

# Using Lean Manufacturing To Achieve Pollution Prevention



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# Lean Manufacturing Is:

A systematic approach to eliminating **waste** through continuous improvement by creating a smooth **flow** of work at the demand of the customer.



- ✦ Waste = non-value added activity (NVA)
- ✦ Flow = single-piece processing, no waiting, no batches
- ✦ Demand = "pull"

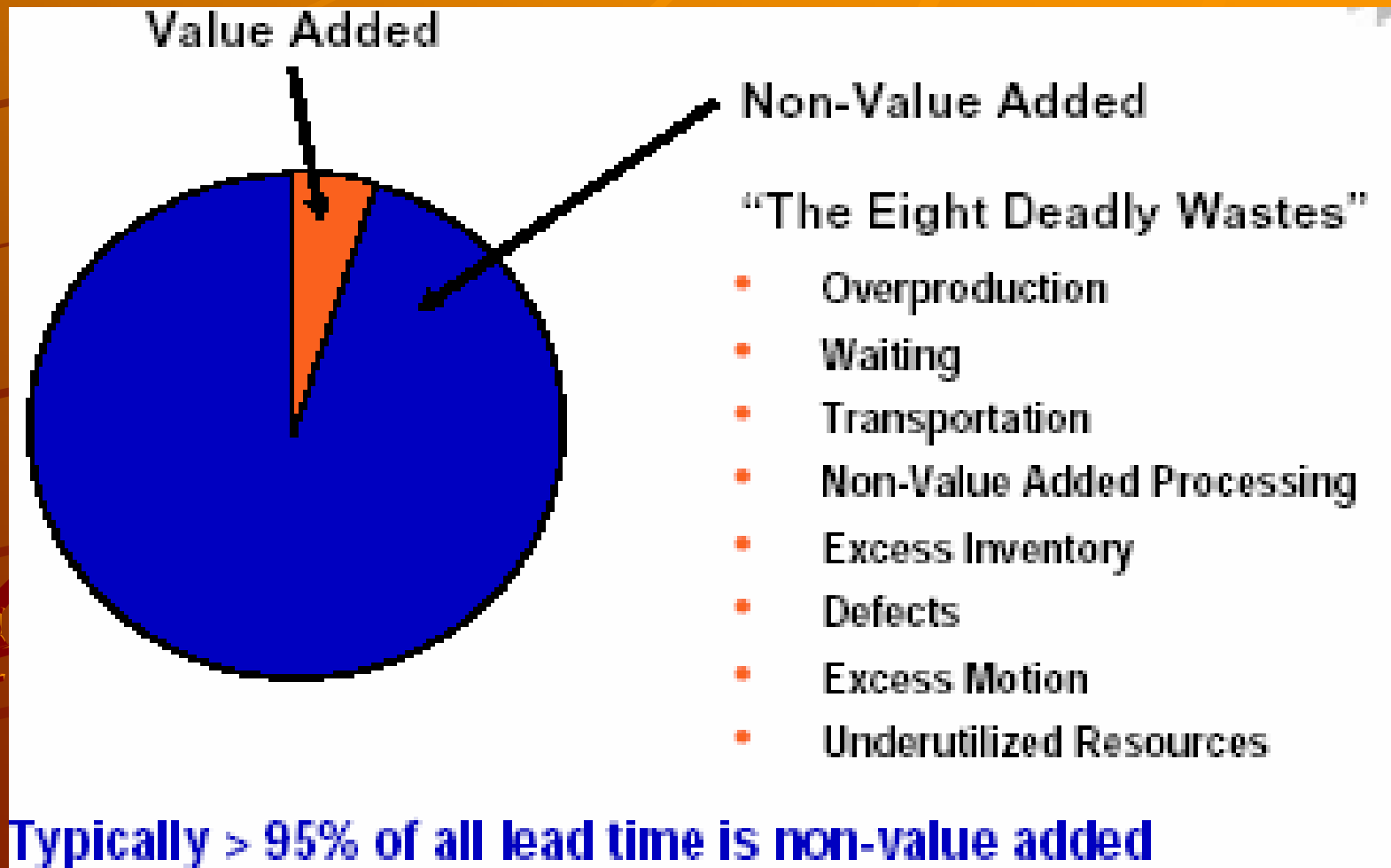
# Value Added vs Non-Value Added Activity

✦ **Value added:** Transforms resources into what the customer wants

✦ **Non-value added (waste):** Consumes resources but does not contribute to what the customer wants



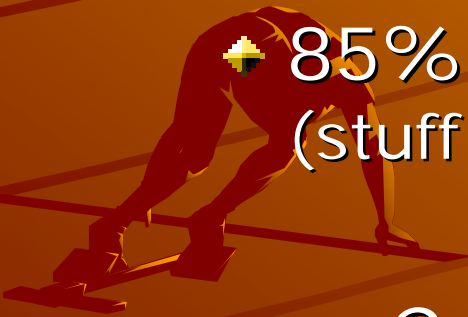
# The Deadly Wastes



# Potential Benefits of Lean

- ◆ 90% reduction of production times
- ◆ 50% increase in productivity
- ◆ 80% quality improvement
- ◆ 75% improvement in space utilization
- ◆ 85% reduction of "work in progress"  
(stuff waiting to be finished)

= Cost savings!



