

Working Smart for Environmental Protection

***Improving State Agency Processes with
Lean and Six Sigma***

September 2006



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Executive Summary

Several state environmental agencies have dramatically improved agency permitting and administrative processes using business process improvement methods such as Lean and Six Sigma. Within a few months of implementation, Delaware, Iowa, Michigan, Minnesota, and Nebraska agencies have drastically reduced permit application backlogs, reduced lead times for permit reviews by more than 50 percent, decreased the complexity of permit application forms, improved the consistency of permit reviews, and made more staff time available for “mission critical” work. They did all of this while improving staff morale and increasing the transparency of their processes to stakeholders, *without* sacrificing environmental protection goals or reducing value-added permit review time.

Lean and Six Sigma Work for Government

Lean is a production approach and set of methods that seeks to eliminate all non-value added activity or “waste” from a process, while Six Sigma is a collection of statistical tools designed to reduce defects and other forms of process variation. Lean and Six Sigma were originally developed for manufacturing systems; however, private and public-sector organizations have adapted and applied these methods (sometimes combined as “Lean Six Sigma”) to office environments, service-delivery processes, and administrative processes including permitting. Interest among state environmental agencies in these methods has grown rapidly since 2003, when the Iowa Department of Natural Resources (DNR) and the Minnesota Pollution Control Agency (PCA) began their Lean and Six Sigma initiatives.

Lean and Six Sigma efforts identify and eliminate unnecessary and non-valued added process steps and activities that have built up over time. In non-manufacturing settings, waste is most prevalent in the information flows associated with processes. Lean and Six Sigma efforts are not just about fixing broken processes. State agencies have found that these methods enable them to understand how their processes are working on the ground and to make adjustments that optimize desired outcomes. By getting routine activities and mechanisms of a process to function smoothly and consistently, staff time can be freed to focus on higher value activities that are more directly linked to environmental protection.

State Agency Lean and Six Sigma Experience

The successful use of Lean and Six Sigma process improvement methods by multiple state environmental agencies means these approaches may have broad applicability to help agencies achieve environmental outcomes more efficiently and effectively. State agencies have applied Lean and Six Sigma methods to all types of agency processes, including air construction permitting, National Pollutant Discharge Elimination System (NPDES) wastewater discharge permitting, and leaking underground storage tank corrective action reporting and implementation.

Highlights of state agency experience include the following:

- **Delaware Department of Natural Resources and Environmental Control** used value stream mapping—a process-mapping method used to identify non-value added activity and plan for future improvement projects—to improve its air construction permitting process in 2005, and it plans to apply value stream mapping to five more processes starting in fall 2006.
- **Iowa DNR** has conducted 17 kaizen events—week-long events focused on making immediate process changes to eliminate waste—on a wide range of agency processes, starting with air construction permitting in 2003. The Agency plans to continue and expand upon its initiative.

- **Michigan Department of Environmental Quality (DEQ)** applied value stream mapping to the Air Quality Division’s permit to install application review process in 2004 and to two additional processes in 2005 and 2006.
- **Minnesota PCA** has initiated 21 Six Sigma improvement projects, starting with an NPDES wastewater permitting project in 2004. The Agency’s Six Sigma initiative has focused on both regulatory and non-regulatory processes.
- **Nebraska DEQ** conducted a kaizen event on air quality construction permitting in 2005, followed by a post-kaizen workshop for new staff. The Agency holds ongoing continual improvement meetings and plans to continue and expand upon its initiative.

Characteristics of Effective Process Improvement Efforts

Experience from state agencies suggests that several factors are common to successful Lean and Six Sigma efforts. These include:

- Secure top management buy-in and support;
- Articulate boundary conditions early (e.g., the focus is on administrative process waste, not environmental standards);
- Scale project scope appropriately to avoid taking on too much at one time;
- Collect sufficient data to understand how the process is really working;
- Engage staff during all stages of planning and implementation;
- Consider involving external stakeholders in improvement events, as they often bring fresh perspectives;
- Be transparent—communicate project progress to staff and external stakeholders; and
- Follow through with periodic meetings to sustain improvement results.

Sustained organizational commitment is critical to the long-term success of process improvement efforts. Despite the quick and impressive results that typically flow from Lean efforts, agency managers are likely to experience internal skepticism and resistance from some staff, especially initially. State agencies have used a variety of communications strategies and tactics to mitigate employee concerns. With the support of senior management, strong performance improvements are possible quickly with Lean and Six Sigma, and lead to broadened organizational support and momentum for future efforts. While external technical assistance can be highly useful for getting initiatives started, building internal staff capacity to guide and implement ongoing process improvement is important to long-term success and culture change.

Future Efforts and Next Steps

All the States profiled in this primer plan to continue with Lean and/or Six Sigma implementation to improve the efficiency and effectiveness of their processes. In several cases, the agencies are making significant organizational commitments in training and staff time to foster broader adoption of process-improvement techniques and agency-wide culture change. Future collaborative efforts around Lean and Six Sigma at environmental agencies—such as information and experience sharing, development and dissemination of problem-solving techniques, training and agency capacity-building assistance, and joint improvement projects—could facilitate increased adoption and diffusion of process-improvement methods. Lean and Six Sigma methods offer powerful new approaches to help environmental agencies to work more effectively, address stakeholder concerns, and achieve better environmental outcomes.

1. Introduction

Since 2003, state environmental agencies have achieved impressive results with improvements to their permitting programs and other processes. This primer is designed to share the implementation experiences and results of five States that have used Lean, Six Sigma, and similar business process improvement methods to improve the effectiveness and efficiency of agency processes.

Typical Results from State Process Improvement Efforts

Process improvement efforts in at least five States—Delaware, Iowa, Michigan, Minnesota, and Nebraska—have dramatically reduced permitting backlogs and issuance timeframes, while also improving quality. In all cases, the improvement activities focused on administrative process steps, fully preserving and protecting environmental outcomes, standards, and policies. Typical results include:

- Michigan Department of Environmental Quality (DEQ) decreased the time needed to process major air construction permits from 422 days to 98 days. Quality improved, with initial application administrative completeness rising from 82 to 95 percent.
- Delaware Department of Natural Resources and Environmental Control (DNREC) lowered a backlog of air construction permits from 199 to 25, while reducing the average permit processing time to less than 76 days.
- Iowa Department of Natural Resources (DNR) reduced the average time to issue standard air quality construction permits from 62 days to 6 days (an 90 percent reduction), and they eliminated 70 percent of the process steps (from 23 to 7 steps). A backlog of nearly 600 permits was cut in half in the first three months after the process improvements were implemented.
- Iowa DNR streamlined the corrective action process activities in the Leaking Underground Storage Tank (LUST) program, reducing the number of decisions by 80 percent and the total number of process steps from 43 to 26 (a 40 percent reduction). This dropped the average decision-making timeframe in the program from 38 months to 3 months.

States achieved these results by adapting and applying process improvement approaches and methods commonly used in business and industry—Lean and Six Sigma.

Questions Addressed in This Primer

This primer answers the following questions:

- What are Lean and Six Sigma, and how do these methods apply to government? (See Section 2 of this primer.)
- How and why have state environmental agencies used these methods to improve their processes? (See Section 3.)
- What results have these States achieved? (See Section 3.)
- What lessons have these States learned from their efforts? (See Section 4 and Appendix C.)

- What opportunities are there for future collaboration and next steps to promote and facilitate process improvement efforts at environmental agencies? (See Section 5.)
- Where can you go for more information? (See Appendices A–D.)

2. Lean and Six Sigma for Government

This section describes recent trends in state environmental agency process improvement initiatives, highlighting several common characteristics of these efforts and describing the main approaches and methods these agencies have employed.

Trends in Environmental Agency Process Improvement

Over the past several years, several state environmental agencies have experimented with process improvement methods adapted from business and industry, such as Lean and Six Sigma. While the exact methods used by these state agencies have varied, these improvement initiatives share several common elements that, when combined, differentiate them from past improvement efforts.

Common Elements of State Environmental Agency Process Improvement Efforts

Most of the recent state environmental agency process improvement initiatives:

- Take a “*customer service*” *perspective* that seeks to optimize value delivered to the environment, the public, and the regulated community;
- *Involve employees and external stakeholders* in continual improvements and problem-solving activities;
- Deploy a *rapid continuous improvement framework* that emphasizes implementation over prolonged planning;
- Seek to *reduce the complexity* of processes and the *variation* in process outputs;
- Use *metrics and visual controls* to provide rapid feedback to improve real-time decision-making and problem-solving; and
- Approach improvement activities from a *systems perspective*.

These process improvement initiatives typically focus on identifying and *eliminating non-value added activity (waste)*. In the context of environmental agencies, most processes—ranging from air construction permitting to travel authorization—accumulate steps, approvals, and activities over time. For example, some permitting processes have been found to have more than 20 approvals steps, with very few adding any value to the permitting process. This occurs as new staff assume process responsibilities and make adjustments, as well as when the process is adjusted to address new needs and circumstances. State agencies have found that processes are almost always more complex than people think they are.

Lean and Six Sigma are process improvement methods designed to help an organization see how its processes are really working and to equip the organization to design and implement its processes more intentionally—tightly focusing on achieving desired outcomes. Lean and Six Sigma both help make “waste” in processes visible so that it can be reduced or eliminated. Common administrative wastes in agency permitting processes are listed in Box 1. Waste can

Box 1: Common Permitting Process Wastes

- Errors in applications
- Incomplete applications
- Backlogs
- Approval bottlenecks
- Redundant review or data entry
- Unnecessary rework on permits
- Unbalanced allocation of work
- Poor visibility to permit status
- Lack of templates

Box 2: Seven “Deadly” Process Wastes

1. Production of defects
2. Overproduction ahead of demand
3. Unnecessary transport of materials
4. Waiting for the next process step
5. Inventories (excess material and information)
6. Unnecessary movement by employees
7. Over-processing

be found in almost any administrative process, from permitting to human resources. Box 2 lists the seven “deadly” wastes that are commonly identified in processes. Case studies of administrative processes in the private and public sector have found that work that adds no value to desired outcomes typically comprises more than 50 percent of total service or process costs, leaving substantial room for improvement.¹

The process improvement approaches being used by state agencies typically target three dimensions: increasing speed, reducing complexity, and improving quality. Quality may relate to the frequency of errors in documents, the completeness of permit applications, and/or the consistency

of permit language used for similar situations. Although more difficult to measure, States are also examining the effectiveness of process improvement efforts in achieving outcomes such as environmental quality and enhanced public involvement. In short, process improvement efforts are about working smarter, not just working faster.

