



# Integrating Lean & EHS for Success

**National Shipbuilding Research Program Lean Forum**

September 12-14, 2006

# Presentation Objectives

- » Briefly review Lean principles and how Lean relates to EHS performance
- » Discuss “Lessons Learned” from Lean Implementations that failed to consider EHS impacts
- » Share Lean EHS Success Stories

# Lean = Eliminating Wastes

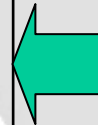
## EHS = Eliminating Hazards

### Lean's "Deadly Wastes"

- » Defects
- » Overproduction
- » Waiting
- » Non-value added processing
- » Transportation
- » Inventory
- » Motion
- » Employees underutilized

### *EHS "Deadly Wastes"*

- Unsafe Workplaces
- Accidents and Incidents
- Excess materials use
- Pollution/emissions
- Scrap & non-product output
- Hazardous wastes



*Many EHS wastes are embedded in, or related to, Lean's deadly wastes*

# Lean Production's EHS "Coattails"

- » Less scrap, fewer defects, less spoilage = **reduced environmental waste**
- » Less overproduction, simpler products, right-sized equipment = **reduced use of raw materials**  
**reduced exposure to ergonomic stressors**
- » Less storage, inventory space needed = **reduced materials, land and energy consumed**
- » Less overproduction, lighting/heating/cooling unneeded space = **less energy use, reduced exposure to hazards**
- » More efficient transport and movement = **fewer people-equipment exposures/lower emissions**

# Lean's “Blind Spots”

- » Lean can be leveraged to produce even more EHS improvement, by addressing “blind spots” in Lean
  - **Environmental and human health risks** are often not explicitly considered in lean initiatives
  - **EHS impacts** throughout the **product lifecycle** can affect customers and stakeholders
  - **Hidden EHS waste** is often buried in overhead and facility support costs
  - What may appear to be a process improvement may end up causing a much more serious EHS exposure.

# The Business Case: Why Connect Lean and EHS?


1. Learn to see hidden EHS waste (blind spots)
  - Reduce costs
  - Reduce risk
  - Save lives
2. Enhance the effectiveness of Lean implementation
  - Anticipate and ease constraints to applying Lean
  - Improve process flow and reduce lead times
3. Deliver what customers and employees want
  - Safeguard company and brand reputation
  - Reduce accidents and incidents
  - Improve employee morale and commitment
  - Improve environmental quality

# Value Stream Mapping Tools

1. Use icons to identify processes with EHS opportunities
2. Record EHS data for processes in VSMS
3. Analyze materials use vs. need in a “materials line” for VSMS
4. Expand the application of value stream mapping to people and natural resource flows
5. Find Lean and EHS opportunities or costs in future state VSMS



# Common Processes with EHS Wastes and Opportunities

- 
- » **Metal fabrication and machining**
  - » **Blasting, cleaning, and surface preparation**
  - » **Bonding and sealing**
  - » **Welding**
  - » **Cutting, burning and grinding**
  - » **Metal finishing and plating**
  - » **Painting and coating**
  - » **Waste management**
  - » **Chemical and hazardous materials management**

# Find Lean and Environment Opportunities in Future State VS Ms

- » **Where are kaizen events needed to address the biggest areas of EHS wastes?**
- » **Will any changes be made to the layout of processes marked with an EHS icon, or to the chemicals used by those processes?**

# Reasons to Include EHS Expertise in Kaizen Events

- » **If not properly managed for EHS impacts, kaizen events can:**
  - **Result in regulatory compliance violations**
  - **Create health and safety hazards for workers**
  - **Overlook opportunities to reduce wastes and help organizations meet their environmental goals**

# Kaizen Event EHS Change Management Strategies

- » **Proactively Involve EHS Staff in Kaizen Events**
- » **Use an EHS Checklist for Lean Events**
  - **Determine which events may have EHS impacts**
- » **Train Lean Team Leaders on EHS Issues**
- » **Identify an EHS Contact for Kaizen Event Teams**

# Questions to Identify Lean & Environment Opportunities

- » **Asking the right questions in Lean events can uncover hidden waste-reduction opportunities and costs**
  - **Chemicals that could harm human health and/or the environment**
  - **Water and energy utilities**
  - **Compliance support infrastructure that may be hidden in facility overhead**



# Why Should EHS Be an Integral Part of 6S?

- » **Avoid productivity losses from injuries and health hazards by providing clean, accident-free work areas**
- » **Meet or exceed your company's environmental performance and waste reduction goals**

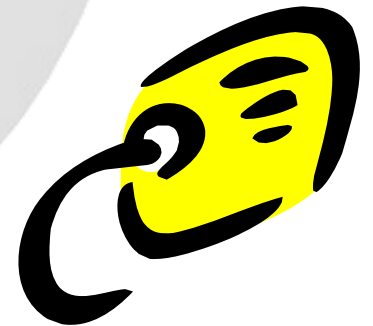
# Tools for Incorporating EHS into 6S

1. **“Yellow-Tagging Items” with EHS Issues**
2. **6S Inspection and Audit Checklists**
3. **Visual Controls to Reinforce EHS Procedures**

