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E C O L O G Y

Lean & Environment Case Study: Columbia Paint & Coatings



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Lean and Environment Pilot Project Case Study: Columbia Paint & Coatings

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Washington State Department of Ecology, Hazardous Waste and Toxics Reduction Program (www.ecy.wa.gov/programs/hwtr)

Washington Manufacturing Services (www.wamfg.org)

Pilot Facility Participant:

Columbia Paint & Coatings, Spokane, Washington (www.columbiapaint.com)

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Lean and Environment Case Study: Columbia Paint & Coatings

The Washington State Department of Ecology (Ecology) and Washington Manufacturing Services (WMS) partnered in a lean and environment pilot project to provide technical assistance to the Columbia Paint & Coatings (Columbia Paint) manufacturing facility in Spokane, Washington. Columbia Paint manufactures high-quality residential, architectural, and industrial paint and coatings. Ecology provided environmental expertise for this pilot project, while WMS provided lean expertise and management of on-site activities at Columbia Paint from October 2006 through March 2007. Funding for the pilot project was provided by Ecology, the National Institute of Standards and Technology, and the U.S. Environmental Protection Agency.

The primary objectives of the pilot project were to:

- Develop a collaborative partnership between Ecology and WMS.
- Evaluate the benefits and synergies of deliberately integrating environmental tools into on-the-ground lean practices.
- Gain the expertise to offer and promote future lean and environment projects to manufacturers statewide.

Project Activities and Results

Pilot project activities included a “lean 101” training session to introduce lean methods to Columbia Paint staff, a value stream mapping workshop to identify improvement opportunities, and three “get ‘r done” events to implement process changes. (Get ‘r done events—often known as kaizen events by companies implementing lean—are rapid process improvement events that typically last 3-5 days.) The three get ‘r done events supported by Ecology and WMS were designed to address the following priority areas:

- Develop a production scheduling system driven by customer demand.
- Streamline the quality control process.
- Improve material organization and flow to increase batch-making velocity.

In addition to the planned pilot project activities, Columbia Paint independently conducted several lean and environment activities during the pilot project period, including changes to the plant’s layout and improvements to the oil-decanting and shrink-wrapping processes.

The collective efforts of Columbia Paint, Ecology, and WMS yielded considerable operational and environmental benefits. Through project activities, Columbia Paint reduced production lead and cycle times, overproduction, material loss and damage, operator travel time, and downtime. The process improvements also reduced raw material wastes, wastewater discharges, volatile organic compound (VOC) emissions, and hazardous wastes. Furthermore, as a result of pilot project activities, Columbia Paint now reuses all wash water from white paints and incorporates it into products. Cost savings for Columbia Paint are expected to total about \$210,000 per year. The cost, time, material, and environmental savings from the project are summarized in Table 1 below.

Table ES-1. Annual Cost, Time, and Environmental Savings

Reductions	Annual Cost Savings	Annual Time, Material, & Environmental Savings
Raw Material	\$109,200	49,200 lbs of paint solids from wash water 18,000 lbs of shrink wrap
Hazardous Waste	\$10,000	17,600 lbs
Wastewater	(included above) ^a	36,900 gallons
Labor	\$90,600	2,500 hours
<i>Total Cost Savings</i>	\$209,800	

^a Cost and material savings associated with the paint solids in wash water are included with raw material savings.

The project also resulted in numerous other benefits, including improvements in product quality, customer service, worker health and safety, and staff morale. Highlights of these benefits include the following:

- Decreased the total lead time for making non-stock products from 6-10 to an average of 5 days.
- Reduced the quality control inspection cycle time by 36 percent and decreased the overall number of process steps in the quality control process
- Lessened the potential for distressed batches by streamlining and standardizing raw material storage.
- Decreased the potential for accidents by reducing forklift traffic congestion, decreasing drum handling, and eliminating safety hazards associated with a conveyer system.
- Reduced worker exposure to ammonia and other volatile organic compounds.
- Freed staff time to focus on value-added tasks such as supporting additional process improvement efforts.
- Enhanced staff morale, improved communications between staff and management, and empowered staff to initiate process improvements activities.

Post-Pilot Project Improvement Activities

Since pilot project activities concluded in March 2007, Columbia Paint has continued to improve its operational and environmental performance. As part of its ongoing continuous improvement efforts, Columbia Paint has (1) reduced water use by recycling white and off-white wash water to clean tanks, (2) saved energy by decreasing the amount of product cycling through the still during the decanting process, (3) taken over all of the production from the Helena, Montana facility using half the labor used in Helena, (4) implemented several 5S projects throughout the facility, and (5) developed a list of improvement activities for future “get ‘r done” events. In September 2007, Columbia Paint was acquired by Sherwin-Williams, the largest national producer of paints and coatings.

Conclusions

All the organizations participating in the pilot project felt that the combination of lean and environmental objectives contributed to the project’s overall success. In many respects, the project was a better lean project because of the environmental component. The project saved Columbia Paint money, improved the facility’s responsiveness to customer demands, and increased the efficiency of the facility’s production system, while it also eliminated an environmental waste stream and improved the health and safety of the workplace. Furthermore, the project provided participants with an opportunity to learn more effective strategies for integrating lean and pollution prevention technical assistance. Finally, the project instilled a continual improvement culture among Columbia Paint staff and generated positive momentum for additional lean and environment improvement efforts.