Key Drivers for Process Improvement

A range of drivers has prompted state environmental agencies to experiment with Lean and Six Sigma methods. In at least four of the States interviewed for this primer, growing external pressure for reducing air construction permitting backlogs and approval timeframes raised the need for process changes. Complaints and encouragement from the regulated community about air permitting have highlighted the need to better align permitting timeframes with the rapid operational change timeframes that are needed for competitiveness in many sectors. Several other factors have contributed to States’ interest in launching process improvement initiatives:

Box 3: Key Drivers

- Industry Success with Lean and Six Sigma
- Legislative Oversight
- Regulated Community Pressure
- Top Leadership Decision
- Funding and Workload Challenges

- New environmental protection priorities are highlighting the need for existing processes to be as efficient as possible to free agency attention and resources for other activities;
- Shrinking federal and state budgets for environmental agencies increasingly means fewer resources are available for core programs and service delivery;
- Witnessing impressive process improvement results in another State’s environmental agency has prompted some States to launch similar improvement initiatives; and
- Occasionally new commissioners or senior managers, particularly those who have worked in the private sector, are familiar with the powerful results that Lean and Six Sigma methods can yield.

Lean and Six Sigma Process Improvement Methods

Lean and Six Sigma are the two main process improvement approaches that the five state environmental agencies involved in preparing this primer have drawn on in their process improvement initiatives. In each case, however, the agencies have adapted these methods to meet their specific needs. Four of the States have focused on the use of Lean improvement methods, while Minnesota has pioneered the use of

¹ Michael George, *Lean Six Sigma for Service: How to Use Lean Speed & Six Sigma Quality to Improve Services and Transactions*, (New York: McGraw Hill, 2003) 3.

Six Sigma in the state agency context. Some agencies, such as Iowa’s Department of Natural Resources, are moving towards a process improvement approach that incorporates aspects from both Lean and Six Sigma (typically referred to as Lean Six Sigma or Lean Sigma), echoing a trend in business.

What is Lean?

Lean² refers to a collection of principles and methods that focus on the systematic identification and elimination of non-value added activity (waste) involved in producing a product or delivering a service to customers. Two common methods used in Lean are value stream mapping and kaizen rapid process improvement events.

Value Stream Mapping (VSM). Value stream mapping refers to the activity of developing a visual representation of the flow of processes, from start to finish, involved in delivering a desired outcome, service, or product (a “value stream”) that is valued by customers. In the context of environmental agencies, a value stream could be the process of permitting the air emissions of a certain type of stationary source, approving a brownfield site for redevelopment, or hiring new agency staff. VSM examines information flows and systems, as well as the flow of the product or service product (e.g., permit) through an agency’s processes. VSM can increase understanding of actual decision-making processes and identify sources of non-value added time (e.g., documents waiting to be reviewed). The typical products of a 2–5 day VSM workshop are two maps—a map of the “current state” of targeted processes and a “future state” map of the desired process flow—and an associated implementation plan for future process improvement activities.

Kaizen Events. Kaizen is a combination of two Japanese words that mean “to take apart” and “to make good.” Kaizen refers to an approach to continuous improvement that is founded on the belief that small, incremental changes routinely applied and sustained over a long period result in significant performance improvements. Kaizen focuses on eliminating waste in a targeted system or process of an organization, improving productivity, and achieving sustained improvement. Kaizen activity is often focused in the form of rapid improvement events (sometimes called a kaizen blitz), which bring together a cross-functional team for two to five days to study a process and begin implementation of process changes.

Box 4: Comparing Lean and Six Sigma

Lean:

- Focuses on maximizing product flow and velocity
- Provides tools for analyzing process flow and delays at each process step
- Centers on the separation of “value-added” from “non-value added” work with tools to eliminate root causes of non-value added activities
- Provides a means for quantifying and eliminating the cost of complexity

Six Sigma:

- Emphasizes the need to recognize opportunities and eliminate defects
- Recognizes that variation hinders the ability to reliably deliver high-quality services
- Requires data-driven decisions and incorporates a comprehensive set of quality tools under a systematic framework for problem solving
- Provides a highly prescriptive cultural infrastructure effective in obtaining sustainable results

Source: Michael George, *Lean Six Sigma for Service: How to Use Lean Speed & Six Sigma Quality to Improve Services and Transactions*, (New York: McGraw Hill, 2003) 7.

² James Womack, Daniel Jones, and Daniel Roos coined the term “Lean” in their 1990 book *The Machine that Changed the World* to describe the manufacturing paradigm (often referred to as the Toyota Production System) developed by the Toyota Motor Company based on principles pioneered by Henry Ford.

What is Six Sigma?

Six Sigma³ is a rigorous methodology that utilizes information (management by facts) and statistical analysis to measure and improve an organization's performance, practices, and systems. The fundamental objective of Six Sigma is the implementation of a measurement-based approach that focuses on process improvement and variation reduction through the application of Six Sigma improvement projects. In the context of state agency processes, unnecessary variation in how a process is implemented can result in significant delays and poor quality of decisions and outputs, such as permits. The Six Sigma DMAIC (Define, Measure, Analyze, Improve, Control) method is a system for improving existing processes that fall below specifications. Like Lean, Six Sigma focuses on identifying and implementing steps that foster continual, incremental improvement. Six Sigma can also be used to develop new processes, services, or products at Six Sigma-quality levels (often referred to as "Design for Six Sigma").

Six Sigma is typically executed by trained personnel (often referred to as "green belts" and "black belts") who have experience with multiple performance measurement and statistical analysis techniques.

Adapting Lean and Six Sigma for Government

While Lean and Six Sigma process improvement approaches were developed originally for use in the private sector to target manufacturing processes, there has been steady progress towards adapting these approaches for use on service and administrative processes. Public sector interest in Lean and Six Sigma appears to be increasing rapidly, fueled by strong improvement results. Government organizations ranging from the Connecticut Department of Labor to the City of Fort Wayne, Indiana to the U.S. Mint to all branches of the U.S. Armed Forces are using Lean and/or Six Sigma to improve their administrative processes. Based in part on Lean successes at Iowa DNR, Governor Tom Vilsack is championing the application of Lean Six Sigma methods throughout Iowa State government.

Differences between Public and Private Sector Methods

There are a few important differences between how Lean and Six Sigma methods are applied at public environmental agencies and in the private sector.

- **Definitions and Language.** Lean terms used in the private sector context may need to be dropped or redefined. For example, companies implementing Lean often talk about the "customer." The concept of "customer" is more complicated in the public sector, with the regulated community, environmental interest groups, and the public all having specific needs and desired outcomes.
- **Event/Project Scoping and Expectations.** Application of Lean and Six Sigma in the public sector can also necessitate more careful project scoping and setting of boundary conditions to ensure that process changes do not adversely affect the overall public interest. Sections later in this primer discuss steps that States have taken to effectively scope their improvement efforts.

State environmental agencies have successfully built upon past improvement efforts to incorporate and adapt the innovative approaches of Lean and Six Sigma. The next section discusses the range of process improvement experiences of five state environmental agencies.

³ Six Sigma methods were first developed by Motorola and Allied Signal, and were refined and popularized by General Electric in the mid-1990s.

3. State Environmental Agency Lean and Six Sigma Initiatives

This section describes some of the main similarities and differences in the Lean and Six Sigma efforts of five state environmental agencies—the Delaware Department of Natural Resources and Environmental Control (DNREC), the Iowa Department of Natural Resources (DNR), the Michigan Department of Environmental Quality (DEQ), the Minnesota Pollution Control Agency (PCA), and the Nebraska DEQ. This section begins with a brief overview of each State’s process improvement initiative, and then compares the implementation experience of all five state agencies.

Overview of State Process Improvement Efforts

Although in many cases they have targeted similar processes, the five state agencies profiled in this primer have used a range of Lean and Six Sigma methods and different implementation approaches to improve their agency processes. Some of the agencies are several years into their Lean and Six Sigma improvement efforts, while others had conducted only one event or project as of summer 2006. The process improvements efforts at the five state agencies include the following:

- **Delaware DNREC** used value stream mapping to improve its air construction permitting process in 2005, and plans to apply value stream mapping to five more processes starting in fall 2006.
- **Iowa DNR** has conducted 17 kaizen events on a wide range of agency processes, starting with air construction permitting in 2003 and Leaking Underground Storage Tank (LUST) corrective action reporting and implementation in 2004. The Agency has also used the design for Lean Six Sigma method to design a new product (agency magazine).
- **Michigan DEQ** applied value stream mapping to the Air Quality Division’s permit to install application review process at a workshop in 2004, to a land and water management permitting process in 2005, and to an administrative process.
- **Minnesota PCA** has initiated 21 Six Sigma improvement projects, addressing both regulatory and non-regulatory processes at the Agency. The first two projects—a National Pollutant Discharge Elimination System (NPDES) wastewater permitting project in 2003 and an air construction permitting project in 2004—occurred in conjunction with a Six Sigma training program administered by the University of Minnesota.
- **Nebraska DEQ** conducted a kaizen event on construction air permitting in 2005, as well as a post-kaizen workshop for new staff seven months afterwards, and has continued to implement the recommendations from the event in 2006.

