The Manufacturing Game®

A Project Approach to Defect Elimination Using The Manufacturing Game®

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Overview

The Manufacturing Game®

¶ Traditional approaches to reliability improvement have a mixed track record. They typically:
- Take a long time, cost a lot of money and are easily abandoned.
- Fail to take a cross-functional approach, instead concentrate on the maintenance function.
- Focus on making the process of removing defects more efficient without tackling the source of defects
- Fail to engage the front-line.

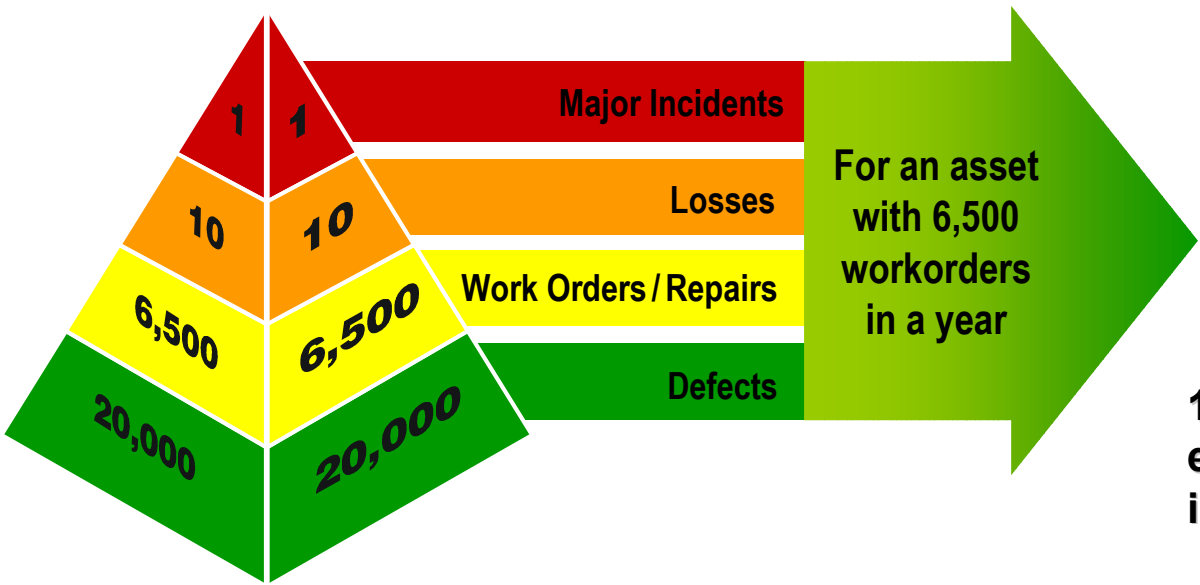
¶ Delivering pacesetter performance requires the engagement of the majority of the workforce in eliminating small defects before they become performance-limiting problems

¶ The Manufacturing Game® inspires front-line workers to take action to eliminate defects and the reactive work that these defects create.

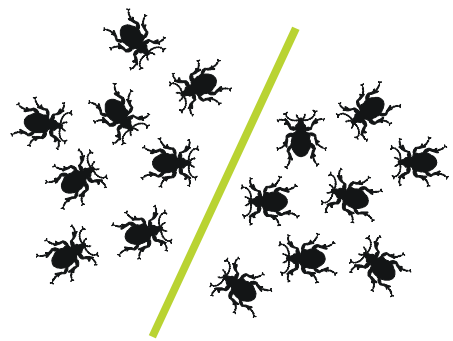
¶ The Manufacturing Game® along with Action Teams as part of an integrated reliability improvement effort will produce significant bottom line results in a short time frame.

Large-Scale Engagement is Required…

Every incident implies thousands of defects



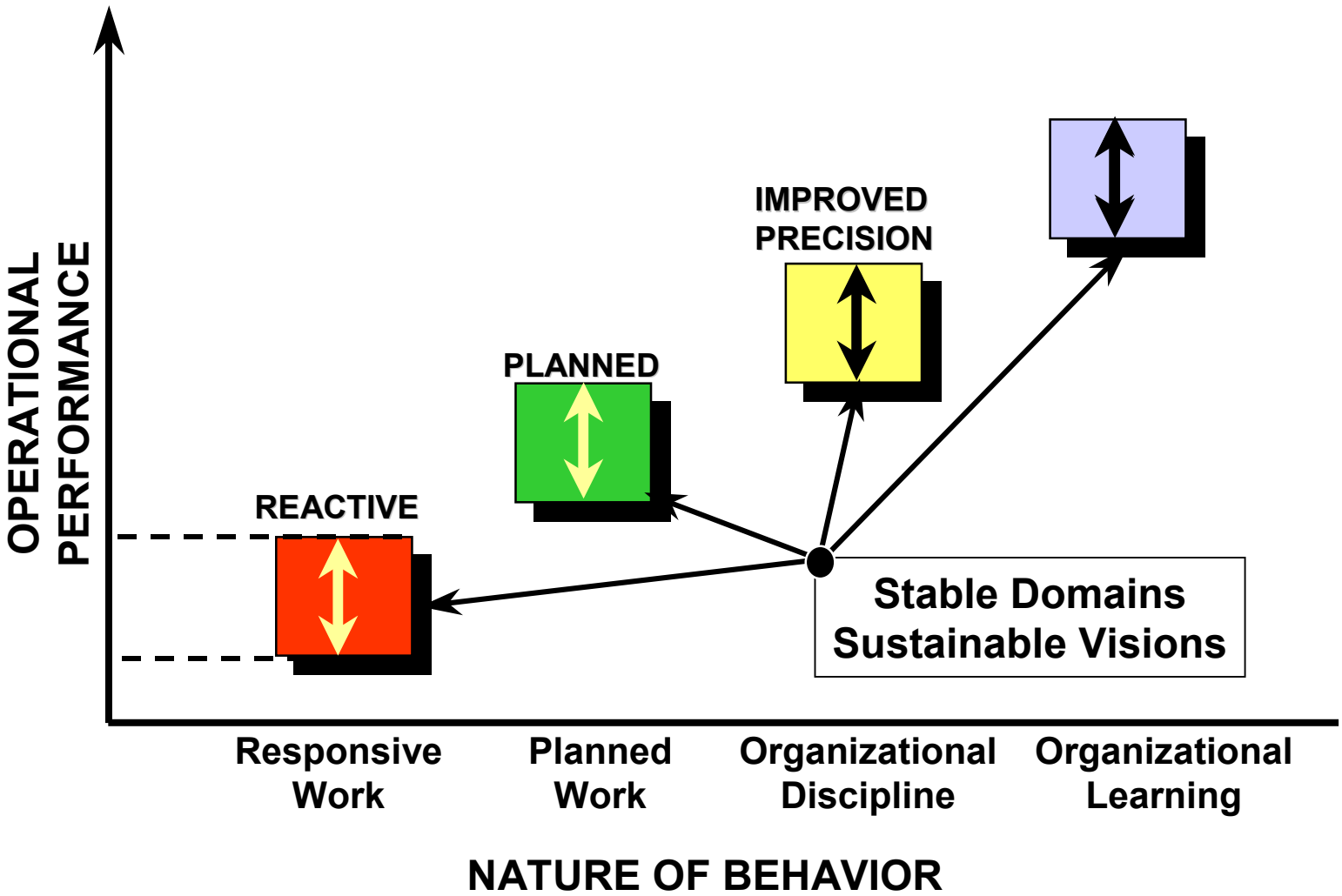
20,000 defects



10,000 defects must be eliminated to reduce the incident rate by 50%

…because a typical top down approach will, at best, target a few hundred defects.

Four stable operating domains



Key Deliverables

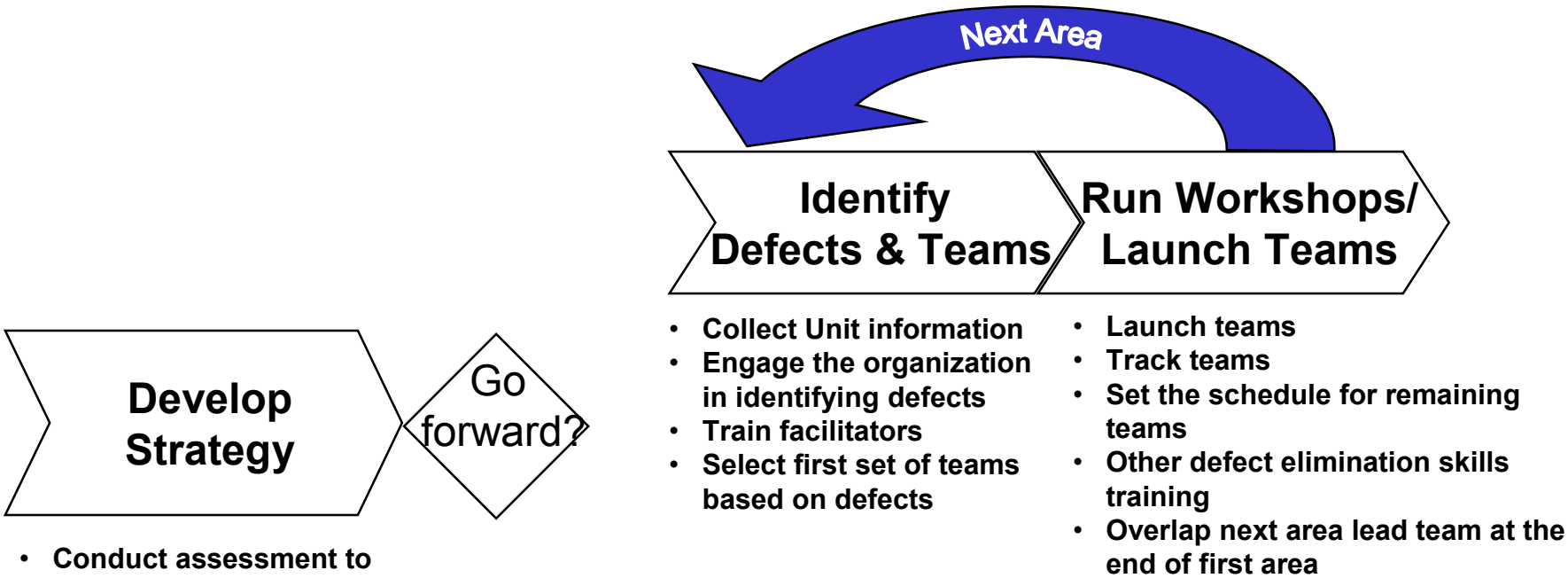
- **<u>An engaged organization:</u> Everyone in the organization exposed to defect elimination and 70-80% actively engaged. Everyone has heard the site vision from site leaders and understands what role they play in achieving it. A Pervasive culture of looking for root causes and eliminating them with cross functional teams**

- **<u>Defects eliminated:</u> Thousands of root cause defects identified and hundreds eliminated. Direct profit improvement of over $25,000 per team plus improved HSE performance.**

- **<u>Skills Development:</u> The technical skills required for defect elimination will be pulled in as they are needed by specific teams addressing specific issues.**

- **<u>Ongoing process:</u> A process to continue defect elimination and lead it at the area/unit level. The supervisor role is also transformed to lead the effort to identify defects and form teams to deal with them.**

Engaging the Workforce in Defect Elimination



- Collect Unit information
- Engage the organization in identifying defects
- Train facilitators
- Select first set of teams based on defects

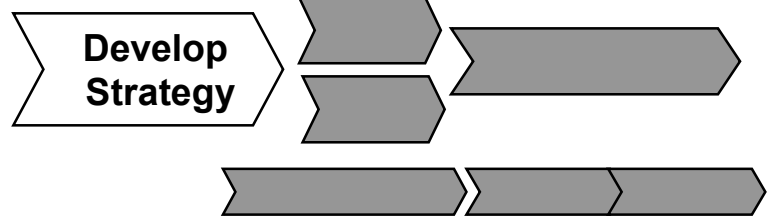
- Launch teams
- Track teams
- Set the schedule for remaining teams
- Other defect elimination skills training
- Overlap next area lead team at the end of first area

- Conduct assessment to determine where the gaps are
- Identify the business driver (calculate the "Cost of Unreliability")
- Create a vision of the future and a roadmap to get there
- Determine priorities, create implementation plan (choose first area)
- Create a Project Team

- Communicate the effort (create visual signs of success)
- Track teams
- Eliminate barriers
- Deal with organizational change issues

- Begin to shift the supervisor role
- Move team launching and tracking to area team

Develop Strategy



Assessment

- Benchmark key metrics and practices.
- Determine Cost of Unreliability by unit.
- Assess change readiness of workforce.
- Assess skills of the workforce.