This case study summary was prepared for the Washington State Department of Ecology by Ross & Associates Environmental Consulting, Ltd. For more information about this pilot project, please contact John Blunt of Ecology’s Eastern Regional Office at jblu461@ecy.wa.gov or 509-329-3525.

Lean and Environment Case Study

Columbia Paint & Coatings

Introduction

This case study describes a lean and environment pilot project conducted at Columbia Paint & Coatings (Columbia Paint) in 2006–07 that sought to integrate lean manufacturing and environmental methods to improve productivity and reduce waste. Columbia Paint, headquartered in Spokane, Washington, manufactures high quality latex and solvent-based paint and coatings for distribution throughout western North America. The Washington State Department of Ecology (Ecology), the National Institute of Standards and Technology (NIST), and the U.S. Environmental Protection Agency (EPA) provided funding for this project, supplementing the service costs paid for by the pilot facility.

The Columbia Paint pilot project is part of an overall lean and environment project involving Washington Manufacturing Services (WMS) and the Hazardous Waste and Toxics Reduction Program of Ecology. WMS is the state's NIST Manufacturing Extension Partnership center and provides a variety of services, including lean manufacturing, to help manufacturers become more competitive. The two organizations formed a partnership to jointly deliver technical assistance to improve the operational and environmental performance at facilities in Washington.¹

The collective efforts of Columbia Paint, Ecology, and WMS in this pilot project reduced operating and environmental costs at the facility by about \$210,000 per year. In addition, the facility improved overall production efficiency and increased customer responsiveness, while also improving employee morale and fostering an organizational culture built around continual improvement.

Pilot Project Objectives

Columbia Paint viewed this project as an opportunity to streamline their manufacturing processes and lessen the physical constraints on the facility by improving product flow. The main objectives for Ecology and WMS' participation in the project were to:

- Develop a collaborative partnership between Ecology and WMS.
- Evaluate the benefits and synergies of deliberately integrating environmental tools into on-the-ground lean practices.
- Gain the expertise to offer and promote future lean and environment projects to manufacturers statewide.

The objectives for Columbia Paint to participate in the pilot project were to:

- Improve batch velocity (decrease lead time) and product flow throughout the facility.
- Identify and implement low-cost, high-impact improvements that reduce waste.

This case study introduces the Columbia Paint facility, provides an overview of the project structure and the lean and environment integration strategy, and describes the lean and environment activities conducted during the project. Additionally, this case study summarizes the results and costs of the project

¹ WMS is a not-for-profit organization that provides assistance to Washington manufacturers; it is an affiliate of the National Institute of Standards and Technology Manufacturing Extension Partnership (for more information, see www.wamfg.org). Ecology managed this pilot project through its Hazardous Waste and Toxics Reduction Program, which works with businesses and citizens to prevent pollution, safely manage wastes, and raise awareness of hazards and safe options (for more information, see www.ecy.wa.gov/programs/hwtr).

and outlines key lessons learned and conclusions from the project. Project activities occurred between October 2006 and March 2007.

About Columbia Paint & Coatings

Columbia Paint & Coatings manufactures high-quality residential, architectural, commercial, and industrial paint and coatings for customers throughout the Pacific and Mountain West. Headquartered in Spokane, Washington, Columbia Paint ranks as the 38th largest paint and coatings company in North America and consistently ranks first throughout its market area.² Latex (water-based) paint represents around 80 percent of Columbia Paint's total production volume, while solvent (oil-based) paint represents the remainder. Oil-based product lines, however, account for 42 percent of the total number of batches Columbia Paint produces.

Founded in 1948, the company produces over 3.25 million gallons of paint per year, reaching \$73.5 million in total sales in 2006. The Spokane facility employs 16 manufacturing staff and 60 total staff, including the company's corporate and sales offices. Prior to this project, Columbia Paint had conducted one informal process improvement event that focused on their packaging lines. The facility used in-house lean expertise for that event. Columbia Paint viewed this pilot project as an opportunity to build its lean experience by streamlining its manufacturing processes and formally introducing lean methods to the Spokane facility.

Columbia Paint's manufacturing processes generate several types of process wastes, including wash water, paint solids, and solvent waste. Improvement activities related to the pilot project targeted each of these environmental and raw material wastes. Columbia Paint, a large quantity generator of hazardous wastes, is making changes to its hazardous waste management practices and hopes to reduce its overall hazardous and process waste generation as well as its generator status. The facility employs a full time environmental health and safety professional and has an environmental management system (EMS).

Following the pilot project, in September 2007, Columbia Paint was acquired by The Sherwin-Williams Company, the largest national producer of paint and coatings.³

Overview of Lean and Environment Activities at Columbia Paint

Project Scope and Structure

WMS and Ecology supported five lean and environment events at Columbia Paint, including:

- A lean 101 and environment training session to train facility staff to identify process improvement opportunities.
- A value stream mapping (VSM) workshop to understand, map, and prioritize improvement opportunities.
- Three "get 'r done" events to identify and implement process changes. (Get 'r done events are rapid process improvement events lasting 3 to 5 days; they are often known as kaizen events in the lean manufacturing community).

² For more information about Columbia Paint & Coatings, see www.columbiapaint.com.

³ For more information about Sherwin-Williams, see www.sherwin-williams.com.

