

Recommendations for Integrating P2 Strategies into the Washington State Department of Ecology's Environmental Management Alternative and P2 Planning Process and Reporting Systems

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1.0 Introduction

There is ample evidence that companies that are required to submit pollution prevention (P2) plans are more likely to implement P2 as a strategy and more likely to see P2 gains than companies that operate without such a requirement. Similarly, the same can be said of those companies that operate with an environmental management system in place versus those companies that do not.

Even so, P2 plans and environmental management systems (EMS) are frequently stand-alone systems that are not fully integrated into all aspects of a company. Often the “low-hanging fruit” is picked and over time, the EMS or P2 plan becomes stagnant. Annual reporting becomes an exercise to demonstrate the lack of financial feasibility for continued change.

The purpose of this paper is to discuss three systems available to business today: lean manufacturing, quality management, and systems tools. It will discuss potential ways an EMS or P2 Plan can integrate with these systems to make pollution prevention (and sustainability) part of every company’s effort to improve efficiency and reduce operational expenses. A comparative table of these systems relative to an EMS is shown in Appendix A.

The report also discusses incentives, mentoring, and quantitative measures that may also offer more comprehensive P2 Planning or EMS effectiveness.

2.0 Compendium of Recommendations

This section summarizes a series of possible suggestions and recommendations for integrating additional environmental tools and systems into Ecology's P2 Planning requirement and EMS alternatives. The suggestions fall under these categories:

- General
- Lean Manufacturing
- Quality Management
- Systems Approaches
- Mentoring
- Incentives
- Measurement

In an attempt to include as many ideas as possible, some of the recommendations may overlap or compete in scope.

2.1 General Suggestions

- Develop tiers for various levels of accomplishment under the P2 Plan or EMS alternative. List requirements necessary to meet each tier level. As an example of a tier structure, E.g.: yes
 - Tier 1 Meets basic Ecology EMS or P2 Plan requirements.
 - Tier 2 Tier 1 plus application of one (or more) process mappings, (or some other measurable application of a P2 tool, such as eco-mapping, or implementing DfE on one product, or instituting green purchasing for one major product category that the business purchases)
 - Tier 3 Tier 2 plus lean implementation OR quality certification
 - Tier 4 Tier 1 plus lean implementation AND quality certification
 - Tier 5 Tier 3 (or 4), plus strong supply chain environmental management program or approved mentor
- Conduct regular trainings on (a) developing an EMS or hybrid EMS-Lean or hybrid EMS-Quality systems, (b) value stream mapping, process mapping, and eco-mapping, or (c) other P2 strategies that Ecology would like to have business incorporate in EMS alternative and P2 Planning. Often the employee responsible for environmental performance may not have formal training in this area, and it may not be that person's sole responsibility at a company. It is also not unusual for that position to be a revolving door. The same is often true of safety, and the Department of Labor and Industries has an excellent program of periodic trainings in different regions to allow people to keep apprised of program requirements. This is helpful for employees new to the position as well as employees who either individually, or as a result of changing company culture or ideals, are stepping up environmentally.

- Increase visibility and emphasis on supply chain opportunities: A Washington Department of Ecology EMS requires a facility to look at direct impacts (waste and pollution generated, energy and water consumed, etc.), and Appendix A of the EMS publication (97-401) suggests continuous improvement by means of supply chain management. To move toward a more holistic definition of sustainability, an EMS should address direct and indirect impacts of suppliers and customers and therefore receive more emphasis than a “possibility” as currently noted in Appendix A of 97-401.
- Provide the eco-mapping tool and tutorial (developed and copyrighted by Mr. Heinz-Werner Engel) where appropriate, to help smaller companies, or those taking their first EMS and P2 steps, identify environmental performance improvements (See http://www.inem.org/htdocs/toolkit/tools2_4_1_1.html)
- Require documentation in current EMS plans and P2 Plans or reports, on specific issues illustrating that the business is truly thinking about and incorporating measures to reduce pollution and waste. For example, require answers to a set of questions such as: “What are the significant environmental impacts of your three principal products and services?”