Elapsed Time: 4-8 weeks
Management time: 8 days

Create Vision and Roadmap

- Engage the site leadership team in understanding current gaps, business drivers, and potential for improvement.
- Develop a vision of where the site wants to go and a roadmap to show how it is going to get there.

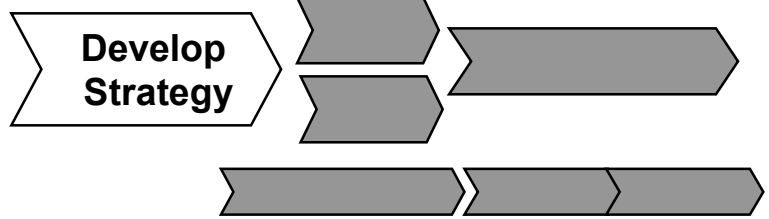
Project Team

- Include strong operational leadership.
- Dedicate significant time.
- Include hourly / union leaders.

Priorities and Implementation Plan

- Choose first area based on the assessment of unit-by-unit opportunities and readiness.
- Create timeline for all areas.
- Agree on a detailed implementation plan including timing, resourcing and funding.

Project Team



Site Manager

- Significant production credibility and experience
- Full time for the project
- Responsible for execution of project and communications

Team Leader

Ledet Enterprises Facilitator(s)

- Project management
- Introducing tools and techniques
- Coach and catalyst

Reliability Leader

- Part time member (1/3)
- Helps to Identify defects
- Facilitates workshops
- Provides access to technology for defect elimination teams

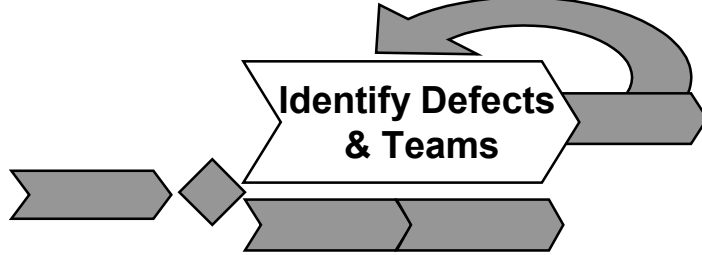
Area Leaders

- Part time member (1/3)
- Facilitates workshops
- Helps to form and track teams
- At least one maintenance person

Hourly Leader(s)

- Respected by peers
- Part time member (1/3)
- Facilitates workshops
- Use peer relationships to cut through issues

Getting Started



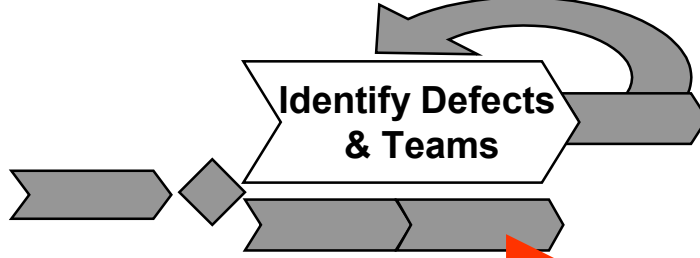
Prepare the project team:

- Develop and refine the detailed implementation plan
- Create a plan to deal with common obstacles (e.g., how will proactive work get done if it has to go through a ranking process in the CMMS)
- Train on facilitation skills

Create an area implementation team in the first area:

- Include key production leaders
- Have at least one maintenance person from each of the relevant trades
- This team may overlap with the day-to-day management team but should be distinct from that group
- This team will eventually take over the defect selection, team tracking function

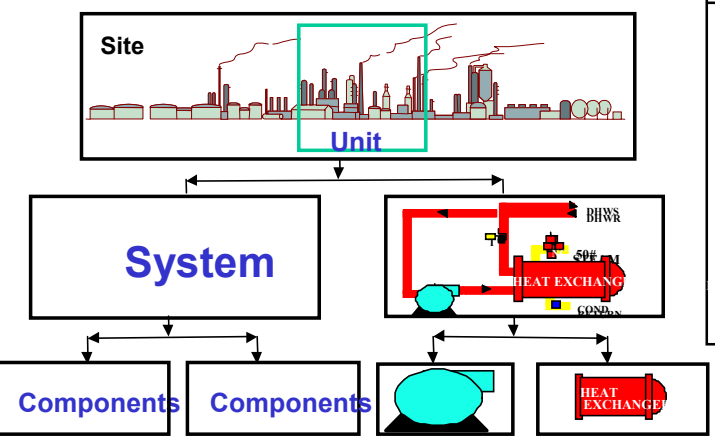
Unit-by-Unit Approach



Elapsed Time: 4 weeks

Collect basic data on the unit:

- Personnel
- Shift schedules
- Vacation schedules
- Equipment hierarchy
- Key contractors and vendors
- Other initiatives

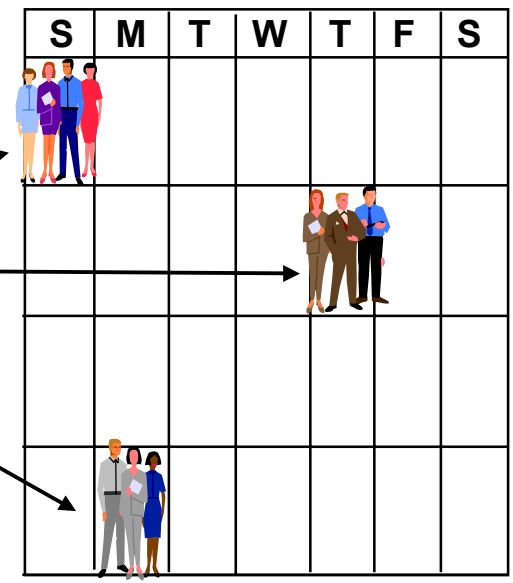


Use "Cost of Unreliability" criticality and FMEAs to create a prioritized list of defects.

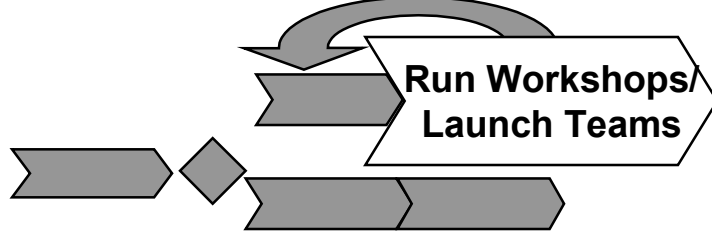
Failure Modes and Effects

Criticality	Function/Failure	Cause

Select defects and schedule action teams to get started



The Manufacturing Game®

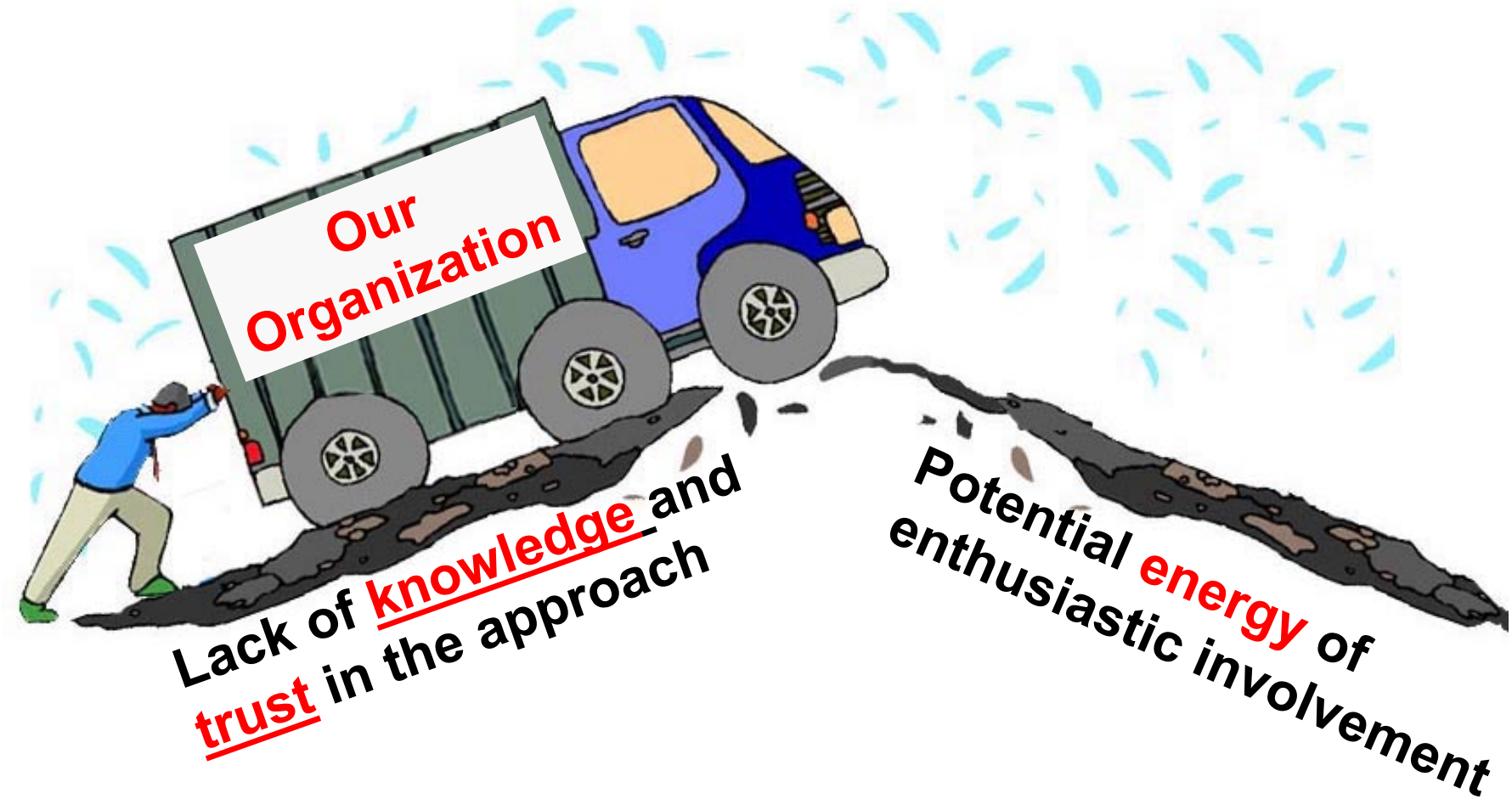


Elapsed Time: 12-13 weeks per area

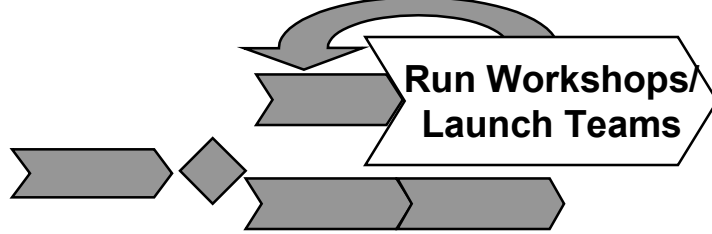
- **Two-day session 24-36 participants (5-7 action teams)**
  - **Day 1**
    - **Increase awareness of how eliminating defects significantly improves operations performance**
  - **Day 2**
    - **Identify real defects**
    - **Develop plan to eliminate defects**