Columbia Paint also conducted several related lean and environment activities during the pilot project period without the direct assistance of Ecology or WMS. These activities are further described below.

Lean and Environment Integration Strategy

The Ecology and WMS team working with Columbia Paint chose a subtle and high-level strategy for integrating environmental considerations into lean implementation activities. The strategy allowed Columbia Paint managers to select the project focus areas based on the facility's production goals (rather than selecting focus areas based on Ecology's interests), and was based on the assumption that environmental improvement opportunities would naturally arise during planning and implementation of lean events. In addition to this general strategy, Ecology and WMS integrated environmental concepts and methods in the following ways:

- Lessened the distinction between Ecology and WMS staff by having Ecology staff present "lean" sections of the lean 101 training presentations.
- Expanded the definition of lean wastes to include "process waste" (a generic term for environmental wastes) in the lean 101 training, and including process waste in the development of the current state value stream map.
- Asked leading questions to encourage Columbia Paint staff to identify environmental wastes and improvement opportunities, especially during the value stream mapping workshop.
- Involved Ecology staff and the environmental health and safety manager at Columbia Paint directly in the planning and implementation activities of the VSM workshop and get 'r done events.
- Used pollution prevention expertise to help participants identify possible environmental improvement opportunities during lean and environment events.

Lean and Environment Events and Projects

This section describes the specific activities and results of each of the pilot project events, including the lean 101 training, the VSM workshop, and the three get 'r done implementation events.

Lean 101 Training

The Columbia Paint pilot project began with a day-long lean 101 training. In addition to the WMS facilitator and two Ecology staff, a cross-functional group of eighteen Columbia Paint staff, most of whom worked in production, attended the event. Participants included the plant manager, the environmental health and safety manager, batch makers, labelers, and warehouse staff.

The training introduced Columbia Paint staff to lean manufacturing methods and terminology as well as the role of Ecology in the pilot project. Ecology and WMS staff modified lean 101 to include environmental wastes, called "process waste," as an additional lean waste. Most manufacturing processes generate process wastes such as pollutant emissions, defects, scrap, wastewater, and other environmental wastes. To lessen the distinction between environmental and traditional lean waste, an Ecology staff person presented a lean 101 training section focused on lean wastes. Columbia Paint also held an internal mini training session for new facility staff and for staff who missed the initial lean 101 training conducted by WMS and Ecology.

Value Stream Mapping Workshop

A cross-functional group of twelve Columbia Paint staff participated in the four-day VSM event, along with two Ecology staff and a lean facilitator from WMS. The VSM team integrated environmental considerations into the value stream map by tracking process waste alongside other lean metrics such as cycle time and changeover time. The VSM team examined overall production levels, processing times, and process wastes (primarily wash water) in order to develop a “current state” value stream map of the latex paint value stream and set goals for improvement efforts. In 2006, the facility produced an average of 7,900 latex gallons per day, and it budgeted for an eight percent increase to 8,530 latex gallons per day in 2007. Columbia Paint set a goal to increase daily batch production to 9-12 batches per day.

Based on the VSM event and Columbia Paint’s production goals, the team identified four areas for the get ‘r done events:

- Standardizing the schedule and product flow.
- Modifying the plant layout to improve the process flow.⁴
- Reducing the time required for the off-line quality-control process.
- Improving raw material organization and developing a kanban (visual signal) system for high volume raw materials.

Get ‘R Done Event Structure

Each of the three pilot project get ‘r done events consisted of two planning days and two or three implementation days, with a one to two-week period between planning and implementation. Participants included a cross-functional team of operators and managers from Columbia Paint, two staff from the Washington State Department of Ecology, and a WMS lean facilitator. Ecology staff participated to a varying degree in implementation, depending on the nature of the work. A description of the activities and the results of each get ‘r done event follows.

Get ‘R Done Event #1

The first get ‘r done event at Columbia Paint focused on:

- Standardizing the product flow.
- Developing a “pull” scheduling system for filling paint batches.
- Creating a visual representation of the schedule so that workers could track the progress of orders and paint batches.

The goals of these activities were to increase the number of batches produced per day without decreasing the volume of paint produced, and to decrease the amount of wash water generated. Traditionally, Columbia Paint used a reactionary “push” production system that was driven by the batch-making process, tank availability, and production forecasts, instead of direct customer demand for products. The get ‘r done team turned this around and developed a production scheduling system for the filling process that was based on customer demand. The new system, a single schedule tied all the operations together; and each process pulled work-in-process (WIP) from the previous process only when it was needed.

⁴ In order to maximize project time and funding, Columbia Paint chose to conduct the plant layout reorganization internally, without the support of WMS or Ecology.

The team analyzed the times required to fill paint batches in the three filling stations (an autofiller machine for latex paints, and two hand-filling stations for latex and oil-based paints), developed a new scheduling tool for determining what paint batches to fill when, and created a visual production control board. In the course of studying wastes in the process (material wastes as well as typical lean wastes), the team discovered that all of the white wash water could be absorbed into products. A Columbia Paint manager then issued the following edict: “Thou shalt not flush white water.”

During the event, the team also conducted a trial run to test the new pull production system, held a training session for operators on the visual production control board, and participated in a report-out presentation. Preliminary results from the trial run were strong, despite having fewer shifts operating than during peak production months. Table 1 outlines the specific activities and results of the event.