Table 1 below and the State summaries in Appendix C of this primer provide more information about these initiatives. Each State summary describes the scope of process improvement activities, the Lean and Six Sigma methods used, the key drivers for project initiation, the role of stakeholders and assistance providers, and the results from the improvement efforts.

Table 1: State Environmental Agency Process Improvement Initiatives

State Agency	Year Started	Number of Projects/Events*	Primary Methods Used	Type of Technical Assistance	Processes Targeted
Delaware DNREC	2005	1, plus 5 in planning stage	Value Stream Mapping	Manufacturing Extension Partnership Center	Construction air permitting
Iowa DNR	2003	17	Kaizen Events	Private consultant	Various—air, water, cleanup, land acquisition, and internal administrative processes
Michigan DEQ	2004	2	Value Stream Mapping	Industry Consultant	Construction air permitting
Minnesota PCA	2003	21	Six Sigma	University Management School	Various—air, water, cleanup, and internal administrative processes
Nebraska DEQ	2005	1, plus a follow-up workshop	Kaizen Event	Industry and Government Representatives	Construction air permitting

* Projects conducted as of summer 2006.

Project Initiation

As mentioned in section 2, there are a number of compelling reasons why government agencies might choose to use Lean, Six Sigma, and similar process improvement methods to reduce the total lead time for processes, eliminate non-value added process steps, improve the consistency and quality of permits and other outputs, and respond to customer needs.

Why did States begin their process improvement efforts?

The five States profiled in this primer identified both external pressure and top agency leadership support as the impetus behind their process improvement efforts. Industry, Governors, and State legislatures recommended process efficiency improvements, and top leadership supported the efforts in light of funding constraints, external complaints, and backlogs of work. The initial success with Lean and Six Sigma then generated momentum for further process improvement efforts.

How did States decide which processes to target for improvement?

For the most part, States initially focused their process improvement efforts on processes with the most “pain” or the greatest perceived problems. In particular, the States

Box 5: Criteria for Project and Process Selection

- Funding Concerns
- High Volume and/or Criticality
- Number of Customer Complaints
- Productivity Problems
- Backlogs
- Administrative Bottlenecks
- Existence of a Project “Champion”
- Staff Willingness and Energy

targeted high-volume agency processes, such as air construction permitting and NPDES permitting that had significant issues regarding industry complaints, permit backlogs, funding challenges, and staff frustration. After establishing their process improvement efforts, however, some States are now looking more systematically at project selection. Iowa, for example, is considering using the value stream mapping method to prioritize and think strategically about future improvement projects across the Agency. Delaware solicited proposals for future Lean projects from Divisions within the Agency and is using an interview process to identify which projects are likely to be most successful.

Implementation Approaches

Within the overall framework of Lean and/or Six Sigma, state agencies have used a range of implementation approaches to achieve process improvements. As in the private sector, States have adapted the methods and deployment options to fit with agency culture and organizational needs. For example, Minnesota decided to take a “slow growth” approach that would build in-house expertise and capacity for Six Sigma implementation from the beginning, rather than using outside technical experts. In addition, several States have designed communications strategies and set boundary conditions for Lean events to alleviate concerns about the effects of process changes on environmental protection. (These specific strategies are discussed further in Appendix C.)

What implementation approaches have States used?

Based on their intensity and duration, the state process improvement efforts discussed in this primer can be divided into two main models:

1. **Event-based projects** involve the rapid identification, selection, and implementation of process changes during a focused time period. These 2–5 day Lean events involve a team of agency staff and stakeholders, and often use an external facilitator.
2. **Extended analytic improvement projects** rely on thorough analysis of process data to determine the causes of problems and involve identifying and implementing process changes over an extended time period. Trained Six Sigma “black belts” typically lead these projects.

As mentioned earlier in the primer, the five States have used three main methods: kaizen events, value stream mapping, and Six Sigma process analysis. The choice of method was largely driven by how the Agency’s process improvement effort began—in most cases an agency Commissioner or business group recommended a particular method to the Agency.

Process Improvements and Results

The five States profiled in this primer have used the principles and methods of Lean and Six Sigma to make significant changes in the way they do business, and this has yielded dramatic results, often within short time frames and for relatively little upfront investment in resources.

How have States improved their processes?

While each State has its own processes, people, and procedures, no organization is unique in having non-value added activity ingrained in its processes. The five States

Box 6: Common Metrics Used for State Lean and Six Sigma Projects

- Number of Process Steps
- Total Lead Time
- Cycle Time
- Number of Applications Submitted that are Complete
- Number of Handoffs
- Amount of Backlog
- Rework Percentage (Percent of Permits Needing Rework)
- Number of Staff Committed to Process Improvement

have eliminated non-value added time and other wastes by using strategies and techniques such as the following:

- Eliminating unnecessary process steps;
- Involving customers in the solutions to problems, through techniques such as check-in calls, permit hotlines, and clearer instructions to improve information flows around permit applications;
- Developing processes for screening and prioritizing incoming permit applications;
- Creating alternatives such as “fast track” or “just in time” permitting under certain conditions;
- Developing and using templates and boilerplate language for permit writers;
- Changing the office layout and organization to improve process flow; and
- Instituting improved permit or process tracking systems, including on-line and visual tracking systems.

More examples of process improvements are included in Appendix D (State Summaries).

What results have the States seen?

As mentioned earlier in the primer, one of the reasons that there has been so much excitement and energy around using Lean and Six Sigma methods at state environmental agencies is the dramatic successes these efforts have yielded. Collectively, the States have:

- Reduced the total lead times for permitting processes by more than 50 percent without reducing the value-added time for substantive review of permit applications;
- Reduced or eliminated permit backlogs within a few months of implementation;
- Made more staff time available for “mission critical” work;
- Improved consistency of permits and decreased the variability of processing times;
- Improved customer satisfaction as measured by reductions in the frequency and magnitude of complaints; and
- Improved staff morale within the processes that have implemented process improvement projects.

Although the overwhelming experience of the States has been positive, there have been a couple of projects that state managers have felt were unsuccessful. These projects present opportunities for learning, however, and are discussed further in the next section with regards to the critical elements of process improvement efforts.

Organizational Deployment and Diffusion

The state environmental agencies profiled in this primer recommend comprehensive diffusion of process-improvement approaches within an agency, at a pace appropriate to the agency’s culture. Long-term project success depends on the allocation of agency resources for training and staff time to support process improvement efforts agency-wide.

Where are the States heading with Lean and Six Sigma deployment?

Most of the States are in a “piloting” phase of their Lean and Six Sigma efforts, having conducted only one or two projects thus far. While most States began with an air construction permitting project, several States are in the planning stages, or have already initiated, broader Lean Six Sigma deployment within their agencies. For example, both Iowa and Minnesota have conducted over a dozen projects, ranging

from land acquisition, landfill permitting, and feedlot inspections, to a number of administrative processes, and continue to plan future agency-wide projects. Similarly, Delaware is planning five future projects following their initial success with the air construction permitting project.

A couple of the state agencies—Iowa DNR and Minnesota PCA—have also looked at broader, Agency-wide strategies for increasing the diffusion of process improvement methods, fostering culture change across the Agency, and sustaining early process gains. These efforts have included hiring or assigning staff to serve as Lean Six Sigma facilitators or black belts, training agency leadership and management, and placing a renewed focus on follow-up activities.

What are these States' future Lean Six Sigma plans?

Although each State is in a different stage of project implementation and specific future plans differ, a number of common goals exist, including:

- Continuing implementation of identified project goals;
- Building greater in-house organizational expertise and facilitation capacity;
- Holding regular project follow-up meetings to address implementation status; and
- Developing employee surveys to measure culture changes and evaluate internal project success among staff.

Overall, the States profiled in this primer have used different implementation approaches for their Lean and Six Sigma process improvement efforts in terms of the improvement methods, technical assistance, length of projects, and the extent of agency-wide deployment. Despite these differences, there is a remarkable amount in common across the States—including drivers for improvement initiatives, the types of process changes made, and the impressive results the States have seen. The next section discusses some of the key lessons States have learned from these varied, but parallel implementation experiences.

4. Lessons Learned About Lean and Six Sigma in Government

In preparing this primer, representatives from the five state environmental agencies reflected on the key factors and lessons that have contributed to their process improvement successes. Several of the States also identified instances where particular Lean events or Six Sigma projects fell short of meeting their expectations. In most cases, the States have found these “failures” to be important learning experiences that have helped them strengthen their Lean and Six Sigma efforts. This section describes several key considerations for project design and implementation that can lead to better results. The section also describes a few overarching lessons that these States have identified through their efforts.

Key Considerations for Project Design and Implementation

The state agencies profiled in this primer identified the following key considerations for process improvement design and implementation success. (See Appendices B and C for additional information and examples related to these considerations.)

- **Top Management Support:** Active support and engagement of senior management is crucial to achieving project success and to building continual improvement and innovation into the agency.
- **Boundary Conditions:** Clear boundary conditions on what process changes are out of scope must be set to ensure that agency objectives, such as environmental protection, are not undermined.
- **Project Scope:** Determining the appropriate scale and scope of individual Lean and Six Sigma projects is important to ensuring their success. In particular, managers should consider the breadth and complexity of processes and be realistic about how much of the process to target initially.
- **Data Collection:** Routinely collecting, compiling, and communicating data on the performance of key aspects of a process—including data not typically collected by environmental agencies—is an important aspect of Lean and Six Sigma implementation.
- **Participant Selection:** Carefully selecting external stakeholders and agency staff for participation in Lean events promotes future coordination, communication, and implementation of process changes.
- **Communication Strategies:** Proactively communicating, building transparency, and coordinating a communication strategy is critical to building organizational buy-in to process improvement efforts.