A good pace is 1-2 workshops or 5-14 action teams a month depending on the size of the site.

Mandating early involvement to get enthusiastic voluntary involvement later

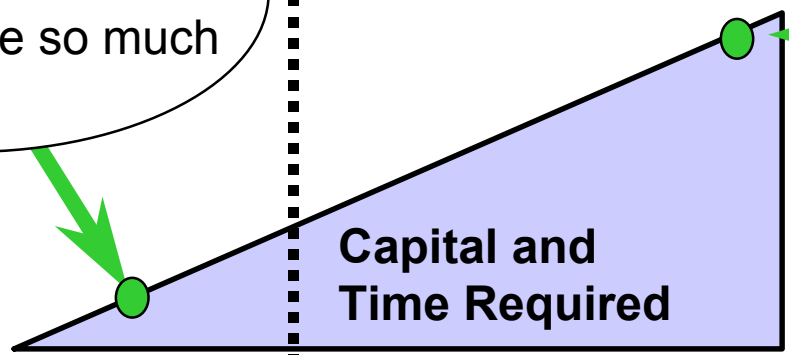


Using Different Approaches for Different Defects



If we would just keep the site glasses clean we wouldn't waste so much product.

We need flow meters on all tanks integrated with the DCS to find the source of all this waste



Action Teams

- Fix problems where there is passion
- Eliminate wasted time
- Don't overdo the process

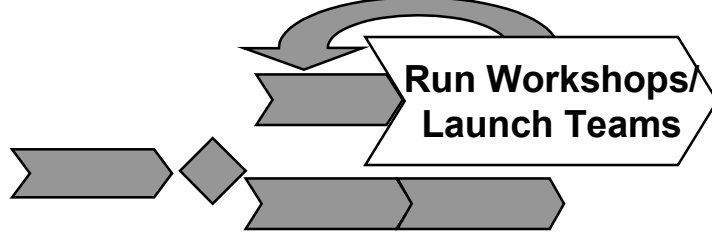
Top Down Defect Elimination

- Formal financial justification
- Lots of management / engineering involvement
- Need for a rigorous process

What are “On the Job Action Teams” for Defect Elimination?

- **Small cross functional teams, who will take action together**
- **Focuses on achieving bottom line results in a short period of time**
- **Promotes learning of new skills and behaviors**
- **Disbands when defect is removed**

Action Team Principles

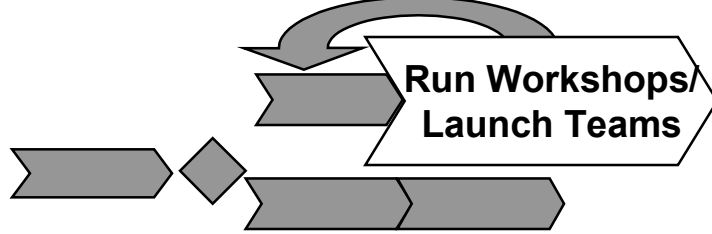


- Be action-oriented
- Focus on eliminating defects
- The team owns the improvement activity
- Concentrate in narrow area
  - 90-day turnaround
  - No capital investment
- Implement easy items first
- Save more manpower than used to run the project
- Use Best Practices
- Track the team's performance

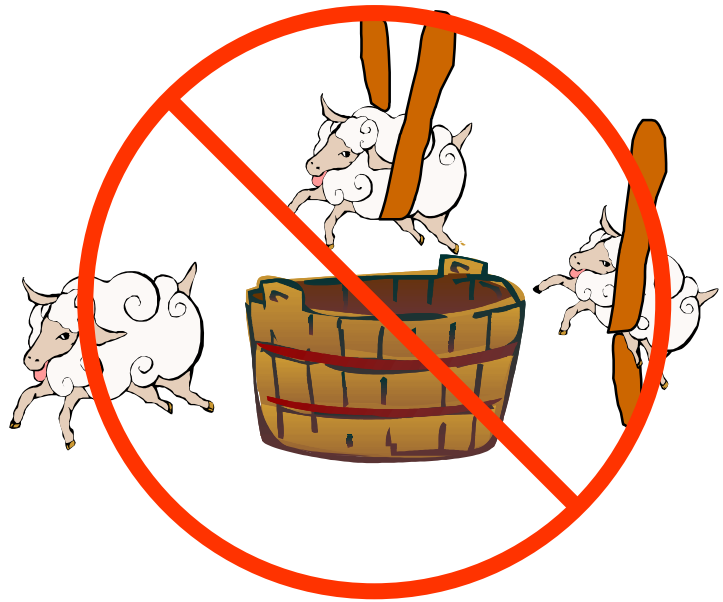
On-the-Job Defect Elimination

- These teams do not take significant time away from "normal" tasks
- Defect elimination becomes part of the daily routine

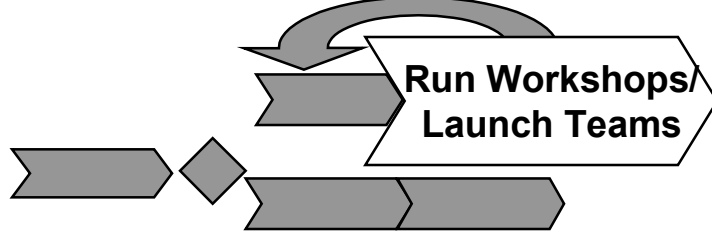
Pull in other necessary solutions



- Root Cause Analysis
- Visual Workplace
- Subject matter experts
- Enhanced operator rounds
- Process upset management

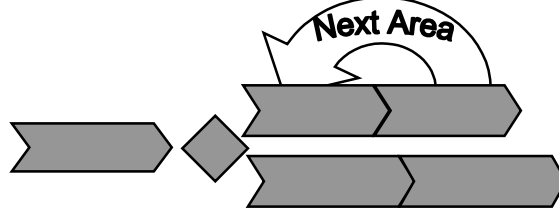


Track Teams

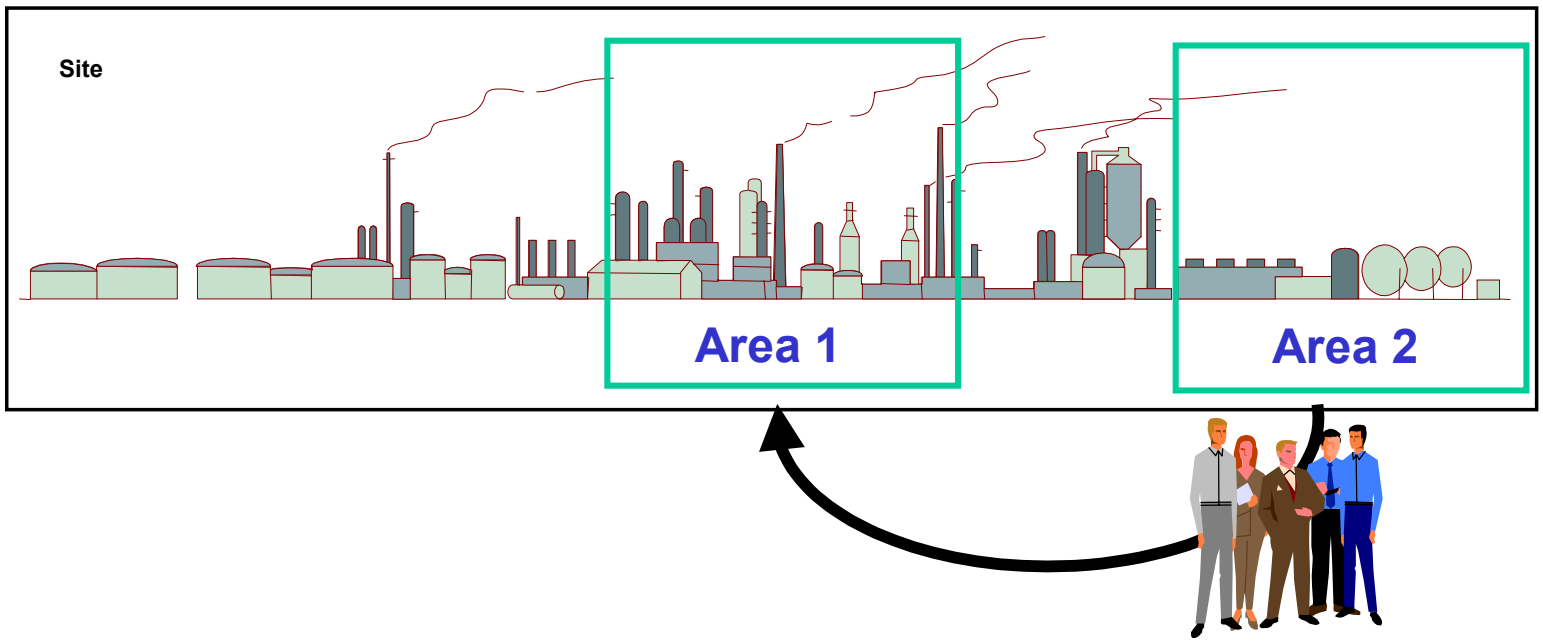


- Logs defects and personnel
- Tracks team progress
- Stores and reports team results

