Lean and Environment Training Modules

Version 1.0 – January 2006

Lean and Environment Training Module 4

Kaizen Events

Purpose of This Module

- Learn how to develop an effective environmental, health, and safety (EHS) change management system for kaizen events
  - Prevent regulatory compliance issues
  - Maximize the waste-reduction benefits of Lean
- Learn how to improve the environmental outcomes and effectiveness of kaizen events at your company
  - Ask key questions
  - Deploy new process-improvement tools

What Are Kaizen Events?

- **Kaizen** means continual improvement
- **Kaizen events** are team-based activities that:
  - Eliminate waste
  - Make rapid changes in the workplace
- Also known as rapid process improvement events and kaizen "blitz" events
- Changes are made in a 2-7 day period, but planning for events can take much longer

Opportunities to Enhance Kaizen Events

- Kaizen events are a primary vehicle for change in organizations implementing Lean

- They are powerful windows of opportunity to:
  - Eliminate non-value added activity
  - Reduce environmental wastes such as scrap, pollution, and hazardous wastes
  - Save money by wasting less energy, water, and raw materials
  - Improve working conditions for employees

Reasons for Including EHS Expertise

- 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

Common Processes with EHS Opportunities

» These processes often have significant EHS waste elimination opportunities and would likely to benefit from EHS expertise:

1. Metal casting
2. Chemical and heat treatment of materials
3. Metal fabrication and machining
4. Cleaning and surface preparation
5. Bonding and sealing
6. Welding
7. Metal finishing and plating
8. Painting and coating
9. Waste management
10. Chemical and hazardous materials management

Kaizen Event Strategies and Tools

Change Management Strategies

1. Train Lean Team Leaders on EHS Impacts
2. Identify an EHS Contact for Kaizen Event Teams
3. Use an EHS Checklist for Lean Events
4. Proactively Involve EHS Staff in Kaizen Events

1. Train Lean Team Leaders on EHS Impacts

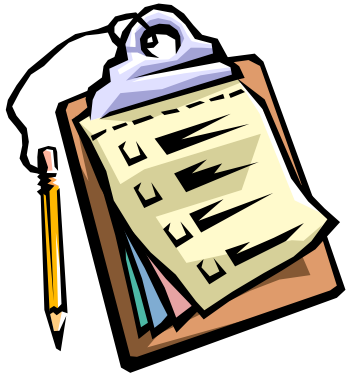
- Simple training can help leaders identify:
  - Issues and operational changes that may require additional EHS expertise
  - Environmental wastes that can be reduced in Lean events
- Add a few slides to Lean training presentations on operational changes that trigger involvement of EHS staff such as:
  - Material/Chemical Use and Storage Changes
  - Waste Management Changes
  - Physical Environment Changes

2. Identify an EHS Contact for Kaizen Event Teams

- Give Lean managers and kaizen team leaders one person to contact with EHS questions and needs
- Since EHS staff cannot participate in all Lean events, assign a general EHS contact to address unexpected issues and concerns
- Things to keep in mind:
  - **Keep it simple**
  - **Provide contact information**
  - **Assign EHS contacts who can be highly responsive**

3. Use an EHS Checklist for Lean Events

- Checklists help team leaders easily identify operational changes proposed in kaizen events that may cause an EHS impact
  - Have team leaders complete a checklist for *each* kaizen event
  - Consult EHS staff immediately when a potential EHS impact is identified



4. Proactively Involve EHS Staff in Kaizen Events

- Involve staff with EHS expertise early on to:
  - Anticipate and help implement changes needed to environmental compliance practices from Lean events
  - Bring a different perspective to Lean teams and additional ideas for waste-reduction opportunities
  - Work with regulatory agencies to tailor requirements and compliance strategies to fit your organization's Lean environment
  - Ensure that Lean activities improve or cause no harm to worker health, safety, or the environment

TO CONSIDER

- What EHS issues and questions have arisen during kaizen events in your organization?
- Which ones have recurred?
- What are three things your organization could do to improve coordination between Lean and EHS personnel regarding kaizen events?