2.2 Incorporating Lean into the Ecology EMS Alternative and P2 Planning

- Provide a basic factsheet for lean outreach efforts, illustrating/demonstrating specific examples (real or hypothetical) showing how lean can be incorporated into either the P2 Planning, or into the EMS option. Refer to EPA’s lean-environment program and case studies. For example, the Boeing Company implemented lean at the Everett plant and Eliminated the use of 350 cubic feet of cardboard and bubble wrap packing material per 747 wing panel set, and reduced chemical usage per airplane by 11.6 percent. The Auburn plant reduced defects from 1,200 per 10,000 in 1996 to fewer than 300 per 10,000. Obviously, this is a huge reduction in scrap waste due to defects. (Source: <http://www.epa.gov/lean/studies/index.htm>).
- Continue and/or expand efforts to utilize lean experts from Washington Manufacturing Services, other qualified technical assistance providers, and in-house staff trained in lean concepts, to step up the lean/environment outreach program and educate businesses on how this can contribute to a good P2 Plan or EMS.
- Provide technical assistance people with the skills to help a facility develop a value stream map, or incorporate into an existing value stream map, and use other lean tools and strategies.
- Utilize a team assistance approach, such as having a lean expert and Ecology representative, and possibly another mentor lean company representative attend site visits.
- Include lean implementation as a ‘checkbox’ item that a business can select in P2 Plan development and EMS documentation in the Numeric Performance Goals Section. See Appendix B for an example.
- Develop criteria for a hybrid EMS/Lean plan including evaluation protocols.

- In the annual P2 report or EMS report, request (or require) quantitative measurements of pollution prevention achieved as a direct result of lean manufacturing in the annual report for EMS or P2 Plan.

2.3 Incorporating Quality Management into the Ecology EMS Alternative and P2 Plan

- Include a quality management system, such as Baldrige (and/or Washington State Quality Award-WSQA), as a ‘checkbox’ item that a business can select in P2 Plan development and EMS documentation in the Numeric Performance Goals Section. (See Appendix B)
- Partner with WSQA or WMS (if in-house expertise) or other quality experts, and possibly mentor companies that have quality plans or awards, to conduct similar outreach on quality systems.
- Develop criteria for a hybrid EMS/Quality management system; possibly including critical elements of the Baldrige, WSQA, or Green Zia models – along with evaluation protocols.
- Develop a streamlined P2 questionnaire that, if determined to be adequate, would qualify a Baldrige or WSQA award winner as already having an acceptable environmental management system. Since these quality systems inherently call for continuous improvement, employee involvement and training, and identification of roles and responsibilities and periodic assessment, simply defining objectives and targets and reporting annual performance with measurements may suffice.
- In the annual P2 Plan or EMS report, request (or require) quantitative measurements of pollution prevention achieved as a direct result of quality management (see measurement section below).

2.4 Incorporating Mapping and Systems Tools into the Ecology EMS Alternative or P2 Plan

- Offer technical assistance providers with the skills to help develop process map(s) and use them to identify opportunities for environmental performance improvement.
- Incorporate or require process mapping as a tool to be used in a lean or hybrid Lean/EMS system. Process mapping can take a facility beyond the value obtained from value stream mapping and identify additional opportunities.
- Incorporate the process mapping resource and activity accounting exercises (Figures 1 and 2 in Section 5.0 below) into the EMS guidance and P2 Planning Guidance as one possible tool for use.
- Provide the eco-mapping tool, where appropriate, to help smaller companies, or those taking their first EMS steps, identify environmental performance improvements. (See http://www.inem.org/htdocs/toolkit/tools2_4_1_1.html)
- Include these mapping and systems analysis tools as a checkbox in the EMS alternative documentation or P2 Plan documentation (in the Numeric Performance

Goals Section) as a means of getting business to commit to using these tools to achieve their to achieve P2 goals. (See Appendix B for an example).

