Lean & EMS Integration Workshop

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Workshop Sponsored by

NSRP and EPA Sector Strategies Program

Lean & EMS Workshop

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- Welcome and Introductions
- Workshop Objectives
- Agenda Review

Lean & EMS Workshop Objectives

- Review the purpose, benefits, and structure of an environmental management system (EMS)
- Learn the principles of lean thinking (and similar business improvement initiatives) and how lean relates to EMSs
- Discuss opportunities for environmental professionals to connect to lean initiatives and to improve environmental performance through lean-EMS integration
- Identify recommended next steps for EPA and NSRP related to lean and EMS integration

Lean & EMS - Agenda Review

1. Review of EMS
2. Overview of Lean & the Environment
   - What is Lean Production?
   - How Lean and EMS compare
   - Lean's environmental performance "coattails"
   - Lean can add value to EMS
   - EMS can add value to Lean
3. Opportunities to Improve Performance through Lean-EMS Integration
   - Examples of "entry points" for successful integration
4. Next Steps Discussion

Review of Environmental Management Systems (EMS)

What is an EMS?

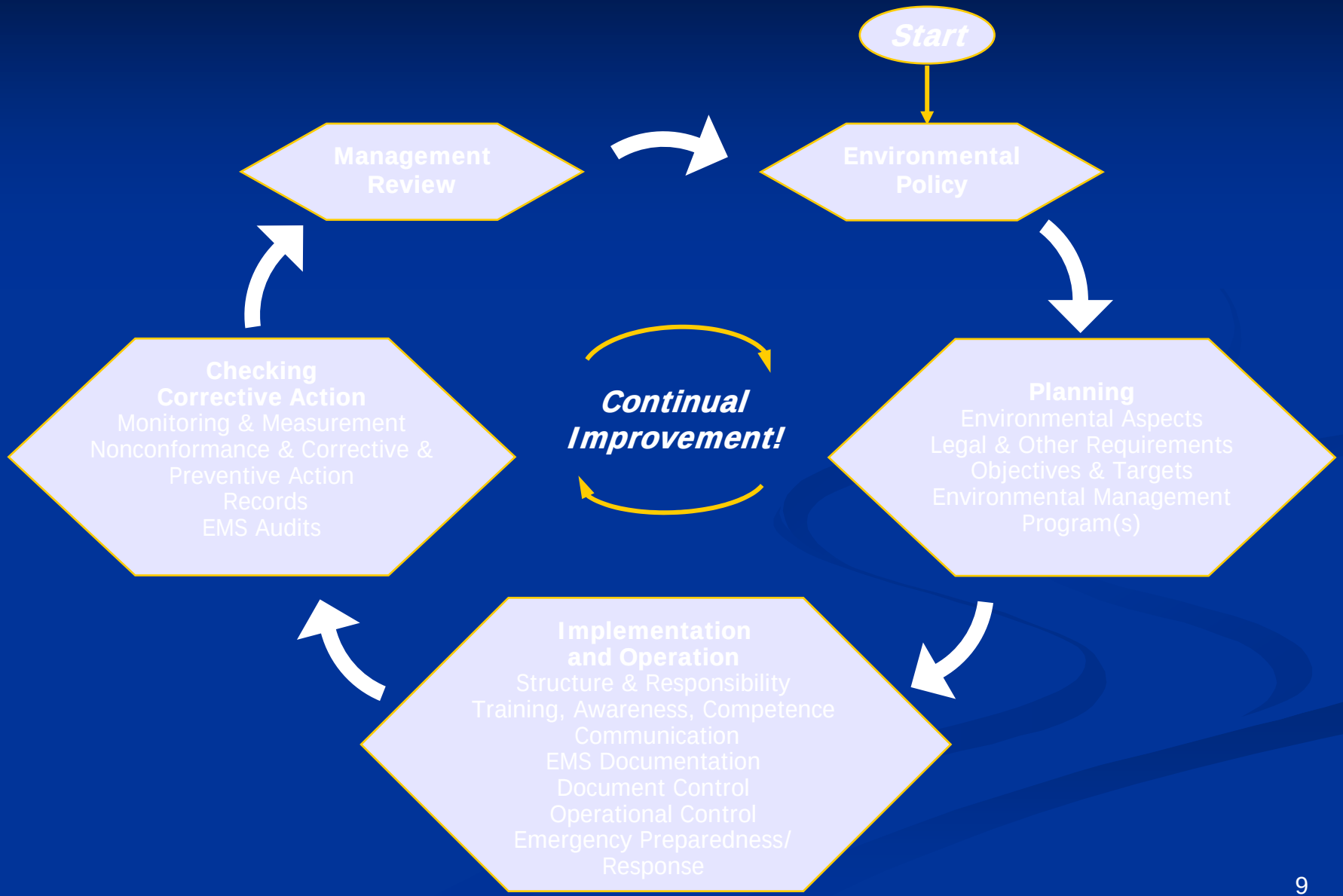
An EMS is a continual cycle of planning, implementing, reviewing, and improving the processes and actions that a facility undertakes to meet its environmental obligations.