Kaizen Event Strategies and Tools

Implementation Tools

1. Questions to Identify Lean and Environment Opportunities

2. Hierarchical Process Mapping

3. Process-Specific Pollution Prevention Resources

1. Questions to Identify Lean & Environment Opportunities

- Asking the right questions when preparing for and conducting a kaizen event can uncover hidden waste-reduction opportunities and costs, such as:
  - Chemicals that could harm human health and/or the environment
  - Water and energy utilities
  - Compliance support infrastructure that may be hidden in facility overhead

Sample Questions to Identify Lean and Environment Opportunities (1 of 2)

- **Energy**
  - How much energy is used in the process and how is it used?
  - How can you reduce overall energy use?
- **Chemicals and Materials**
  - What types & quantities of chemicals/materials are used in the process?
  - Can you switch to less harmful chemicals?

Sample Questions to Identify Lean and Environment Opportunities (2 of 2)

Hazardous Waste

- What types and quantities of hazardous waste are generated by the process?
- How can you reduce the amount or toxicity of hazardous wastes?

Air Emissions

- What types and amounts of air emissions are generated by the process?
- How can you reduce the overall amount or toxicity of air emissions?

2. Hierarchical Process Mapping

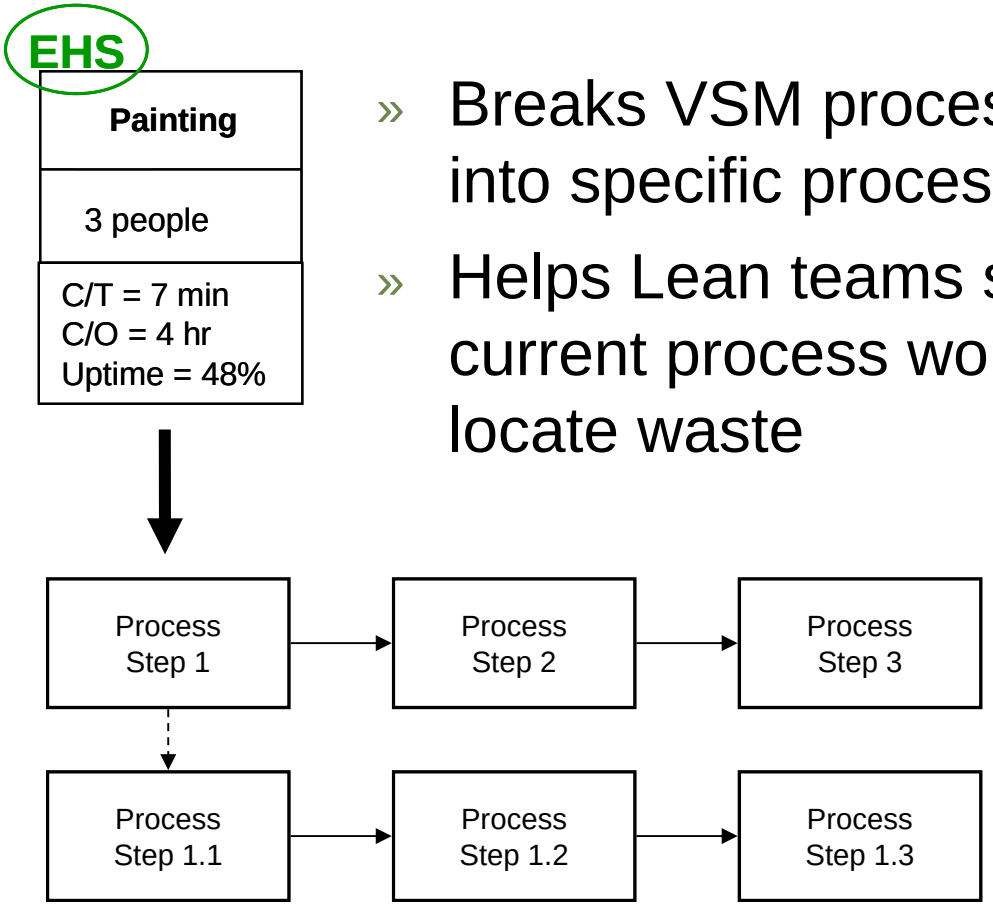
- **Hierarchical process mapping** is a tool used to create a workflow diagram to “drill down” steps within a single process in a value stream

- Uses a tired approach that can:
  - Help identify specific sources and root causes of waste
  - Uncover new waste reduction opportunities
  - Identify and prioritize among potential Lean improvement projects

Why Use Process Flow Maps?

