

# Process Safety Management in R&D



Human Energy®

**Jeff Hedges**  
**Division Manager**  
**Integrated Laboratory Technologies**

Richmond CA  
August 21, 2013

# ETC Laboratory Process Safety/Operational Excellence Overview



2 Facility Design & Construction	3 Safe Operations	4 Management of Change	5 Reliability & Efficiency	6 Third Party Services	9 Incident Investigation	11 Emergency Management	12 Compliance Assurance
Corporate Standard Technical Codes & Standards	Corporate Risk Management Process	Management of Change Process	Corporate Standard Asset Integrity Management	Contractor HES Management Process	Incident Investigation Process	Emergency Management Process	Corporate Compliance Assurance Process
Operational Readiness & Pre-Start up Procedures	Corporate Standard Process Safety Information		Reliability & Asset Integrity Process				
	Corporate Standard Operating Procedures						
	Managing Safe Work Process						
	Training for Process Safety Competency						

## History

- Meeting some OE expectations, some OE expectations found Less Than Satisfactory based on Corp OE Audit 2004.
- Incidents and Injuries led to several safety stand downs and data driven PSM /OE improvement initiative in 2008

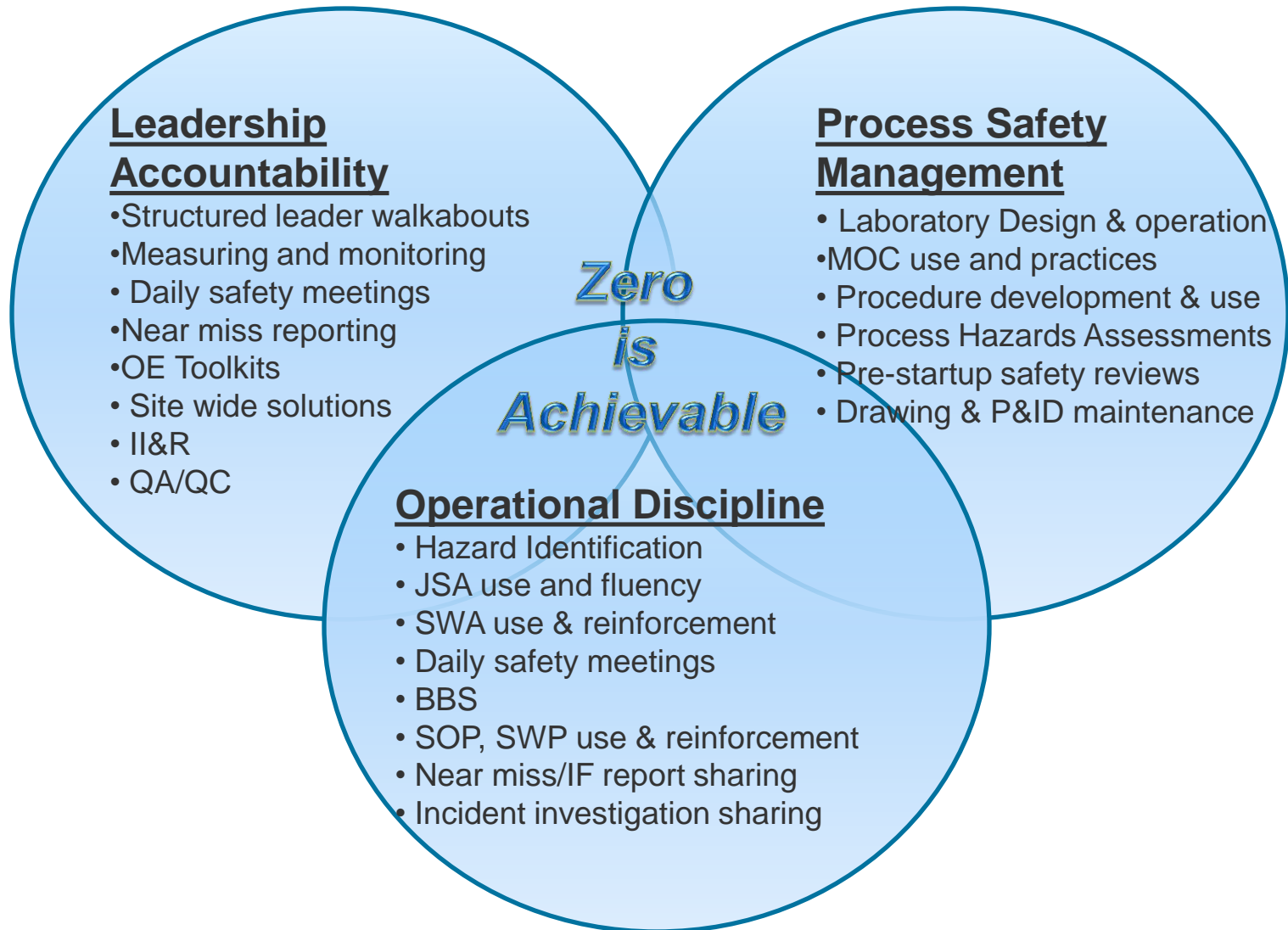
## Current State

- Meeting PSM/OE expectations based on Corp OE Audit in 2009 & 2013 and annual ETC Self Assessments.
- Sustained decrease in incidents, injuries and serious near misses

## Future State

- Continue to drive to Zero Incidents and Injuries

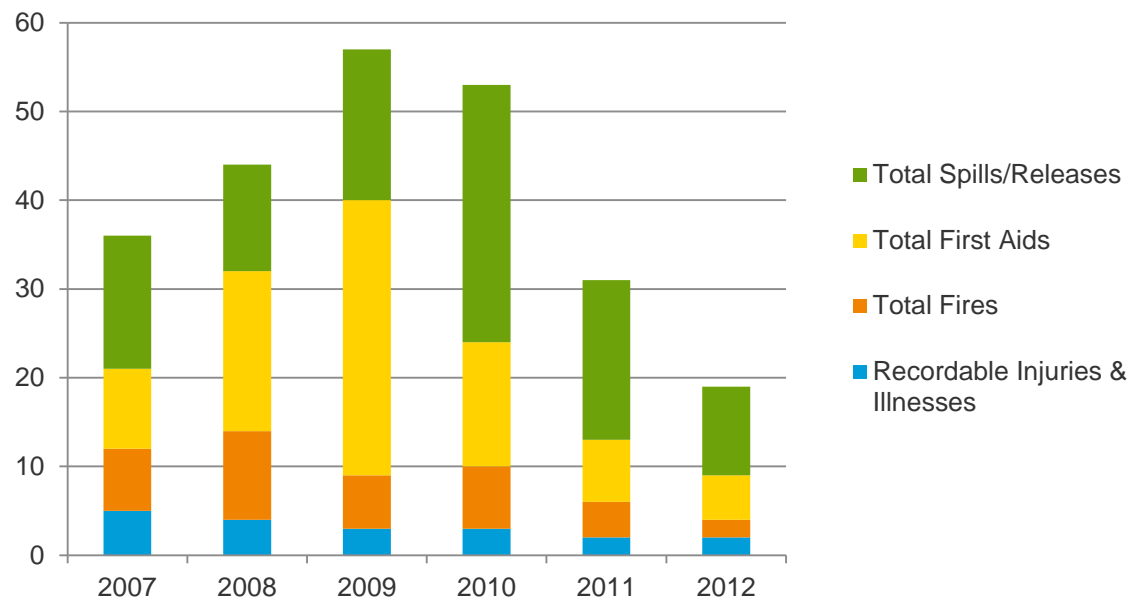
# ETC Laboratories: Shaping an OE/IFO Culture



# ETC Lab – Total Incidents & Significant Near Misses



## Total Incidents & Significant Near Misses



### Trends:

- Three straight years of incidents & significant near misses trending down.
- Spills/Releases continue to be the most common type of incident & near miss.
- Fires continuing to trend down over past three years.