EMS Drivers and Benefits

- Reduce operating costs
- Improve environmental compliance
- Improve internal communication
- Bolster corporate image
- Enhance environmental decision-making
- Reduce constraints on process change and improvement
- Enhance “learning to see” environmental wastes

The ISO 14001 EMS Model

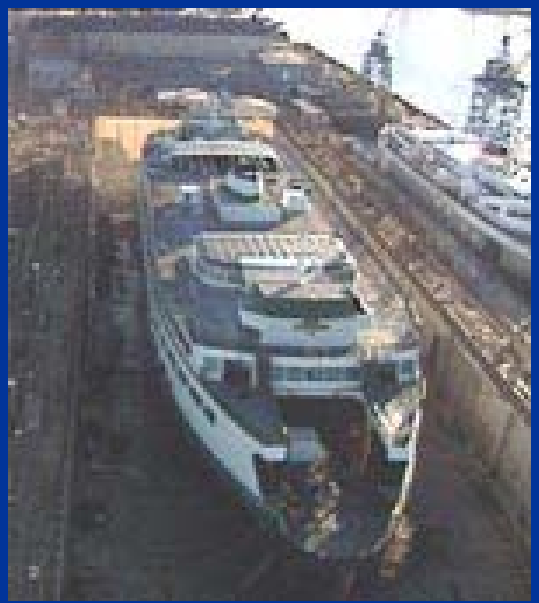
Elements of an EMS



Learning to See

- **Environmental Aspect:** An element of a facility's activities, products, or services that can or does interact with the environment (create an environmental impact)
- **Environmental Impact:** Any change to the environment, whether adverse or beneficial, resulting from a facility's activities, products, or services
- **Legal and Other Requirements**

An EMS can be an efficient and effective way to meet your organization's environmental goals.



Overview of Lean Production and the Environment

What is Lean Production?

- A production approach (philosophy and methods) developed by Toyota, adapted by others
- Lean thinking aims to produce:
  - high quality products and services
  - at the lowest cost
  - with maximum customer responsiveness
- Key metrics are quality, cost, and time
- Similar to Six Sigma, TQM, etc.

What is Lean Production?

- Lean involves the ***systematic identification and elimination of waste,*** with emphasis on:
  - Continuous improvement
  - Employee involvement
- Implemented in frequent rapid process improvement events

Lean Eliminates Waste (All Non-Value Added Activity)

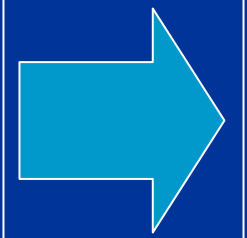
- Inventory
- Defects/Errors
- Overproduction
- Complexity
- Waiting
- Movement
- Transportation
- Unused Creativity

Lean does not include releases to the environment or human health and ecological risk as wastes.

How Mass Production and Lean Thinking Compare

Mass Production

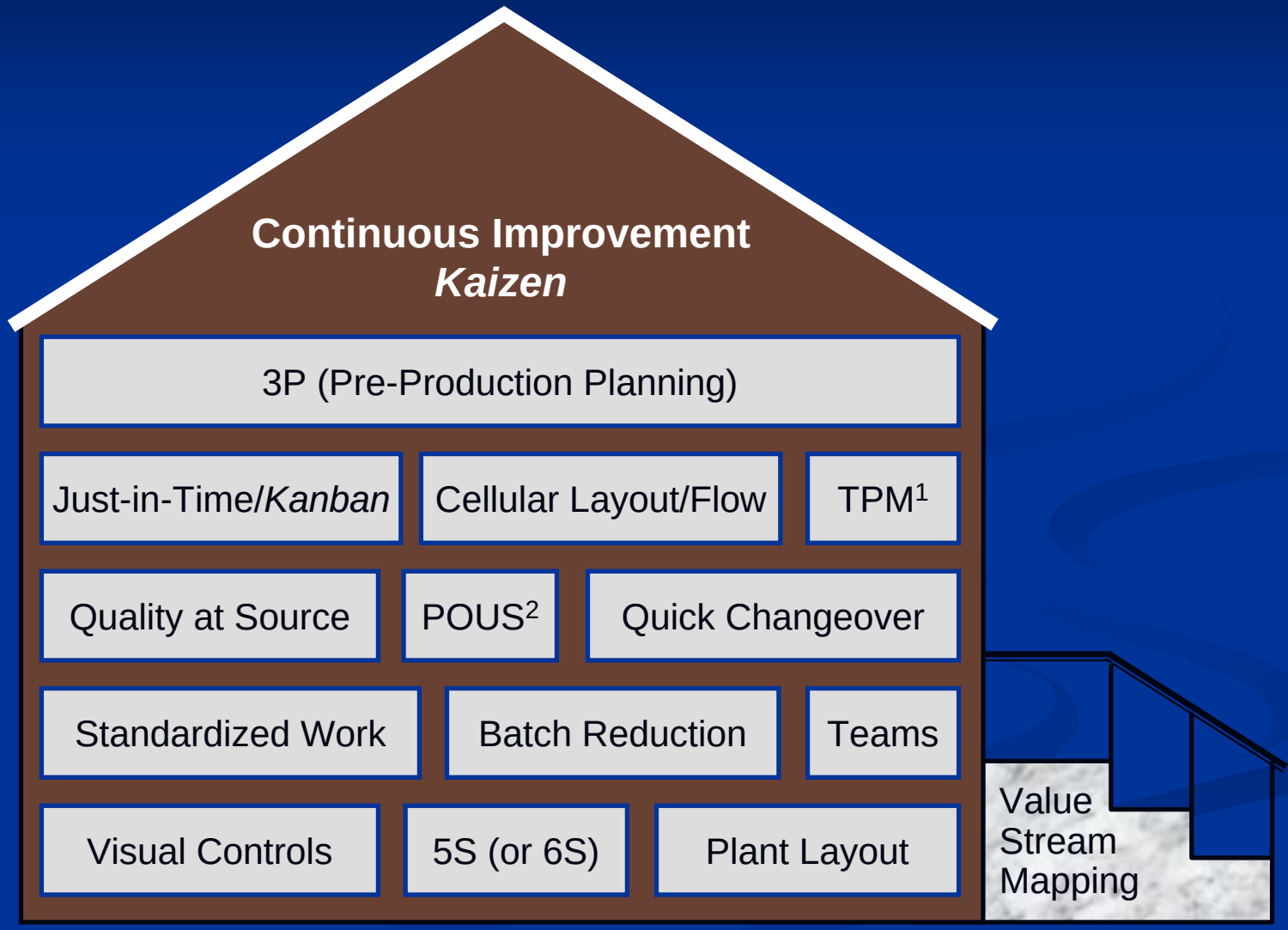
- Aim: Reduce cost and increase efficiency
- Focus on product
- Business Strategy: Economies of scale
- "Batch and queue" operations
- Functional organization
- Periodic, expert-driven improvement