Box 7: Key Success Factors

- Secure Top Management Buy-in and Support
- Articulate Boundary Conditions Early
- Scale Project Scope Appropriately
- Engage Staff During All Stages of Planning and Implementation
- Communicate Project Progress to Staff
- Communicate with Regulated Community
- Be Transparent
- Conduct Project Follow-up Meetings

- **Strategies for Ensuring Follow Through:** Developing explicit strategies to sustain the effectiveness of process changes and resolving action items identified during events or projects will help ensure that momentum doesn't wane once employees leave an event.

Box 8: Overcoming Staff Resistance to Lean and Six Sigma

Agency managers implementing Lean or Six Sigma are likely to experience skepticism and resistance from some staff. Below are common staff objections and brief descriptions of how some States have addressed them:

“We’ve already tried that.” Many agencies have conducted successful and unsuccessful process improvement efforts over the past decade. Lean and Six Sigma have several attributes that make them considerably different from past improvement efforts. First, Lean has a strong bias towards implementation over prolonged planning, enabling lean events to deliver compelling results quickly. Second, Lean and Six Sigma incorporate many best practices from past improvement approaches such as Total Quality Management (TQM). Third, broad-based acceptance of Lean and Six Sigma in the business community can sharpen support and commitment for sustained success.

“The focus on streamlining processes may erode environmental protections.” Lean and Six Sigma efforts often generate significant improvements in the speed and flow of a process. By setting explicit scoping and boundary criteria for improvement events, agencies can ensure that process changes do not adversely affect decisions or desired outcomes. In fact, the public interest can be well served by improving the quality of permits and other process outputs and by freeing staff to focus on ways to better achieve desired environmental and public involvement goals.

“We don’t have time to focus on process improvement.” This is precisely why it is important to build continual improvement efforts into an agency. The goal and focus of Lean and Six Sigma are to help an organization work smarter, freeing time to focus on value added activities, rather than tedious activities that do not contribute to desired process outcomes.

Proactive communication to staff and stakeholders around these themes can mitigate skepticism and resistance. (Appendix B of this primer contains an example Questions and Answers document that Iowa DNR used for its initial kaizen events.) The momentum generated by compelling results from pilot process improvement efforts, however, offers the best mechanism for addressing concerns.

Summary of Lessons Learned

In summary, discussions with and among the five States who participated in developing this primer revealed the following overarching findings and lessons.

1. State environmental agencies are successfully using Lean and Six Sigma improvement methods to streamline regulatory and non-regulatory processes.
2. These efforts have yielded impressive results in reducing processing time while maintaining or enhancing levels of environmental protection and public involvement.
3. Lean and Six Sigma efforts eliminate unnecessary and non-valued added process steps that have built up over time. This enables staff to focus on what is important for good decision-making.

4. The successful use of Lean and Six Sigma process improvement methods by multiple state environmental agencies means these approaches may have broad applicability to help agencies achieve environmental outcomes more efficiently and effectively.
5. Sustained organizational commitment is critical to success; when this occurs, strong performance improvements are possible very quickly and lead to broadened organizational support and momentum for additional process improvement throughout an agency.

Lean and Six Sigma methods offer some powerful tools for public environmental agencies to improve a broad range of agency processes. Success, however, is not given—it requires organizational leadership and commitment along with consideration of several other key factors discussed above. The experience of these five States provides insights into how to effectively address challenges and make sure process improvements are sustained. The final section of this primer looks at possible opportunities for future collaboration among environmental agencies to further support process improvement efforts.

5. Future Directions and Next Steps

Interest in the use of Lean and Six Sigma process improvement methods is on the rise among public environmental agencies.

- The five state environmental agencies involved in developing this primer—Delaware, Iowa, Michigan, Minnesota, and Nebraska—plan to continue and expand their Lean and Six Sigma process improvement efforts.
- Other state environmental agencies, such as Vermont and Virginia, are embarking on their own process improvement efforts, drawing on Lean and/or Six Sigma methods.
- Additional state environmental agencies and Program Offices within the U.S. EPA have expressed interest in these process improvement methods and may consider whether to use them in their organizations.

In light of this growing interest, the five States involved in the development of this primer identified the *important need to continue and expand state-to-state and state-EPA collaboration on the use of Lean and Six Sigma* process improvement methods. Several potential areas for future collaboration include:

- **Information and Experience Sharing.** Forums should be continued and expanded for sharing information on experiences and lessons learned at both the commissioner and staff levels. Periodic conference calls, meetings, or forums can be used to facilitate information sharing.
- **Tool and Resource Development.** Updating and expanding this primer with new information and state experience could ensure that this resource remains relevant. Documentation of detailed, process-specific information, such as strategies, improvement techniques, performance metrics, and lessons, could help States benefit from each others' experience. In addition, template documents, such as the Questions and Answers document in Appendix B, and other tools, such as questions for prioritizing and selecting improvement events, could be developed and shared.
- **Capacity Building.** Efforts to support guest participation in environmental agencies' Lean and Six Sigma improvement events can open opportunities for States and the EPA to learn from each other first-hand, while transferring improvement and innovation ideas. The development of a training program on the use of Lean and Six Sigma in environmental agencies may be worth exploring, potentially in partnership with the National Institute of Standards and Technology's Manufacturing Extension Partnership or the Lean Enterprise Institute.
- **Joint Improvement Projects.** Lean and Six Sigma methods could be used to improve processes that involve multiple States or the States and EPA. Shared processes ranging from the Clean Air Act State Implementation Plan review and approval process to the development of State-EPA Performance Partnership Agreements may benefit from targeted improvement efforts.

State environmental agencies have found that Lean and Six Sigma process improvement methods enable them to work smarter for environmental protection, eliminating unnecessary variation and non-value added activities, while advancing the missions of their agencies. Future collaborative efforts to share experiences, develop resources, and implement joint improvement projects may yield even greater gains in the performance and outcomes of agency processes.

Appendices

Appendix A: Resources

Appendix B: Sample Question and Answer Document for Kaizen Event

Appendix C: Additional Information about State Lean and Six Sigma Implementation Experience

Appendix D: State Summaries

Delaware Lean Process Improvement Initiative

Iowa Lean Six Sigma Business Process Improvement initiative

Michigan Lean Process Improvement Initiative

Minnesota Six Sigma Process Improvement Initiative

Nebraska Business Process Improvement Initiative

Appendix A: Resources

Books on Lean and Six Sigma Methods for Office and Administrative Processes

Fabrizio, Thomas and Don Tapping. *5S for the Office: Organizing the Workplace to Eliminate Waste*. New York: Productivity Press, 2006.

George, Michael. *Lean Six Sigma for Service: How to Use Lean Speed & Six Sigma Quality to Improve Services and Transactions*. New York: McGraw-Hill, 2003.

Keyte, Beau and Drew Locher. *The Complete Lean Enterprise: Value Stream Mapping for Administrative and Office Processes*. New York: Productivity Press, 2004.

Tapping, Don and Tom Shuker. *Value Stream Management for the Lean Office: Eight Steps to Planning, Mapping, and Sustaining Lean Improvements in Administrative Areas*. New York: Productivity Press, 2003.

Books on Lean Thinking and Principles

Womack, James P. and Daniel T. Jones. *Lean Solutions: How Companies and Customers Can Create Value and Wealth Together*. New York: Free Press, 2005.

Womack, James P. and Daniel T. Jones. *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*. New York: Simon & Schuster, 1996.

Web Resources

Lean Enterprise Institute, <http://www.lean.org/>. (LEI is a non-profit research and training organization focused on value stream mapping and Lean principles.)

National Institute of Standards and Technology, Manufacturing Extension Partnership, <http://www.mep.nist.gov/>. (NIST MEP Centers are non-profit Lean technical assistance providers.)

Productivity Press, <http://www.productivitypress.com/>. (Productivity Press is a private Lean publishing company.)

U.S. Environmental Protection Agency: Lean Manufacturing and the Environment Website, <http://www.epa.gov/lean/index.htm>. (This is an EPA webpage providing resources and information on Lean and the environment for the private and public sector.)

Appendix B: Sample Question and Answer Document for Kaizen Events

This is a sample Q & A document distributed to Iowa Department of Natural Resources staff prior to a kaizen business process improvement event.

- 1. Are we compromising environmental protection?**
This is not about loosening environmental regulations or our agency's commitment to environmental protection. We are looking for efficiencies in workflow, paper processing, number of steps in our process, etc. In fact, our goals are to enhance our ability to protect the environment by being able shift more time and resources on environmental protection activities.
- 2. Will anyone lose his or her job by making this process so efficient?**
Our people are very important and will continue to be part of this agency. Some people's job duties may change, some may have different office locations or configurations. But all staff will remain part of this agency.
- 3. Municipalities, consulting engineers, and other external entities slow down the permitting process. How are they involved, and who will make them more efficient?**
Two representatives from consulting engineering firms will take part in the event to help identify opportunities and concerns, as well as two city representatives. However, this is not about how other organizations conduct processes, which we cannot control. Rather, we are focusing on what we can control, and that is how we move a permit through the approval process.
- 4. What guarantees do we have that this will actually help the process?**
Kaizen is a proven methodology used to break through barriers and cut through bureaucracy, helping teams reach their goals.
- 5. Why are we doing this on [Event Name]? Why not another issue?**
First, [Event Name] meets the three criteria for undertaking a BPI event: it should be a large-volume process; it should use the same steps every time; and it should be a core business activity. Second, we see this issue as an integral step to improving the water quality in the State.
- 6. Have we messed up? Have we done something wrong?**
The DNR is proud of the professionalism and performance of this staff. Conducting a process improvement event is a way to enhance that performance. The goal is to give people the tools to do their jobs better. Each of us, in our own work areas, could benefit from that type of assistance.
- 7. Is this a test of my job performance? Will I get in trouble for not doing well in my job?**
BPI Events are performed under the assumption that everyone involved is already doing their best—but that with some assistance, efforts can be altered to lessen steps, delays, and time, with no loss of performance or quality. Improvements will focus on reducing the time that no one is working on a project. The time it sits in someone's in-box or is waiting for a reply is waste that can be reduced.