Other analysis opportunities might include:

- Streamlined GAP Analysis tools (as used in evaluating ISO 14001 status)
- Environmental self-assessment tools or surveys
- Process characterization tools
- Pollution Prevention Opportunity Assessment (P2OA) methodology developed by Battelle's Pacific Northwest National Lab (See <http://www.battelle.org/bookstore/BookTemplate.aspx?ISBN=1-57477-070-5>).

2.5 Incorporating Other P2 Methodologies into the Ecology EMS Alternative or P2 Plan

- Include P2 strategies, such as material use efficiency, chemical management systems, and others listed in Ecology's Appendix A of Publication 97-401, (e.g., material tracking, DfE, process control technologies, supply chain management, process mapping, etc.) as methods that a business can commit to using in their EMS or P2 Plan development and documentation. Having these in an optional checklist up front, may get companies to actually commit to and/or at least start thinking about applying these strategies to address specific wastes or hazardous substance use. (See Appendix B for an example).

2.6 Using Mentoring Relationships within the Ecology EMS Alternative or P2 Plan Framework

- Establish a list of willing mentor contacts, that have implemented EMS, lean or quality management programs and are willing to assist other companies or work with Ecology and technical assistance providers to
- Mentoring may require some initial, brief training for mentors, including a section on concerns about competitive advantage, and on liability protection.

2.7 Incorporating Environmental Performance Rating into the Ecology EMS Alternative or P2 Plan Framework

A program with some intriguing application for P2 is the Washington State Department of Labor and Industries (L&I) Worker's Compensation Insurance Program. L&I's goal is to produce fair insurance rates which reflect the hazardous nature of each industry. Businesses pay premiums based on the degree of hazard their workers are exposed to. For example, employers engaged in industries such as metal fabrication will tend to pay higher insurance rates than employers engaged in retail store operations. Some recommendations for applying this type of system to P2 and EMS follow:

- Develop a rating system for companies, based along the lines of L&I's system of rating by group or sector performance, combined with individual performance within

that sector or group. Ratings would be negatively impacted based on the generation of hazardous waste, solid waste and resource consumption. Companies would see their ratings positively impacted by reductions in waste creation and resource consumption and by instituting such systems as green purchasing, supply chain management, design for environment (DfE), lean/EMS etc.

- These ratings could be used in a variety of ways, such as:
 - Provide the list to businesses and business associations so companies can see where they are overall as well as how they are performing in relation to their competition. The desire to be one of the better performers in your sector or group can be a strong business driver for improvement.
 - Provide the list annually to financial institutions and insurance companies. This type of system would be well suited to serve as measures of the liability risks of insuring and financing businesses who do not address their environmental footprint. Pressure from banks and insurance companies are very strong drivers for change in the business community. Ecology could work with these two sectors to develop policies that, in the case of banks, provide better loan rates, and in the case of insurance companies, either provide a premium reduction or a way to avoid a premium increase. Banks may be able to use the discounted portion of a loan as a means of obtaining community development credits.
 - Use the rating system as a factor in determining permit fees.

2.8 Incentives

Incentives are critical to the success of any regulatory program, whether those incentives are internal or external. Here are some suggestions.

Permit Flexibility

- Develop a system whereby companies with good compliance records and either an approved Lean-EMS hybrid system or Quality /EMS hybrid, can receive permit flexibility, such as grace period in which to file permit applications or revisions after a manufacturing process change (as long as all compliance issues were addressed from the beginning).
- Allow approved Lean-EMS hybrid businesses or Quality/EMS hybrid businesses to file permits on a month by month basis and pay the cost of the monthly permit fee only when the process is in use. This allows forward-thinking companies a competitive advantage and would provide additional incentive to implement an EMS. It now becomes a business liability not to have an approved EMS.