# Use Yellow Tagging to Identify EHS Issues During the Sort Process

## » *Supplement Red Tagging with Yellow Tagging*

- Identify EHS wastes and hazards
- Evaluate the need for these items
- Evaluate potential alternatives for these items
- Address them appropriately

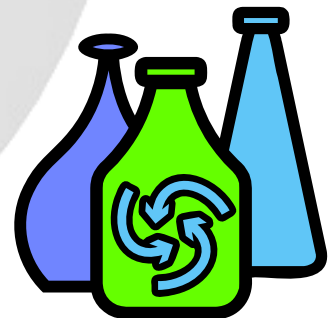


# Example Yellow Tag

Category (circle one)	1. Health or safety concern 2. Environmental concern		
Item Name and Number			
Description of Issue or Question			
Division Responsible:		Date:	

# 6S Inspection and Audit Checklists

- » Expand 6S inspections of the Shine pillar to include EHS issues
- » Expand 6S audits performed as part of the Sustain pillar to include EHS issues



## Example 6S Inspection and Audit Questions for Eliminating EHS Waste and Risk

- » **Sort:** Are red-tag items being disposed of properly?
- » **Set in Order:** Are containers with chemicals or wastes covered or sealed when not in use?
- » **Shine:** Are there any leaks from equipment, piping, tanks, exhaust lines, or other areas?
- » **Safety:** Are lockout and emergency procedures posted and easily accessible?
- » **Standardize:** Are relevant EHS procedures for the work area integrated into standard work?
- » **Sustain:** Are workers in the area aware of chemical hazards associated with standard work tasks?

# Detailed 6S Audit Checklist

Document Title:  6S AUDIT RECORD (SAFETY)	Document No.	Revision No.	Page: 1 of: 4
Required by:			

Audit Type:  Initial Certification  
 Sustaining

Auditors: \_\_\_\_\_ Date: \_\_\_\_\_  
 Name: \_\_\_\_\_ Name: \_\_\_\_\_  
 Name: \_\_\_\_\_  
 Workplace Representatives: \_\_\_\_\_  
 Name: \_\_\_\_\_ Name: \_\_\_\_\_

Subject	Questions	Yes	No
<b>1. Aisles</b>	<b>A.</b> Are aisles marked? 29 CFR 1910.22(b)(2)		
	<b>B.</b> Are aisle widths maintained? 29 CFR 1910.22(b)(1)		
	<b>C.</b> Are aisles in good condition? 29 CFR 1910.22(b)(1)		
	<b>D.</b> Are aisles and passageways properly illuminated?		
	<b>E.</b> Are aisles kept clean and free of obstruction? 29 CFR 1910.22(b)(1)		
	<b>F.</b> Are fire aisles, access stairways, and fire equipment kept clear? 29 CFR 1910.178(m)(14)		
	<b>G.</b> Is there a safe clearance for equipment through aisles and doorways? 29 CFR 1910.176(a)		

See the full example checklist: <http://www.epa.gov/lean/toolkit/app-e.htm>

# Getting Started with Lean and EHS

- 1. Understand the “business case” for connecting Lean and EHS**
- 2. Begin dialogue between Lean and EHS managers**
- 3. Cross-train Lean and EHS leaders**
- 4. Pilot test Lean and environment integration techniques**
- 5. Expand and fully integrate Lean and EHS improvement efforts**

## Lessons Learned

### Process:

Involving EHS professionals in the LEAN process must accommodate the relatively small number of EHS staff. There are not enough specialists to attend every LEAN event, but the following steps can help maximize EHS support:

- Ensure that EHS personnel trained in the process are identified as a POC who can attend closing events
  - Use “parking lots” for issues that require EHS input
  - Use an EHS checklist to identify impacts that require specialists to be involved
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# Lessons Learned

## Assembly Building Mezzanine

As part of a 5S / Kaizen event in the Assembly Building, mezzanines were installed to support unit construction. Upon discovery and review by EHS personnel the following issues were found requiring corrective action:

- Lack of adequate grounding of the welding equipment;
  - inadequate access, and;
  - Inadequate fall protection.
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# Lessons Learned

## PO2 Tool Crib drop boxes

As part of a 5S initiative in the PreOutfit 2 building, drop boxes were built and installed for distributing and returning of certain material. Upon discovery and review by EHS personnel the following issues were found requiring corrective action:

1. Improper Respirator handling – Tool crib attendant not qualified
  2. Aerosol can return had inadequate ventilation
  3. Paint Kit return had inadequate ventilation
-

# Lessons Learned

## **Electrical load-out platforms sequence change**

**As part of a 5S reorganization, outrigger platforms were installed on ships under construction to hold electrical equipment (transformer, welding grids, etc.) to keep work areas open. Upon discovery and review by EHS personnel the following issues were found requiring corrective action:**

- 1. Clearance for employees inadequate**
  - 2. Weight testing method needed to be changed**
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# Lean-EHS Collaborative Successes

