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"When the Safety System Fails the Worker: Did We Do Our Job?...a Case Study"

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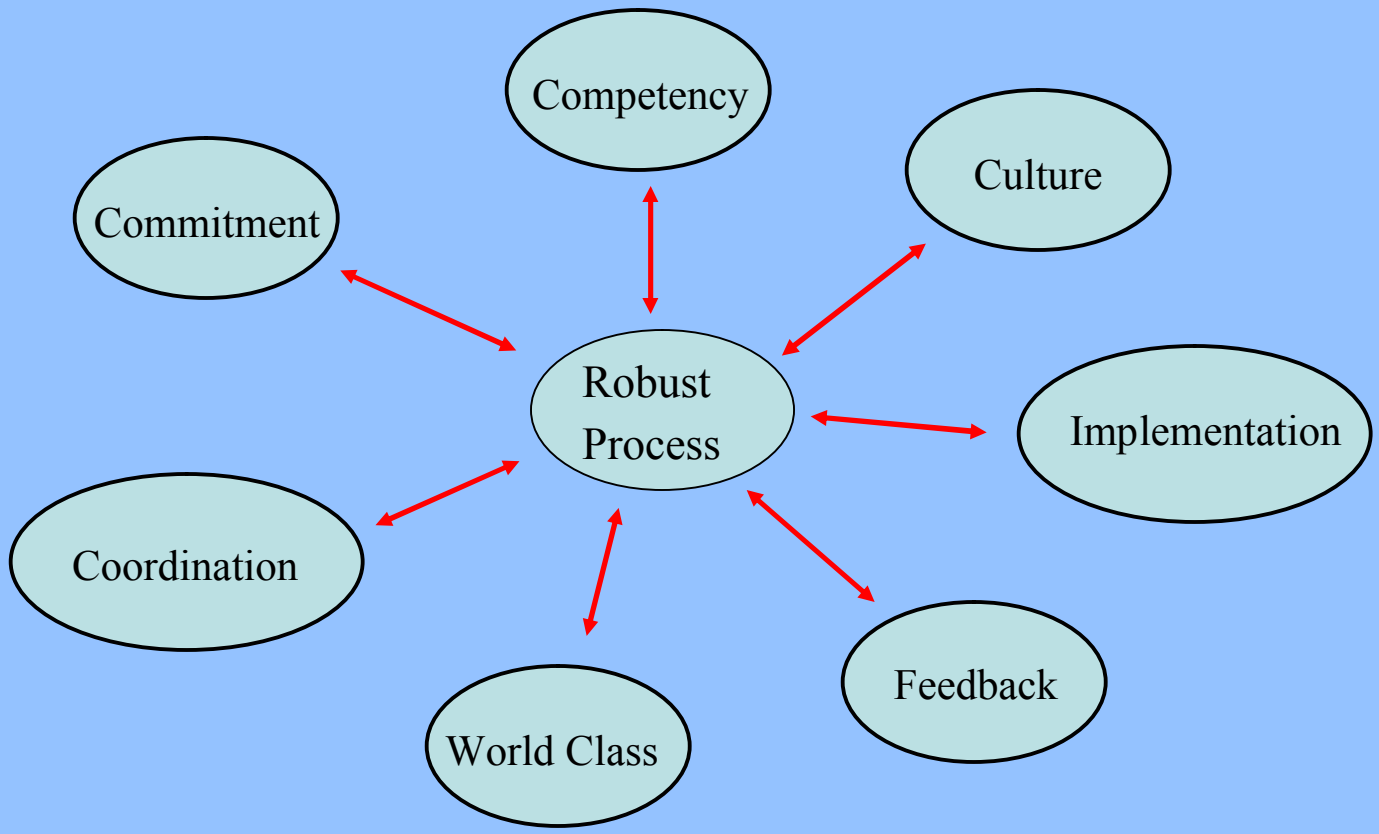
We aim for *robust*, don't we?

Robust Defined

- Strong, relentless commitment from senior management
- Technically competent, motivated safety professionals
- Successful implementation of process fundamentals:
  - System for hazard identification, analysis and control
  - "grassroots" involvement
  - Employee training
  - Accident investigation / lessons learned
- System to coordinate work across departments, work teams
- Mechanisms facilitating worker feedback to management
- A desire to achieve "world class"

Dissecting The Robust Safety Process



This Isn’t It!

Tom Peters…

Excellent companies focus consciously and consistently on rigorous practices!

Employee Expectations Are High…We're the Experts!

Does Anyone Sell Themselves As Less Than the Expert?