Tax Leniency

- When a company reaches (or is already at) the top level of EMS proficiency (as defined by Ecology), or meets a minimum of one of the upper “ tiers” in the example in section 2.1 above), offer a one-time B&O tax break. For manufacturing, the current rate of business and occupational taxes is 0.00484%. A business with annual sales of \$15 million would have a \$72,600 tax bill. A one-time reduction of 10%, to a

rate of 0.004356%, for this business would result in a tax bill of \$65,340, a savings of \$7,260. This is a sizable incentive that provides a reward for investing the time and effort needed to develop a good environmental management system.

- Alternatively, When a company reaches (or is already at) the top level of EMS proficiency (as defined by Ecology), or meets a minimum of one of the upper “ tiers” in the example in section 2.x above), , offer a continuing B&O tax break. At a 5% reduction for the same business example above, to a rate of 0.004598, would mean a tax bill of \$68,790 and a savings of \$3,630. The business would be eligible for continued tax breaks as long as the environmental management system continued at a high level.

Loan Funds¹

- Option 1: Add a small secondary fee to the one currently charged on hazardous waste generators. The fee would be designed to generate revenue of between \$100,000 and \$250,000 annually, and placed in a fund from which no-interest loans could be made. These loans would be available first and foremost (or only) to those companies whose EMS programs achieve a desired level of proficiency. It is fairly common that environmental managers find themselves competing with production for project funding. The comparative dollar savings on P2 projects may be quite small compared to production improvements, and even if all projects have a good ROI, in most manufacturing environments, production usually wins. Having a no-interest fund available to implement pollution prevention projects would provide an incentive to develop a good EMS as well as provide funding for projects that have sound environmental gains but might not be funded the traditional way. Payback schedules would vary depending on the amount funded and whether there was a reduction in operating expense. In some cases the payment would simply be using the monthly savings derived from the project to pay back the loan, similar to the payment systems in a performance contract. This fee would have a five year sunset, at which time the success of the program would be reviewed. If the fund had adequate resources to maintain the program the fee would be allowed to expire. Ideally the number of businesses borrowing from the fund would increase and the number of contributors, or at least the size of their contributions, would decrease. If the fund was this successful and cash flow required additional contributions, the fee would be continued and reviewed after another two or three year period.
- Option 2: Add a small secondary fee to the one currently charged on hazardous waste generators. The fee would be designed to generate revenue of between \$50,000 and \$250,000 annually and used to fund a system of tax credits. These credits would be available first and foremost (or only) to those companies whose EMS programs achieve a desired level of proficiency. Those companies using the EMS option to P2 planning would be eligible for tax credits based on the financial scope of the project

¹**Notes:** Each loan fund has an advantage. In Fund 1 the advantage is a fee (tax) that has a limited lifespan and the fund would become self-sustaining at some point. In the case of Fund 2 the fee would likely be smaller, since it would require less capital to provide a tax credit than it would to make a loan.

as well as the environmental gains achieved. Part of the eligibility for the credit will be a requirement to provide quantitative measurements; a one page report containing baseline information, reductions achieved and a normalization factor. The tax credit would serve as incentive for the development of an EMS as well as provide financing to offset the time involved in collecting measurement data.

Environmental Performance Rating

- Consider using the Environmental performance Rating (emulating L&I's system) as a factor in determining permit fees.

2.9 Measurement

- Devise a one page summary sheet to be submitted with the EMS annual report, with fill-in-the-blank sheet of environmental outcome measures for the annual reporting of goals. This could act in conjunction with the national P2 results database which will eventually supersede the Region X database. If the goal is to entice more companies to use the EMS option, this would give more complete data.
 - Possible additional measures, such as those captured by the Region 10 P2 Results Measurement Project, might be of interest. Examples include greenhouse gas emission reductions, reductions in vehicle miles traveled, and use of recovered (recycled content) materials.
- If not already occurring, report EMS and P2 Plan outcome measures in a way that would enable internal auditors or external assurance providers to attest to the reliability of the data. This may help address this issue, which is commonly brought up in measurement circles. Right now there is no known auditing of P2 plan annual reports and the data they contain.