Lean Production

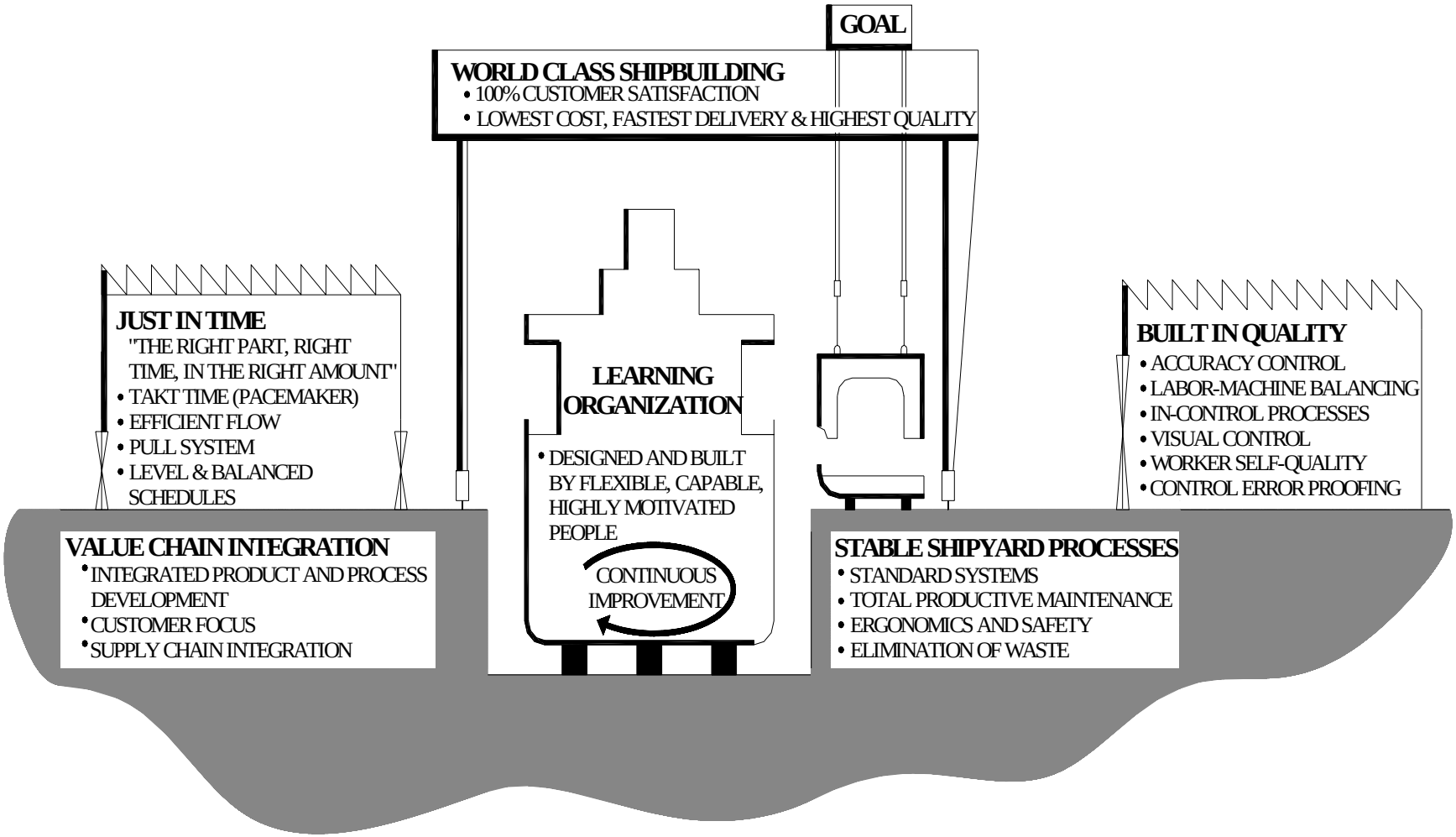
- Aim: Eliminate waste and add value
- Focus on customer
- Business Strategy: Flexibility and adaptability
- One-piece flow, "pull" production
- Value-stream organization
- Continual, workforce-driven improvement