Moving to the Next Area

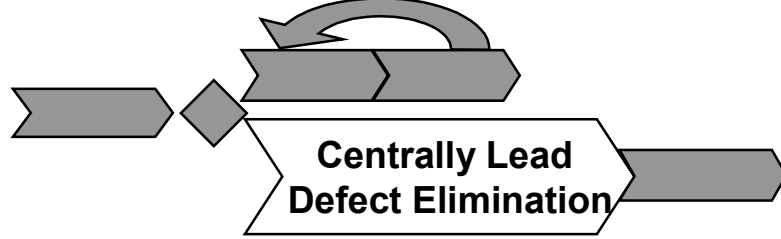


Elapsed Time: 16 weeks per area



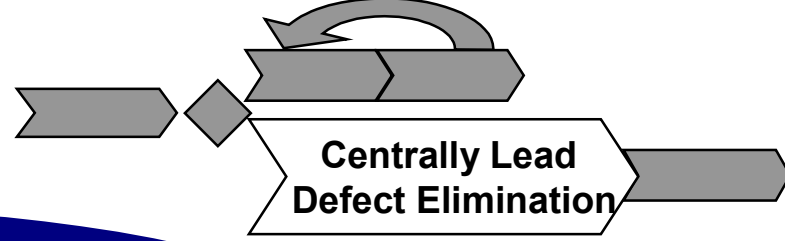
As the first area is wrapping up, the second area leadership team will attend a workshop and begin its defect identification and action team scheduling process

The Steering Team



- Begins meeting monthly 3 months into implementation
- We use a two day “Leadership of Change” workshop to kick this off
- Site manager and direct reports should attend
- Attendance should ideally be open but consciously invite key site leaders
- Avoid canceling for reactive events
- Focus on developing and communicating a shared vision
- Create visible signs of the new approach and expectations

Monthly Process



Identification of barriers

Progress reporting

Central Steering Committee

- Review current progress in achieving site vision
- Prioritization of issues
- Team selection
- Elimination of barriers

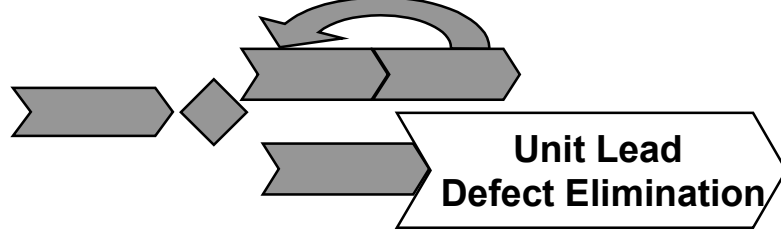
New Action Teams

Success Stories Celebrated & Communicated

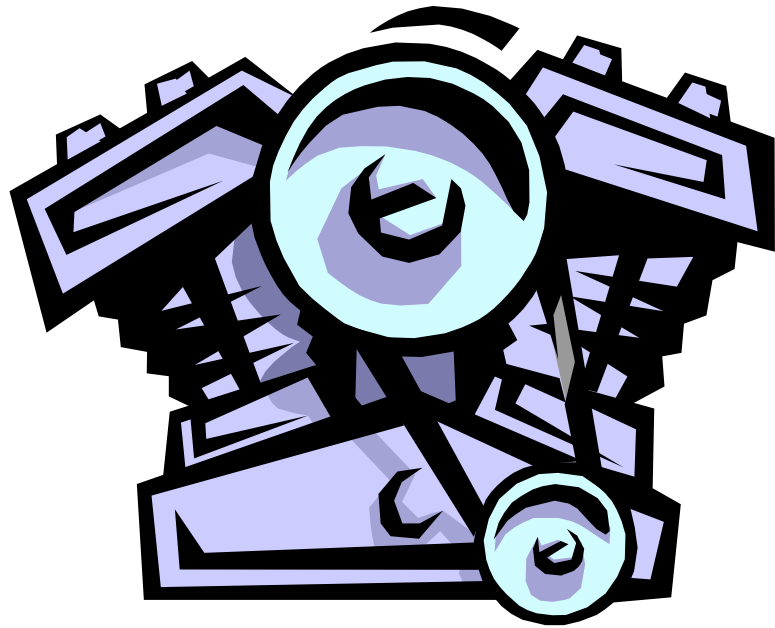
Rationale

- Provides consistency of approach
- Demonstrate top management's commitment
- Significant organizational authority needed to break through old ways of doing things
- Need high level recognition of teams to inspire participation

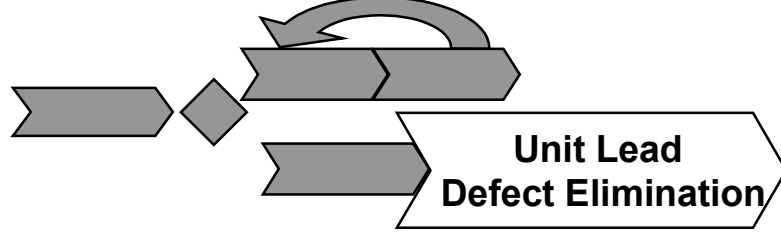
Unit Teams are the engine for sustainability



- Typically transition to this model 6 months after defect elimination efforts start in the area.
- Format is the same as central steering team but is typically more specific in its pursuit of defects.
- This is a team for creating change (leadership) not keeping order (management) so its make up should reflect its purpose.
- Drives responsibility for performance to the units.
- Requires changing the role of the supervisor from command and control to coach.
- Central Steering Team stays intact focused on new units, ones that are struggling, publicizing successes and the overall culture change.



Transition Process



- Formation of the Unit Team including setting purpose, process, schedule and norms
- Coaching for the first couple of meetings
- “Leadership of Change” workshop to kick off the effort
- “Supervising the Change” workshop for all Unit managers to help transition their role
  - Two day workshop
  - Focus on leadership approaches under different operation circumstances
  - Output is a list of defect and teams that the participant will sponsor

Achieving World Class Performance

Focus on the Defect Elimination Activities

Quick removal of accumulated defects

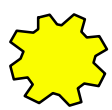
Awareness and removal of defects early in their life

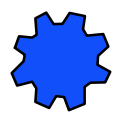
Reduction in number of defects being put into the equipment, or products

Leads to:
waste elimination,
production efficiency,
and
growth opportunities

Recap of Key Activities

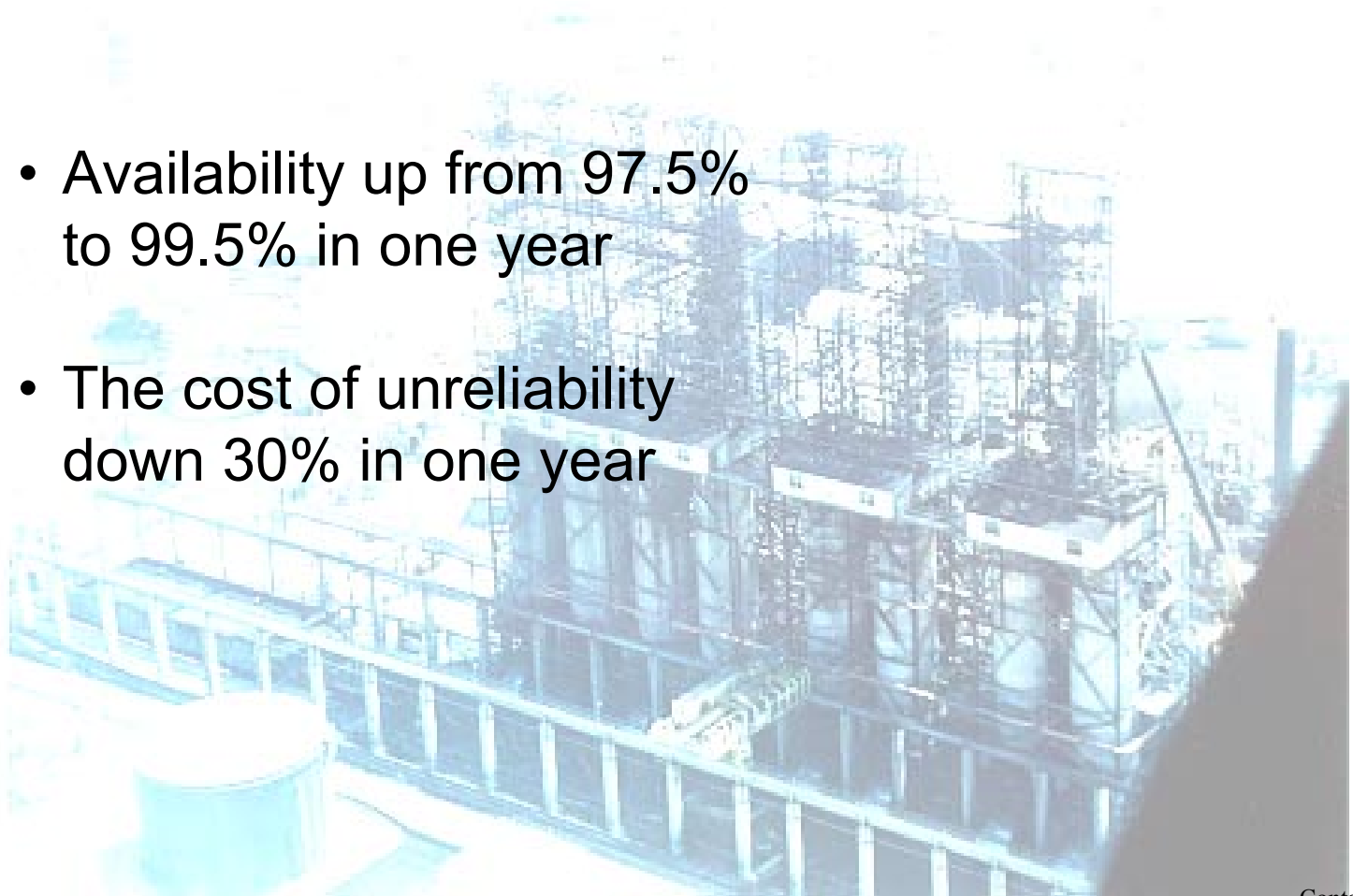
- Overall Project Management
- Defect identification and FMEAs
- Manufacturing game workshops for all employees
- Specific defect elimination tools as needed
- Supervising the change workshops for area leaders
- Leadership of Change workshop for Central Steering Team and Area Teams