8. **How can you expect to get meaningful change in one week?**
These events are specifically engineered to achieve results in an intense, one-week work session. Additionally, preparation has taken place prior to the actual event.
9. **How can they understand something as complex as [Event Name] in a week?**
The participants will learn the steps in the process, not how to conduct the process. The process will be laid out in graphical form to make it easier to understand the sequence and how steps are interrelated.
10. **What will go on the week of the event? Where will the event participants be in the building?**
Event participants will be in the [Event Location]. The week's agenda looks like this:
Monday: Kaizen methodology training
Tuesday: Day of Discovery—establish the existing method of standard operations; analyze the current process: time observations; create implementation plan
Wednesday: Day of Change (DO DAY)—eliminate wastes; brainstorm new ideas; share new layout
Thursday: Day of Sustain—do, re-do, document results; implement new process; document results and prepare for report out
Friday: Day of Celebration (Debrief)—report out: communication to management and to staff
11. **Who is involved and why?**
The team that will be designing the new process is composed of [Team Members], other DNR employees involved in the [Event Name], and some of the people who are impacted by the process or who impact the process. All of these different viewpoints are important in designing a better process.
12. **Even if I'm not directly involved on the team, what will I need to do during that week?**
You may be asked questions by the team members to clarify your part in the process. Please take the time to answer their questions completely. Team members may also ask to observe and time you while you complete a step in the process or discuss the time necessary to complete a step.
13. **Will people be in my office? Will they observe us talking about confidential issues, sensitive operations, controversial issues, sensitive policy issue debates, and phone calls that all occur each week?**
The team is not interested in specific projects, but how the process works in general.
14. **What happens if I have to leave during the week?**
If you are a member of the team, please coordinate your absence with the team leader, [Team Leader Name]. If you are not on the team, you only need to coordinate your absence with your supervisor, as usual.
15. **Will the recommendations be rigid or able to change in the future if they fail or cause unintended consequences?**
The team will not be making recommendation—they will design an improved process that will be implemented immediately. The new process will be tested during the event, but if adjustments need to be made later, they will be made.
16. **How is this process to be judged a success or failure?**
Data are being gathered on how well the process performs before the event and data will be collected after the event for comparison.

Appendix C: Additional Information about State Lean and Six Sigma Implementation Experience

This Appendix provides additional information about State Lean and Six Sigma implementation and key considerations, which are more broadly addressed in Sections 3 and 4 of the primer. In particular, this appendix outlines Lean Six Sigma implementation steps, improvement methods and technical assistance providers States have used, as well as key considerations for project design and implementation.

What process improvement methods have States used?

The five States profiled in the primer have used three main methods: kaizen events, value stream mapping, and Six Sigma process analysis. The choice of method was largely driven by how the Agency's process improvement effort began—in most cases an agency commissioner or business group recommended a particular method to the Agency. Kaizen events rely on rapid identification and implementation of process changes, while Six Sigma workshops rely on a longer analytic process. More details on the implementation steps are provided in Boxes 9 and 10.

Box 9: Lean Event Implementation Steps

Project Phases

- **Planning/Preparation**—Identify the mission, vision, core values, objectives, and methods/action steps
- **Event**—Map process, identify goals, and implement new process
 - **Kaizen**—Highly focused, action oriented, 2–5 day event in which an empowered team takes immediate action to improve a specific process
 - **Value Stream Mapping**—Workshop held to identify all steps, both value added and non-value added, required to complete a product or service from beginning to end
- **Follow-up**—Hold periodic follow-up meetings to focus on continuous improvement

Box 10: Six Sigma Implementation Steps

Project Phases

- **Define**—Use data to understand what users of the process need and expect
- **Measure**—Use data to understand how the current process performs
- **Analyze**—Use data to test theories of why a process under-performs and determine root causes
- **Improve/Design**—Develop steps that will consistently achieve improved performance by focusing on root causes
- **Control Validate**—Develop measures that make transparent whether the improved process is performing up to the project objective

In the context of the Lean and Six Sigma implementation, the States also used other specific Lean and Six Sigma methods, including:

- **Standard work** (e.g., States developed standard boilerplate language for permit writers);
- **Visual controls** (e.g., States using a visual tracking board to monitor implementation efforts);
- **5S** (e.g., using the 5S pillars of Sort, Set in order, Shine, Standardize, and Sustain to organize offices and improve work flow);
- **Root cause analysis** (e.g., to identify the root causes of variation in permitting processing lead time); and

- **Design for Lean Six Sigma** (applying the principles of Lean and Six Sigma to design new processes or products).

Thus far, the State agencies have focused primarily on process-level improvement projects, rather than more overarching Lean and Six Sigma efforts that address multiple processes simultaneously. Delaware and Michigan have used the value stream mapping tool to improve individual processes (e.g., air construction permitting), rather than examining the full “value stream” for the Agency (e.g., a value stream for a state environmental agency might include all the agency’s permitting processes that apply to a new facility in the state). Likewise, the kaizen events that Iowa and Nebraska have done and Minnesota’s Six Sigma projects have focused on process-level improvements. An improvement project or event at the level of an agency’s value stream, as the Iowa DNR is considering, might allow an agency to prioritize improvement efforts across processes affecting multiple environmental media.

What forms of technical assistance are available?

Most of the States have received some outside technical assistance or training to support their Lean and Six Sigma efforts, especially in the early stages. States have used a range of technical assistance providers, including: private consultants that facilitate Lean events; non-profit State Manufacturing Extension Partnership (MEP) Centers; and university-based training programs. In addition, individual businesses have also provided technical support to state agencies, by allowing agency staff to attend industry trainings and providing for Lean facilitators. States are also working to build and maintain in-house expertise to assist with Lean and Six Sigma deployment. Nebraska’s kaizen event was facilitated by an organizational behavior and development professor at the Agency and Iowa and Minnesota are training staff to serve as black belts, green belts, and kaizen facilitators for their improvement efforts.

Box 11: Lean and Six Sigma Technical Assistance Providers

- Industry Representatives
- Manufacturing Extension Partnership (MEP) Centers
- Private Consulting Firms
- University Business and Management Schools

The Resource List in Appendix A outlines written materials and websites on Lean and Six Sigma methods, particularly as they pertain to service organizations.

Key Considerations for Project Design and Implementation

The five state environmental agencies profiled in this primer identified the following key considerations for process improvement design and implementation.

Top Management Support

All five States emphasized the importance of commissioner and top management support for successful process improvement. Top management plays a vital role in communicating the importance of building an organizational culture accepting of continual improvement and innovation. Additionally, top management support is critical to overcoming middle management resistance, which has the potential to thwart implementation through inertia. Managers can also help dispel employee concerns related to job security, public involvement, and the potential for erosion of environmental protections (see discussion of boundary conditions below). They can also strengthen commitment by discounting the idea that process improvement efforts are only the “flavor of the month.” Having senior management attend all or critical portions of Lean events can be a useful way of demonstrating commitment to the efforts.

Several effective paths to securing top management support exist. In some cases, such as Minnesota, top management may be the primary champion of Lean or Six Sigma and play an instrumental role in bringing these process improvement methods into their agency. In other organizations, it may be necessary to strengthen top management support over time by piloting improvement methods and demonstrating results.

Boundary Conditions

Establishing and articulating clear boundary conditions for process improvement events and projects is critical for focusing efforts and addressing potential stakeholder concerns. Boundary conditions define what types of process changes are out of scope, as well as criteria that might be used to vet process changes to ensure that they do not undermine key agency objectives, such as public involvement or environmental protection. Common boundary conditions established by the five state environmental agencies include:

- Process improvement must focus on agency administrative aspects of the process changes to federal policy, and standards are off-limits;
- Environmental protection and outcomes should not be adversely impacted by process changes;
- Public involvement and transparency should not be adversely impacted by process changes;
- Public comment periods during permitting and other processes cannot be shortened; and
- Agency employees will not be laid off or dismissed as the result of process improvement efforts, although their specific job responsibilities may shift.

Box 12: Boundary Conditions⁴	
In Scope	Out of Scope
<ul style="list-style-type: none"> ▫ Interpretation of agency rules, policies, and guidance documents ▫ Internal organizational structure ▫ Internal permit process and timing ▫ Applicant internal process and timing ▫ Electronic submittals ▫ Application content and format ▫ Permit and technical memo format ▫ Special condition content ▫ Communication (internal/external) 	<ul style="list-style-type: none"> ▫ EPA regulations ▫ Interpretation of EPA rules, policies, and guidance documents ▫ Modifying existing agency rules ▫ Additional resources ▫ Permit appeal process ▫ New software/computer systems ▫ Mandated public participation requirements ▫ Permit involving enforcement action ▫ Public hearing process/officer

Project Scope

Determining the appropriate scope for a process improvement event or project is important for success. If an event or project takes on too much, the breadth and complexity of the process can make it difficult to identify and implement specific improvements. Minnesota, in particular, has scaled back the scope of its Six Sigma projects (instead of trying to “boil the ocean,” as one manager described) so that they could be implemented more quickly and effectively. If an event or project is scoped too narrowly, process improvements in one area can exacerbate problems in the broader process or system.

Several States identified value stream mapping as a useful tool for scoping future process improvement efforts. A value stream map can help ensure that all improvement efforts, even if narrowly focused, are

⁴ Example In Scope, Out of Scope from a presentation of Delaware DNREC.

aligned with the needs and desired future state for the full process or system. In addition, by identifying process improvement as a continual, on-going process, pressures to bite off too much at once can be reduced.

Data Collection

Collecting data on the performance of key aspects of a process is essential to identifying and implementing improvements. Processes are often more complex and more laden with non-value added activity than we imagine them to be. Data collection enables fact-based analysis that equips process improvement teams to zero in on waste that would otherwise remain hidden. Pre-event or project planning should give careful consideration to what data are important to collect. For example, Iowa DNR found that by measuring permitting timeframes from the date of initial facility inquiry (instead of from the submittal of a complete air permit application) to the permit issuance date increased DNR attention to improving outreach and services to sources in the pre-application phase.