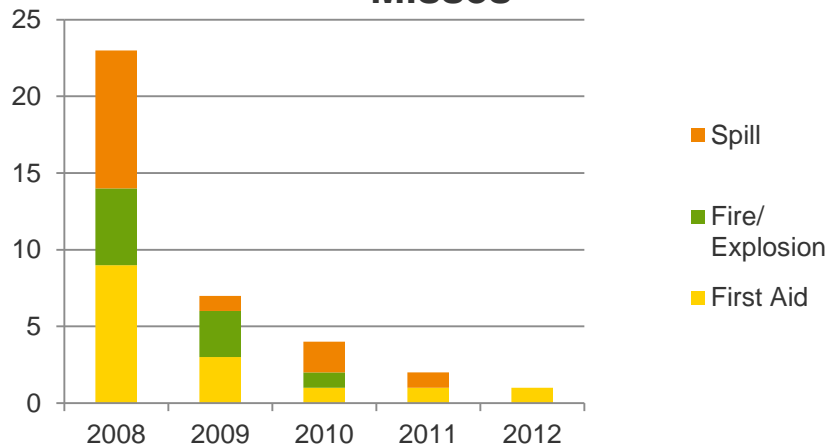
- Laboratory Design & Operation
- MOC Use and Practices
- Procedure Development & Use
- Process Hazards Assessments
- Pre-startup Safety Reviews
- Drawing & P&ID Maintenance

# ETC Labs – Hood Analysis

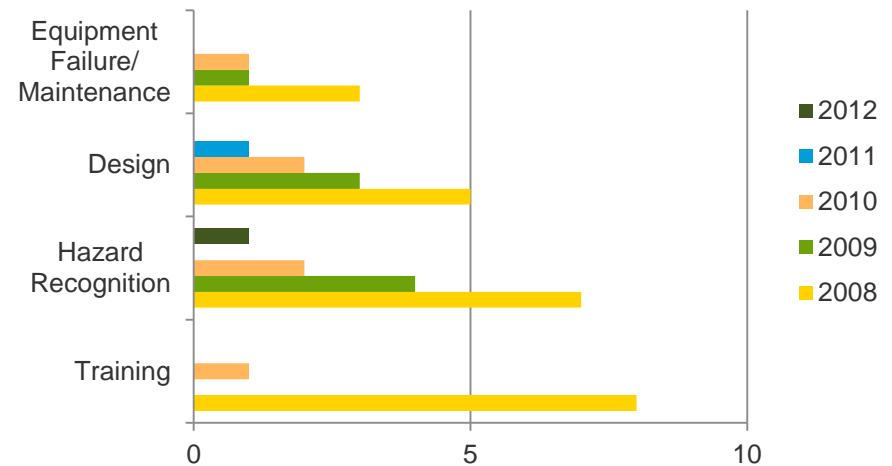
## Dramatically helped reduce Incidents! Kicked off Dec 2008



### Hood Incidents & Significant Near Misses



### Top Root Causes



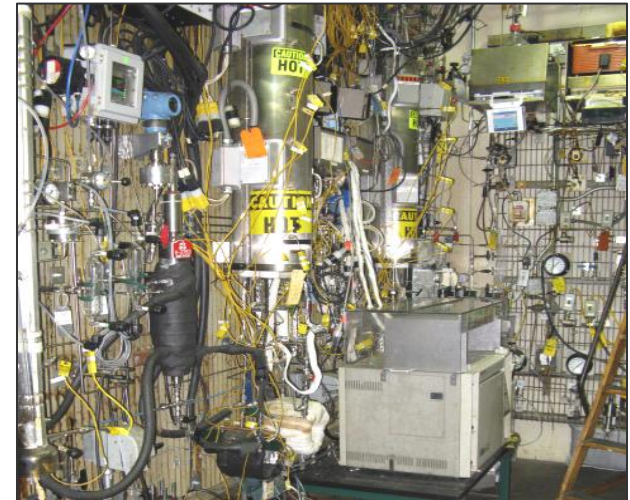
### Hood Audit Team (HAT) Mission: Promoting Safe Fume Hood Practices and Reducing Incidents in Hoods by Auditing, Teaching, and Closing Gaps.

- Hazard Recognition has improved!
- All Lab personnel trained in 2009 on Hazards Identification Tool but need to continue efforts to improve fluency.
- Major effort to close gaps on procedures, design, and training over last 3 years is paying off !!!