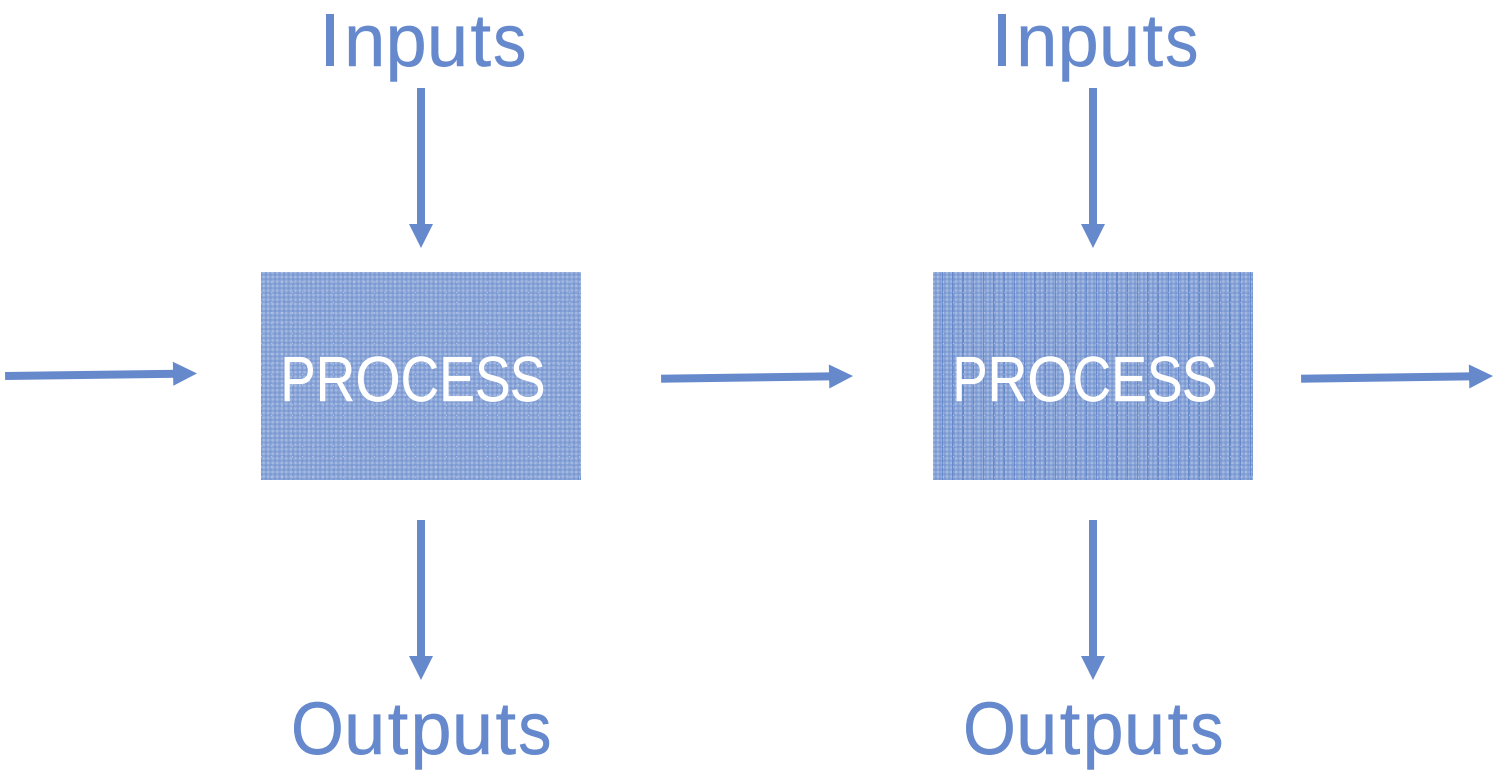
- Process flow maps provide structure for:
  - how you seek data
  - how you turn data into applicable, understandable information
  - and how you use it to make conclusions
- Builds understanding of costs associated with processes and steps
- Enables assignment of costs to activities, feeding prioritized continuous improvement
- Provide a visual document that can be shared by a team to facilitate improvements