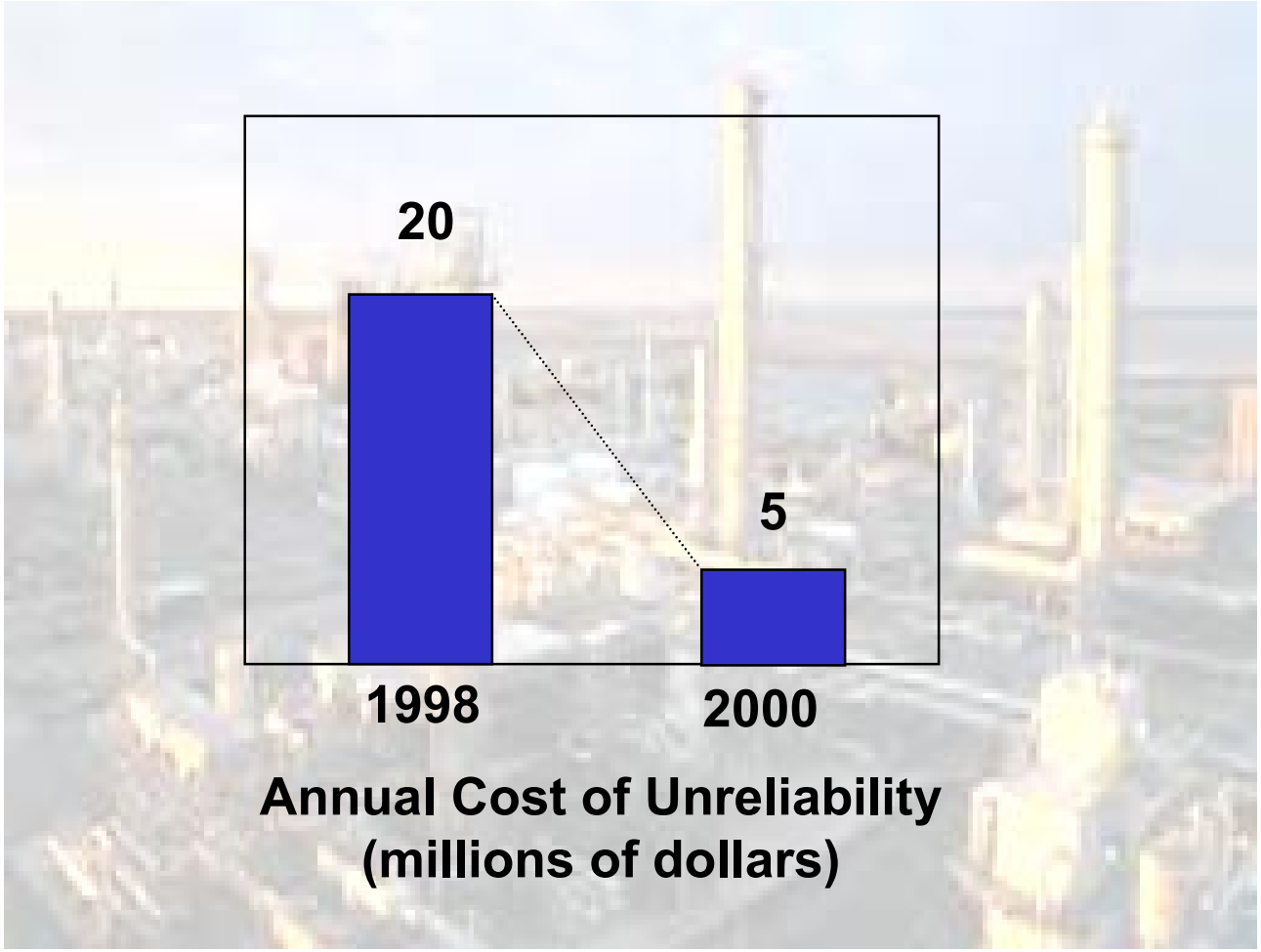
ExxonMobil Beaumont Refinery

- Availability up from 97.5% to 99.5% in one year
- The cost of unreliability down 30% in one year



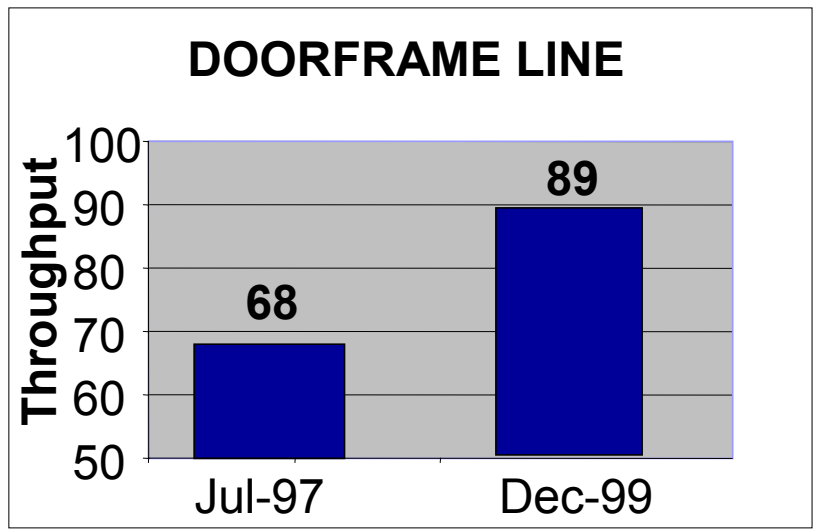
Contact: Walter Jones
Reliability Engineer
409-757 3256

Valero Refining - Paulsboro

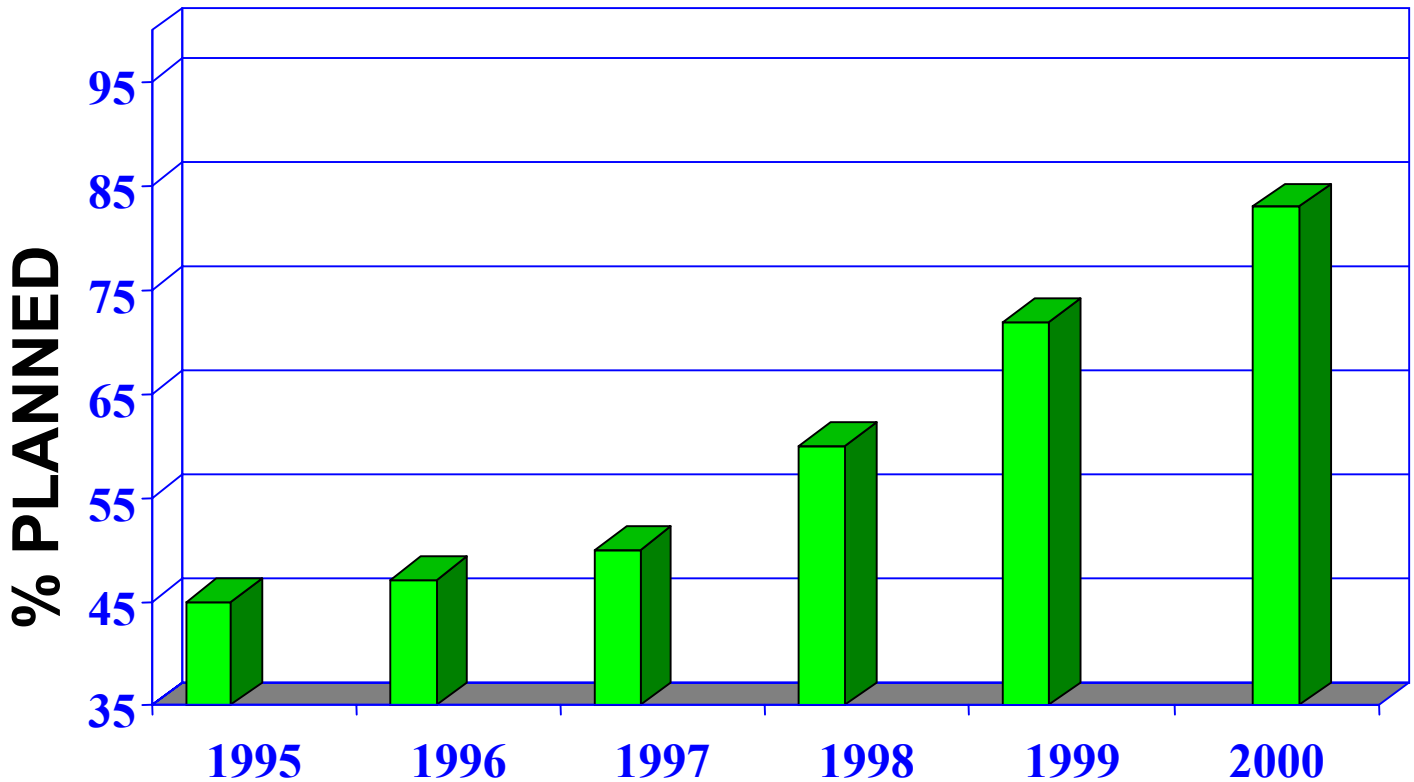


Whirlpool - Findlay

- 21% improvement in throughput
- Over $1 million in cost savings
- Zero Capital Investment

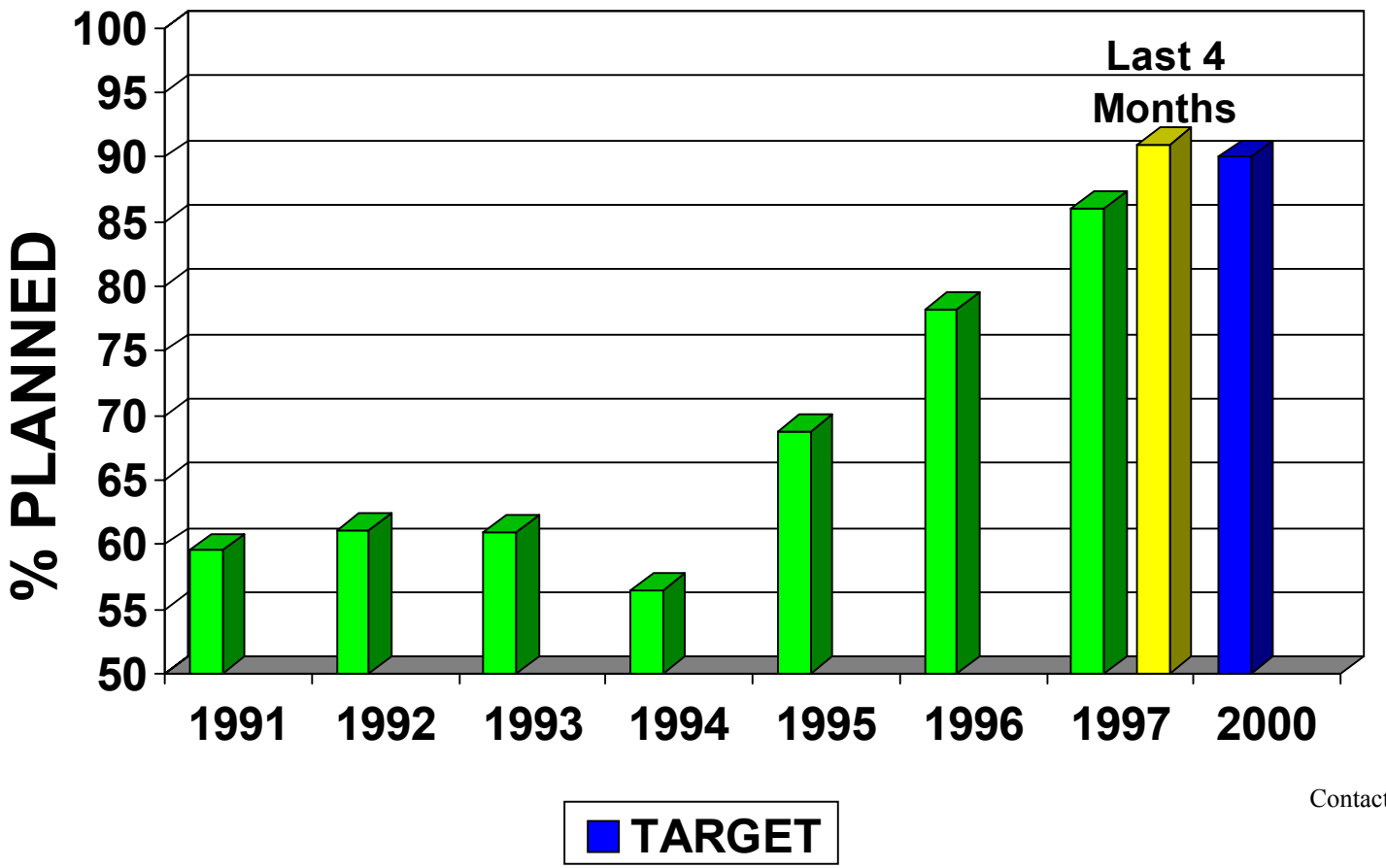


Whirlpool- Findlay -- Improved Planning



This improvement was achieved NOT ONLY with better planning, but by eliminating Defects. The outcome was higher % planned work