# Why are MOC and Pre-Startup Important?



- **Incident:** Reactor modifications lead to poor seal control and increased temps. After 3 months of failed attempts to operate including 1 spill/vapor release and 3 fires, the unit was shutdown.
- **Findings:** Modifications had been made without a MOC, without a reliable design and operating envelope for existing equipment (pump). Flow rates were greater than the equipment capacity (letdown system and product cooling).
- **Solution:** Conducted a MOC including a HazOp study. Redesigned pump, reactor and cooling system, revised operating envelope and safeguards. Within 5 weeks retrofits were installed, personnel were re-trained and the unit was re-started. No safety incidents or business interruption to date.
- **The objective of MOC and Pre-Startup is to prevent Incidents, improve Reliability and improve Efficiency** by ensuring that unacceptable risks are not introduced into our businesses



***"There is always time to do it right"***

# Purpose of MOC and Pre-Startup Procedures



- Systematically manage changes to equipment, facilities and operations
- Ensure changes are:
  - Evaluated for health and safety hazards, environmental impacts and mitigations
  - Reviewed and approved for installation/implementation by designated Subject Matter Experts (SMEs)
  - Communicated to ALL personnel impacted by the change
  - Adequately trained on
  - Approved for Startup
  - Updated in critical OE documentation such as Procedures, Drawings, Operating Envelopes, Maintenance & Inspection Records





- Structured leader walkabouts
- Measuring and monitoring
- Daily safety meetings
- Near miss reporting
- OE Toolkits
- Site wide solutions
- Incident Investigation and Reporting (II&R)
- QA/QC

# Incident Investigation & Reporting OE Process

## Current State in ETC Laboratories



- Rigorous and well established in lab operations since 2008.
- Use of Incident Tracking database to track and manage incident data and fulfill reporting requirements to Corp as well as outside agencies.
- Near Miss Safety Sharing System used for reporting Near Misses, Safety Sharing's and Spill Releases.
- Monthly review of incidents at all levels of leadership (team leaders to Department GM).
- Annual review of all incident data trends to determine how best to steer
- Investigations and Studies continue to daylight process safety improvement opportunities – Lessons Learned are shared broadly in monthly OE Toolkits
  - Example - Heptane Spill:



Microsoft Office  
Word Document

9  
Incident  
Investigation

Incident  
Investigation  
Process

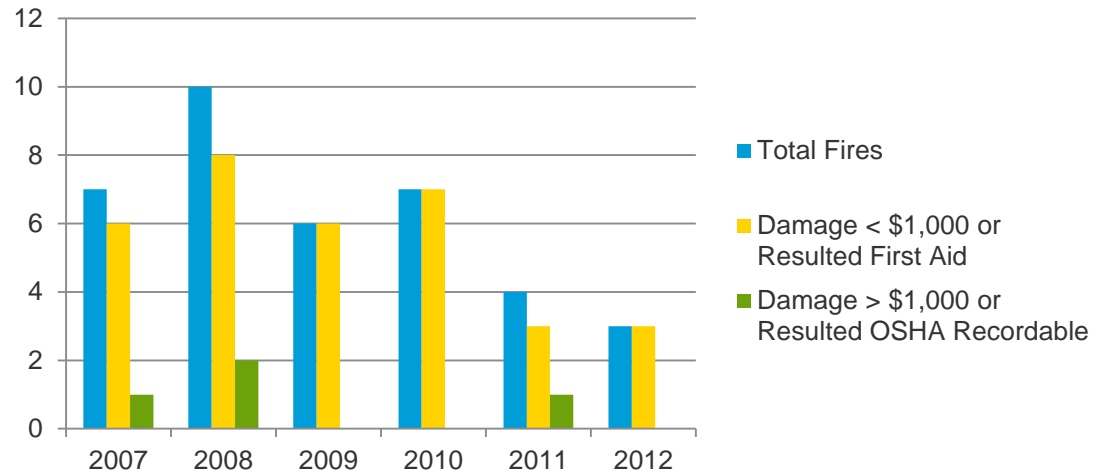
# ETC Labs – Fire Incident Analysis



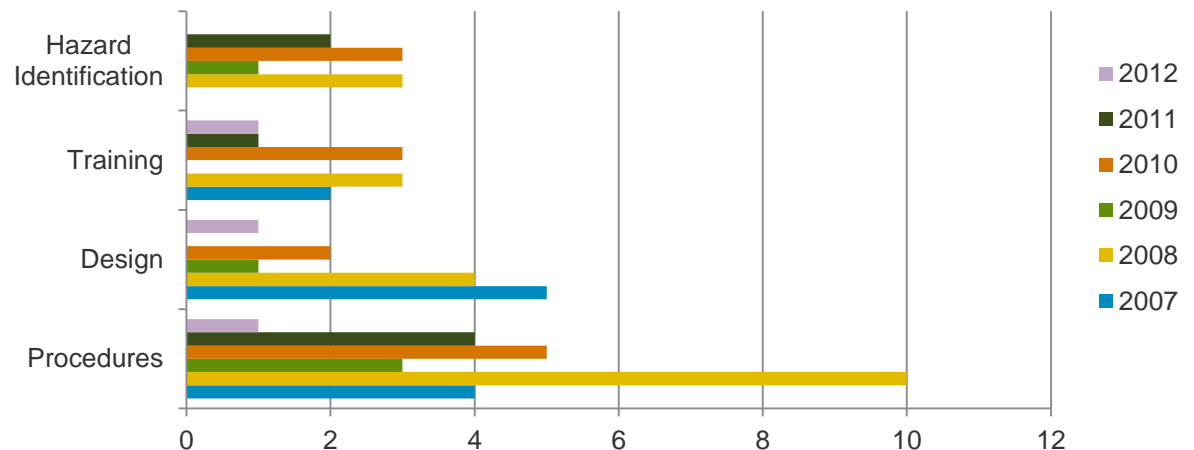
## Trends:

- Our effort to close gaps on procedures, design, and training over last 3 years are helping to reduce fires.
- Lack of or inadequate procedures and design used to be a major root cause of fires.
- Designs have improved using reviews through MOC and PHAs.
- To help recognize hazards, all Lab personnel have been trained on Hazard Identification Tool.
- Oversight and Operational Discipline are the keys.