Sample Hierarchical Process Map

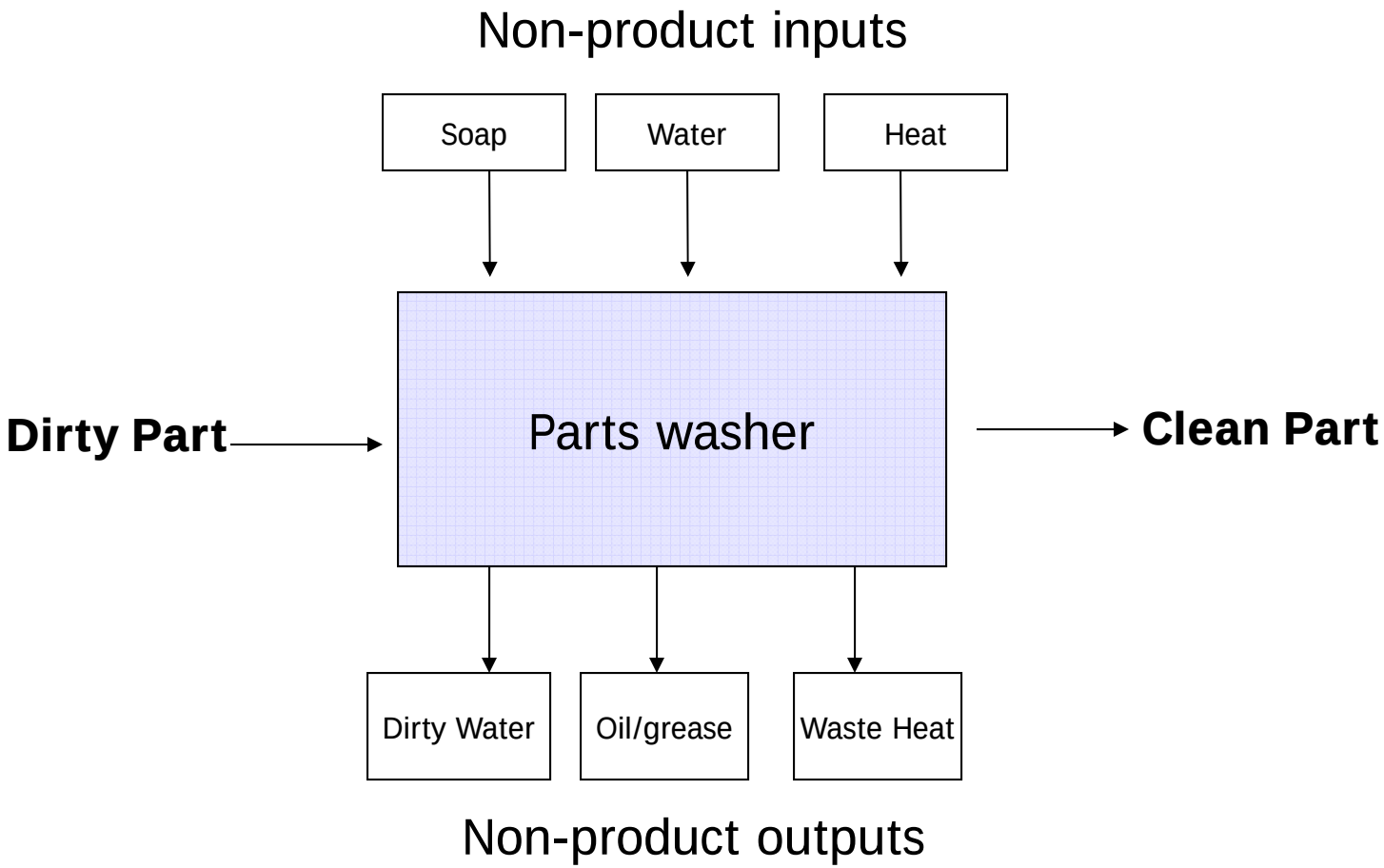


- Breaks VSM process boxes into specific process steps
- Helps Lean teams see how the current process works and locate waste