Table 1. Process Changes and Results for Get ‘R Done Event #1

Activities	Results
Developed a new scheduling system based on the filling process, and created an associated visual production control board.	<ul style="list-style-type: none"> • Saved \$20,600 in labor costs by avoiding the need to hire staff to meet the growth in sales. • Reduced overtime costs by \$13,000 per year. • Saved \$10,000 by avoiding inventory carrying costs associated with increased growth. • Increased awareness of the production schedule and the status of orders, and reduced the potential for confusion and miscommunication. • More people are able to set the schedule because it is based on customer demand data, rather than simply institutional knowledge. • Improved service levels for completing paint orders, causing less missed sales opportunities. • Reduced the total lead time for production from 6-10 to 5 days, including: <ul style="list-style-type: none"> ○ time checking raw material availability ○ time answering status questions for sales (1 hour per week) ○ time spent managing the schedule (1 hour per day) ○ warehouse time required to manage inventory for anticipated growth in sales
Issued edict requiring all white wash water to be reused and incorporated into products.	<ul style="list-style-type: none"> • Reused 197 lbs of paint solids per day rather than disposing of the solids in the wash water.^a (This includes wash water from yellow and white traffic paints and regular white wash water.) • Saved \$67,100 per year in wastewater paint solids costs. • Reduced time handling wastewater by 6 hours per week. • Reduced wastewater discharges by about 148 gallons per day, which is a 31% reduction in the facility’s total wastewater volume.^b
Added a code for wash water to the company’s raw material tracking system.	<ul style="list-style-type: none"> • Allows managers to better understand the amount of wash water reused in products and the cost savings from incorporating wash water into products. (Note: the paint solids savings reported above reflect these improved data.)

^a Wash water reuse and cost savings are based on annualized equivalents of the amounts of wash water and paint solids recycled from 5/1/07 through 4/4/08.

^b Total wastewater discharges (including wash water and other sources) before get ‘r done event #1 averaged 480 gallons/day.

Get ‘R Done Event #2

The second get ‘r done event focused on reducing the time required for the separate, off-line quality control (QC) process. Designed to support and build on the accomplishments of get ‘r done event #1, this event sought to eliminate the QC bottleneck identified in the VSM event. Activities focused on:

- Reducing the cycle time of the QC and tinting processes.
- Establishing a visual representation of QC capacity.
- Supporting the potential for increased batches.

- Improving product throughput and velocity (i.e., reducing process lead time by eliminating non-value added activity).

Event activities included videotaping the lead QC operator during his normal workday and recording and timing each process step required to move a paint batch through the QC process. Participants also developed a spreadsheet to organize and analyze the data, and brainstormed improvement ideas for streamlining the QC process. Based on the brainstorming session, the team restructured both the QC and the tinting processes to improve product throughput, reduce cycle time, and decrease the labor costs. Table 2 below describes the improvement activities and associated results for get ‘r done event #2.

Table 2. Process Changes and Results for Get ‘R Done Event #2

Activities	Results
<ul style="list-style-type: none"> • Established visual tools to track QC capacity. • Separated the critical QC steps from those that could be eliminated or absorbed into the batch-making or filling processes. <ul style="list-style-type: none"> ◦ Absorbed grind checks and standard primer tinting into the batch making process. • Separated the gloss and tint strength checks. • Created a second draw-down sheet for gloss paint that can be immediately force dried in QC. • Reduced shake time for QC samples. • Reduced the time it takes for a QC sample to heat or cool. 	<ul style="list-style-type: none"> • Reduced the QC final inspection cycle time by 36%. • Reduced QC labor costs by \$8,000/year (based on the cycle time reductions at final QC). • Freed up to five hours of QC/tinting labor with soft savings estimated at \$20,000/year.^a • Increased product velocity and throughput. • Increased ownership and responsibility in the lead filler and batch maker positions. • Decreased QC staff worker exposure to ammonia and other volatile organic compounds (VOCs).

^a This cost savings estimate could be higher since much of the labor savings have been directed towards other continuous improvement activities (e.g., the 5S workstation mentioned in Table 4 below).

Get ‘R Done Event #3

The final lean and environment event in the pilot project focused on improving the storage and handling of raw materials. The event had the following goals:

- Increase the efficiency of the batch-making process by improving raw materials placement.
- Improve flow by reducing unnecessary handling and transportation of raw materials.
- Reorganize and optimize the use of storage space.

During the two planning days for the event, participants reviewed and analyzed historical data about the facility’s use of raw materials. The team created a report that outlined the number of times each raw material was “touched” or used by workers, the amount of each raw material included in a batch, and the frequency with which each raw material was used. This data analysis confirmed workers’ informal understanding of the most used raw materials, and provided a basis for developing an improved system for locating raw materials at the facility. Prior to the event, raw materials were not stored in standard locations; instead, incoming raw materials were placed in whichever storage racks were empty or available at the time. In the old system, operators from the batch-making process (the “batch makers”) needed to review two whiteboards to identify which rack had a particular raw material, and then often had to search the plant for a forklift to extract the materials.