# Environmental Non-Value Added Activities

- ◆ Waste management and disposal
- ◆ Contaminated site clean-ups
- ◆ Extra requirements for hazardous materials
- ◆ Regulatory paperwork and reporting
- ◆ Waste treatment
- ◆ Emissions controls
- ◆ Hazardous material & right-to-know training

*...classic Lean Mfg has overlooked this NVA!*

# P2 through Lean Mfg

Use Lean Mfg to ...

- ◆ Reduce environmental waste and resource consumption
- ◆ Get more value out of Lean Mfg programs
- ◆ Get P2 implemented by capitalizing on business interest in Lean

# P2 through Lean Mfg: Past Washington Successes

## ✦ Boeing

- Reduced production time from 24 days to 12; target is 8 days
- Hazardous waste reduced 31% in 3 years

## ✦ Gary Loomis Fishing Rods

- Reduced the time it takes to make a fishing rod from 22 days to 4 days
- Reduced hazardous waste by 4 tons/yr and became a CESQG

## ✦ Precision Aerospace

- Reduced hazardous waste by 60%; became CESQG
- Stayed profitable during post-9/11 aerospace downturn

# P2 through Lean Mfg

What are some specific techniques for integrating P2 into Lean programs?



# USEPA Lean & Environment Program

- ◆ Concept studies

- ◆ Lean & Environment Toolkit

<http://www.epa.gov/lean/toolkit/index.htm>

- ◆ Demonstration grant to WDOE



# WDOE Pilot Grant

- ◆ Demonstrate integration of environment into Lean Mfg programs
- ◆ Test and add to L&E Toolkit (USEPA)
- ◆ Case studies and workshops to transfer this technology

Washington Mfg Services on-site leads

WDOE provides environmental assistance

Pollution Prevention Resource Center (NW-P2Rx)

Ross & Associates Environmental Consulting

# Grant Activities

- ◆ 3 pilot facilities
- ◆ Modify “Lean 101” training to include environment
- ◆ Value Stream Mapping that includes environmental waste
- ◆ 3 week-long improvement events at each facility
- ◆ Use EPA’s L&E Toolkit
- ◆ Case study documentation

CANYON CREEK



# Canyon Creek Cabinets (Monroe)

## ◆ Millwork

- Improve layout, reduce bottlenecks
- Reduce wasted wood

## ◆ Coating operations

- Quick change-over of coatings
- Less purging waste (aqueous)
- Dedicated stations (solvent-based)