Process Flow Map



Parts Washing Process

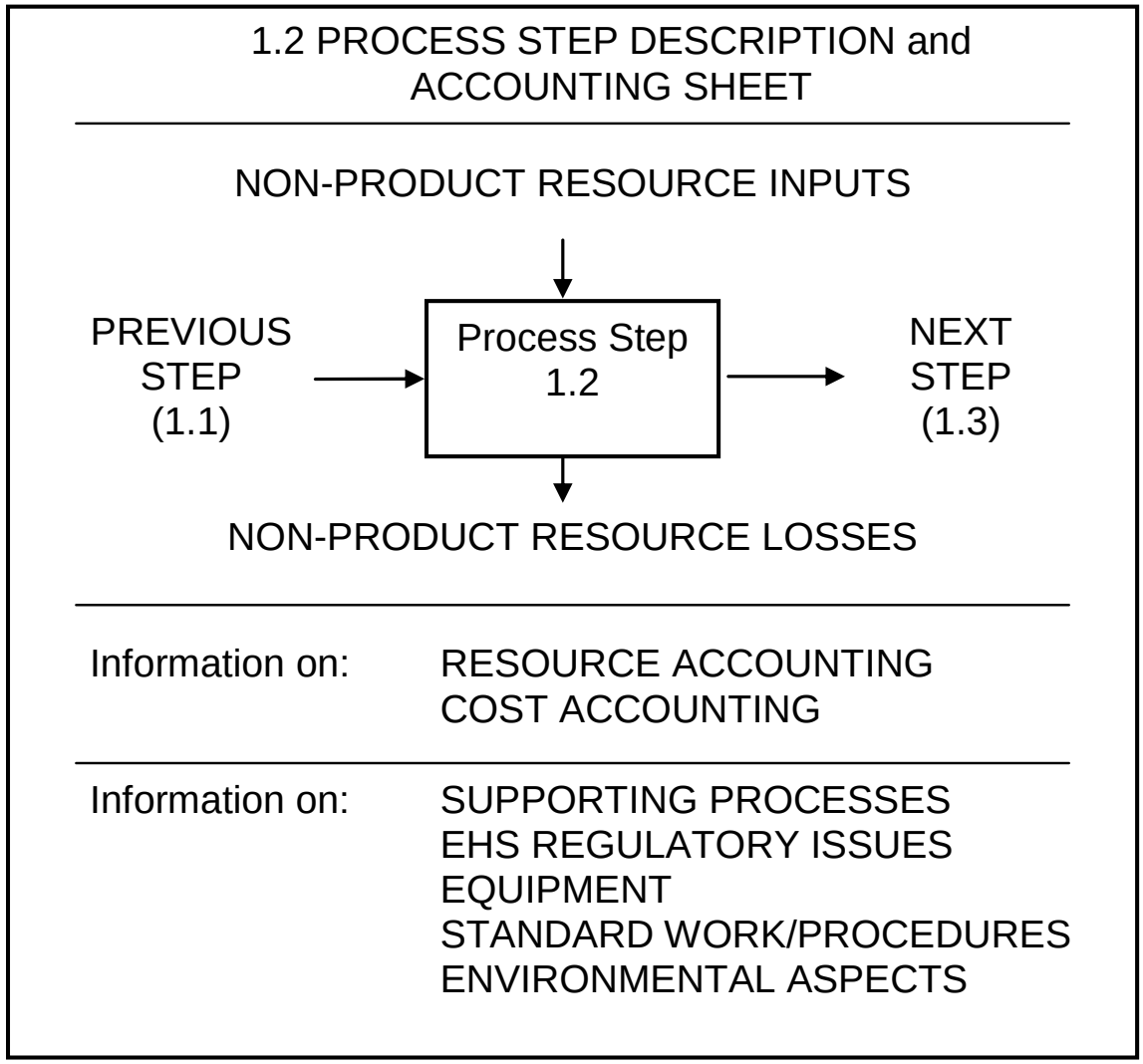


Capturing Detailed Process Information

- Process mapping provides additional information on:
  - Resource inputs (raw materials, energy used)
  - Non-product outputs (pollution, scrap, etc.)
  - Resource and cost accounting data
  - Regulatory issues and requirements

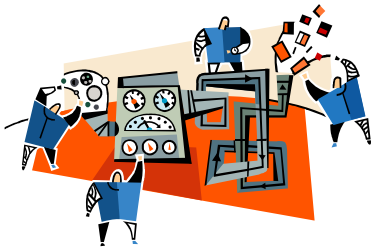
- This information can be recorded on Process Step Description and Accounting Sheets

Process Step Description and Accounting Worksheet Template



TO CONSIDER

- What are 3 processes at your company that could benefit from hierarchical process mapping?
- Which value streams (e.g., products or product families) use those processes?
- Who would you need to talk to about doing hierarchical process mapping on those processes?



3. Process-Specific Pollution Prevention Resources

- A wealth of information detailing techniques and technologies is available from national and regional "pollution prevention" (P2) clearinghouses such as:
  - U.S. Environmental Protection Agency Pollution Prevention (P2) website – www.epa.gov/p2
  - Pollution Prevention Resource Exchange – www.p2rx.org
  - U.S. Department of Defense Pollution Prevention Technical Library – p2library.nfesc.navy.mil

Reflections on Kaizen Event Opportunities

- Collectively, the strategies and tools in this training module are designed to help your organization:
  - Effectively manage changes identified in kaizen events to prevent and address EHS impacts
  - Leverage kaizen events so that they achieve greater environmental performance gains and Lean results
- Experiment with using some of these tools and try more as you go along
- Adapt the tools to meet your organization's needs and context