Using the data from the “touch” report, line operators took the lead in designing a new plan for raw material storage and handling at the plant and helped run the three implementation days of the event. The operators recommended locations for storing raw materials at the plant, placing the most frequently

used materials closer to their point of use in the batch-making process, and also recommended other changes to improve product flow through the materials storage and batch-making areas. Columbia Paint managers on the event team empowered the operators to make these changes during the event. As a result of the Columbia Paint team’s initiative, the WMS lean facilitator, along with Ecology staff, had a less directive, support role during this event (e.g., the WMS facilitator helped prepare labels during the final days of the event). Table 3 below outlines the specific activities and results of the event.

Table 3. Process Changes and Results for Get ‘R Done Event #3

Activities	Results
<p>Reorganized and re-labeled raw material storage areas:</p> <ul style="list-style-type: none"> • Organized storage areas based on historical demand for items, with frequently used items (the most touched items) stored closer to the batch-making area. • Moved small quantities (5-gallon containers) of the most used raw materials to the point of use in the batch-making area. • Standardized the locations where raw materials are stored and developed a new labeling system for the storage racks. • Separated raw materials used for latex paint and solvent paint production. • Assigned materials that are used together in batches to the same storage racks. 	<ul style="list-style-type: none"> • Improved flow in the raw material storage area and in batch-making process, which should increase batch-making velocity and improve customer service. • Reduced confusion and the amount of time spent looking for raw materials. • Eliminated unnecessary transportation of raw materials and decreased worker travel in the plant. • Freed up to 15 pallet spaces in the raw materials storage area.
<p>Established a kanban (signal) system with visual controls for managing raw material inventory:</p> <ul style="list-style-type: none"> • Used a visual control (red tape with a line showing the fill level) to mark partially full drums. • Established standard inventory levels for raw materials. Empty spots on racks serve as a trigger for replenishing raw materials. 	<ul style="list-style-type: none"> • Visual control allows workers to quickly identify inventory levels. • Improved the system for ordering and restocking raw materials.
<p>Assigned a forklift and an order picker machine to dedicated locations at the plant (rather than floating locations).</p>	<ul style="list-style-type: none"> • Improved safety by reducing forklift traffic congestion. • Decreased the potential for accidents by safer and less frequent drum handling. • Reduced the risk of damaging raw materials and the potential for spills.
<p>Used existing floor scales (instead of a tape measure or “eye-balling” amounts) for weighing raw materials near where they are used.</p>	<p>Improved product quality and consistency from more accurate measurement of materials.</p>
<p>Overall Event (All Activities Combined)</p>	<p><i>Receiving Area</i></p> <ul style="list-style-type: none"> • Saved 400 hours per year in labor costs, or \$8,000. <p><i>Oil-Based Product Lines (the “Factory”)</i></p> <ul style="list-style-type: none"> • Saved 400 hours per year in labor costs, or \$8,000. • Reduced the number of foot steps from 789 to 220. • Expected to improve make-and-ship turnaround time. <p><i>Latex Product Lines</i></p> <ul style="list-style-type: none"> • Saved 150 hours per year in labor costs, or \$3,000.

Related Lean and Environment Activities Conducted During the Pilot Project Period

In addition to the lean 101 training, value stream mapping workshop, and three get 'r done events supported by WMS and Ecology, Columbia Paint conducted several internal lean and environment improvement efforts during the pilot project period. (See the description of these activities in Table 4.)

Table 4. Process Changes and Results for Other Lean and Environment Activities

Process/Area	Completed Actions	Results
Plant Layout (Internal Get 'R Done Event)	<ul style="list-style-type: none"> • Changed the layout of equipment, materials, and process operations in the plant to improve product flow. • Moved the labeling process closer to the autofiller machine. • Changed the orientation of the ergonomic lift used to move product onto pallets. • Removed the conveyor system for moving filled buckets onto pallets (for transportation to the warehouse). • Eliminated process steps for loading finished goods. (Finished good are loaded directly onto trucks instead of into temporary storage areas.) 	<ul style="list-style-type: none"> • Allowed the right number of labels to be produced based on the needs of the filling process, which reduced the number relabeled buckets and bucket and label waste. • Improved ergonomics and safety and eliminated the pinch hazard associated with the previously used scissor-shaped loading platform and conveyor system. • Improved product flow and reduced overall lead time for products. • Reduced unnecessary worker travel and excess transportation of work in process (WIP) and finished product. • Allowed workers to install and use floor scales (a change made in get 'r done event #3). • Reduced the number of product touches from five or six touches to one touch for loading finished goods onto trucks. • Freed up floor space and lessened the need for future facility expansion (brick and mortar savings).
5S Workstation	Used the lean method of 5S to develop an organized, visual, and centrally located workstation for workers to repair squeegees.	<ul style="list-style-type: none"> • Made tools available to workers at a readily accessible location. • Reduced time spent looking for tools and supplies.
Oil Decanting Process	<ul style="list-style-type: none"> • Changed the solvents used in the oil decanting process. • Changed from a slanted-bottom to a flat-bottom drum design. 	<ul style="list-style-type: none"> • Reduced solvent waste by 17,600 lbs/year and \$13,100/year in raw material costs. (These savings—combined with other changes to hazardous waste management practices—could potentially shift the Columbia Paint facility from large to medium quantity generator status under State law in the future.) • Expected savings of \$10,000/year in hazardous waste disposal costs.^a • Decreased the amount of wasted paint solids. • Decreased total time for oil decanting. • Reduced energy use because less product goes through the still with the new process.
Shrink Wrap Process	Mechanized the shrink wrapping process for shipped sundries and manufactured goods.	<ul style="list-style-type: none"> • Improved the quality of product delivery and increased customer satisfaction. • Improved ergonomics and worker safety. • Saved 18,000 lbs/year of shrink wrap by decreasing the amount used in shipping.^b • Saved \$29,000 in annual material costs.