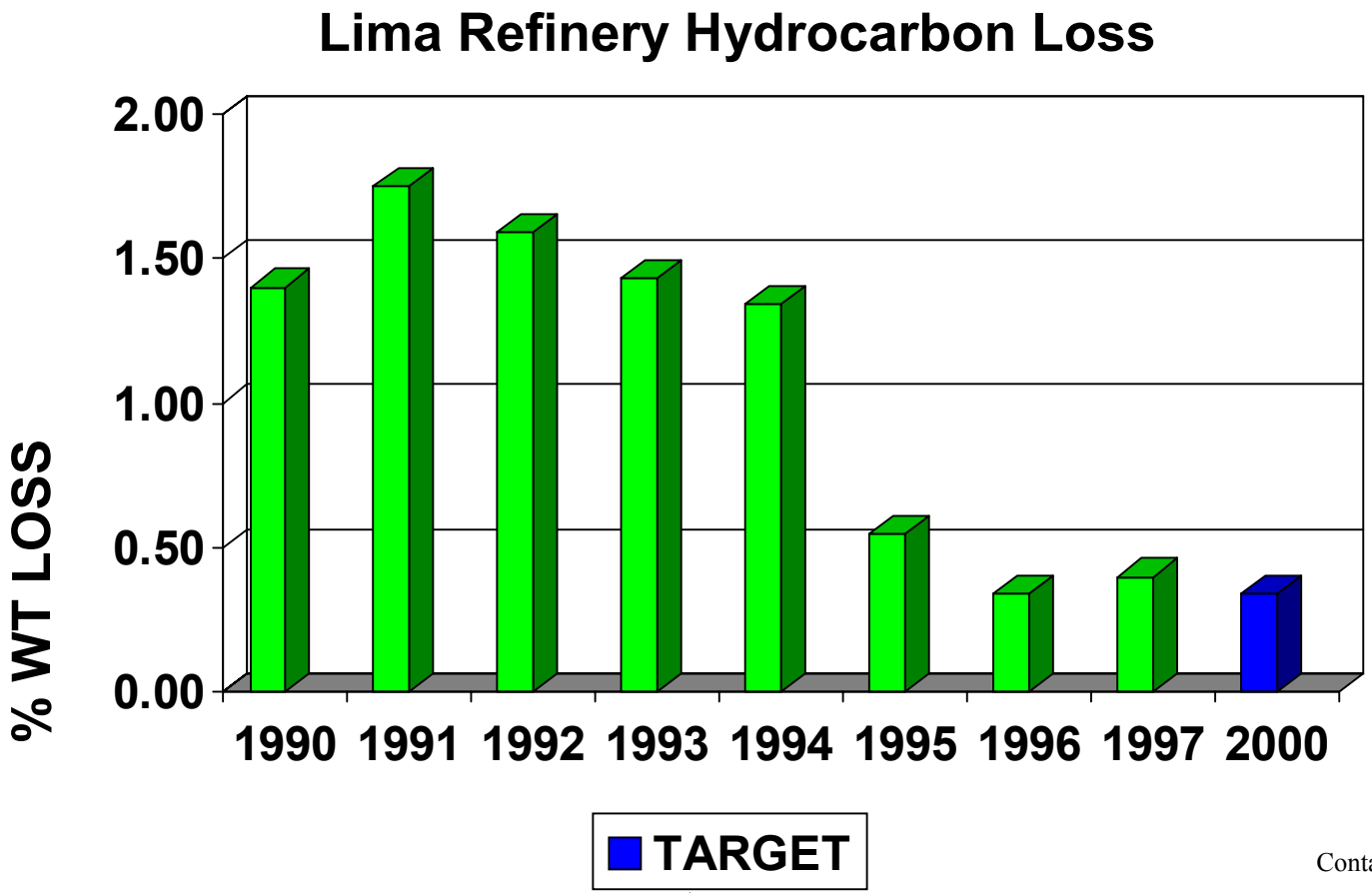
Eliminating Defects Helps Accelerate Other Efforts



Contact: Paul Monus
Senior Project Manager
(419) 226-1218

This improvement was achieved NOT by better planning, but by eliminating work via action team strategy. The outcome was higher % planned work.

The largest benefits from reliability will be in production not maintenance cost cutting



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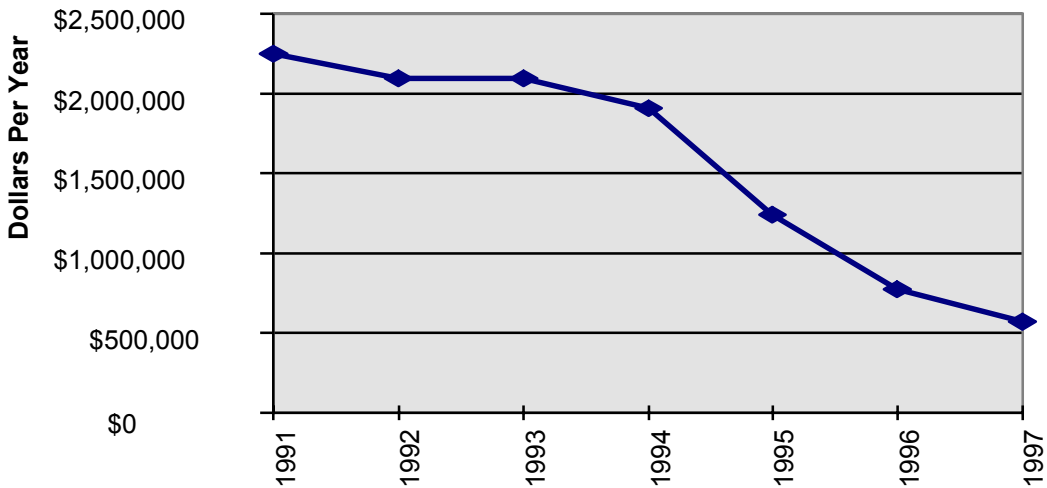
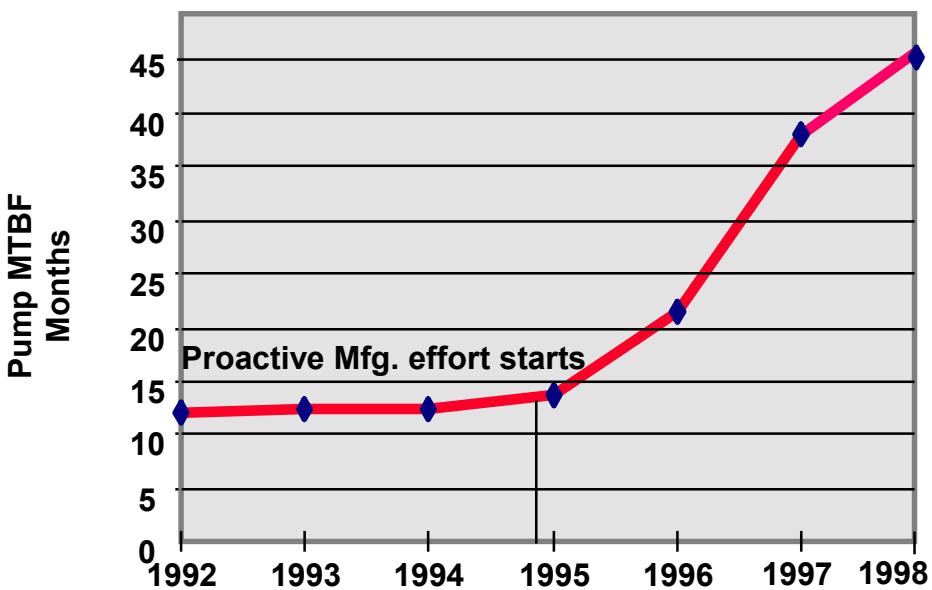
this improvement is worth $10million/yr, and has been sustained

Reliability goes up while costs go down





Lima Refinery - Rotating Equipment Results

Year	# Repairs	Repair Cost
1991	643	$2,250,500
1992	599	$2,096,500
1993	599	$2,096,500
1994	545	$1,907,500
1995	355	$1,242,500
1996	221	$773,500
1997	163	$570,500

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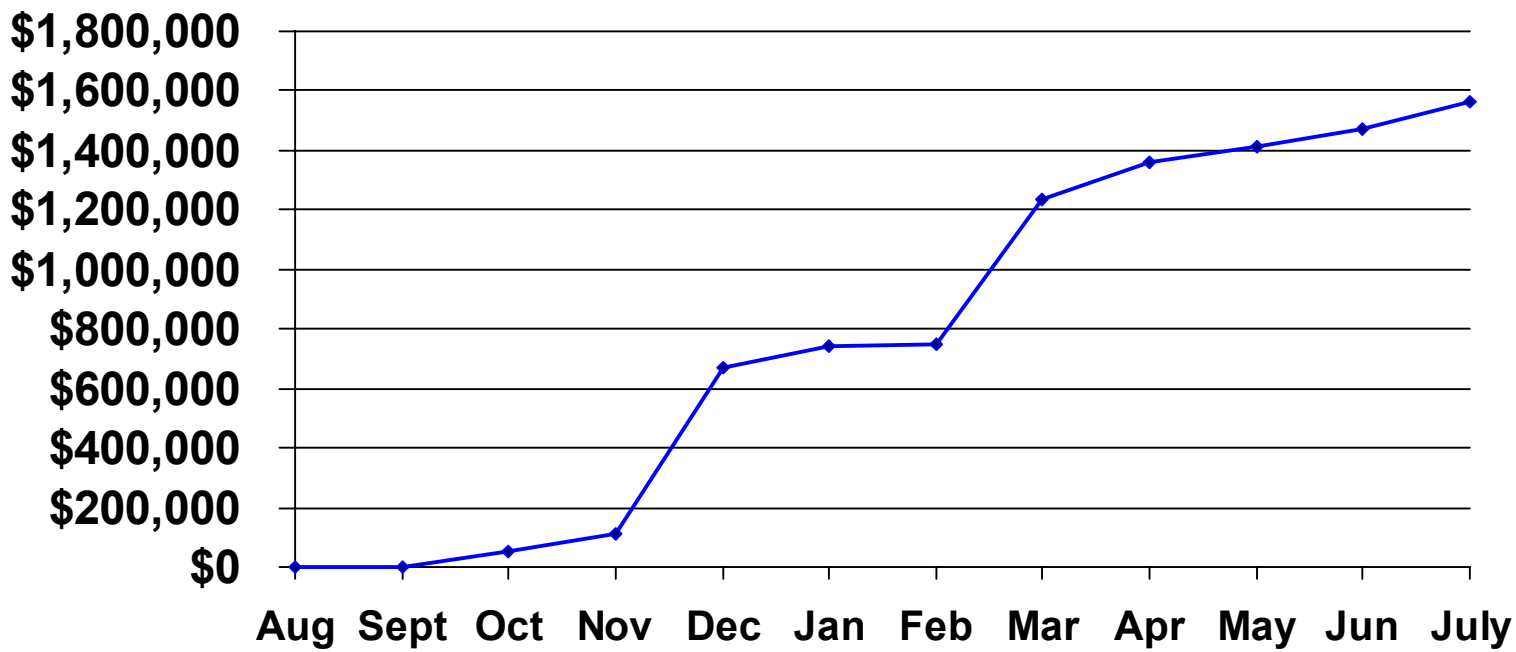
North Sea Asset Shutdowns