## Fires and Damage



## Top Root Causes

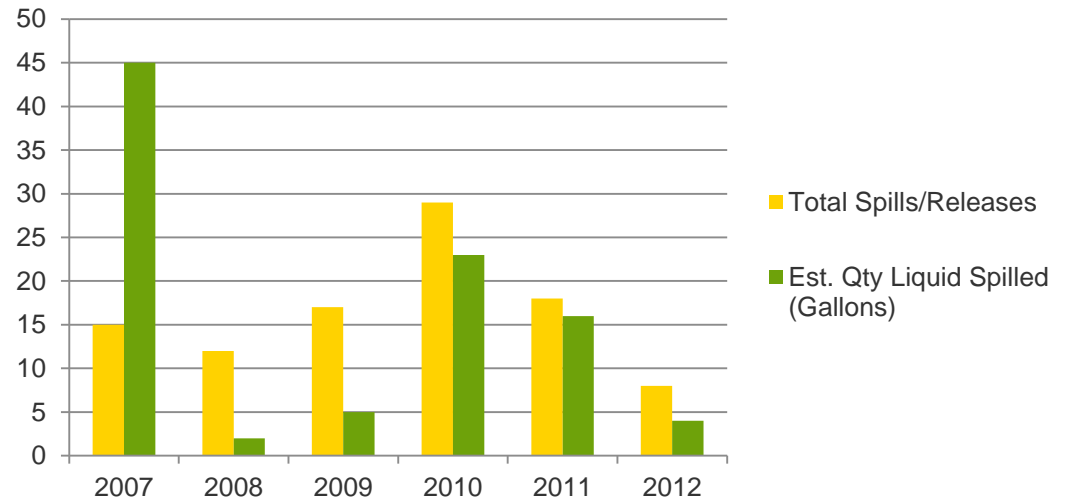


# ETC Labs - Spills & Release Incident Analysis

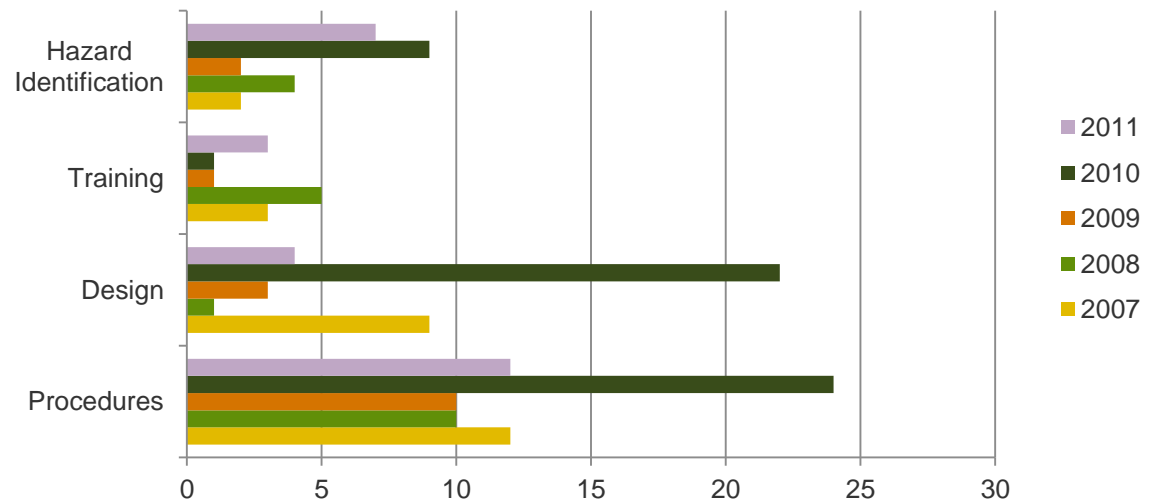


## Trends:

- Attention to secondary containment and use of Incidental Spill Plans has helped to reduce the severity of spills.
- Recognizing hazards remains an area of opportunity.



## Top Root Causes



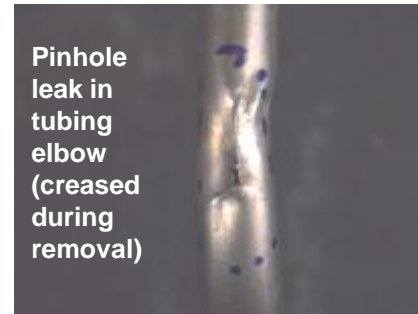
# ETC Lab Incidents/Near Misses

## No Injuries but Unscheduled Research Unit Downtime



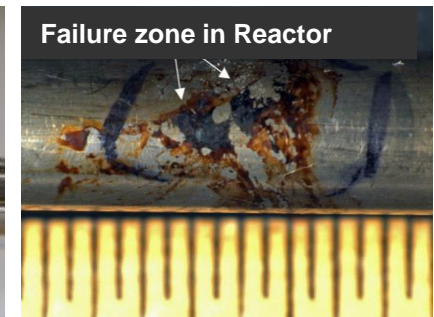
### New Ionic Liquid Technology

- Pin hole leaks of ionic liquid/ hydrogen vapors due to corrosion
- ***Material was constructed of Monel, should have been Hastelloy***



### New Biofuels Technology

- Pin hole leak of hydrogen/hydrocarbon vapor due to corrosion
- ***Material was constructed of 321SS, should have been 316SS***



### New Hydroprocessing Technology

- Pin hole leak of VGO & deionized water due to corrosion
- ***Material was constructed of 347SS, should have been 316SS***





- Hazard Identification
- Job Safety Analysis use and fluency
- Stop Work Authority use & reinforcement
- Daily safety meetings
- Behavioral Based Safety
- SOP, SWP use & reinforcement
- Near miss/IF report sharing
- Incident investigation sharing

# Stop-Work Authority



All Chevron Employees and contractors have the authority – and responsibility – to stop any unsafe condition.