Lean Methods



[1] Total Productive Maintenance
[2] Point of Use Storage

LEAN SHIPBUILDING



From NSRP *Lean Manufacturing Principles Guide*, www.nsrp.org/projects/world_class_deliverables.html

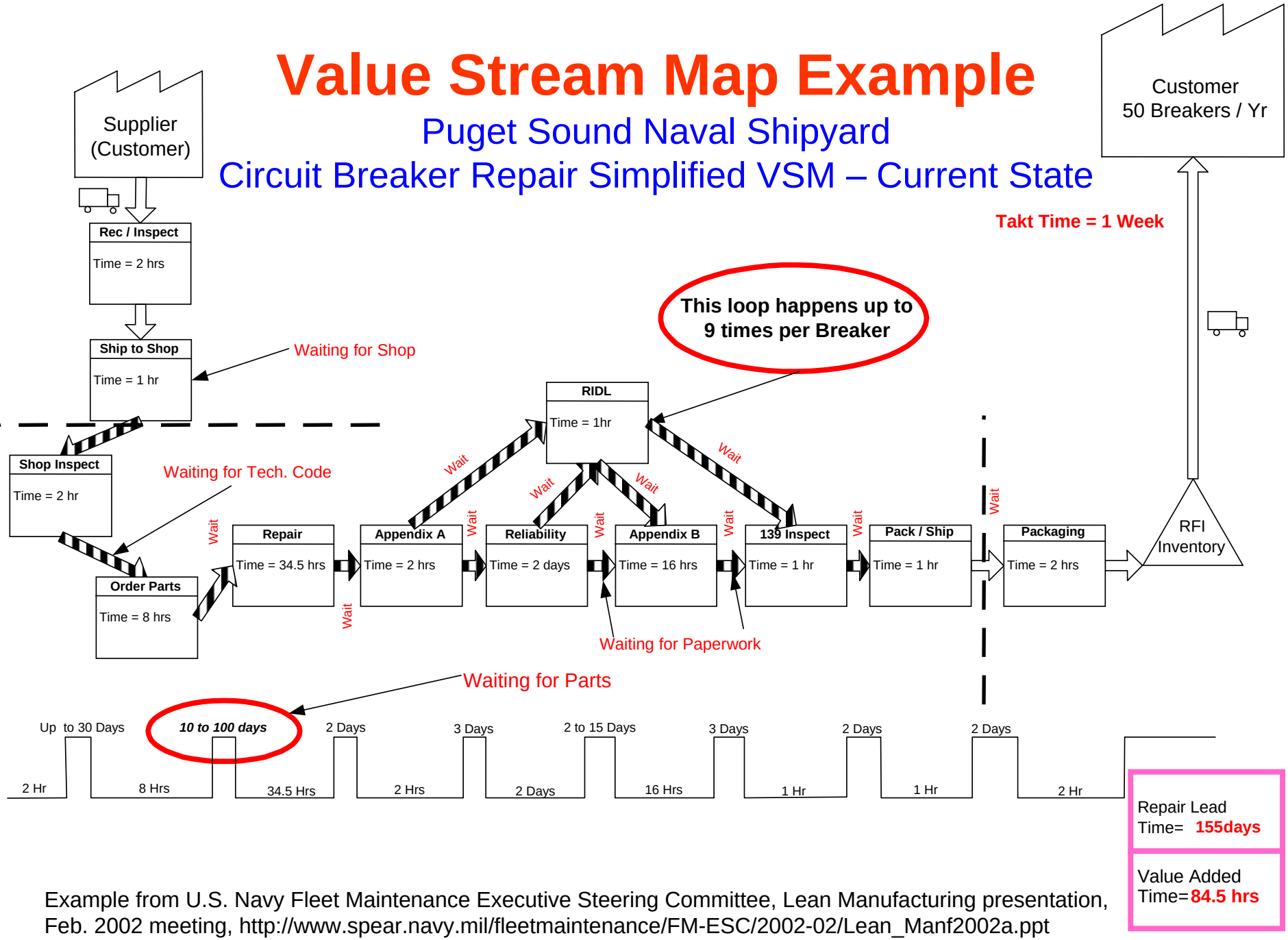
Value Stream Mapping (VSM)

- VSM is a process mapping method (with standard forms, symbols, and software) used to document the current and future states for a "value stream" (e.g., product line or service provided)
- Goal: Identify non-value added activity and waste, and target and guide lean improvement events

Value Stream Map Example

Puget Sound Naval Shipyard

Circuit Breaker Repair Simplified VSM – Current State



Repair Lead Time= **155days**

Value Added Time=**84.5 hrs**

Example from U.S. Navy Fleet Maintenance Executive Steering Committee, Lean Manufacturing presentation, Feb. 2002 meeting, http://www.spear.navy.mil/fleetmaintenance/FM-ESC/2002-02/Lean_Manf2002a.ppt

VSM: Bath Iron Works

- VSM applied to equipment cleaning processes
  - Focus on streamlining equipment washing process revealed excess use of wash solvent
  - Environmental Benefits: reduced solvent use and shifted to solvent reuse
- VSM applied to "preservation value stream" – prepping, blasting and painting steel
  - Found 90% of waste was from painting; led to focus on streamlining the painting process
  - Environmental Benefits: reduced hazardous waste from paint and thinners/solvents