Cost Improvement at Eastman Chemical

Cost Savings at Eastman Chemical's Power and Services Bldg 584



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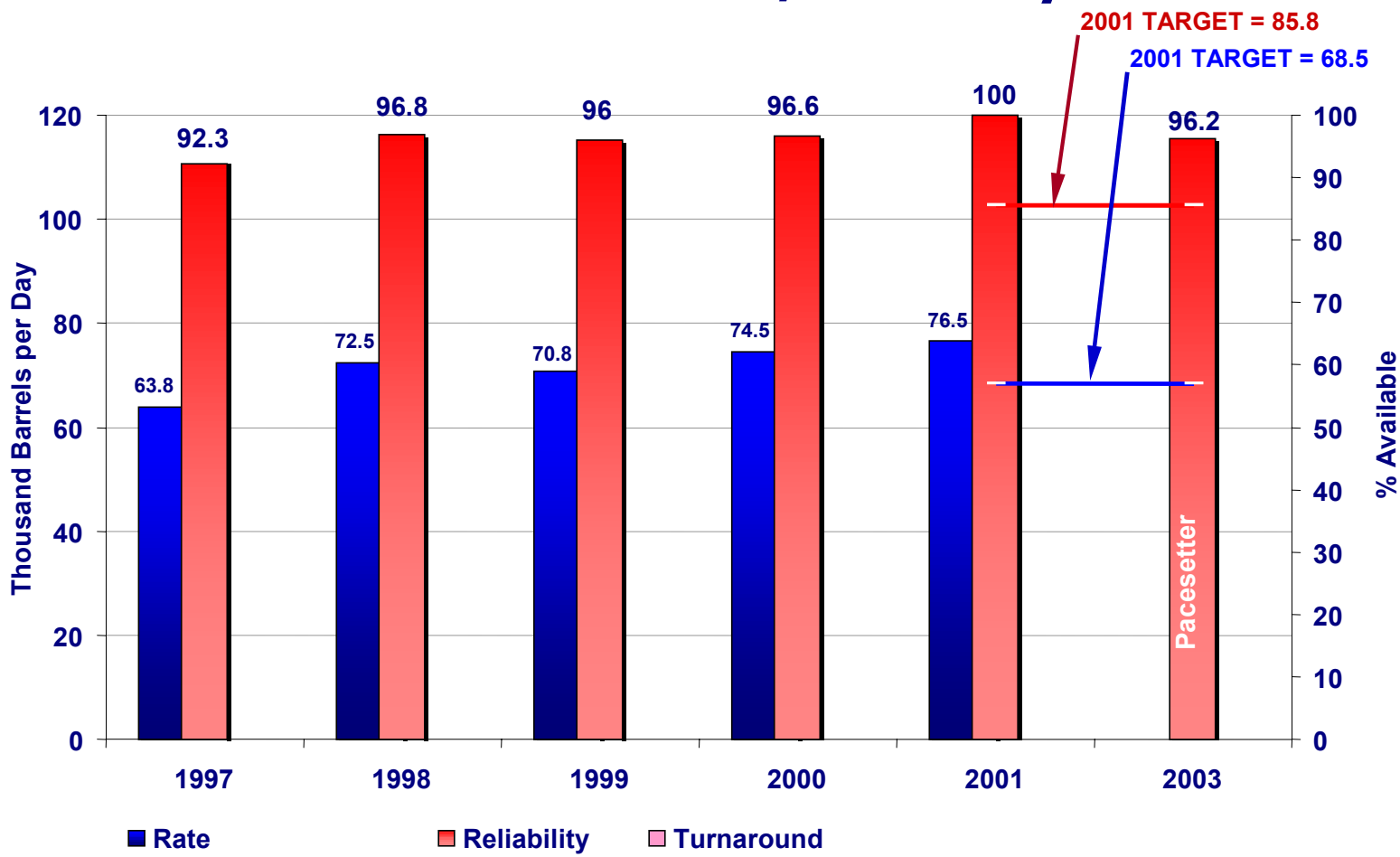
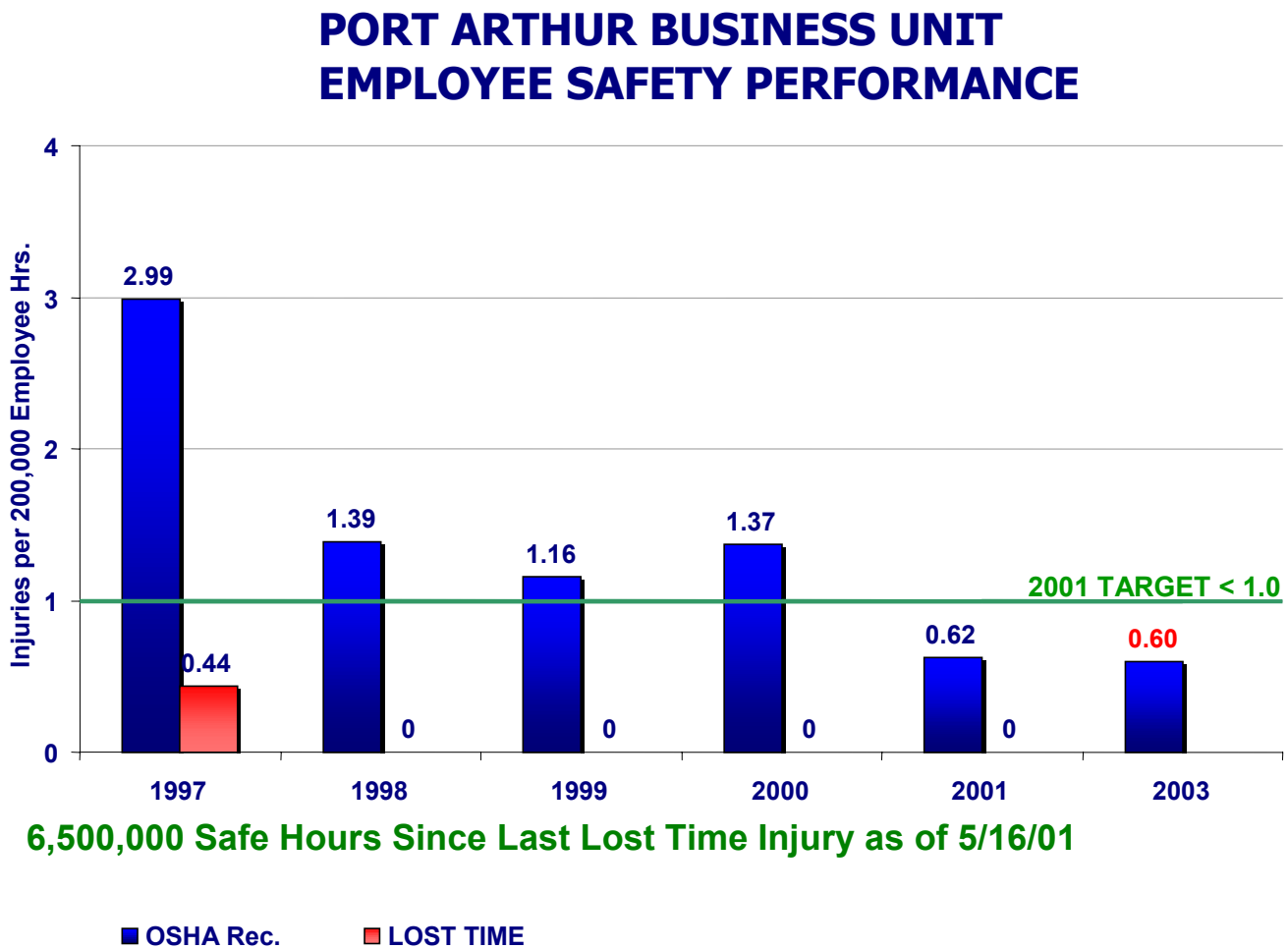
Availability and Rate Improvements