Ongoing data collection to support routinely compiled key process metrics is also critical. Metrics focus attention on sustaining process improvements over time—what gets measured gets managed.

Participant Selection

Careful selection of participants for involvement in process improvement events and projects is also a key to success. Most of the States indicated that external stakeholder participants—from industry, other state or federal agencies, or public interest organizations—can make significant contributions while helping to communicate an agency’s process improvement work to external audiences. At least some employees who perform the actual work in the targeted process must be involved in an improvement event, for they have intimate knowledge of how the process currently works and they often have numerous ideas for improvement opportunities. In most cases, improvement teams should include staff from different levels in the organization, which can bring in different perspectives on the targeted process. While involving skeptics of the process improvement effort can be very useful (and help to nurture culture change), lack of sufficient commitment to the improvement effort among participants can lead to outcomes falling short of initial expectations. In the worse case, poor participant selection can set back broader organizational improvement efforts and culture change.

Box 13: Team Composition

- Directly work on the process
- Touch the process but do not work on it on a regular basis
- External stakeholders (i.e., those who are directly impacted by the outcomes of the process)

It is often helpful to involve one or more participants who are not intimately familiar with the current process, as they can often infuse creative thinking and fresh perspectives into the effort.

Communication Strategies

Proactive communication is critical to building organizational buy-in to process improvement efforts. Sustained and coordinated internal communication can also help build an organizational culture that is highly receptive to continual improvement and innovation. Numerous communication approaches can be used to inform employees about agency process improvement efforts and results, including:

- Updates and articles in agency newsletters and intranet websites;
- Fact sheets and communications documents;
- Internal meetings at all levels in the organization;

- Talks and presentations by top management; and
- Participation in Lean event training sessions and report-out presentations.

Appendix B includes a Questions and Answers communications document that Iowa DNR has used to communicate internally about its Lean Six Sigma efforts, particularly in the early stages of Iowa’s Lean Six Sigma implementation. This document directly takes on many questions and concerns that agency employees are likely to have about the process improvement effort.

States indicated that transparency and a coordinated communication strategy for reaching external stakeholders is also important, particularly when process improvement efforts have potential to affect or benefit these stakeholders. Active involvement of some stakeholders in the actual improvement events can assist with this. In addition, most of the five States have set up publicly-accessible web pages that describe their process improvement efforts and report on results and key metrics.

Strategies for Ensuring Follow Through

Even though Lean has a bias towards moving rapidly to implementation ideas, momentum can wane once employees leave a Lean event. All five States identified the need for explicit strategies to sustain the effectiveness of process changes and to ensure that action items identified during events or projects are resolved. Helpful techniques can include dedicating staff time and assigning clear responsibility for follow through, as well as creating a schedule of follow-up meetings to check on project status. For example, Iowa DNR has collected process performance data and prepared follow-up reports for kaizen events after intervals of 30 days, 60 days, 90 days, and six months following the events. As mentioned above, key process metrics can also be useful for sustaining attention and ensuring follow through.

Several of the States are committed to improving the extent to which they measure and evaluate the success of their process improvement efforts. Future evaluation efforts will likely focus on continuing the follow up on processes that were changed (e.g., doing more frequent follow-up reports), measuring the extent to which agency culture is changing (through surveys of employee awareness of Lean and Six Sigma efforts and staff perceptions about their work), and collecting additional data to measure other types of results from projects (e.g., customer service and quality metrics). State managers recognize the importance of measuring environmental outcomes, such as changes in air or water quality, but have struggled with reliably linking environmental quality data to changes in agency processes.

Box 14: Characteristics of Lean Six Sigma Deployment Models

Agency Wide (traditional model)

- Top down driven
- Comprehensive
- Major culture change
- Rapid, highly visible deployment

Division/Department Unit (scalable model)

- Division leadership with Agency management support
- Department pilot for Agency
- Comprehensive at the department level
- Culture change

Targeted (problem solving model)

- Top management leadership
- Focused on a few specific business problems
- Driven by a desire for strategic impact
- Culture change not a deployment objective

Grass Roots (bottom-up model)

- Originates at the bottom of the organization
- Highly motivated individuals lead the effort
- Project or problem specific
- Culture change not an objective

Appendix D: State Summaries

The State summaries outline each State's specific experiences using Lean and Six Sigma. In particular, the summaries address the process improvement activities, project initiation and key drivers, external involvement and technical assistance, results, and the future plans for each of the States representing the Lean workgroup. The five States highlighted in the primer are listed below.

- Delaware Department of Natural Resources and Environmental Control
- Iowa Department of Natural Resources
- Michigan Department of Environmental Quality
- Minnesota Pollution Control Agency
- Nebraska Department of Environmental Quality

Delaware Lean Process Improvement Initiative

State Agency: Delaware Department of Natural Resources and Environmental Control
Methods Implemented: Value Stream Mapping

The Delaware Department of Natural Resources and Environmental Control (DNREC) first used Value Stream Mapping (VSM) in August 2005 to identify ways to make air construction permitting processes more efficient. Michigan's success using VSM to improve a similar air permitting process served as a model for Delaware's initiative. The Department's "Future state" VSM workshop goals focused on improving permit processing times by significantly reducing rework and waiting periods and increasing early communication with the permit applicant. The Delaware Economic Development Office, General Motors, and other industry representatives provided technical assistance and guidance during all phases of the VSM process improvement initiative. Success stemming from the air construction permitting VSM workshop has led Delaware DNREC to expand its process improvement initiative—the Department is currently in the planning stages for five additional VSM projects.

Process Improvement Activities

Process	Improvement Activities
Air Construction Permitting	Conducted a VSM workshop on minor source air construction permitting (2005)

Project Initiation and Key Drivers

The Delaware Economic Development Office, in conjunction with local industry representatives familiar with Michigan's success using VSM, recommended that Delaware DNREC apply VSM tools to increase efficiency in their permitting processes.

The Delaware Economic Development Office provided funding for a facilitator from the Delaware Manufacturing Extension Partnership.

External Involvement and Technical Assistance

Industry Project Team

Industry representatives, primarily from the automotive and applied chemistry sectors, were part of the project team and participated in the VSM workshop, permit redesign, and subsequent monthly project review meetings.

Consultant/Facilitator

The Delaware Manufacturing Extension Partnership facilitated the workshop and is providing on-going assistance to the DNREC.

Results

The Delaware DNREC Air Division has implemented a number of process changes as a result of the air construction permitting VSM workshop, including:

- Developing new permit applications;

- Installing visual permit tracking boards;
- Implementing a “First In, First Out” permitting system;
- Initiating pre-submittal application meetings; and
- Implementing administrative and technical completeness gates.

As a result of these process changes, Delaware DNREC Air Division has seen:

- Backlog reduced from 199 to 59 natural minor permits in three months and to 25 in one year;
- Natural minor air construction permits issued within 76 days of application submittal;
- Delaware DNREC staff time allocated more effectively to “mission critical” work;
- Rework reduced by 45 percent;
- Devotion of ½ FTE employees devoted to VSM efforts during project planning and implementation stages;
- Improved communication with industry applicants;
- A process improvement culture integrated into the Division; and
- Staff gained ownership of the process, empowering them to identify and address improvement opportunities.

Future Plans

- Delaware DNREC continues to implement VSM-identified goals for the minor source air construction permitting process.
- Delaware DNREC is initiating the following three VSM workshops in September 2006: Brownfields, underground storage tanks, and synthetic minor air construction permitting.
- The Department is also scoping two additional projects (wetlands permitting and storm water Permitting) for process improvement using VSM tools.

For More Information

Delaware DNREC, VSM Process Improvement Initiative:

<http://www.dnrec.state.de.us/DNREC2000/VSM/Index.htm>

For additional information, contact:

Bob Zimmerman, Director of External Affairs
 Office of the Secretary, Delaware DNREC
 89 Kings Hwy, PO Box 1401
 Dover, DE 19901
 (302) 739-4403
Robert.Zimmerman@state.de.us

Iowa Lean Six Sigma Business Process Improvement Initiative

State Agency: Iowa Department of Natural Resources

Methods Implemented: Kaizen Events, Value Stream Mapping, 5S, and Design for Lean Six Sigma

As part of a major commitment to increase efficiency and foster continuous improvement, the Iowa Department of Natural Resources (DNR) has conducted sixteen Lean business process improvement events since June 2003 using primarily kaizen events. Iowa DNR first targeted air quality construction permitting and has since conducted events on processes such as Leaking Underground Storage Tank (LUST) corrective action reporting and implementation, clean water construction permits, National Pollution Discharge Elimination System (NPDES) wastewater permits, as well as a number of administrative processes. Iowa DNR has achieved compelling results from its Lean Six Sigma Business Process Improvement initiative, reducing most process lead times by more than half. The Department received guidance and assistance in its Lean initiative from the Iowa Coalition for Innovation and Growth, Lean consultants, and from a number of companies in Iowa that have significant Lean experience, such as Pella Corporation, Rockwell Collins, and Vermeer Manufacturing.

Process Improvement Activities

Iowa DNR has conducted kaizen events on the following projects:

- Air quality complex permitting (2004)
- Air quality new source construction permits (2003)
- Animal feeding operations construction permits (2005)
- Clean water construction project permits (2004)
- Floodplain permits (2005)
- Land acquisition (2005)
- Landfill permits (2004)
- Leaking underground storage tank (LUST) corrective action decisions (2004)
- Legal service: administrative orders (2005)
- Magazine production (2005)
- Manure management plans (2005)
- NPDES wastewater permits (2004)
- Sovereign lands permits: environmental reviews (2004)
- State revolving fund (SRF) cross-cutters (2006)
- Vehicle fleet management (2005)

In addition, Iowa DNR conducted a Design for Lean Six Sigma event on this project:

- Magazine redesign (2005)

Project Initiation and Key Drivers

The Iowa Coalition for Innovation and Growth's Business Process Hot Team approached the Iowa DNR about cutting the lead time for air construction permits. The Coalition recommended that the Department conduct a kaizen event. With the support of the Iowa Business Council, the Coalition also paid the initial consultation fees for the kaizen event and assisted with the process.