The remaining sections provide supplemental information and discussion on these recommendations.

3.0 Lean Manufacturing

There is a nationwide push to incorporate environmental management systems with lean manufacturing. On the surface this seems an obvious fit as both systems rely on continual improvement, designed to eliminate waste. The circle of those practicing lean manufacturing is continuously expanding, not only in the United States and Japan but throughout the world. Lean addresses waste and inefficiencies in the language of business. This presents an opportunity for linking Lean and EMS in a very productive way.

Many organizations have found that implementing lean concepts and tools results in improvements in environmental performance, even when lean activities were not initiated for environmental reasons.

Lean focuses on waste elimination as one of the best ways for business to increase profitability. In doing so, lean identifies seven manufacturing wastes. They are:

1. Overproduction – the creation of excessive inventory or more specifically, producing more than is needed before it is needed. Overproduction has been called “just in case” manufacturing, versus “just in time” manufacturing, defined as producing only what is needed in the immediate future.
2. Waiting – one of manufacturing’s biggest wastes is the idle time a product spends waiting to be processed. Inefficient material flow, production bottlenecks, idle employees, equipment breakdown all add cost to the final product that cannot be recovered.
3. Transporting – Handling and transporting product between processes adds no value to the product and can increase process “wait” time as well as increase the chance of product damage, a quality issue.
4. Processing – using overly complex and expensive equipment, redundant effort, unclear information or instruction, these all add unrecoverable cost.
5. Inventory – excess inventory ties up capital first in the purchase and storage of excess raw material and then in the production and storage of excess finished goods. It also ties up what could otherwise be productive manufacturing space. Given enough time the product may never be sold at a rate that would actually make a profit. Excess inventory also works to obscure those areas where real problems lie.
6. Motion – this waste refers to the movement of people, ranging from such things as trips to the far end of the building for tools to a poorly designed process from an ergonomic standpoint
7. Defects – product (or service) repair or rework is extremely costly. The time needed to repair, rework or remanufacture the defective item will likely swallow the profit margin. It may also result in the creation of scrap waste and add processing waste.
8. Some lean practitioners include an eighth waste: underutilization of employees – this refers to a lack of employee development. Companies that do not take advantage of the wealth of knowledge in their workforce end up with low morale, reduced productivity, increased product defects and high turnover. If a company is not continuously improving their workforce, it is doubtful that it will continuously improve as an organization.

One of the best ways to identify where these wastes are is through value stream mapping. Value stream mapping is the process of identifying/charting the flow of material and information through the processes from supplier to customer. Value stream mapping gives an organization a good pictorial view of its operations, including those areas that produce waste.

Most lean manufacturing materials are not designed specifically with improved environmental performance in mind, although it is usually a natural outcome with reduction in scrap and other inefficiencies. In addition, many lean manufacturing trainers and practitioners may not be thinking of waste in environmental terms, as noted by presentation notes from the draft summary of the “Lean and Environment Meeting” held in Deerfield, IL June 8-10, 2005: “The receptivity of organizations to lean-environment opportunities will likely be greater for organizations that already have environmental objectives as part of their organizational strategy.” Any Lean-EMS system should include some fairly specific guidance on how to implement lean for environmental performance improvements. This would be particularly helpful for smaller businesses.

Several articles discussing hybrid lean-environment programs mention the presumption of benefit in lean and hope to create the same presumption of benefit in lean-environment programs. Huh? The reasoning is that lean fosters a culture of efficiency and waste reduction that easily translates into environmental gains. There is one caution with this expectation. It is widely accepted that both P2 and lean manufacturing reduce operational expense, thus theoretically improving the competitiveness of the organization. Yet, requiring a cost-based justification for lean projects (as well as P2 projects) is still very common. The presumption of benefit in lean does not necessarily seem universal.