FCCU-1241 Rate/Reliability

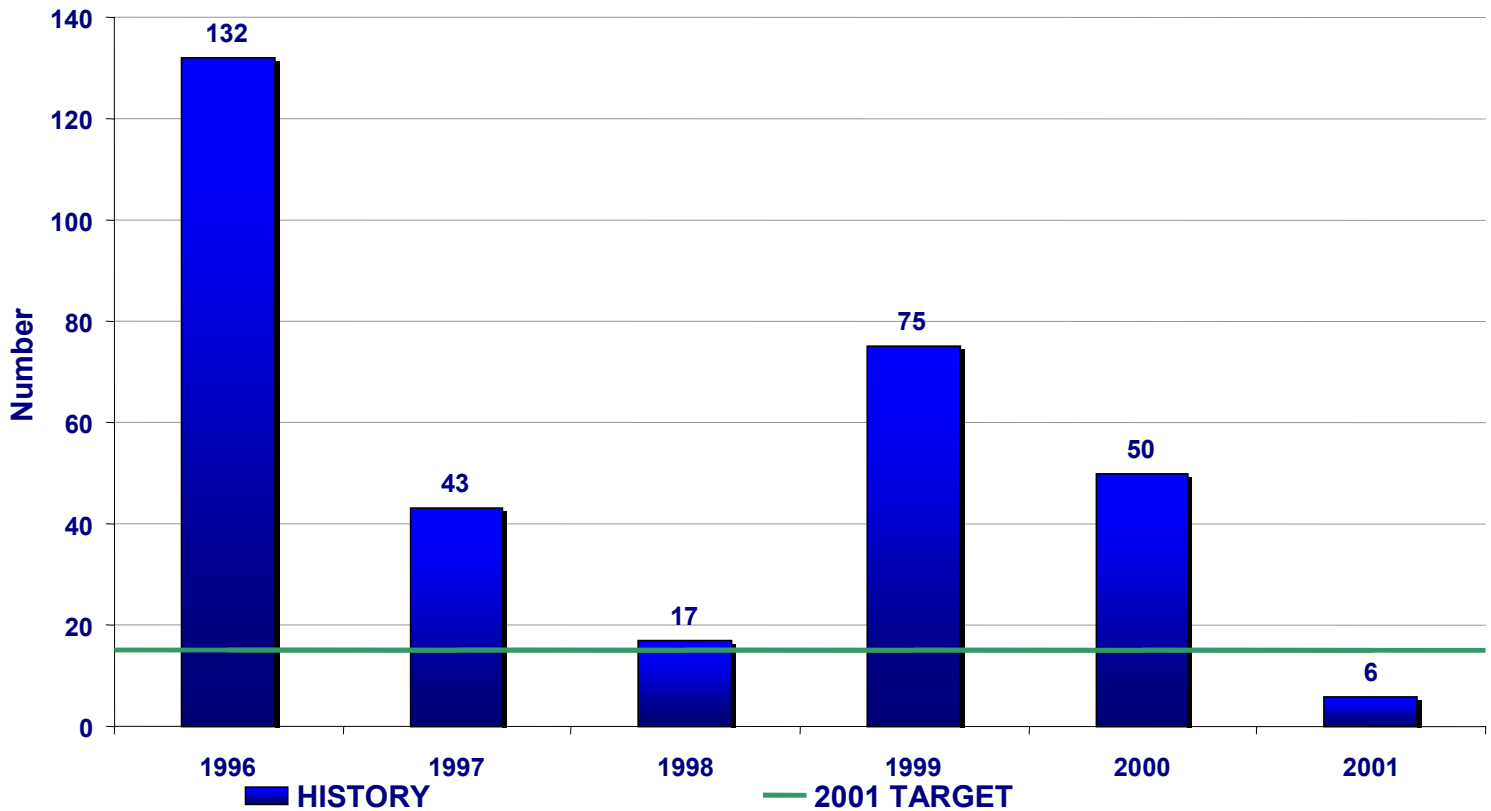


Safety Improvements

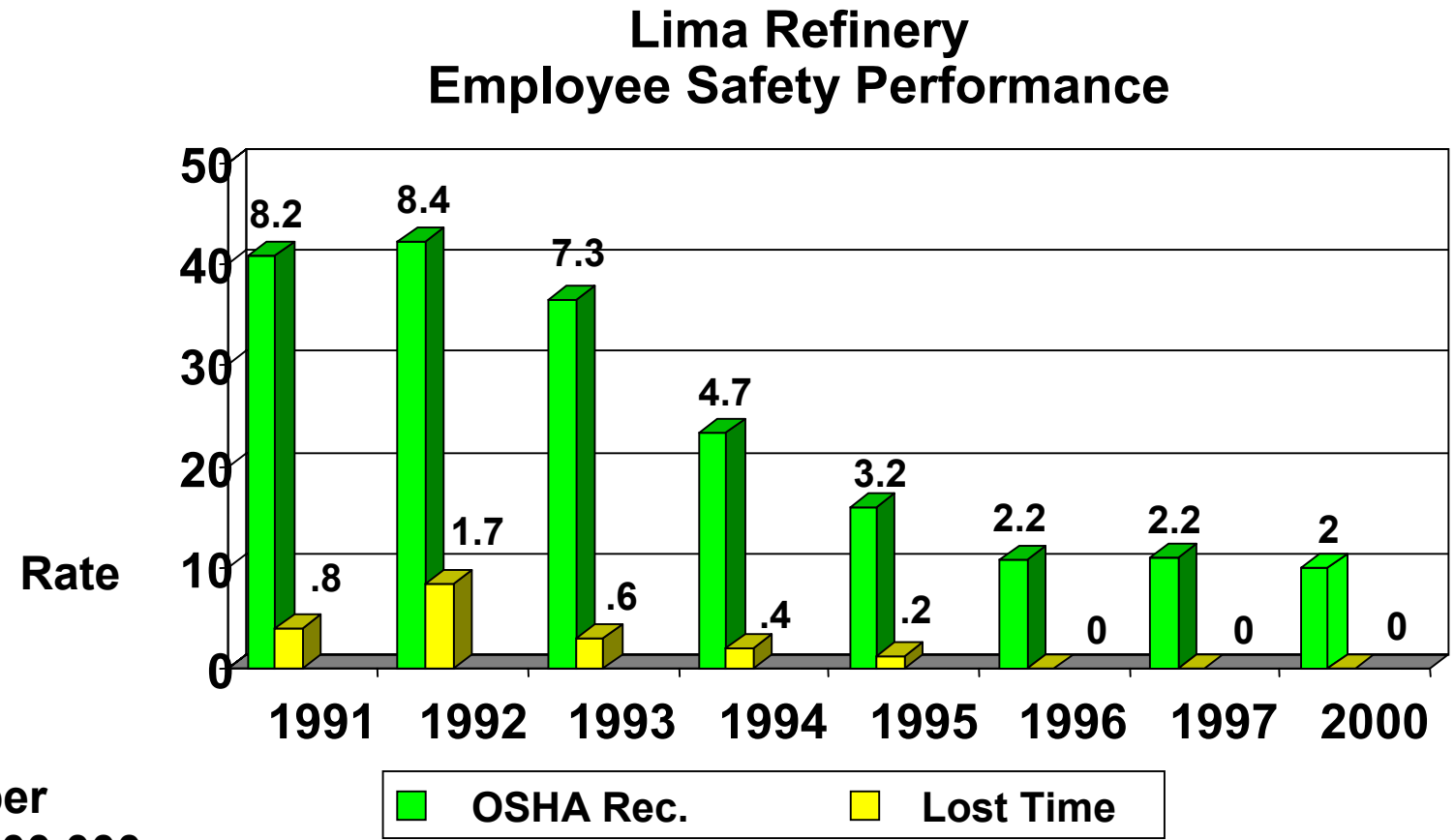


Environmental Performance

PORT ARTHUR BUSINESS UNIT
REPORTABLE AIR RELEASES



When reliability improves, safety and environmental will follow



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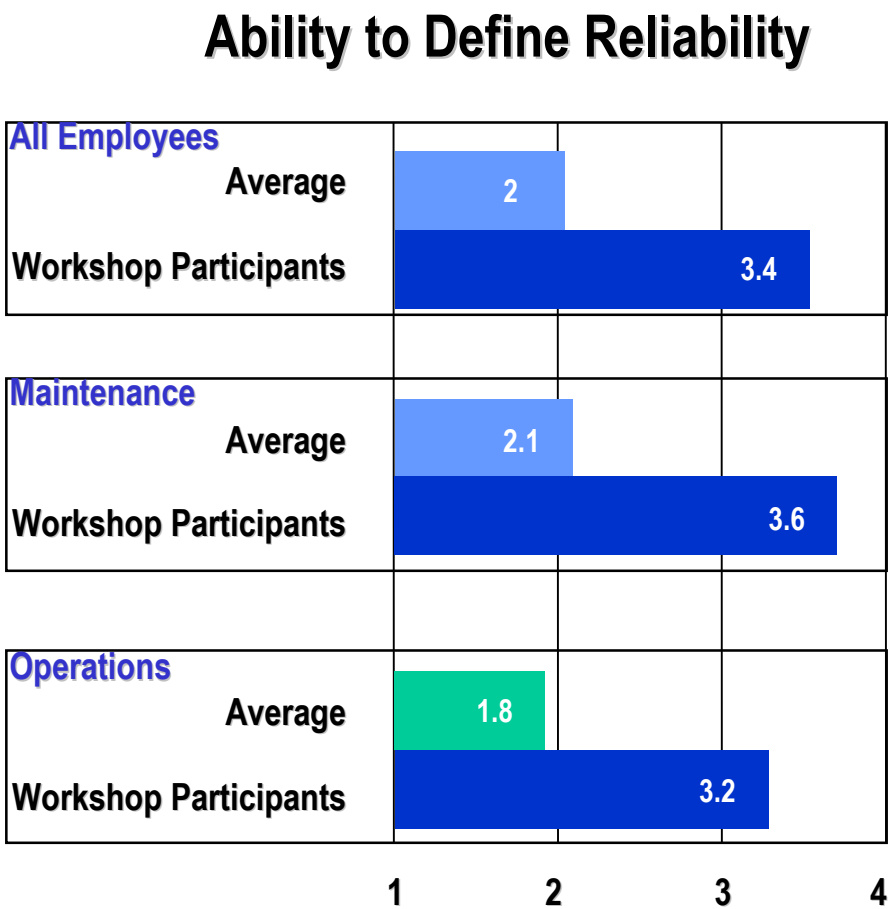
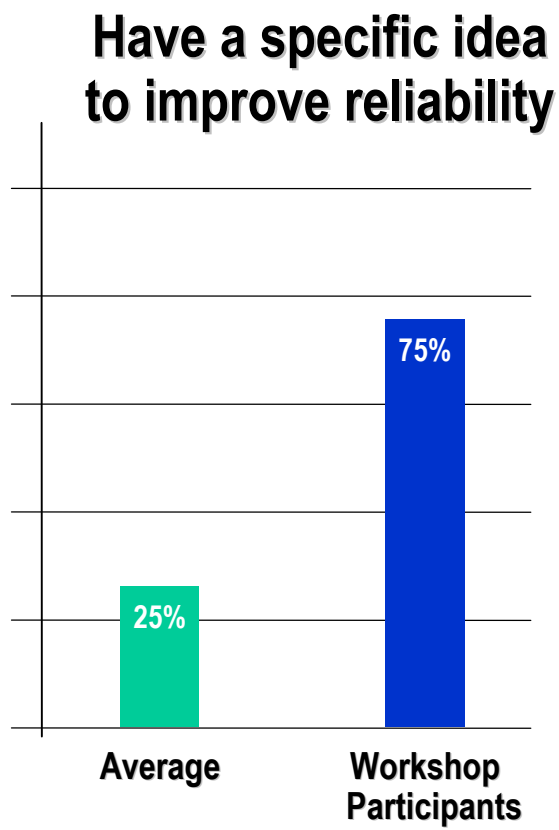
(419) 226-1218

Workshop Participation Initiates the Required Culture Change





Who has Used The Manufacturing Game®?

Company	Industry
Agrium	Fertilizer Manufacturer
Alyeska Pipeline	Pipeline Operations
ARCO Pipeline	Pipeline Operations
Augusta Newsprint	Paper
BP Amoco	Chemicals
BP Refining	Petroleum Refining
BP Exploration	Off-shore production
BP Chemicals	Chemicals
Celanese	Chemicals
Chevron Chemicals	Chemicals
Clark Oil	Petroleum Refining
Diesel Technology	Automotive Components
Dofasco	Steel Manufacturing
DuPont	Chemicals
Eastman Chemical	Chemicals
Eastman Kodak	Film
Eli Lilly	Pharmaceuticals
Entergy	Power Generation
Exxon	Refining & Mining
Frontier Oil	Petroleum Refining
GPM	Pipeline Operations

Company	Industry
Honda	Automobiles
ICI	Chemicals
Inland Steel	Steel Manufacturing
Iron Ore of Canada	Mining
Kimberly Clark	Packaged Goods
Lyondell-Citgo	Petroleum Refining
Marathon	Petroleum Refining
Michelin	Tires
Millennium	Chemicals
Mobil	Refining & Chemicals
Monsanto	Chemicals
Shell	Petroleum Refining
Shell Western	Gas Plants
Nestlé	Food Products
Phillips	Chemicals
Rohm & Haas	Chemicals
Sun	Petroleum Refining
Texaco	Petroleum Refining
Valero	Petroleum Refining
Weyerhaeuser	Paper
Whirlpool	White Goods