## EHS Metrics

- 1. Risk Reduction:** Acts as a leading indicator, and a positive reinforcement tool. Gives a “double count” for hours saved
  - 2. Injury Rates:** Although a trailing indicator, if used in specific work areas with before/after results published, it can indicate trends
  - 3. Regulatory Inspection:** Another trailing indicator that shows a reduction in the number of discrepancies found in an area before and after a Lean event
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# Lean-EHS Collaborative Successes

## New mobile equipment

**EHS was part of the team to evaluate new mobile equipment (man-lifts, etc.) to improve process flows in several areas. EHS staff contributed to the following during the event and subsequent implementation:**

- 1. Risk assessment of equipment vs. the areas they will be used**
  - 2. Assessment of the type of work to be performed**
  - 3. Researched fall protection requirements**
  - 4. Reviewed equipment for training requirements**
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# Lean-EHS Collaborative Successes

## 5-Skid reorganization

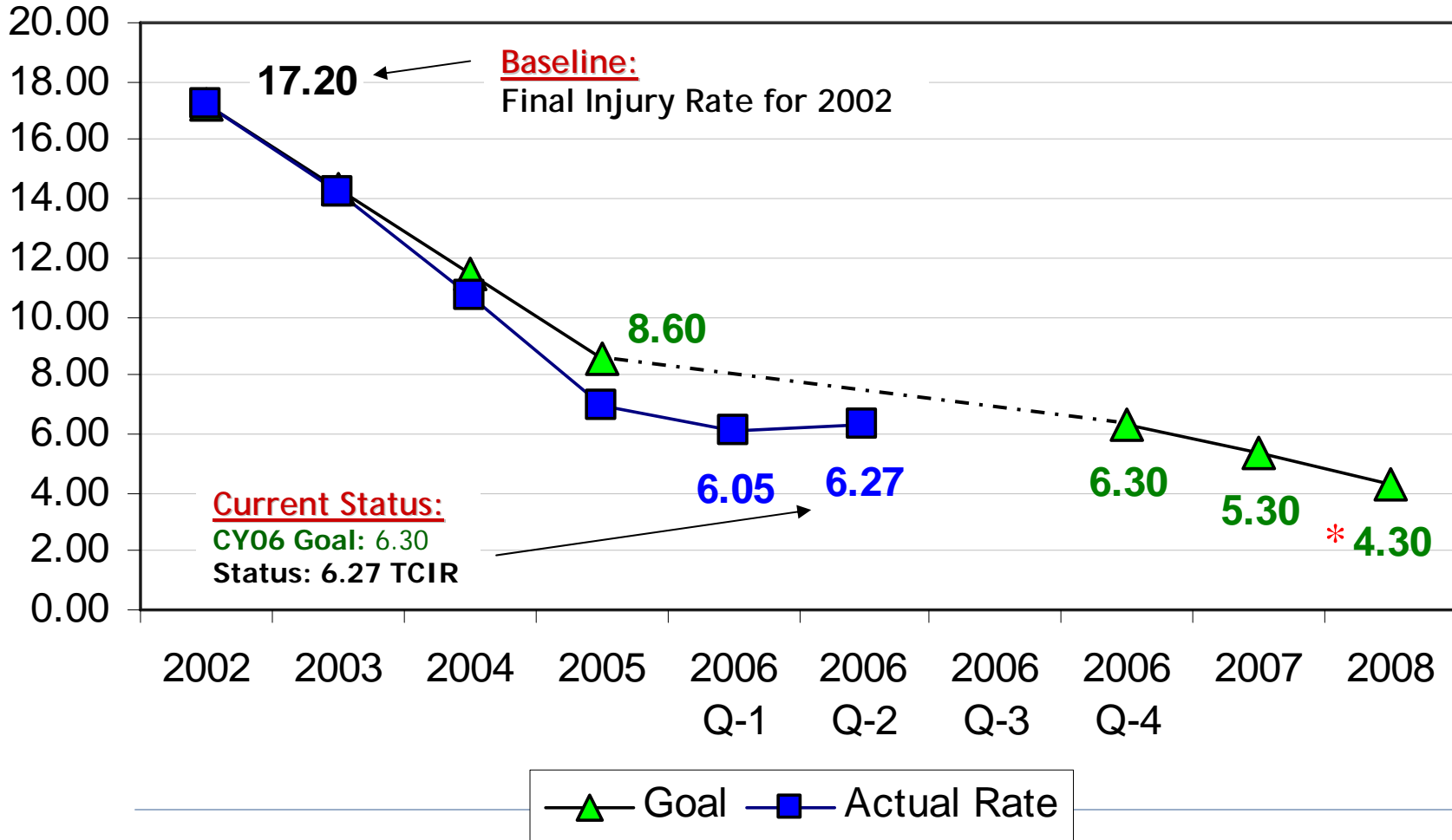
**EHS was part of the team to do a 5S event in the 5-Skid area. EHS staff contributed to the following during the event and subsequent implementation:**