# Job Safety Analysis



## Technology Center Job Safety Analysis (JSA)

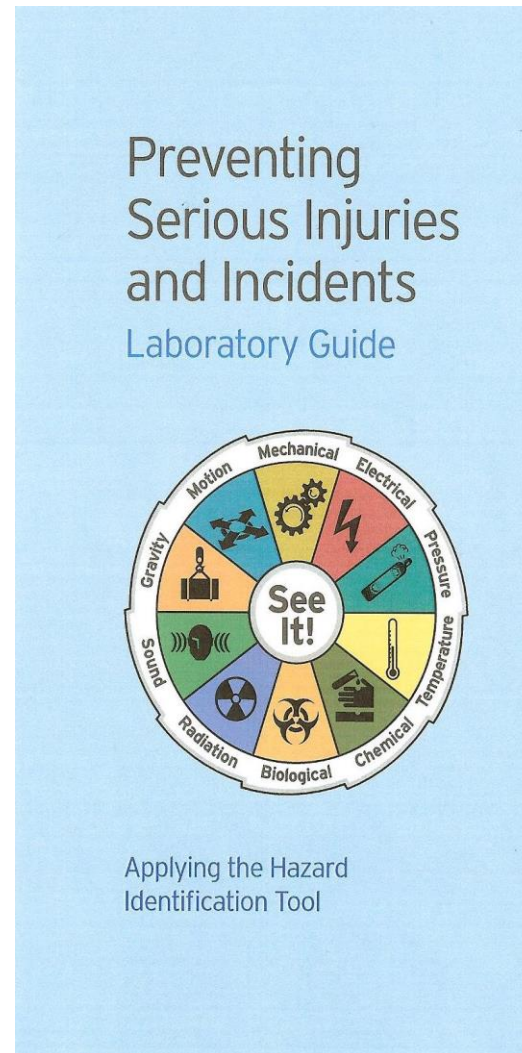
Date: [ ]	Name of Task: [ ]	Type of Work: <input type="checkbox"/> Lab/Shop <input type="checkbox"/> Field <input type="checkbox"/> Office	JSA: <input type="checkbox"/> New <input type="checkbox"/> Revised  <i>If revised, date or document number of original:</i> [ ]	Team Members Creating JSA: 1. [ ] 2. [ ] 3. [ ] 4. [ ] 5. [ ] 6. [ ]		<b>Hierarchy of Controls</b> 1. Remove energy source 2. Prevent the release of energy 3. Protect from the release 4. Use Stop Work Authority
OpCo: [ ]	Task Description: [ ]	Responsible Person (Approver) (print & sign): [ ]				
Unit/Group: [ ]						
Facility Location: [ ]						

Hazardous Energies List and Examples (which apply to Task)			
Type	Example		
Gravity	<input type="checkbox"/> A falling object <input type="checkbox"/> A collapsing roof	<input type="checkbox"/> A body (item or person) tripping or falling <input type="checkbox"/> Open excavation	<input type="checkbox"/> Other _____ _____ _____
Motion	<input type="checkbox"/> A person body positioning while working (lifting, straining, bending, reaching) <input type="checkbox"/> Vehicle, vessel or equipment movement	<input type="checkbox"/> Flowing water <input type="checkbox"/> Wind	<input type="checkbox"/> Other _____ _____ _____
Mechanical	<input type="checkbox"/> Rotating equipment <input type="checkbox"/> Compressed springs <input type="checkbox"/> Pinch/puncture points	<input type="checkbox"/> Drive belts <input type="checkbox"/> Conveyors and motors	<input type="checkbox"/> Other _____ _____ _____
Electrical	<input type="checkbox"/> Power lines <input type="checkbox"/> Static charges <input type="checkbox"/> Lighting	<input type="checkbox"/> Energized equipment <input type="checkbox"/> Wiring <input type="checkbox"/> Batteries	<input type="checkbox"/> Other _____ _____ _____
Pressure	<input type="checkbox"/> Pressure piping <input type="checkbox"/> Compressed cylinders <input type="checkbox"/> Control lines <input type="checkbox"/> Vessels	<input type="checkbox"/> Tanks <input type="checkbox"/> Hoses <input type="checkbox"/> Pneumatic and hydraulic equipment	<input type="checkbox"/> Other _____ _____ _____

CRTC-9538(1) (9/12)



# Preventing Serious Injuries and Incidents Laboratory Guide



# What We Have Learned From Our Journey?



- Using a data-driven approach to identify and prioritize gaps in operational discipline works.
- Setting expectations and measuring results for visible PSM/OE leadership works. What gets measured, gets done.
- Creating an open culture of sharing and reporting can move the OE needle in the right direction.
- Never let up on striving to get to the next level of excellence in PSM/OE.

# CVX Global Laboratory: Shaping an OE/IFO Culture