^a The disposal fee savings is a “soft” cost savings that the facility expects to realize in the future.

^b After the pilot project, the facility began shrink wrapping an additional line of products (Euclid items); this offset some of the reductions in shrink wrap usage from the pilot project. The facility estimates that there has been a net reduction in shrink wrap usage of about 13,500 lbs/year, which is 75% of the 18,000 lbs/year of savings from the pilot project.

Some of these efforts—conducting a get ‘r done event to improve the plant layout and developing a workstation for squeegee repair using the 5S lean method—were directly related to get ‘r done events #1, 2, and 3. Other activities, namely the changes to the oil-decanting process and the shrink-wrapping process, emerged out of the culture change generated by the pilot project. Columbia Paint operations staff championed these lean and environment improvement activities with the support of Columbia Paint management.

Post-Pilot Project Activities

Since pilot project activities concluded in March 2007, there have been a number of changes at Columbia Paint. The facility continued to refine and expand upon the process changes implemented during the pilot project period, including applying process improvements from the latex paint lines to the oil-based paint lines, improving workplace organization and cleanliness through 5S projects, and finding additional ways to recover paint solids from wash water and reduce wastewater discharges. There was less than 10 percent staff turnover (most of them newer staff) at the facility in 2007, and the staff has continued to embrace the continual improvement philosophy of lean.

Two large external factors shaped the company’s activities and performance following the pilot project and limited the extent and pace of lean and environment pilot project follow-on activities to some degree. First, in September 2007, The Sherwin Williams Company purchased Columbia Paint. Since then, the Spokane facility’s focus has been to integrate its processes and procedures into Sherwin-Williams systems (e.g., point of sale, inventory and order management, formulation software, etc). Second, at about the same time as the merger, the housing market contracted, and this reduced the facility’s sales and production volume. The downturn also resulted in Columbia Paint closing its Helena, Montana facility in February 2008. The Spokane facility was able to absorb the volume from the Helena facility without additional staffing.

Despite the activities associated with the merger, Columbia Paint continued to improve its operational and environmental performance and build on the successes of the pilot project. As part of its ongoing continual improvement efforts, Columbia Paint has:

- Reduced water use by recycling white and off-white wash water to clean tanks instead of using virgin water.
- Saved energy by decreasing the amount of product cycling through the still during the decanting process, and reduced the number of products used in the decanting process from nine to four.
- Extended lean and environment process improvements from the pilot project, including the practices of reusing all white wash water, to the Helena, Montana facility before it was closed. This resulted in the Helena facility having zero wastewater discharges from production operations.
- Taken over all of the production from the Helena facility using only half the labor used in Helena. (Note: The lean process improvements at the Spokane facility may have helped make this production increase possible; however, due to the economic downturn, this cannot be entirely attributed to lean.)
- Implemented several 5S improvement projects to foster housekeeping excellence throughout the facility.
- Developed a list of improvement activities for future get ‘r done events.

As of June 2008, Columbia Paint is installing and integrating a new enterprise resource planning (ERP) software system for scheduling and tracking the purchase and use of raw materials. This should

improve the facility's ability to accurately understand material costs and losses, as well as measure material variances per batch to help improve quality. In addition, the batch-tracking software should help the facility track the time between various batch stages (mixing, QC, filling, etc.) and examine other production variables. (These improvements will also apply to the raw material tracking code the facility instituted during the pilot project to measure the amount and value of paint solids in wash water that is reincorporated into new products.)

Once Columbia Paint finishes integrating its systems into those of Sherwin-Williams and the business model stabilizes, the facility plans to renew its attention on lean, potentially conducting more get 'r done events as early as the second quarter of 2008. Planned future lean and environment improvements include the following:

- Improve the efficiency of the warehouse order-picking process through a get 'r done event.
- Institute new in-line labeling for the autofiller process through a get 'r done event.
- Increase awareness among sales and marketing staff around the effects of the new production system (e.g., that only five days of lead time are needed for custom batches instead of up to 10 days).
- Conduct lean improvement events in other processes at the facility, such as administrative processes and warehouse/shipping operations.
- Install cone-bottom plastic tanks to separate paint solids from dirty wash water and siphon and reuse the wash water off the top in the filling equipment cleaning process, as a way of lessening overall water consumption and wastewater generation.
- Review and consider bulk raw material storage opportunities. Anticipated results include material costs savings as well as environmental benefits, since fewer drums and totes would be used and discarded.

Summary of Pilot Project Results

The Columbia Paint lean and environment pilot project resulted in substantial cost savings, operational improvements, and environmental benefits, as well as other benefits for the company and employees.

Cost and Environmental Savings

The lean and environment pilot project efforts, along with other process changes at Columbia Paint, are expected to result in annual savings of about \$210,000. Table 5 summarizes the quantifiable cost, material, and environmental savings from implemented actions.