- 1. Review employee access and egress**
  - 2. Layout of machinery**
  - 3. New equipment reviewed**
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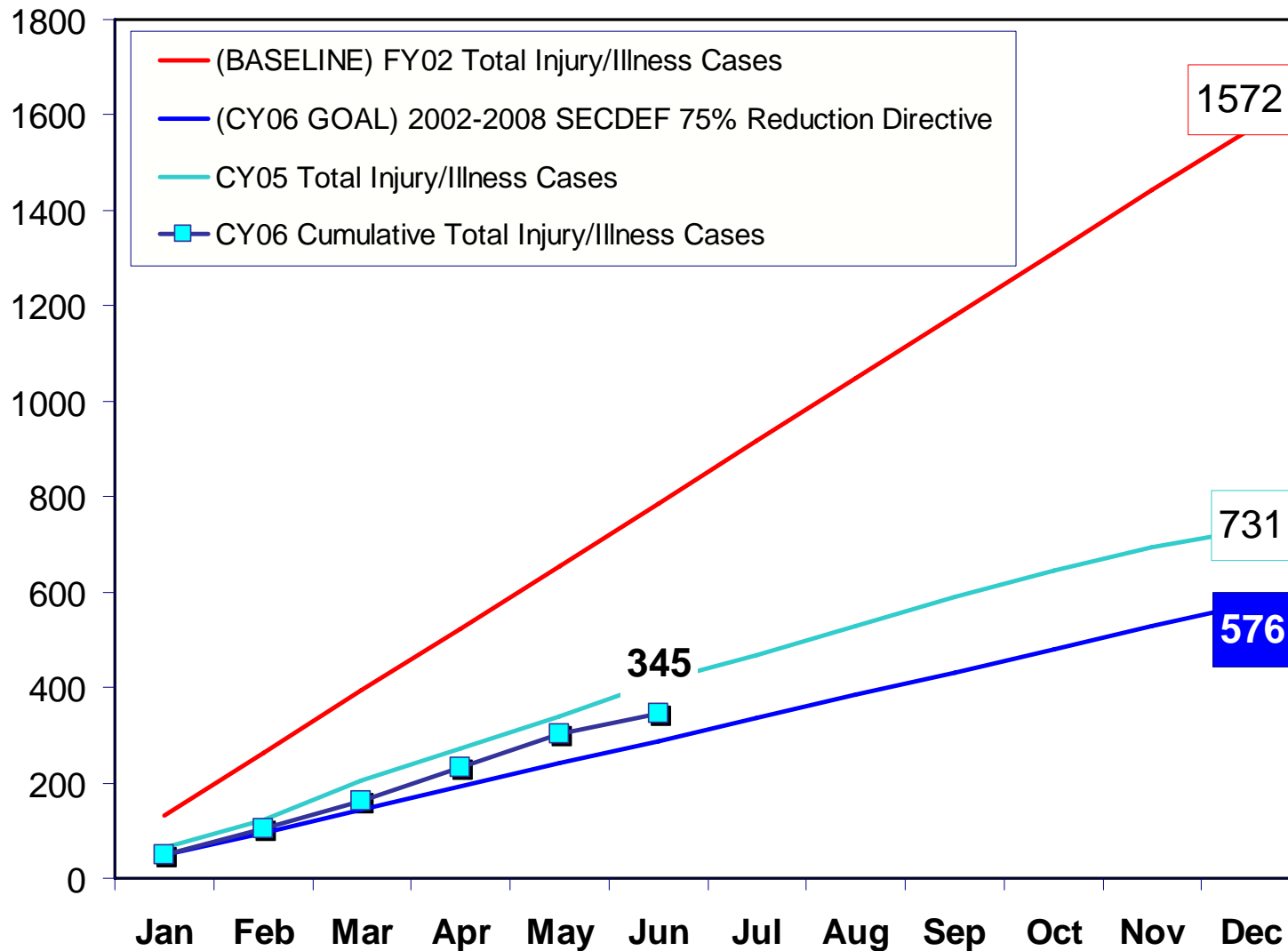
# Present & Future Mishap Reduction Goals