5S

- Method introduces a systemic implementation of a Sort, Set in Order, Shine, Standardize, and Sustain (5S) process to a work area
  - Many organizations add a 6th "S" for safety
- Goal: an orderly, neat, and clean work environment, with unnecessary items removed and remaining items easy to find and use

5S Examples – Before 5S





5S Examples from Texas Die Casting, available at www.tocforme.com/

After 5S






5S Examples from Texas Die Casting, available at www.tocforme.com/

5S: Todd Pacific Shipyards

- 5S applied to handling and storage of hazardous materials and waste
  - Organized material and waste storage areas and significantly reduced need to move materials
  - Reduced fork lift trips by 50%
  - Improved material and waste labeling and "checking"
  - Environmental Benefits: reduced risk of spills and mishandling during movement; reduced energy use, emissions and oil leaks associated with fork lift trips, improving storm water quality

The Power of Lean

Lean integrates the best of numerous business improvement methodologies to deliver rapid and significant results.

The lean journey is just beginning….

Key Findings about Lean & EMS

- Lean and EMS are different, but highly complementary and synergistic
- Lean can significantly improve environmental performance
- Lean can add value to EMS
- EMS can add value to Lean

How Lean & EMS Compare: Key Similarities

	Lean	EMS
Waste Elimination Focus	Eliminate non-value added activities	Eliminate waste and risk
Culture Change	Employee-involved problem-solving culture; empowerment of decision-making to address needs where they occur	Same
Improvement	Continual improvement, based on Plan-Do-Check-Act model	Same

How Lean & EMS Compare: Key Differences

	Lean	EMS
Overall Type	Production philosophy with operationally-oriented tactics and practical tools	Management system framework
Organizational Ownership/ Primary Participants	Operations, with involvement of all employees where appropriate	Environmental professionals, with involvement of all employees where appropriate
Drivers/ Motivation	Business competitiveness & customer expectations; improve cost, time & quality	Need to better or more cost-effectively manage environmental compliance, risk & performance; and to demonstrate this to external customers/stakeholders

Lean Significantly Improves Environmental Performance

- **Resource productivity** improvements of 30-70% are common in a short timeframe
- Lean produces an operational setting highly conducive to EMS
  - Lean fosters a **continual improvement, waste-elimination culture** that involves workers in teams.
  - Focus on **right-sized, simple operations**/equipment
  - Long-term lean focus on product/process **design** to "deliver only want the customer wants"
- Environmental wastes are embedded in wastes targeted by lean—creating **environmental "coattails"**

Lean Production's Environmental "Coattails"

- Less scrap, fewer defects, less spoilage = **reduced waste**
- Fewer defects, less overproduction, simpler products, right-sized equipment = **reduced use of raw materials**
- Less storage, inventory space needed = **reduced materials, land, and energy consumed**
- Less overproduction, lighting/heating/cooling unneeded space, oversized equipment = **less energy use**
- Less overprocessing, more efficient transport and movement = **lower emissions**
- Clean, orderly workplace w/ well-maintained equipment = **fewer accidents; leaks & spills are noticed quickly**

Lean-Environmental Performance Examples

- **Northrop Grumman Newport News Shipyard**
  - Applied Just-in-Time to materials management
  - Shift from paint procurement in high volumes (50,000 gallons) to smaller quantity deliveries in right-sized containers
  - Positive impact on set-up times, inventory and storage space
  - Coattails: Reduced amount of unused paint that becomes hazardous waste; reduced waste disposal costs; reuse of paint containers