Table 5. Annual Cost, Time, Material, and Environmental Savings

Reductions	Source of Saving	Annual Cost Savings	Time, Material, & Environmental Savings
Raw Material	Get 'r done #1 – Usable paint solids discharged along with wash water	\$67,100	49,200 lbs/year ^a
	Side project – Shrink wrap material savings	\$29,000	18,000 lbs/year
	Side project – Oil decanting process improvements (raw material savings)	\$13,100 in solvent raw material costs	N/A
Hazardous Waste	Side project – Oil decanting process improvements (hazardous waste savings)	\$10,000 in disposal costs	17,600 lbs/year ^b
Waste Water	Get 'r done #1 – Incorporation of wash water into paint product	(included above) ^c	36,900 gallons/year
Labor	Get 'r done #1 – Combined savings	\$43,600	550 hours/year
	Get 'r done #2 – Combined savings	\$28,000	1,000 hours/year
	Get 'r done #3 – Combined savings	\$19,000	950 hours/year
Total Quantified Cost Savings		\$209,800	

^a Includes savings from reused yellow traffic paint wash water, white traffic paint wash water, and regular white wash water.

^b This solvent wash waste is ultimately reincorporated back into new products. These hazardous waste savings—combined with other changes to hazardous waste management practices—could potentially shift the Columbia Paint facility from large to medium quantity generator status under State law in the future.

^c Cost and material savings associated with the paint solids in wash water are included with raw material savings.

The pilot project resulted in numerous other benefits, including improvements to product quality, worker health and safety, morale, and reduced environmental risk. Examples of these benefits are listed below.

Quality, Time, and Customer Service Improvements

- Decreased the total lead time for making non-stock products from 6-10 to an average of 5 days, as of April 2008.
- Improved product velocity and increased throughput for several processes.
- Lessened the potential for distressed batches by streamlining and standardizing raw material storage.
- Reduced final QC inspection cycle time by 36 percent.
- Reduced the number of process steps associated with the oil-based product line and QC.
- Improved the service level of paint items leading to fewer missed sales opportunities.

Environmental Health and Safety Improvements

- Reduced worker exposure to ammonia and other VOCs.
- Improved safety and ergonomics by improving product handling in the filling process, eliminating safety hazards associated with a conveyer system, and automating the shrink-wrapping process.
- Decreased the potential for accidents by decreasing drum handling and reducing forklift traffic congestion.

Other Workplace Improvements

- Freed staff time to focus on value-added tasks such as supporting additional process improvement efforts.
- Generated positive momentum for future lean and environmental gains.
- Enhanced staff morale, improved communications between staff and management, and empowered staff to initiate process improvements activities.

Project Costs

The total direct costs to Columbia Paint to conduct this project are shown in Table 6.

Table 6. Direct Project Costs to Columbia Paint (Excludes Grant Contributions and Administration Costs)

Project Component	Cost
Columbia Paint Staff: Lean 101 Training	\$4,200
Columbia Paint Staff: Value Stream Mapping	\$2,300
Columbia Paint Staff: Get 'R Done Event #1	\$800
Columbia Paint Staff: Get 'R Done Event #2	\$800
Columbia Paint Staff: Get 'R Done Event #3	\$800
Columbia Paint Staff: Preparation and follow-up between events	\$1,000
Lean Consultant (WMS)	\$6,000
Capital Expenditures	\$1,200
Total	\$17,100

Grant Contributions to Conduct the Pilot Project

Table 7 shows pilot project costs that were not covered by Columbia Paint, including a portion of WMS facilitation services, Ecology staff participation, and outside assistance documenting project activities and results.

Table 7. Other Project Costs Not Incurred by Columbia Paint

Costs	
Labor: Ecology Staff Training ^a	\$5,300
Labor: Ecology Assistance to Business	\$ 5,600
Overhead ^b	\$19,100
WMS	\$ 24,000
Total	\$54,000
Funding	
Ecology	\$10,900
National Institute of Standards and Technology (NIST)	\$8,500
Pollution Prevention Grant (A 50/50 split of U.S. Environmental Protection Agency [EPA] and Ecology funding)	\$31,850
U.S. EPA National Center for Environmental Innovation funding	\$2,750
Total	\$54,000

^a This pilot project served as an opportunity to train Ecology staff. In the future, it is likely that fewer Ecology staff would attend training at a facility, and only those needed to provide environmental expertise during planning and implementation events would participate.

^b Overhead costs cover pilot project support and management activities, including contract management, conducting initial research, attending event report-out sessions, conducting interviews of various participants, and documenting project activities and results. Overhead costs do not include overall project start-up costs, such as time spent on marketing.

Challenges, Successes, and Conclusions

To help others interested in combining lean and pollution prevention, this section describes some of the challenges, successes, and overarching conclusions from the Columbia Paint pilot project.

Challenges

Although pilot project participants from Columbia Paint, WMS, and Ecology were all pleased with the results from the project, participants did face a few challenges during the project, as follows.