**\* SECDEF Directive:**

**Goal: 75% Reduction from 2002  
4.30 Injury Rate by the end of 2008**

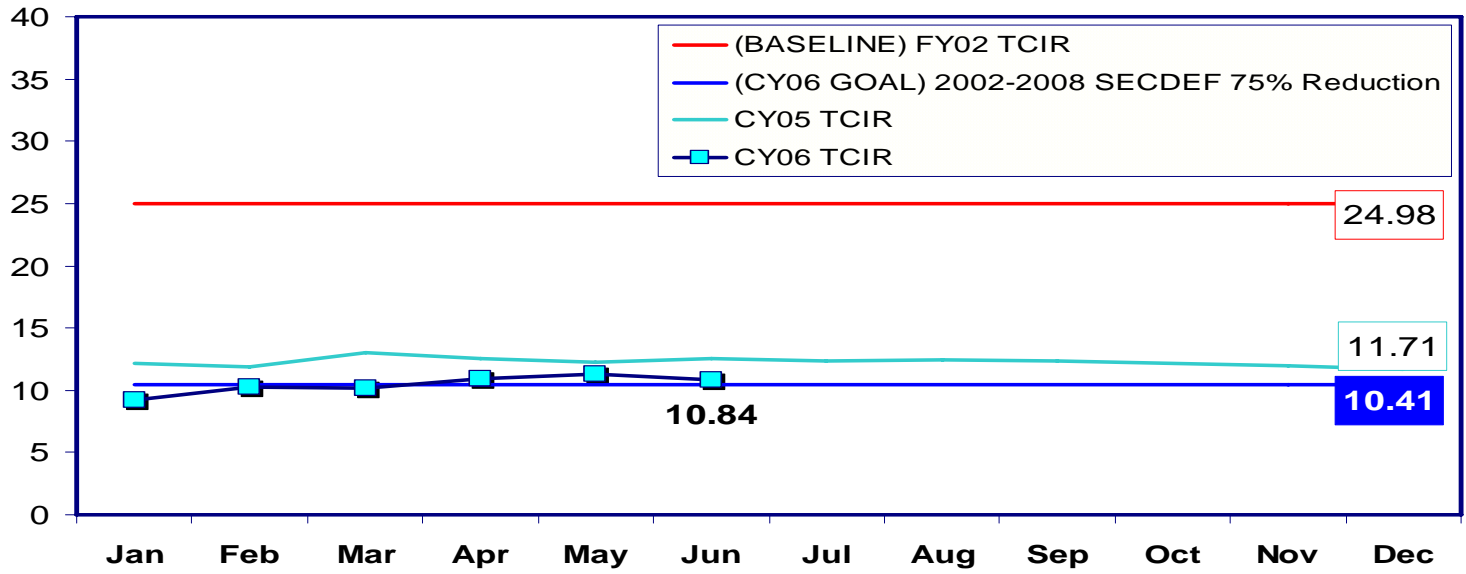


Total Injury/Illness Cases

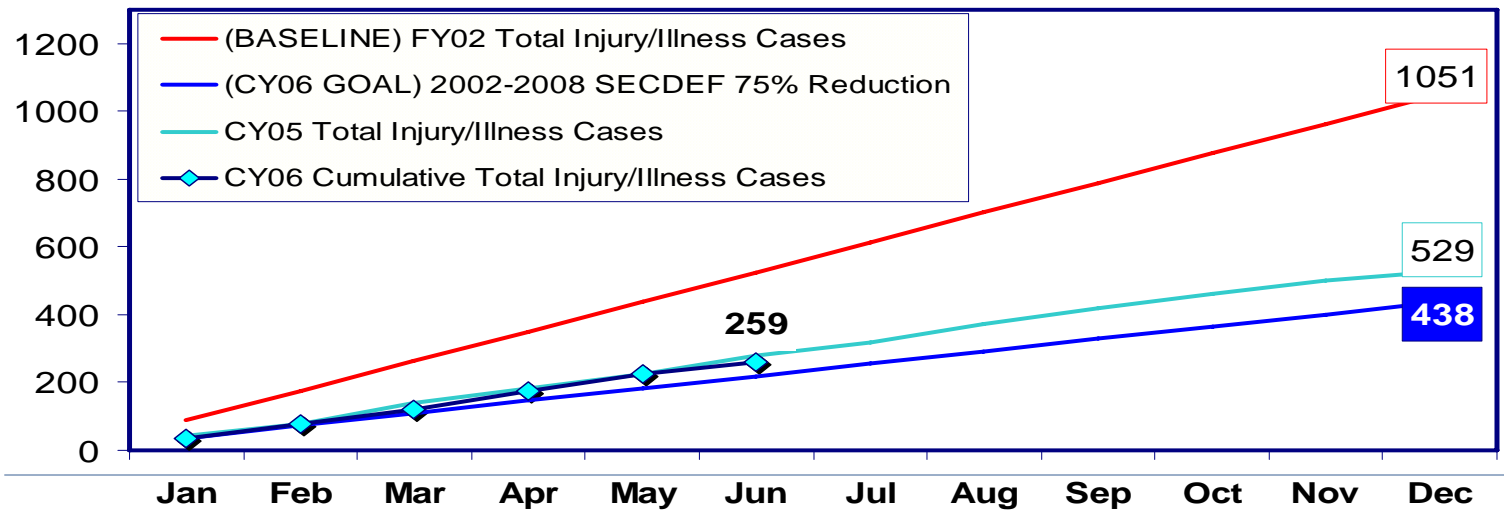


Production Dept Injuries/Illnesses

**Total Case Incident Rate (TCIR)**



**Total Cases**



# Before Lean Improvements To DD Layout

- Work area cluttered
- Damaged services not easily identifiable
- Unused materials improperly stored
- Trip, strain, twist hazards



