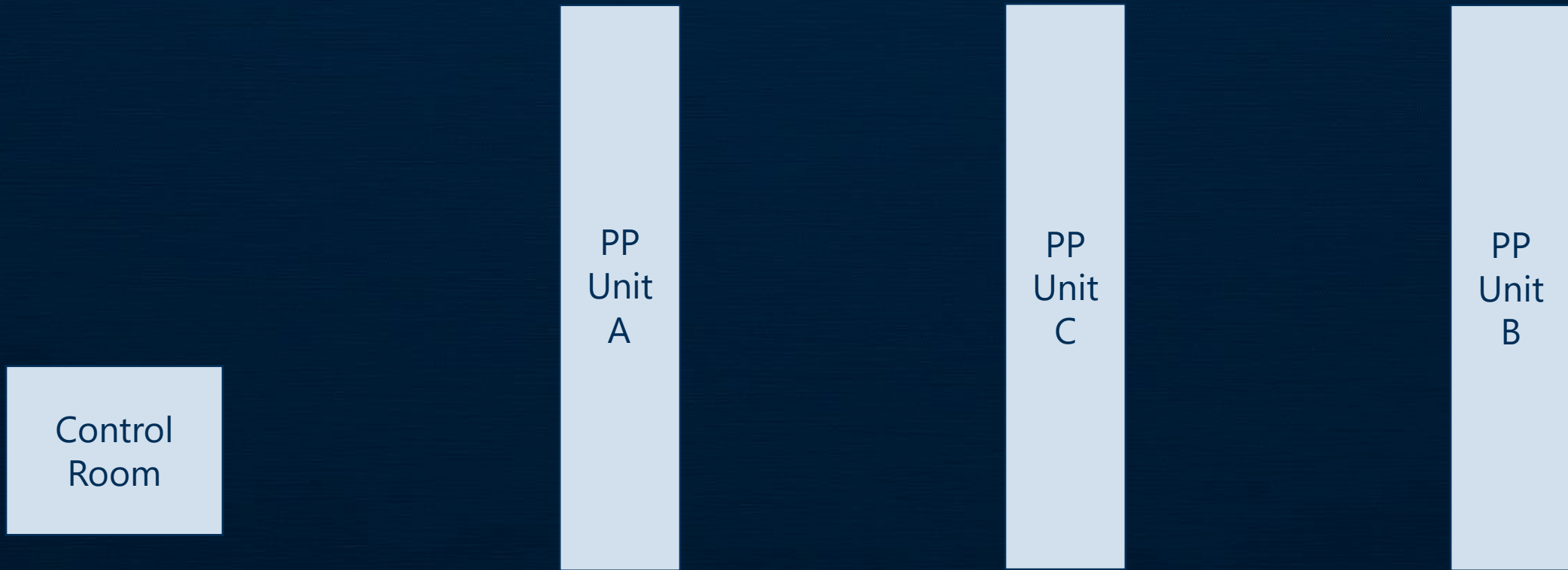
Resource: *ASM Consortium Guideline – Effective Console Operator HMI Design*

Keys to successful information displays

- Ensure needed information is displayed
- Ensure suitability of format
 - *Easy to read*
 - *Easy to understand*
 - *Easy to use*
- Ensure data quality and update rate is adequate
- Ensure displays can be easily selected, navigated, etc.

Layout: Poor example

Phillips Polypropylene Units – Pasadena, Texas
Flammable fluid, 40 barg



ENHANCING HUMAN SYSTEM INTERFACE (HSI) CAPABILITIES

- 1 Develop appropriate Human System Interface (HSI) design standards *(engineers take the lead on this)*
Alarm management, DCS screens, etc.
- 2 Ensure field (frontline) staff are properly trained in identifying HSI improvement opportunities
- 3 Implement routine HSI inspections

Checklist
Human
Factors

Item	Topic	Questions/Issues	Responses
1	Housekeeping and General Work Environment	Are adequate signs posted near maintenance, cleanup, or staging areas to warn workers of special or unique hazards associated with the areas?	
		Are adequate barriers erected to limit access to maintenance, cleanup, or staging areas?	
		Are working areas generally clean?	
		Are provisions in place to limit the time a worker spends in an extremely hot or cold area?	
		Is noise maintained at a tolerable level?	
		Are alarms audible above background noise both inside the control room and in the process area?	
		Are normal and emergency lighting sufficient for all area operations?	
		Is there adequate backup power for emergency lighting?	
		Is the general environment conducive to safe job performance?	

PATH FORWARD

Path forward

- 1 Commit to fully delegate the authority and responsibilities for the activities listed above
- 2 Develop the necessary competencies within the frontline staff
- 3 Track progress towards the competency attainment for these activities and for turnover of these activities to the frontline staff

Potential KPIs for your site

- Number of near misses reported per worker, along with type of near miss incident
- Accuracy of operating procedures
- Number of troubleshooting guides created
- Number of Root Cause Analyses led by field staff
- Number of field staff that are trained & coached on Activities in PS such as:
 - *How to write procedures*
 - *How to lead RCAs*
- Number of Root Cause Analyses identifying valid root causes, rather than listing errors as a root causes

THANK YOU

William Bridges

wbridges@piii.com

David Moore

dmoore@acutech-consulting.com