Beware Of Single-point Failure Traps

Examples:

- A procedure that requires an experimenter to survey a shipping package upon receipt and notify the safety professional only when radioactive levels exceed a pre-determined threshold rely solely on the experimenter to act as expected

  - how would you improve this procedure?

- Other examples of single-point failure traps?

Our Process At Livermore Is Robust

Indicators

- Management does *"believe"*
- We are strong in technical depth
- We have the vision to be the best in class
- We are process driven…and it is repeatable
- Work beyond *"commonly performed by the public"* requires an authorization document
- We measure performance…and strive for continuous improvement

The process can still fail the worker!

… case study

“Exposure to Exhaust Gases, Including Carbon Monoxide, During Manlift Operations”

The Job

- Replace smoke detectors in B-334 East & West Bays
  - Biennial calibration required by code never performed due to difficult access
    - Smoke tests only on biennial schedule
  - Replacement detectors self-checking, biennial calibration not required
  - Detectors mounted to 33’ high ceiling
    - Located above HVAC ducting
    - Fixed equipment and a pit in East Bay make vertical assent difficult

Organization scheduled this work as part of a *100% completion goal* subsequent to a finding that it had not previously completed all required alarm checks and maintenance.

A "Bridging" Document Was Completed by the Facility and the Task Lead

PLANT ENGINEERING
Success through superior service

Plant Engineering
ES&H Assessment Document

ISM

The purpose of this form is to communicate, review and understand all facility safety issues and Plant Engineering safety issues that need to be defined, mitigated and authorized prior to start of work.

Work Request # _____ JO PM Facility _____ Room _____

Customer Use

Please answer the following five ISM questions related to the facility in which the work requested will be performed in.

1) Are there any Operational Impacts/Scheduling required? Yes No

2) Are there unique Facility hazards associated with this request? Yes No

3) Is there a Facility IWS/Procedure(s) that applies to this request? Yes No
IWS # Work Permit #

4) Will this request have any significant Programmatic Impact? Yes No

5) Does the FPOC need to be contacted Yes No

Bridging Document, con't

Plant Engineering Use

All work activity that is performed by Plant Engineering craft services are documented in our Trade/Service IWSs. These worksheets may be accessed through the Plant Engineering web pages. *http://www-r.llnl.gov/plant_eng/safety/ism/iws.html*
The Trade/Service IWS that covers this work activity is IWS#
To perform this work activity, the following permits, procedures and/or safety plans are required;

Permits

Asbestos Work	Concrete Penetration/Jackhammering	Confined Space
Critical Lift	Drain Work	Excavation Permit
Fire/Burning	Lead Abatement	Low Voltage Outage
Roof Access	Facility Work Permit	

Procedures

- Ceiling and Wall Penetration
- Scaffolding Installation
- Inspection of Cryogenic Storage Systems
- Lock Out & Tag

Safety Plans

- Use of Bridge Crane as mobile platform
- Working on or near energized equipment

Training

All personnel working this request are appropriately trained for this work activity and the use of necessary tools/equipment

Concurrence

Facility Hazards/Impacts have been identified, controls are in place.
Work has been authorized to proceed.

FPOC Name: Ext: Beeper:

FPOC Concurrence: Date:

Employee# and Signature

Plant Engineering's Individual Responsible for Job Execution

PE Individual's Name: Ext: Beeper :

PE Concurrence: Date:

Employee# and Signature

The *only hazard noted* on the Bridging Document was the need for the bridge crane to be locked out of service before work could begin.

…the Task Lead and FPOC signed the document

Accessing the Detectors

- FPOC and Task Lead agree a manlift is the most feasible way to reach the detectors
- Although several sizes are on site, the JLG 60 was the only one available at the time

Sequence of Work

- Three person crew assigned to task
  - Task Lead and 2 Techncians
- JLG 60 would not physically fit into the West Bay
  - Canceled work in West Bay
  - Proceeded with work in East Bay
- Technician prepares to move lift into building

First Sign of Trouble

- Technician observed by FPOC reviewing operator manual for lift
  - Technician "qualified" to operate the lift
  - No operating experience sine completing hands on certification 4.5 years earlier
  - Operator intended to practice in the yard outside the building
- FPOC asks Technician if she is qualified to operate the lift
  - Technician answers "YES"
  - Requests permission to practice in the yard
- FPOC relays request for practice to Security
  - Yard Sergeant denies request

The operator was not able to maneuver the lift into the building - another operator in the area provided help