While lean is designed to be an employee involved and culture driven system, there is no shortage of companies implementing lean in standard top-down or single champion type system. A Lean-EMS hybrid that involves cooperation by management and all employees, will have a higher rate of success.

4.0 Quality Management Systems

There are many ways to implement continuous quality management aspects into a business. It can happen very basically with use of the traditional Plan-Do-Check-Act cycle. Or, a business can implement a more stringent and comprehensive system by following and meeting the Malcolm Baldrige Quality criteria and/or the Washington State Quality Award (WSQA), which closely follows the Baldrige model. There is also ISO 9000/9001 standard. And, finally, models such as the Green Zia offered in New Mexico, and systems like Oklahoma's Environmental performance & Recognition Program.

The Baldrige criteria are used nationally, and by WSQA. There are significant differences between ISO 9000 and Baldrige/WSQA. First, ISO is a very prescriptive program and is somewhat a "one size fits all" concept. It has a series of elements that a company must specifically address. The Baldrige and WSQA models are more open. While there are questions to answer for these models, how a business addresses the questions can be as individual as each company.

The Malcolm Baldrige Award (and similarly, the WSQA) is given to businesses and organizations that apply and are judged to be outstanding in seven areas:

1. **Leadership** - Examines how senior executives guide the organization and how the organization addresses its responsibilities to the public and practices good citizenship.
2. **Strategic planning** - Examines how the organization sets strategic directions and how it determines key action plans.
3. **Customer and market focus** - Examines how the organization determines requirements and expectations of customers and markets; builds relationships with customers; and acquires, satisfies, and retains customers.
4. **Measurement, analysis, and knowledge management** - Examines the management, effective use, analysis, and improvement of data and information to support key organization processes and the organization's performance management system.
5. **Human resource focus** - Examines how the organization enables its workforce to develop its full potential and how the workforce is aligned with the organization's objectives.
6. **Process management** - Examines aspects of how key production/delivery and support processes are designed, managed, and improved.
7. **Results** - Examines the organization's performance and improvement in key business areas: customer satisfaction, financial and marketplace performance, human resources, supplier and partner performance, operational performance, and governance and social responsibility. The category also examines how the organization performs relative to competitors.

Baldrige Award winners have repeatedly shown bottom line results in areas such as:

- Improved customer satisfaction
- Higher return on assets
- Greater employee productivity and satisfaction

- Increased market share
- Reduced cycle time
- Decreased time to market
- Lowered operating costs
- Increased revenue

Baldrige takes a different approach from most quality management systems in 5 different ways:

1. **The Criteria for Performance Excellence provide a framework for improvement without being prescriptive.** Organizations are encouraged to develop creative and flexible approaches aligned with organizational needs and to demonstrate cause-effect linkages between these approaches and their results.
2. **The Criteria are inclusive.** While other approaches focus on a single aspect, such as leadership, strategic planning, or process management, the Criteria describe an integrated management framework that addresses all the factors that define the organization, its operations, and its results.
3. **The Criteria focus on common requirements, rather than procedures, tools, or techniques.** Other improvement efforts (e.g., ISO, Six Sigma, Lean Manufacturing or accreditation) may be integrated into the organization's performance management system and included as part of a response to Criteria requirements.
4. **The Criteria are adaptable.** They can be used by large and small businesses, education and health care organizations, government and nonprofit organizations, and organizations with one site or multiple locations worldwide.
5. **The Criteria are at the leading edge of validated management practices.** They are regularly improved to enhance coverage of strategy-driven performance, address the needs of all stakeholders, and accommodate important organizational needs and practices.