External Involvement and Technical Assistance

Consultant/Facilitator

Iowa DNR uses Guidon Performance Solutions, a company that specializes in business process improvement and has experience in the public sector.

Iowa Coalition for Innovation and Growth

The Coalition for Innovation and Growth's Business Process Hot Team represents Iowa's primary industries, including Pella Corporation, Rockwell Collins, Alliant Energy, and Vermeer Manufacturing. The Hot Team invited DNR staff to participate in industry kaizen events, and was instrumental in initiating Iowa DNR's Lean Six Sigma efforts, as noted above. Coalition representatives continue to participate in Iowa DNR's process improvement events.

Pella Corporation

A top Iowa business, the corporation chaired the Business Process Hot Team and offered on-going support to the Iowa DNR following their first kaizen event.

Results

Iowa DNR has achieved compelling results from its Lean Six Sigma business process improvement initiatives. The events have resulted in both organizational and cultural changes in the Department, as well as specific process changes identified during the Lean Six Sigma events.

Department-Wide Results

Iowa DNR has conducted sixteen process improvement events, most of which have focused on reducing lead times as shown in the table below.

Kaizen Event Projects	Before Process Improvement	After Process Improvement
Air quality complex permit	214 days	180 days
Air quality new source construction permit	62 days	6 days
Animal feeding operations construction permits	66 days	36 days
Clean water construction project permits	28 months	4.5 months
Floodplain permits	Implemented: <ul style="list-style-type: none">▫ Pre-design meeting and outreach strategy▫ Database design▫ Permit redesign	
Landfill permits	187 days	30 days
Land acquisition: best case Land acquisition: worst case	24 months 22 years	9 months 6.3 years
Leaking underground storage tanks corrective action decision	38 months	3 months

Kaizen Event Projects	Before Process Improvement	After Process Improvement
Legal services: administrative orders	<ul style="list-style-type: none"> ▫ Consent orders ▫ Unilateral orders ▫ Attorney General referrals 	<ul style="list-style-type: none"> ▫ 40–90% improvement in lead time reduction
Manure management plans	▫ Incomplete submittals reduced by 50%	
NPDES wastewater permitting	425 days	15 days
Sovereign lands permits: environmental reviews	163 days	86 days
SRF cross-cutters	<ul style="list-style-type: none"> ▫ Delays reduced by 40% ▫ Steps reduced by 32% 	
Vehicle dispatch	Pool vehicles reassigned to Department of Administrative Services-General Services Enterprise	
Magazine production	Allows on-time quality production while meeting day-to-day communication needs	

One of these events focused on a new project and used Lean Six Sigma Design tools, as described below.

Lean Design Projects	Results
Magazine redesign	New Iowa DNR magazine designed for January 2007 launch

In addition to lead time reductions, Iowa DNR's has seen:

- The overall quality of permit applications increase;
- An increased ability to focus on “mission critical” work;
- A continuous process improvement culture integrated into the department; and
- Improved relationships with the regulated community and permit applicants.

As a result of these successes, Iowa DNR has committed to continuous process improvement by:

- Dedicating 1.5 full-time employees (FTEs) to focus on Lean Six Sigma development and facilitation; and
- Training twelve DNR staff at Six Sigma green belt level to support future Lean Six Sigma events.

Iowa DNR, Air Division Results:

Success stemming from the first kaizen event in air construction permitting has fueled subsequent process improvement initiatives within the Department. Results of this project include:

- Dedicating a team to address the air permit backlog;
- Eliminating sixteen process steps (23 to 7);
- Reducing permit handoffs from 18 to 4;
- Moving staff offices for better work flow;
- More complete air construction permit applications submitted; and

- 600 air construction permit backlog eliminated.

Future Plans

- Iowa DNR plans to develop greater in-house capacity for leading lean six sigma events by training a staff member to the Six Sigma black belt level.
- Iowa DNR will begin using value stream mapping techniques to identify priority projects for process improvement.
- Beyond Iowa DNR, the Iowa Department of Management will add an Office of Lean Enterprise. This Office will have a full time staff position charged with supporting Lean implementation throughout Iowa's executive branch.

For More Information

State of Iowa, Office of Lean Enterprise

http://www.dom.state.ia.us/planning_performance/lean/index.html

Iowa Department of Natural Resources, Air Quality Division—Air Construction Permitting Event

<http://www.iowadnr.com/air/prof/kaizen/kaizen.html>

<http://www.iowadnr.com/air/news/articles/03nov13.html>

<http://www.iowadnr.com/air/news/articles/05jan08.html>

Iowa Department of Natural Resource, Land Quality Division—LUST event

<http://www.iowadnr.com/land/ust/kaizen.html>

For additional information, contact:

Teresa Hay McMahon
Performance Results Director
Iowa Department of Management
State Capitol Building
Des Moines, IA. 50319
(515) 281-6537
teresa.mcmahon@iowa.gov

Liz Christiansen, Deputy Director
Iowa Department of Natural Resources
502 E. 9th Street
Des Moines, IA. 50319-0034
(515) 281-3388
liz.christiansen@dnr.state.ia.us

Michigan Lean Process Improvement Initiative

State Agency: Michigan Department of Environmental Quality

Methods Implemented: Value Stream Mapping

Michigan Department of Environmental Quality (DEQ), partly in response to pressure from the regulated community, citizens, and state government, applied value stream mapping to the air “permit to install” (PTI) application review process in April 2004 and to a land and water management wetland permitting process in 2005. For the air permitting process, Michigan DEQ Air Quality Division (AQD), along with General Motors, DaimlerChrysler, Ford, the Michigan Manufacturer’s Association, and Michigan’s Department of Labor and Economic Growth, conducted a pre-scoping exercise to identify customer needs and then used a VSM workshop to develop an implementation plan for process improvements to achieve a “future state” goal of having all applications reviewed and acted upon in less than six calendar months. The new process enables permit applicants to provide more complete and timely submittals and has allowed the AQD to perform technical analyses quickly and efficiently by eliminating rework and waiting. Within one year of conducting the VSM process improvement, air permit processing time decreased by two-thirds (66 percent) to less than 60 days and the number of in-house applications was reduced by one half (50 percent). While the results have not been as dramatic to date for the other VSM initiatives due to budget constraints and timing, the Michigan DEQ continues its commitment to improve its business processes.

Process Improvement Activities

Process	Improvement Activities
Air construction permitting	Conducted a value stream mapping (VSM) workshop on the Permit to Install (PTI) application review process (April 2004); results fully implemented in September 2004
Land and water management wetland permitting	Conducted a VSM workshop on land and water management wetland permitting (2005); results implementation is on-going
Log letters (such as responses to constituent letters to Governor)	Conducted a VSM workshop on log letter response process (2006); results implementation on-going

Project Initiation and Key Drivers

Industry considered Michigan’s air permitting program to be cumbersome, slow, and unresponsive to the needs of the regulated community. General Motors, supported by other members of the regulated community, met with Michigan DEQ to discuss options for improving the Department air construction permitting process, and they recommended holding a VSM workshop.

External Involvement and Technical Assistance

Process Improvement Advisory Group

Participants in the VSM workshop included staff-level people from the Michigan DEQ AQD, General Motors, DaimlerChrysler, and Michigan’s Department of Labor and Economic Growth. The Advisory Group, made up of senior officials of these organizations, supported this Air Permitting Team throughout the VSM initiative.

General Motors

General Motors, one of the largest companies operating in Michigan, expressed specific interest in improving the air construction permitting process.

Facilitator

A General Motors facilitator with experience in value stream mapping was used.

Results

Based on the air permitting VSM workshop, the Michigan DEQ AQD has implemented a number of process changes, including:

- Standardizing application information requirements for many source categories;
- Initiating permit scoping meetings;
- Creating “just in time” fast track permitting;
- Providing preliminary draft conditions to begin discussions and ensure clear communication between the applicant and Michigan DEQ AQD;
- Establishing interim deadlines throughout the process for both the applicant and Michigan DEQ AQD staff; and
- Installing an Access database permit tracking system.

As a result of these process changes, Michigan DEQ AQD has seen:

- Application process time for major permits reduced from 422 to 98 days;
- Application process time for minor permits reduced from 143 to 50 days;
- Application administrative completeness rise from 82 percent to 95 percent;
- ADQ staff time more effectively allocated to “mission critical” work;
- Improved relationships and communication with industry applicants and others; and
- A significant increase in staff morale.

Future Plans

- Michigan DEQ AQD will continue to maintain and improve upon the “future state” goals for the air PTI process.
- Michigan DEQ AQD has begun to survey applicants and staff to evaluate the effectiveness of the process and glean additional improvement ideas.
- The Michigan DEQ Director is looking into broader VSM implementation within the Department.