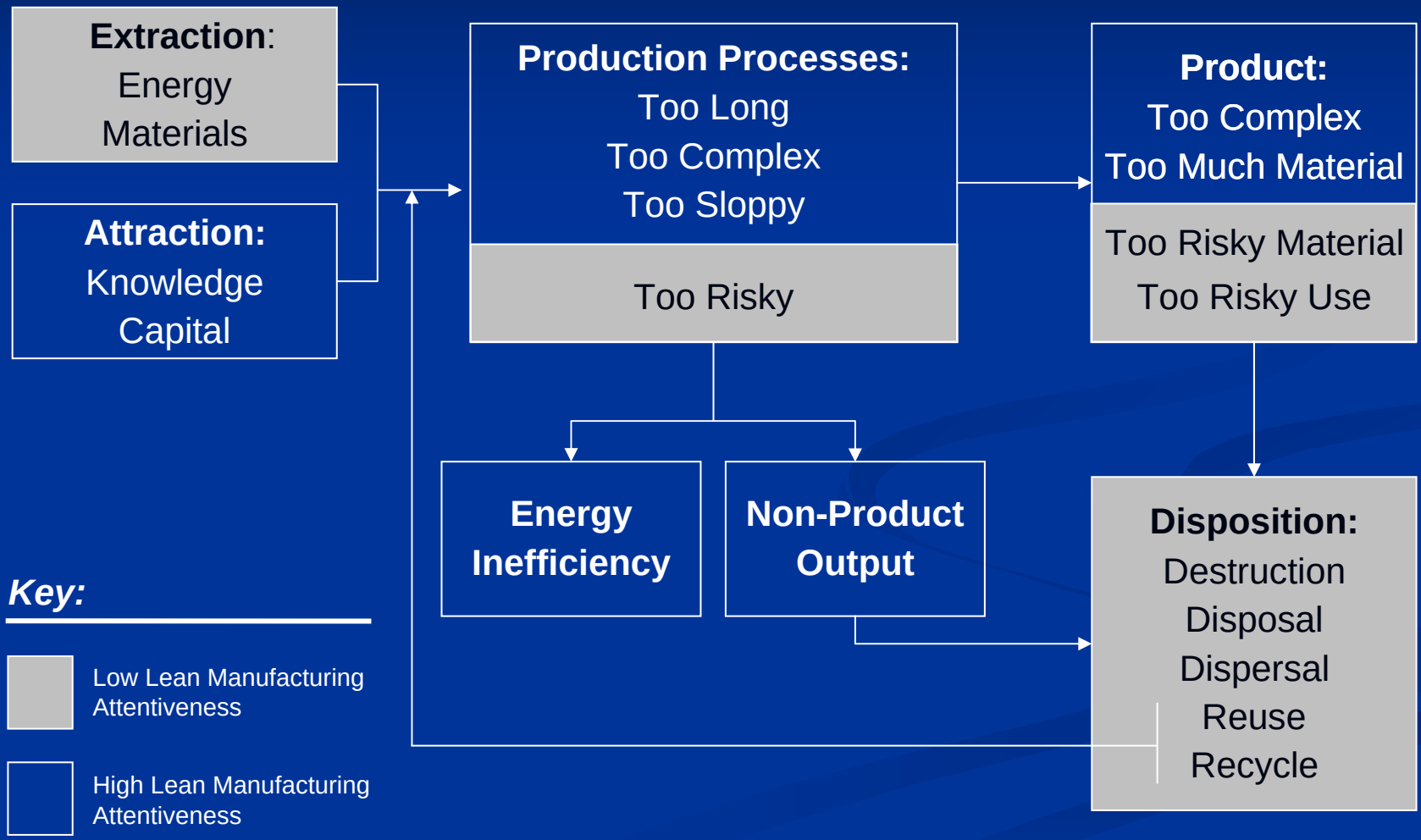
Lean Can Add Value to EMS

- Lean coattails can speed and intensify environmental improvement and culture change
- Lean methods offer a common structure in which EMS roles, responsibilities, and procedures can be integrated
- Linking to operations-driven lean initiatives can help EMS efforts “compete,” not just “pay”
- Lean tools can directly target EMS aspects & impacts and support EMS implementation
- Lean can be used to streamline EMS processes

EMS Can Add Value to Lean

- "Learn to see" environmental waste, which is often buried in overhead costs
- Address lean's environmental "blind spots":
  - Environmental and human health risks posed by chemicals and processes
  - Lifecycle considerations
- Establish procedures that prevent regulatory compliance issues
- Minimize regulatory constraints on process changes to avoid production delays

Lean "Blind Spots": Risk and Lifecycle Impacts



EMS can Reduce Regulatory Constraints on Lean

- Lean's plant floor conversions and rapid change initiatives can experience regulatory constraints:
  - Air permitting and the ability to make rapid, frequent operational changes
  - Shifting to chemical point-of-use systems can raise compliance questions and uncertainty under RCRA
- EMS provides systematic change management process and procedures to reduce constraints

Opportunities to Improve Performance Through Lean-EMS Integration

Opportunities to Integrate Lean & Environment ("Entry Points")

1. Modify lean implementation tools to include environmental considerations (VSM, 5S, 3P)
2. Align EMS procedures and tools to work with lean and use P2 tools lean & environmental objectives
3. Use lean methods to address EMS objectives and to target environmental impacts
4. Change who is involved

Lean & Environmental Integration: 5S

Integrate Environment, Health, and Safety Throughout 5S and 5S Tools or Include as a 6th S for Safety

Lean & Environmental Integration: 5S

- 5S job cycle charts and 5S checklists can address environmental responsibilities and performance
  - Develop or adapt 5S checklists to include environmental aspects, impacts, etc.
- Red Tagging identifies items as hazardous for separate handling; disposition criteria include reuse/recycle options; red-tag criteria include risk; remaining hazardous materials are right sized
- "Shine inspections" have an explicit environmental aspect

Lean & Environmental Integration: 5S

- Five-Minute 5S Campaigns have periodic environmental focus
- Visual Management tools enhance worker awareness of EMS procedures & requirements
  - Use visual controls to reinforce chemical and waste handling and management procedures

Lean & Environmental Integration: 5S

- HNI added environmental questions to its Safe Workplace Design Checklist (for 6S):
  - Are aisles free from debris (dust, water, oil, etc.)?
  - Is the operator aware of chemical hazards associated with the tasks?
  - Is air flow/ventilation adequate?
  - Is air quality free from odors/fumes?
  - Is air quality free from air contaminants such as dust or fibers?
- Checklist is used to evaluate results from lean events
- Corrective actions identified for any “No” answers