# After Lean Improvements to DD Layout

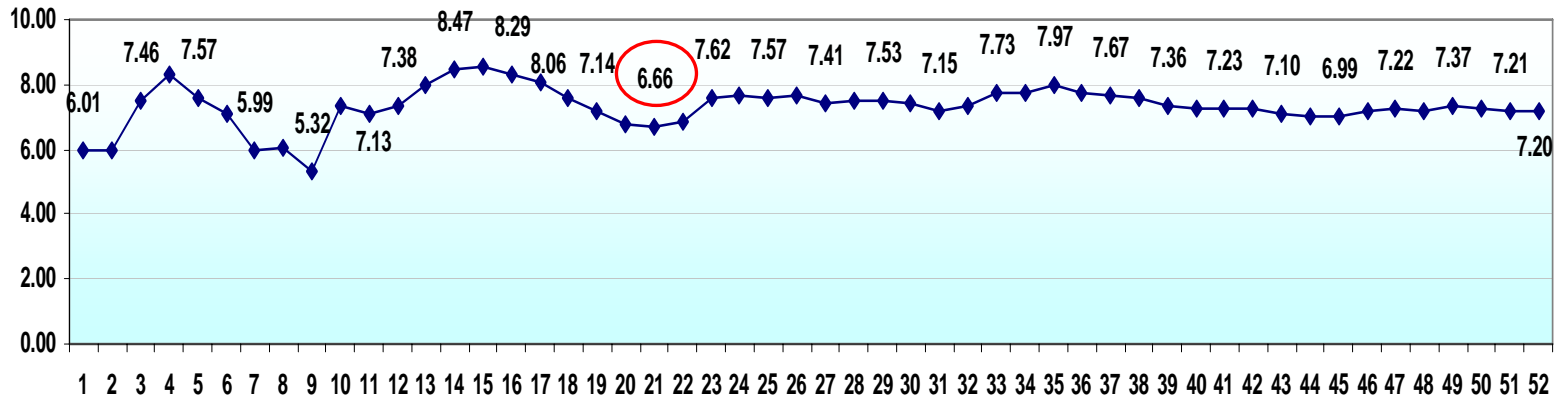
- Services off the dry-dock floor
- Equipment organized
- Equipment located / secured within assigned footprint
- Dedicated shipping path



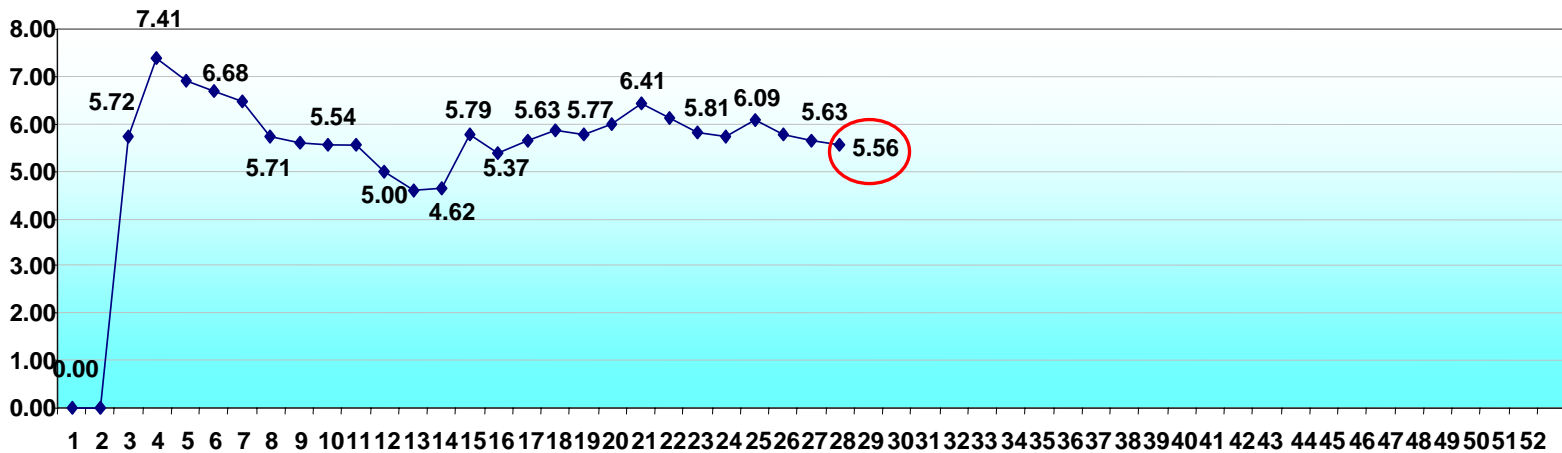
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# Before & After TCI R Comparisons