For More Information

Michigan DEQ Overview of PTI Application Process Improvement:

<http://www.deq.state.mi.us/aps/miparp.shtml>

For additional information, contact:

Lynn Fiedler, AQD Permit Section Chief
P.O. Box 30260
Lansing, Michigan 48909
517-373-7087
fiedlerl@michigan.gov

Bill Presson, AQD Jackson District Supervisor
State Office Building, 4th Floor
301 East Glick Highway
Jackson, Michigan 49201
517-780-7481
presson@michigan.gov

Minnesota Six Sigma Process Improvement Initiative

State Agency: Minnesota Pollution Control Agency

Methods Implemented: Six Sigma Process Improvement, Design for Six Sigma, Customer Focus, and Lateral Thinking

As part of a continued commitment to increase efficiency and effectiveness, the Minnesota Pollution Control Agency (PCA) has initiated 21 Six Sigma agency projects (15 improvement, 4 design, and 2 discovery) and nearly 50 division projects focused on process standardization, all addressing both regulatory and non-regulatory processes at the Agency. The Agency Commissioner recommended Six Sigma improvement methods in response to an increasing number of industry complaints and an audit by the state legislature drawing attention to permitting process inefficiencies. The first two projects—a National Pollution Discharge Elimination System (NPDES) wastewater permitting project in 2003 and an air construction permitting project in 2004—both occurred in conjunction with a Six Sigma training program administered by the University of Minnesota. The Agency has since developed internal Six Sigma methodology training and leadership capacity, and has used lean tools in addition to Six Sigma process analyses. Minnesota PCA has also started to concentrate the time frame to complete its Six Sigma projects.

Process Improvement Activities

Minnesota PCA has used Six Sigma process analysis on the following projects:

- Air construction permits (2004)
- Administrative Penalty Order (APO) issuance (2004)
- Board item process (2006)
- Communication (2005)
- Contracts (2004)
- Data management strategy (2006)
- DELTA (regulatory database system) discovery project (2005)
- Employee performance management system (2005)
- Feedlot inspections (2005)
- File management (2005)
- Individual sewage treatment systems (ISTS) county support (2005)
- NPDES compliance determinations (2005)
- NPDES wastewater permits (2003)
- Office of Environmental Assistance/PCA grant effectiveness (2004)
- Pollution prevention discovery project (2004)
- Spills information and data tracking (2005)
- Storm water program compliance (2004)
- Waste Water Treatment Plant (WWTP) operator need to know (2004)
- Water quality funding gap (2005)
- Water quality grant data entry (2004)
- Watershed pass-through funding (2004)

Project Initiation and Key Drivers

- The Minnesota PCA Commissioner used Six Sigma successfully at the 3M Company, and initiated an Agency-wide Six Sigma process improvement initiative to address industry complaints, improve Agency efficiency, and reduce permit backlogs. In addition, the Assistant Commissioner provided a leadership role and significant guidance and support to Six Sigma project teams.

External Involvement and Technical Assistance

University of Minnesota Carlson School of Management

The Carlson School of Management trained Minnesota PCA staff as champions and coaches at the Six Sigma green and black belt level. Together with trained staff, University instructors assisted in the development of deployment models for the NPDES project and the air construction permitting project.

Internal Consultant/Facilitator

Certified green and black belt Minnesota PCA staff to facilitate the Six Sigma process improvement projects.

Results

Minnesota Pollution Control Agency has achieved compelling results from its Six Sigma process improvement. Six Sigma project success is commonly measured by the project's progression from Stage 1 (define) to Stage 5 (control), in addition to specific improvement metrics. The following is an overview of both organizational and cultural changes in the Agency, and specific process changes identified during the Six Sigma process analysis.

Minnesota PCA Six Sigma Project Status and Sample Results

Minnesota PCA has used Six Sigma Process methodology on 21 Agency projects. The projects are each in various stages of progress as shown in the table below.

Six Sigma Projects	Define	Measure	Analyze	Improve/ Design	Control/ Validate
Air construction permits					X
Administrative Penalty Order Issuance				X	
Board item process			X		
Communication				X	
Contracts					X
Data management strategy		X			
DELTA discovery project			X	N/A	N/A
Employee performance management system					X
Feedlot inspections					X
File management					X
ISTS county support					X
NPDES inspection					X
NPDES wastewater permits					X
OEA/PCA grant effectiveness					X
Pollution prevention discovery			X	N/A	N/A
Spills information and data tracking					X
Storm water program compliance					X

Six Sigma Projects	Define	Measure	Analyze	Improve/ Design	Control/ Validate
(WWTP) operator need to know					X
Water quality funding gap					X
Water quality grant data entry					X
Watershed pass-through funding					X

In addition to project progression through the five Six Sigma stages, Minnesota PCA has improved permitting timeliness by:

- Issuing 75 percent of NPDES permits within 180 days (historical baseline of 9 percent);
- Reducing the NPDES reissuance permitting backlog from nearly 50 percent to 8 percent;
- Issuing 75 percent of air construction permits within 150 days (baseline of 33 percent);
- Public noticing 88 percent of air construction permits within 120 days (baseline 44 percent); and
- Administrative Penalty Orders issued and case closed 69 percent within 165 days (baseline 23 percent).

Agency-Wide Results

As a result of Six Sigma project process improvements, Minnesota PCA has experienced:

- Greater staff ownership of projects and processes;
- An increased ability to focus on “mission critical” work;
- Improved internal Agency communication;
- Improved communication with external stakeholders;
- Integration of a continuous process improvement culture into the Agency; and
- Improved relationships with the regulated community.

The Agency successes have led Minnesota PCA to commit to continuous process improvement by:

- Training all Agency managers and supervisors at green belt leadership level;
- Training all Agency executives at black belt leadership level;
- Trained 4 certified black belt level Agency staff to support the process improvement efforts at both the Agency and division level;
- Developing internal capability to train staff at a green belt level;
- Trained 35 staff at “internal black belt” leadership level; and
- Successfully trained and certified 183 employees at the green belt level.

Future Plans

- Minnesota PCA will continue to follow the deployment plan to reach project objectives.
- The Agency will integrate a process management approach into the Agency’s leadership.
- The Agency plans to further its process capability and to continuously seek out improvement and standardization of mission critical work at the division level.
- Minnesota PCA plans to maintain long-term gains and improvements through the incorporation of a culture change mentality.

For More Information

Minnesota Pollution Control Agency—Water Quality Six Sigma Process Improvement Project
<http://www.pca.state.mn.us/water/wq-complianceprocess.html>

Minnesota Pollution Control Agency—Quality Management Plan
<http://www.pca.state.mn.us/publications/reports/qmp.pdf>

For additional information, contact:

Rod Massey, P.E. Director
Operational Support Division
Minnesota Pollution Control Agency
rod.massey@pca.state.mn.us
651-297-8320

James Warner, P.E. Director
Industrial Division
Minnesota Pollution Control Agency
jim.warner@pca.state.mn.us
651-296-7333

Nebraska's Business Process Improvement Initiative

State Agency: Nebraska Department of Environmental Quality

Methods Implemented: Kaizen Event, On-Going Process Reviews, and Evaluations

The Nebraska Department of Environmental Quality (DEQ), in response to a dramatic increase in the number of air construction permit applications submitted, especially those for ethanol production facilities, held a week-long kaizen rapid process improvement event in February 2005, aimed at improving its air quality construction permitting process. A post-kaizen workshop followed for new staff, as well as those who did not participate in the kaizen event. Several changes were implemented as a result of these events, including adding additional staff positions, placing an emphasis on the pre-application process, standardizing permit applications, implementing a permit review timeframe, creating a permit hotline, and establishing a permit tracking system. The changes implemented have reduced the amount of time between when Nebraska DEQ receives completed applications and starts the public comment period, and the time needed to make a decision after the close of the public comment period.

Process Improvement Activities

Process	Improvement Activities
Air Construction Permitting	Conducted kaizen event focusing on all aspects of the air construction permitting process, including outreach and information, public participation and staff concerns, modeling, and the permitting process itself.

Project Initiation and Key Drivers

- Nebraska DEQ developed a multifaceted improvement action plan that included participating in a related kaizen event at the Iowa Department of Natural Resources and conducting a kaizen event focused on Nebraska DEQ air construction permitting process. The Department identified possible improvements to the air construction permitting program in order to address an increased number of ethanol plant permit applications, Nebraska DEQ permit backlog, and the need to process applications within shorter timeframes.
- The Nebraska DEQ Director invited persons from government and industry to be part of a Business Advisory Group to help NDEQ identify areas in the permitting process where improvements could be made.

External Involvement and Technical Assistance

Business Advisory Group

Members of the Business Advisory Group provided Nebraska DEQ with a list of recommendations in the permitting process where improvements were needed and identified individuals from business, industry, and government to participate with the Department in the kaizen process.

Facilitator

A Nebraska DEQ Air Quality Division staff member with a background in teaching graduate college courses in organizational behavior and development facilitated both the activities of the Business Advisory Group and the kaizen event.

Results

Nebraska DEQ has implemented a number of changes as a result of the kaizen event, including:

- Standardizing permit template language;
- Requiring pre-application meetings for more complex permit applications;
- Emphasizing pre-application information and activities;
- Implementing program with agreed upon timeframes (Applicant and Department);
- Developing Ethanol and Generic Air Construction Permit Application Packages;
- Establishing a toll-free permit hotline;
- Increasing the number of Department staff positions; and
- Developing a rudimentary permit tracking system on the Department webpage.

As a result of these process changes, Nebraska DEQ has seen:

- More complete permit applications submitted;
- Improved communication with industry applicants;
- A 50 percent reduction in review time for ethanol plant air construction permits;
- An almost 50 percent reduction in review time for all air construction permits;
- A 55 percent reduction in the air construction permitting backlog; and
- Air Quality Division staff gain greater ownership of the process, empowering them to identify and address improvement opportunities.

Future Plans

- Nebraska DEQ will continue to implement the kaizen event goals by improving the Agency's website, and establish a more refined permit tracking system.
- Nebraska DEQ will continue to have process improvement meetings with staff, as well as senior Department management, to monitor progress and identify additional areas for improvement.

For More Information

The Nebraska Department of Environmental Quality Website:

<http://www.deq.state.ne.us/>

For additional information, contact:

The Nebraska Department of
Environmental Quality
1200 "N" Street, Suite 400
P.O. Box 98922
Lincoln, NE 68509-8922
(402) 471-2186

Shelley Kaderly
Division Administrator
Air Quality Division
Nebraska Department of Environmental Quality
(402) 471-2186
Shelley.Kaderly@ndeq.state.ne.us

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