Reflections on Kaizen Event Opportunities, Continued

- What did you learn from this training module that was particularly useful?
- What questions do you have about the kaizen event strategies and tools presented?
- What other ideas do you have to improve the environmental performance of your organization with kaizen events?

EPA Lean & Environment Training Modules

- For more information about EPA's Lean-Environment Training Modules, visit: www.epa.gov/lean
- EPA is interested in learning from organizations' experiences with Lean and environment, and welcomes your comments on this training module
- Please contact EPA by using the form found at http://www.epa.gov/lean/auxfiles/contact.htm

DETAILS

More Information on Kaizen Events

- Kaizen events are used to implement other Lean methods, such as:
  - 6S (5S+Safety)
  - Standard work
  - Cellular manufacturing and plant layout changes
- Value stream mapping often serves as the basis for kaizen implementation plans
  - See the Value Stream Mapping Training Module

LP1

DETAILS

Kaizen Event Implementation Process

- Kaizen Implementation Consists of Three Phases:
  - Phase 1: Planning and Preparation
  - Phase 2: Implementation – The Event
  - Phase 3: Follow Up

Slide 31

LP1 I have split this informaiton into three slides so that it is easier to access. It would also be useful to include additional information on what some of the steps listed and examples of the follow-up activities.
Laura, 12/16/2005

DETAILS

Phase 1: Planning and Preparation

» Planning and preparing for kaizen events includes:

- Collecting background data
- Selecting a target area and problem
- Scheduling the event
- Selecting team members
- Making other necessary preparations to ensure a successful event