- **Quantifying Results of the Project:** The process changes implemented during the project will not be fully tested until Columbia Paint completes the changes associated with the Sherwin-Williams acquisition and then enters its peak production months in summer 2008. This made it difficult to evaluate the overall effectiveness of the new pull production system and to quantify the benefits of the project for this case study. In addition, Columbia Paint managers were reluctant to quantify “soft” costs that did not directly translate into monetary savings for the company (e.g., less time spent tracking orders, etc.); the facility preferred to focus on hard dollar savings with strong supporting data. Columbia Paint also did not have precise baseline data on the amount of wastewater generated before the project and the associated costs to the company.
- **Determining Ecology’s Role in On-Site Activities:** Ecology staff served a valuable role in planning project activities (especially during the value stream mapping workshop), building relationships with Columbia Paint staff, and asking questions to help line operators identify environmental improvement opportunities; however, the role for Ecology staff in the implementation days of the get ‘r done events was not well defined. As a result, participants may have missed opportunities to achieve additional environmental and operational gains from the project.
- **Broadening Involvement of Columbia Paint Staff:** It may have been useful to have included additional Columbia Paint staff and management in the lean and environment training session and/or events to increase awareness and support for lean process improvements. This could have reduced the “stop-and-go” nature of initial project activities as well as created the opportunity for further lean and environment diffusion at the company. To help address this challenge, Columbia Paint conducted an additional lean training for new staff and those who missed the lean 101 training.

On the positive side, these challenges were not insurmountable; in several instances, project participants adjusted their plans and activities to make the most of lean and environmental opportunities at the facility. The challenges may also represent potential areas for improvement in the future.

Successes and Key Elements of Project Design and Implementation

Several aspects of the Columbia Paint pilot project helped make it successful, including the following.

- **Leading with Lean in Project Design:** WMS and Ecology project managers decided to lead with lean rather than the environment in marketing and determining the scope of the project with Columbia Paint managers. This helped ensure that the project would address the company’s top priorities, and it was useful for building the relationship between Ecology and the facility.
- **High-Level Integration of Environmental Considerations:** WMS and Ecology integrated environmental considerations into the project at a high level by adding process waste to the list of wastes in the lean 101 training and to the data in the current state value stream map. The level of

detail in the analysis of process waste (primarily wash water) was similar to the level of detail used to analyze typical lean metrics. This lessened the distinction between lean and the environment. Ecology staff also effectively drew out environmental improvement opportunities through questioning, which gave employees greater ownership of the improvements.

- **Strong Relationships and Effective Team Composition:** Participants commented on the effectiveness of the WMS and Ecology partnership, as well as the strength of the relationships between the facility and both WMS and Ecology. In particular, the WMS lean facilitator worked well with Columbia Paint managers involved in the project, and Ecology staff established a good rapport with the line operators. The project team also included a number of informal leaders from the production floor, which helped to advance and sustain process changes.
- **Employee Empowerment and Culture Change:** There was a remarkable transformation and culture change among project participants at the facility as a result of the lean and environment training and implementation efforts. Many production staff were initially skeptical about lean methods and reluctant to change existing systems. By the final get ‘r done event, however, line operators were leading implementation activities and were excited about future opportunities. The support of Columbia Paint managers for the project (e.g., by investing staff time and resources) and their willingness to listen to employee suggestions were critical to this culture change.
- **Capacity Building for Future Efforts:** As demonstrated by the side projects that Columbia Paint conducted on its own, this pilot project built capacity at Columbia Paint for future lean and environmental improvement efforts. WMS and Ecology worked with Columbia Paint managers to build that capacity by training staff on lean concepts and methods, providing practical experience during the lean and environment events, increasing awareness of environmental and other production wastes, and encouraging the adoption of a continual improvement culture. The pilot project also positioned the facility well to initiate future lean and environmental improvements following the changes associated with the Sherwin-Williams merger.

Conclusions

While it is difficult to isolate the impact that the environmental component of the project had on the overall results of lean implementation, project participants noted that Columbia Paint probably would not have stopped disposing white wash water and realized those cost savings without Ecology’s participation in the project. In that and other respects, the project was a better lean project because of the environmental component. Moreover, the lean 101 training and implementation of lean methods led to unexpected environmental gains at the facility through efforts such as improving the oil-decanting and shrink-wrapping processes. All three organizations participating in the pilot project—Ecology, WMS, and Columbia Paint—felt that combination of lean and environmental objectives and improvement efforts contributed to the project’s overall success.

A few overarching conclusions stand out from this pilot project:

- **WMS and the Department of Ecology effectively combined their technical assistance services to provide a “win-win” opportunity for Columbia Paint.** The combination of lean and pollution prevention technical assistance enhanced the overall effectiveness of process improvement efforts at Columbia Paint. The facility eliminated an entire waste stream, dramatically improved production efficiency, reduced labor and materials costs, improved the work environment, and became more efficient and effective at responding to customer needs.

- The project provided an opportunity to learn effective strategies for integrating lean and environmental improvement efforts. Through the project, Columbia Paint managers and staff learned about the value of explicitly addressing environmental wastes through lean process improvement efforts. The subtle and high-level integration of environmental considerations into lean methods in the project was effective, yet there was a sense that there may have been missed opportunities to achieve greater lean and environmental gains through Ecology’s participation. This suggests that it may be valuable to think more strategically about effective roles and opportunities for Ecology’s services and assistance in lean events.
- The project generated positive momentum for future lean and environmental gains at Columbia Paint. The project demonstrated the applicability and usefulness of lean methods to Columbia Paint, helped build in-house capacity for lean and environmental improvement efforts, and empowered employees to identify additional improvement opportunities. As a result, Columbia Paint is well positioned to meet customer demands during peak production months, and to continue to improve its operational and environmental performance.

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