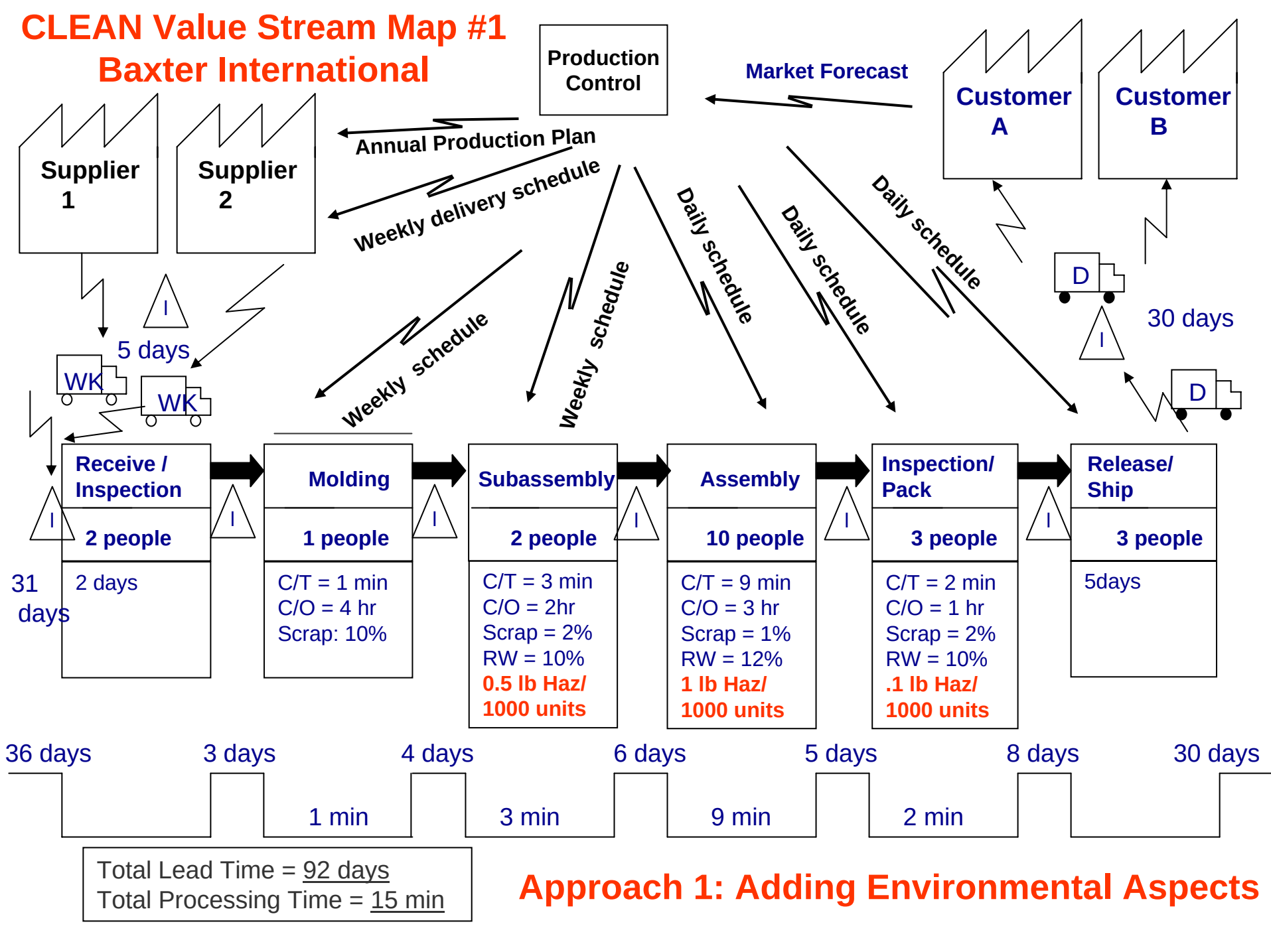
Lean & Environmental Integration: Value Stream Mapping (VSM)

- Integrate EMS aspects & impacts into Value-Stream Maps
  - Use VSM to identify and communicate aspects & impacts; influence lean event targeting
  - Adapt VSM tools (methods, forms, and software) to include symbols, notations, or overlays that explicitly map environmental waste areas

Lean & Environmental Integration: Value Stream Mapping (VSM)

- Baxter International has used two approaches for integrating environment into VSM:
  - Approach #1: Add environmental metrics to the lean metrics tracked in VSMs (time remains focus)
  - Approach #2: Use VSMs to target environmental wastes (e.g., water use as the overall focus)
- Baxter has also used pollution prevention (P2) process mapping methods to drill down further to identify even more environmental wastes