Phase 2: Implementation – The Event

DETAILS

- Process changes are made during a facilitated, 2-7 day event. Typical steps include:
  - Team orientation
  - Gathering baseline data (time studies, etc.)
  - Mapping the process
  - Brainstorming improvement ideas
  - Testing ideas
  - Analyzing the results
  - Documenting the new process, and
  - Presenting the results

Phase 3: Follow Up

DETAILS

- Wrap-up and follow-up activities ensure that the results of a kaizen event are communicated and sustained. Some suggestions include:
  - Highlight improvements made during the event on bulletin boards or in company newsletters
  - Have a celebration to cultivate a culture of worker involvement
  - Recognize and award team member contributions
  - Hold monthly “mini-meetings” to discuss the need for adjustments and to ensure unresolved actions are completed

Kaizen Event References

DETAILS

» Productivity Press Development Team. *Kaizen for the Shopfloor* Portland, Oregon: Productivity Press, 2002.

DETAILS

Environmental Benefits of Kaizen Events

- Environmental wastes are embedded in the “7 deadly wastes” targeted by kaizen events so,
- Implementing kaizen events can reduce:
  - Raw materials use
  - Energy and water use
  - Air pollutant emissions and wastewater discharges
  - Scrap, solid waste, and hazardous waste
- Learn more about the relationship of Lean’s deadly wastes and environmental wastes in the Identifying Environmental Waste Training Module

DETAILS

Common Operational Changes That Trigger EHS Involvement (1 of 2)

- **Material/Chemical Use and Storage**
  - Include changes in the type, volume, or introduction/issuance procedure for chemicals and materials
  - These changes can a*ffect chemical exposure, regulatory compliance, and reporting needs*
- **Waste Management**
  - Include changes in the type or volume of waste generated by a process, including air emissions, water discharges, and liquid and solid waste.
  - These changes can a*ffect compliance with regulatory & permitted limits, as well as pollution control & management capacity*

Common Operational Changes That Trigger EHS Involvement (2 of 2)

DETAILS

- **Physical Environment:**
  - Include changes to the…
    - physical layout of the process -- moving work or storage areas
    - equipment and technologies used, or
    - to the facility--moving, replacing, or installing vent hoods, stacks, floor drains, or process tanks
  - These changes can affect compliance with regulations and permits, as well as work practice requirements

DETAILS

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			
As a result of the Lean event, will there be:	**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)?			

DETAILS

Sample Lean Event EHS Checklist (2 of 2)

Material/Chemical Use and Storage			
As a result of the Lean event, will there be:	**Unk**	**Yes**	**No**
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?			
Waste Management			
As a result of the Lean event, will there be:	**Unk**	**Yes**	**No**
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?			

Tailoring Air Permitting

DETAILS

- The U.S. Environmental Protection Agency and various States have pioneered innovative approaches to air permitting that can streamline a plant's ability to make many types of operational changes

- Many of these flexible air permitting techniques are being piloted by companies implementing Lean

- To learn more about innovations in air permitting, use the form found at http://www.epa.gov/lean/auxfiles/contact.htm to get in touch with an EPA Lean and environment specialist

DETAILS

Kaizen Questions for Identifying Environmental Wastes and Opportunities (1 of 2)

Water

- ✓ How much water is used in the process and how is it used?
- ✓ How can you reuse water and/or reduce overall water use?
- ✓ Can you reduce contaminants in wastewater discharges?

Energy

- ✓ How much energy is used in the process and how is it used?
- ✓ How can you reduce overall energy use?
- ✓ Is equipment running or are lights on when not being used?
- ✓ Are you using efficient light bulbs?
- ✓ Can you save energy by consolidating operations and/or storage space?
- ✓ Can you shift to a cleaner source of energy?

Chemicals and Materials

- ✓ What types and quantities of chemicals/materials are used in the process?
- ✓ How can you reduce the overall amount of chemicals and materials used?
- ✓ Can you switch to less harmful chemicals?
- ✓ Can you eliminate any non-value added use of chemicals or materials from the product or process (excess packaging, unneeded painting, etc.)?