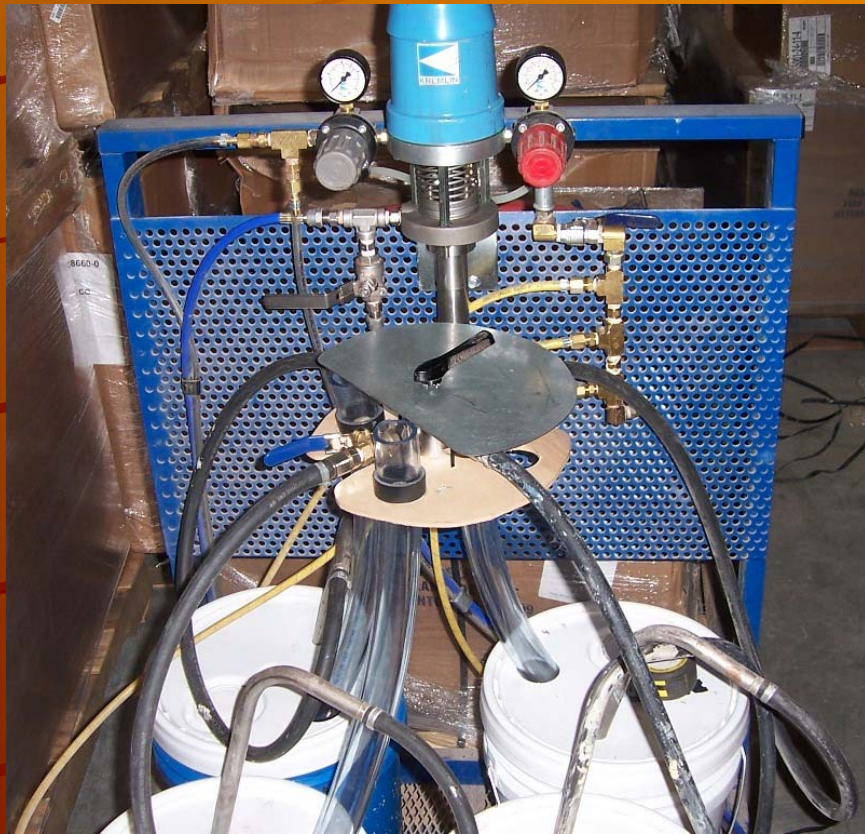
CANYON CREEK

# Stains ... before



CANYON CREEK

# Stains ... after

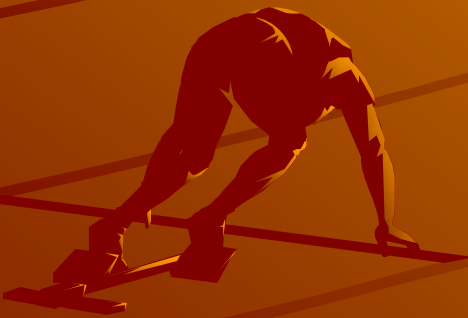


# Environmental Results


- ◆ Reduce Hazardous Waste 48,000 lbs/yr
- ◆ Reduce Haz material by 124,000 lbs/yr
- ◆ Reduced solid waste by 508,000 lbs/yr
- ◆ Reduced VOCs by 55,131 lbs/yr
- ◆ Allows 70% additional growth before Title V air permit threshold
- ◆ Reduces employee exposure

**Saved \$1,360,000/yr** in material, energy, waste

# Lasco Bathware (Yelm)



# Lasco Bathware

- ✦ Improved flow of work through packaging & shipping
  - ✦ Improved spray transfer efficiency and reduced variability
  - ✦ Improved layout and mold change-over time in acrylic vacuum-forming area
- 

# Lasco: Work Organization



Before



After

# Lasco: Work Flow



Before: work flow problems



After: visual cues and "pull"



# Spray Variability/Efficiency

- ✦ Reduced variability from  $\pm 13$  lbs/unit to  $\pm 4$  lbs/unit
- ✦ Reduced overspray waste 70%
- ✦ Potential future decrease in resin use and emissions



# Vacuum Mold Changeover

- Improved layout reduces transport
- Changeover time cut in half
- Reduced taping waste
- Reduced inventory



# Lasco Annual Benefits

Solid Waste disposal	29,000 lbs	(\$1400)
Natural gas	12,600 MCF	(\$99,288)
Labor	1,949 hours	(\$31,190)

***Total Cost Savings***      **\$132,000**

Additional \$30,400 savings pending



# Columbia Paint (Spokane)

- ✦ Reduce and reuse latex rinse water
- ✦ Inventory organization reduces waste and excess labor
- ✦ Improved work flow and volume by eliminating bottlenecks



# Columbia Paint: Batch Tracking And Scheduling



- ✦ Based on “pull” system and “visual workplace”
- ✦ New system saves time and labor
- ✦ Allows reduction & reuse of wastewater

# Reducing Inventory Waste & Labor By Reorganizing Ingredients



BEFORE



AFTER

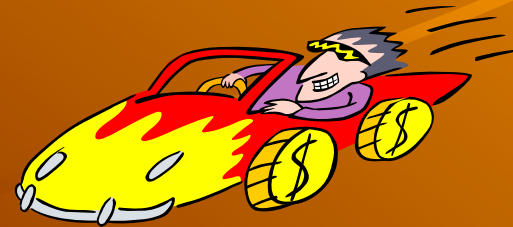
# Columbia Paint Savings

- ◆ Achieve target 12% growth
  - without increasing labor costs = \$90,640/yr
  - without expanding facility footprint
- ◆ Wastewater solids savings = \$17,000/yr
- ◆ Rinsewater/rinsate reduced 40%
- ◆ Will probably change from LQG to SQG
- ◆ Lead time shrank from 6 days to 4 days

**Total Annual Savings > \$107,000**

# Pilot Project Findings

- ✦ Inclusion of environment increases benefits/value of Lean Mfg
- ✦ Lean Mfg uncovers P2 opportunities and benefits
- ✦ Improve the environment by appealing to production concerns



# Next: Lean Design Pilot Project

- ✦ Pilot project to design toxics out of product or process
- ✦ Demonstrate 3P and other Lean Design tools



# Future Application: Lean Mfg P2 Plan Option

- Use Lean Mfg program in lieu of Pollution Prevention Plan
- Modified plan tested at 2 facilities
- Planning guidance developed
- Results Fall 2007

# New Technical Assistance: Environmental Advisor to Lean Mfg. Programs

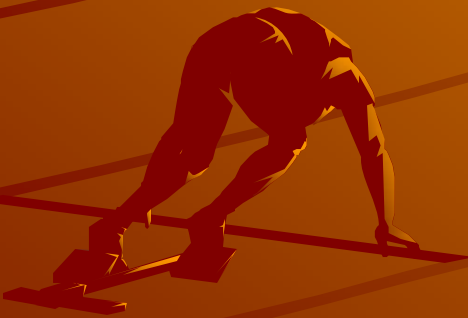
- ✦ WDOE's P2 staff available to advise and assist Lean events at facilities
  - Assess environmental and regulatory impacts
  - Environmental data and cost analysis
- ✦ Respond to new type of demand from our "customers"

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Lean and Environment  
pilot project case studies available at  
<http://www.ecy.wa.gov/pubs.shtm>