A conscious decision was made to keep the double doors closed

- Yard Sergeant asks FPOC if he wanted the doors left open
- FPOC replies “no”
  - believed two armed guards required if doors are open
  - told Yard sergeant the ventilation system was “adequate”
  - informed the Task Lead the doors would be closed for security reasons
  - suggests engine be turned off at each detector head

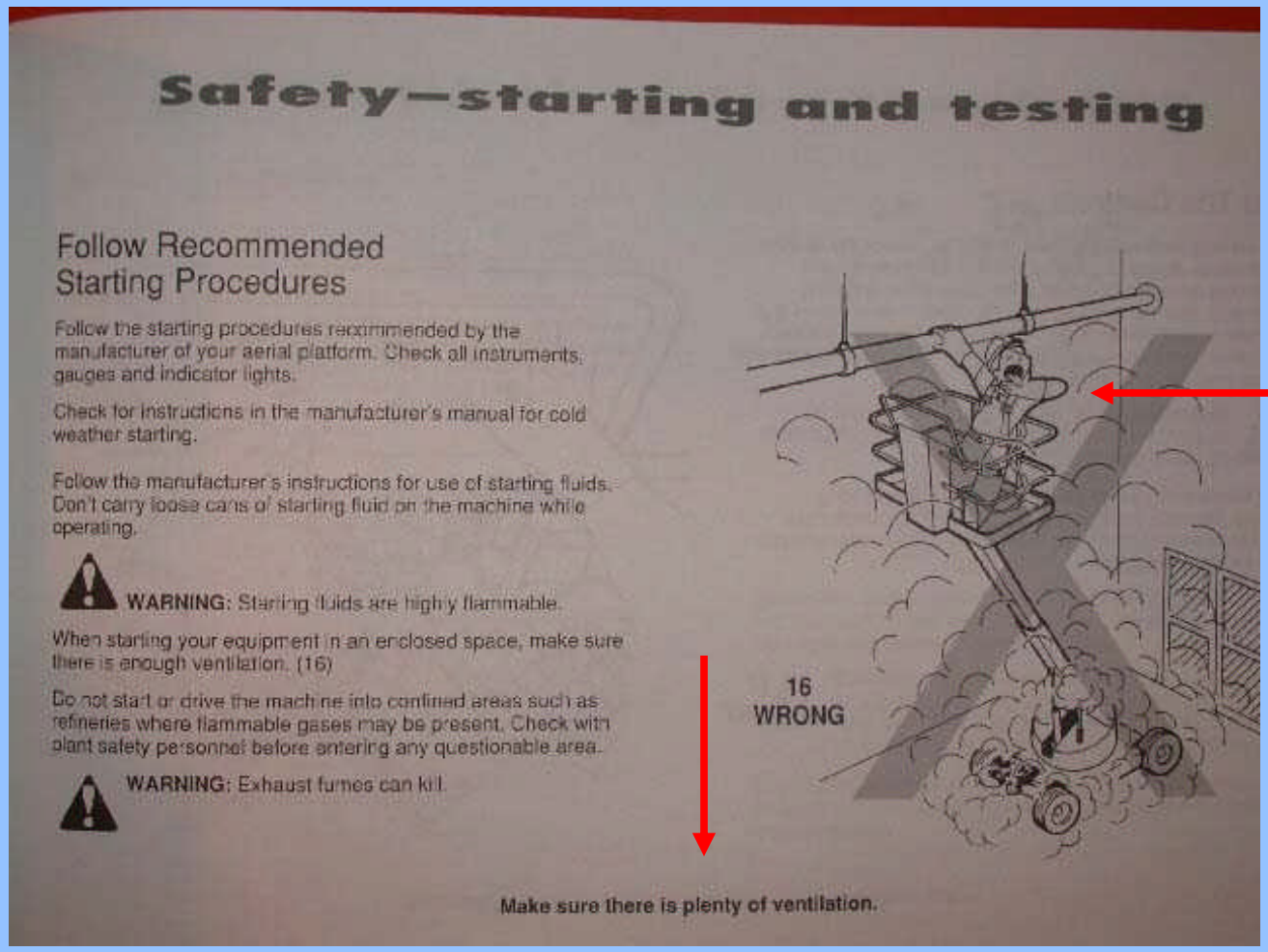
Open doors did not require guards when SNM not present

Once the manlift was inside the building, operator 1 took control

- Operator dons PPE
- FPOC leaves area to attend a meeting
- Operator experiences difficulty with equipment controls
- Operator requests help from second operator in the area
- Second operator returns and reviews controls

The crew was ready to begin work

No one paid attention to the warning label below



Safety—starting and testing

Follow Recommended Starting Procedures

Follow the starting procedures recommended by the manufacturer of your aerial platform. Check all instruments, gauges and indicator lights.