DETAILS

Kaizen Questions for Identifying Environmental Wastes and Opportunities (2 of 2)

Solid Waste

- ✓ What types and quantities of solid waste are generated by the process?
- ✓ How can you reduce the overall amount of solid waste generated?
- ✓ How can you reuse or recycle solid wastes?
- ✓ Is there a local composting facility that the waste can be taken to?

Hazardous Waste

- ✓ What types and quantities of hazardous waste are generated by the process?
- ✓ How can you reduce the amount or toxicity of hazardous waste generated?
- ✓ Can you better isolate and separate hazardous wastes from other wastes?

Air Emissions

- ✓ What types and amounts of air emissions are generated by the process?
- ✓ How can you reduce the overall amount or toxicity of air emissions?
- ✓ How far did vehicles travel to deliver parts and supplies?
- ✓ Can you reduce the vehicle miles traveled and emissions from transportation?

DETAILS

Six Steps of Process Mapping

- A **hierarchical process map** presents a high-level map, and then maps the specific steps that lie within each high-level step, and so on with tiers of increasing detail

- There are six main steps associated with process mapping
  1. Select the target process and determine map perspective and boundaries
  2. Collect information
  3. Draw the top-level map, and then draw more levels as needed
  4. Verify the map of process steps with employees and revise as needed
  5. Develop process step description and accounting sheets for process steps at the lowest level of the map
  6. Feed hierarchical process mapping information into improvement events

More Information on Process Mapping

DETAILS

- Dr. Robert Pojasek has pioneered the use of hierarchical process mapping for improving processes and eliminating waste. See:
  - www.pojasek-associates.com
  - Robert B. Pojasek, "Mapping Information Flow Through the Production Process," *Environmental Quality Management*, 13 (3), 2004.

DETAILS

Sample Process Description and Accounting Sheet

1.2 Assemble Clamp and Tubing
(Assembly Process)

Description of Work Step:
The side clamp is fed into the machine. The plastic tubing is fed into the machine and passed through the clamp. The tubing is cut to size. The machine verifies the length of the tubing and the presence of the side clamps.

Non-Product Resource Inputs
(Resources)
- Plastic tubing (extruded)
- Electricity for assembly machine (~.5 kW/hour)

Previous Step
1.1 Assemble Clamp

→ **1.2 Assemble Clamp and Tubing** →

Next Step
1.3 Attach tubing to device interface

Non-Product Resource Losses
(Wastes)
- Plastic bags (tubing packaging)
- Waste tubing/scraps
- Lost or broken clamps

Supporting Processes:
- Recycling – plastic tubing scrap, plastic bags (~10 lbs./shift)
- Storage and handling of parts
- Maintenance and lubrication of assembly machine
- Cleaning of part feeding station
- Particulate matter (PM) sensors
- Compressed air
- Exhaust

No environmental regulatory requirements associated with this process step.

DETAILS

Regional Pollution Prevention Resource Centers (1 of 2)

- Great Lakes Regional Pollution Prevention Information Center (IL, IN, MI, MN, NY, OH, PA, WI, & Ontario, Canada) – www.glrppr.org
- Northeast Waste Management Officials' Association (CT, MA, ME, NH, NJ, NY, RI, & VT) – www.newmoa.org
- Pacific Northwest Pollution Prevention Resource Center (WA, ID, OR, & AK) – www.pprc.org
- Peaks to Prairies Pollution Prevention Information Center (CO, MT, ND, SD, UT, & WY) – http://peakstoprairies.org
- Pollution Prevention Regional Information Center (IA, KS, MO, & NE) – www.p2ric.org

DETAILS

Regional Pollution Prevention Resource Centers (2 of 2)

- Southwest Network for Zero Waste (AR, LA, NM, OK, & TX) – www.zerowastenetwork.org
- Waste Reduction Resource Center (AL, DC, DE, FL, GA, KY, MD, MS, NC, PA, SC, TN, VA, & WV) – http://wrrc.p2pays.org
- Western Regional Pollution Prevention Network (AZ, CA, HI, & NV) – www.wrppn.org