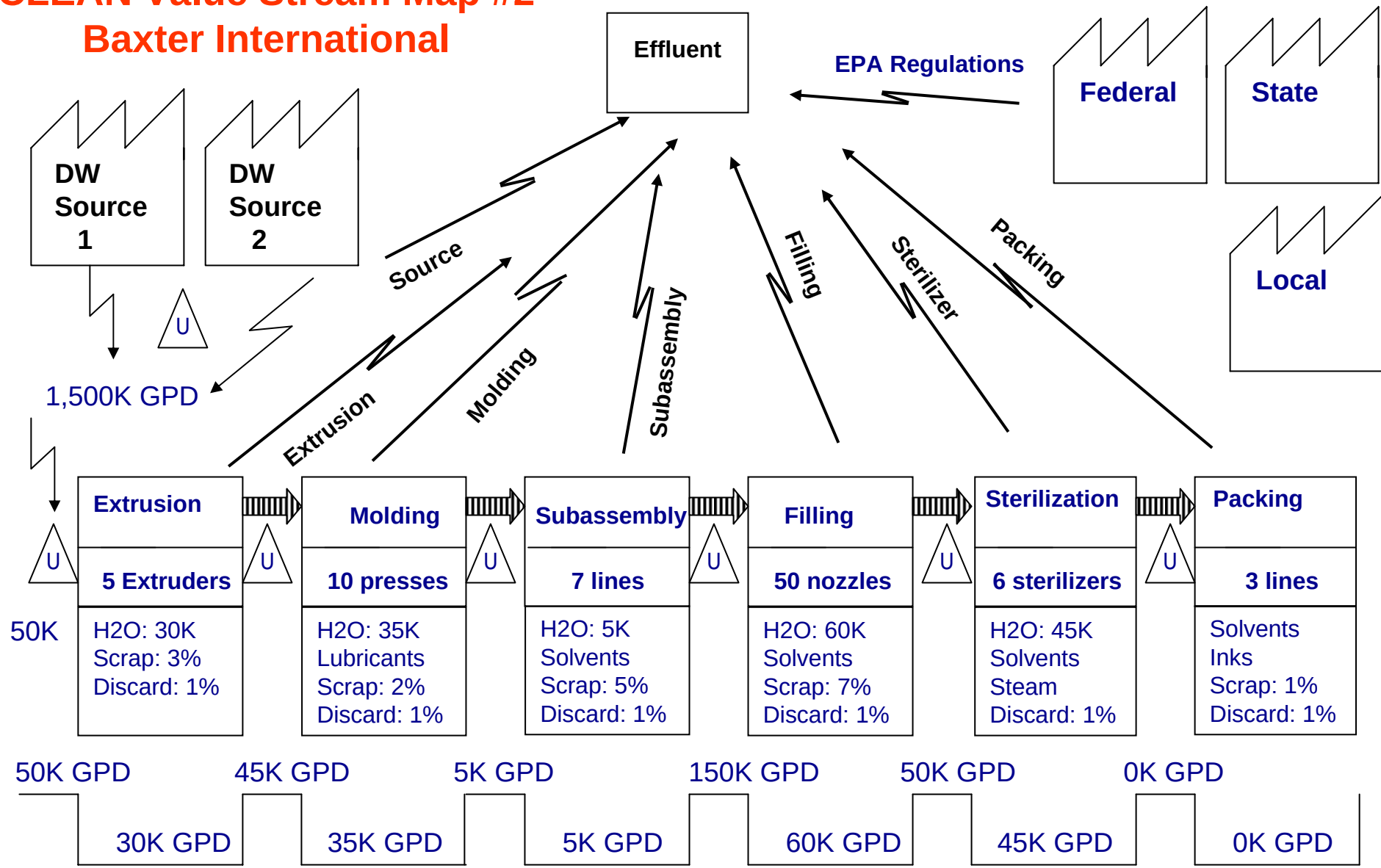
CLEAN Value Stream Map #1
Baxter International



Total Lead Time = 92 days
Total Processing Time = 15 min

Approach 1: Adding Environmental Aspects

CLEAN Value Stream Map #2
Baxter International



Total H2O Usage GPD = 301K Gallons Per Day
Total Need Per Day = 175K Gallons Per Day

Approach 2: Using VSM to Target Environmental Wastes (Water Use)

Integration: Lean Improvement Events & Change Management

- Align EMS Change Management processes with operational realities of lean
  - Use checklists to identify process changes that affect environmental aspects/impacts
  - Develop "*kaizen* questions" that should be asked during rapid improvement events
- Integrate EMS procedures into Standard Work
  - Incorporate EMS procedures, roles and responsibilities (where relevant) into standard work and visual instructions

Integration: Lean Improvement Events & Change Management

- Robins Air Force Base requires change agents to complete a checklist for lean events on:
  - Changes to Physical Layout of Process or Facility
  - Changes to Material/Chemical Use and Storage
  - Changes to Wastes or Waste Management
- Questions marked “Yes” or “Unknown” identify the potential for EHS impacts
- Environmental Managers provide assistance to lean events when EHS impacts are identified

Integration: Lean Improvement Events & Change Management

- Southwest Marine uses a “Tollgate Review” as part of LeanSigma process
  - “Improve” step in the process includes a check-off list for evaluating environmental impacts
  - If unknowns, lean manager must have a face-to-face meeting with environmental staff
  - Environmental review includes a weighted system with an aspect identification process
- Bath Iron Works has an environmental checklist for kaizen events, and Environmental personnel approve changes to standard work that result from lean events

Integration: Lean Improvement Events & Change Management

- Focus kaizen rapid improvement events on environmental aspects and impacts
  - Targeted improvement events on chemical management, waste management, stormwater management, reduction of welding smoke

Integration: Lean Improvement Events & Change Management

- Bender Shipbuilding & Repair Company targeted the welding process to reduce weld smoke emissions
- 13 staff and a welding expert participated in a kaizen rapid improvement event
- Team focused on reducing over welding – reduced weld size lowered costs (time, materials, etc.)
- Environmental Benefits: Less weld smoke emissions

Change Who is Involved – Environmental personnel can add value to lean initiatives

Wrap-Up: Key Findings about Lean & EMS

- Lean and EMS are different, but highly complementary and synergistic
- Lean can significantly improve environmental performance
- Lean can add value to EMS
- EMS can add value to Lean