Check for instructions in the manufacturer's manual for cold weather starting.

Follow the manufacturer's instructions for use of starting fluids. Don't carry loose cans of starting fluid on the machine while operating.

WARNING: Starting fluids are highly flammable.

When starting your equipment in an enclosed space, make sure there is enough ventilation. (16)

Do not start or drive the machine into confined areas such as refineries where flammable gases may be present. Check with plant safety personnel before entering any questionable area.

WARNING: Exhaust fumes can kill.

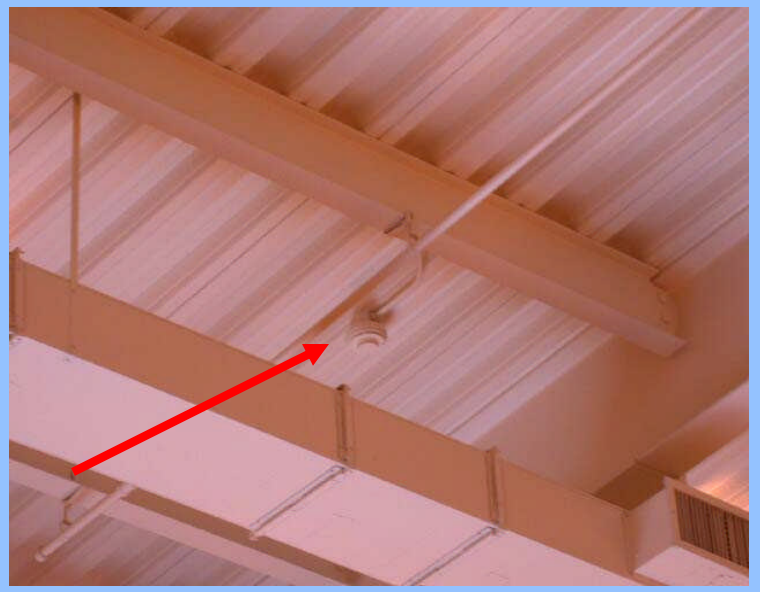
16
WRONG

Make sure there is plenty of ventilation.

Work begins as operator begins to maneuver the manlift

The Sequence

- ~ 30 minutes to complete Northwest detector
- Engine ran on propane continuously ~ 30 minutes due to frequent relocation of basket
- Operator begins to move to Southwest detector head



Location of detectors made access difficult

Operator begins to experience difficulty while maneuvering manlift

- Physiological symptoms of fatigue, irritability, thirst and butterflies
- Made request to Task Lead (ground support) for a drink of water
- Operator begins to lower the manlift basket as the Task Lead goes to get water
- While in route, Task Lead is paged by supervisor and agrees to meet him outside building, delayed return by ~ 5 minutes

Task Leads returns to room and finds operator in trouble

- Operator is sitting on floor of basket
- Basket is ~ 10 feet above floor over a pit
- Task Lead uses ladder to get drink to operator
- Recognizes operator is in trouble

Task Lead helps operator out of basket, down the ladder and into fresh air

Post Incident

- Vehicle was found to operating "rich" resulting in a higher level of CO being exhausted
- Fired Department recorded 854 ppm in the East Bay ~ 30 minutes after engine shut off
  - TWA = 50 ppm

The work crew did not monitor for CO while performing their work.

Did the system fail the worker?

YES!

- Training program did not ensure operator capability
- Bridging document was not adequate to identify all hazards & controls
- FPOC did not understand security rules
- FPOC did not understand the building ventilation system
- The *100% goal* pressured the supervisor
- Assistance from the ES&H Team was not triggered when initial scope changed - use of manlift (no formal risk assessment requested)

Did the system fail the worker?

YES!

- Less than adequate guidance in ES&H Manual in that the operation of manlifts indoors was not addressed
- General misconception that propane powered equipment is safe for use indoors

Elimination of any of these factors may have prevented this incident!

Making rigorous…more rigorous

- Site-wide policy for the use of internal combustion engines indoors
  - Include hazard assessment by ES&H Team
  - Portable CO monitors
- More rigorous requirements for operators to demonstrate their capability
- Posting of warning labels on internal combustion equipment to warn personnel about it's use indoors or in confined spaces
  - Fleet maintenance to check legibility of labels/stickers during PMs
- Site-wide emission standards for JLGs, Forklifts, Scissor Lifts and other internal combustion equipment

Workers have high expectations!