SSBN 730, USS Jackson Cumulative Weekly Total Case Incident Rate



SSBN 731, USS Alabama Cumulative Weekly Total Case Incident Rate



# Before Lean Improvements in Crane Maintenance Shop Area



# After Lean Improvements in Crane Maintenance Shop Area



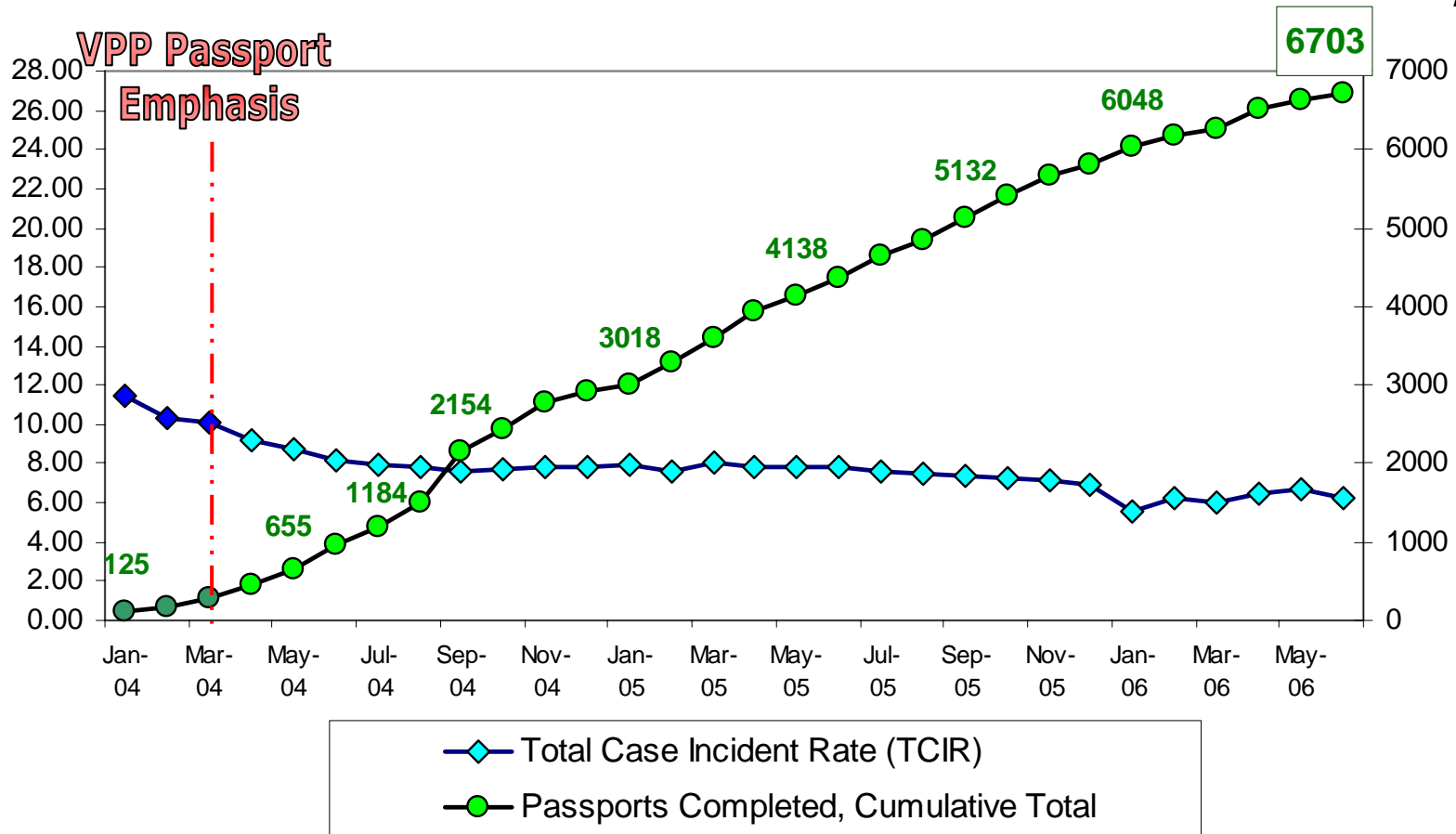


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VPP Passport Trends

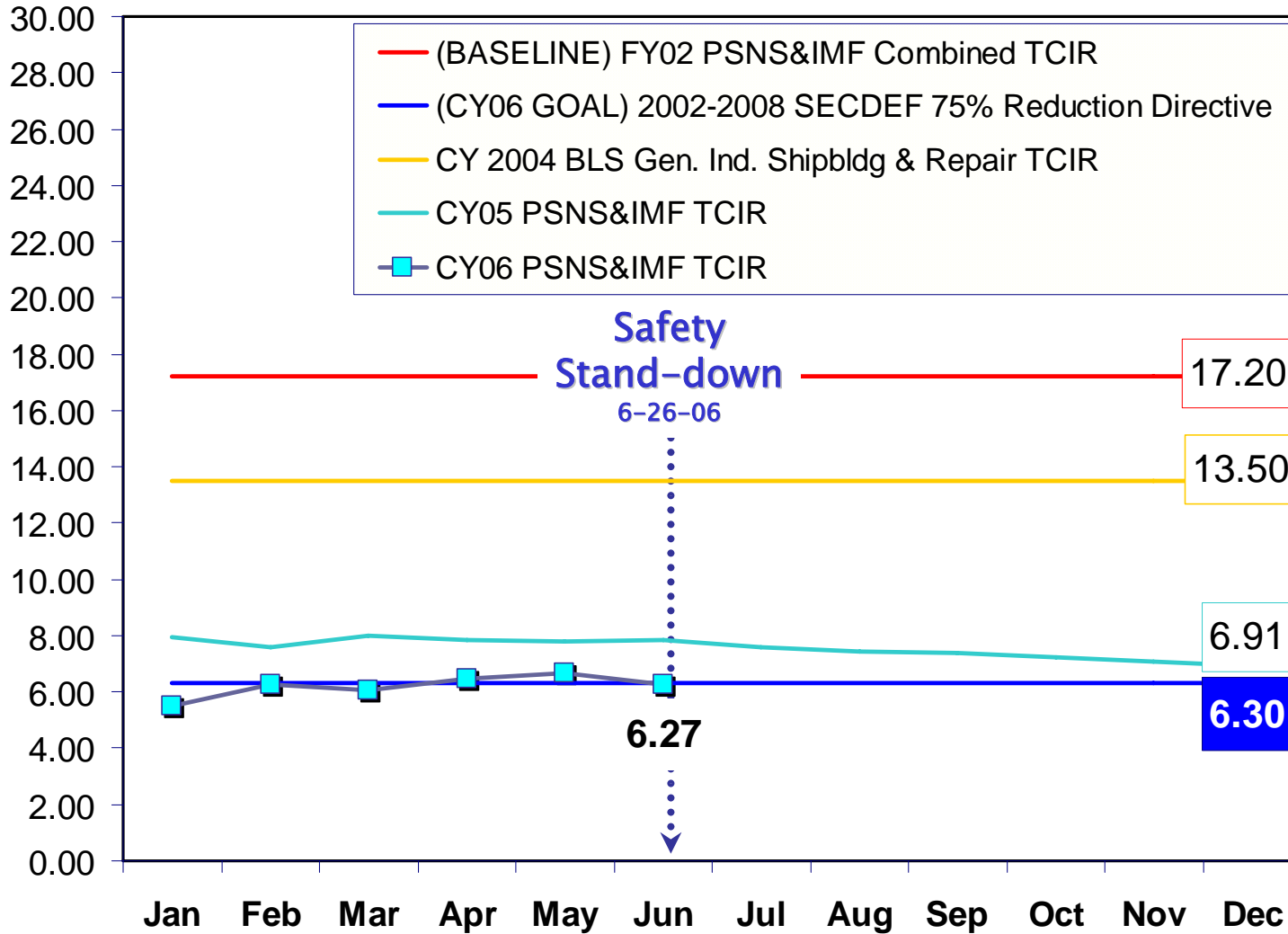
CHANGING CULTURE/BEHAVIOR



Invest your time! It's worth it – for you and your co-workers!

Total Case Incident Rate (TCIR)

**(TCIR = Normalized rate that measures Total Cases occurring per 100 employees working full-time over the course of one year)**



# Sample Lean Event EHS Checklist (1 of 2)

**Instructions:** Describe the Lean event/process and answer the following questions about proposed process changes. If any of the questions are answered either “Yes” or “Unk” (unknown), there may be the potential for environmental impacts that need to be reviewed by EHS staff.

Physical Environment			
<i>As a result of the Lean event, will there be:</i>	Unk	Yes	No
Any changes to the locations where either maintenance work or use of hazardous chemical/material will occur?			
Any changes to your personnel’s work zone assignments?			
Any new equipment or modifications to existing equipment, or movement of existing equipment that has the potential to produce air or water emissions (e.g., rinse equipment/operations, cleaning tank, heating ovens)?			
Any changes to the facility (e.g., vents, stacks, floor drains, oil/water separators)?			
Any changes in the location(s) of the current flammable storage locker/areas?			
Any new confined space entry activities or procedures (e.g., personnel entering fuel tanks for cleaning)?			

# Sample Lean Event EHS Checklist (2 of 2)

<b>Material/Chemical Use and Storage</b>			
<i>As a result of the Lean event, will there be:</i>	<b>Unk</b>	<b>Yes</b>	<b>No</b>
Any changes to the type or volume of materials issued to personnel and/or used? This includes the introduction of new chemicals, elimination of chemicals, etc.			
Any changes to the chemical introduction or issuance procedure for chemicals/materials containing hazardous materials?			
Any changes in the volume of chemicals/materials stored?			
Any flammable materials that are not returned to the storage cabinets at the end of each shift?			
<b>Waste Management</b>			
<i>As a result of the Lean event, will there be:</i>	<b>Unk</b>	<b>Yes</b>	<b>No</b>
Any change(s) to the waste profiles for wastes stored at any initial accumulation points?			
Any change(s) to the location or number of initial waste accumulation points?			
Any change(s) to the volume of waste(s) that require disposal (i.e., wastewater, hazardous or solid waste) or to the volume of material that will be recycled or reused?			