Baldrige helps organizations in a number of ways, for example:

- It improves an organization's performance on the critical factors that drive success.
- It is a cost-effective way to gain an outside perspective on an organization's strengths and opportunities for improvement.
- It addresses the culture change component critical to creating continuous improvement after the low hanging fruit is picked.
- It is a way to energize and motivate employees, improving employee performance and satisfaction.
- It is a way to improve an organization's bottom line and increase market share. (The stock performance of Baldrige Award winners outperformed the S&P 500 for eight straight years by factor ranging from 3.5 to 5).

Baldrige core values include: visionary leadership, organizational and personal learning, valuing employees and partners, agility, focus on the future, managing for innovation, management by fact, social responsibility, focus on results and creating value, systems perspective. The questions asked on a Baldrige application relative to these core values are not dissimilar to the guidelines in Part C of the Global Reporting Initiative. For example:

- GRI 1.1 Provide a statement of the organization’s vision and strategy regarding its contribution to sustainable development.
- Baldrige 1.2 Describe your organization’s governance system. Describe how your organization addresses its responsibilities to the public, ensures ethical behavior, and practices good citizenship.
- GRI 2.9 Provide a list of stakeholders, key attributes of each, and relationship to the reporting organization.
- Baldrige P.1 Describe your organization’s business environment and your key relationships with customers, suppliers, partners and stakeholders.

A business that meets these criteria invariably finds itself with improved internal operations and improved stakeholder relations. Some of the Baldrige criteria have already been successfully incorporated into environmental recognition programs, such as New Mexico’s Green Zia Program and Oklahoma’s Environmental Performance and Recognition Program.

5.0 Mapping and Systems Tools

Despite the gains achievable through lean manufacturing, lean as a system is not designed specifically to achieve environmental gains.

5.1 *Process Mapping*

Lean can certainly be directed toward these gains, but the systems approach advocated by Bob Pojasek appears to be the one model that most directly targets environmental gains. This makes process mapping an ideal tool for integrating lean manufacturing and pollution prevention.

Hierarchical process maps “have been used for the following tasks:

- Determining “aspects” in an environmental management system (e.g., ISO 14001)
- Determining “hazards” in an occupational health and safety management system (e.g., OHSAS 18001)
- Taking a “process view” in a quality management system (e.g., ISO 9000)
- Looking for the sources of process variability in a Six Sigma project.
- Making the value stream understandable to workers and managers in a Lean project
- Determining security vulnerabilities throughout an operation

- Replace the “baked in” process descriptions in an enterprise resources planning system (ERP) with a system that is designed to support the business processes and allow flexibility in how the business processes are defined
- Implementation of effective financial controls to ensure that the financial reports are accurate and reliable for compliance with Sarbanes-Oxley”²

Process mapping has widespread applicability to a variety of business issues. It is not uncommon for purchasing, environmental management, accounting, shop management and other functions to not only operate independent of each other but often to work against the interest of one another. Process mapping can be used to demonstrate the interrelationship of all departments and processes, helping identify conflicts and redundancies and, working alone or with systems such as lean, help to eliminate waste.

Like value stream mapping, process mapping provides a visual representation of the flow of work in the facility. However, process mapping involves more complete identification of the sub-layers in a process and therefore provides a more thorough analysis of the waste streams and opportunities for improvement.

Process mapping also avoids one of the pitfalls of a non-EMS lean system; specifically that some processes, for example parts cleaning or painting, are not environmentally preferable choices yet meet Lean’s value-added criteria. As with Lean and Baldrige, process mapping requires employee participation at all levels, truly functioning well only when driven from the bottom up.

Process mapping diagrams the complete steps that a material passes through in the manufacturing process. The maps allow easy identification of all process inputs and outputs, yielding an easily identifiable way to document all waste streams. The accounting sheets³ (see below) can be used for each work step mapped out, and provide an excellent tool to identify P2 opportunities. Furthermore, process mapping software allows easy identification of product flow, making it easier to address such “lean” wastes as waiting and transportation.

² Dr. Robert B. Pojasek, Pojasek and Associates, Environmental Quality Management, 15 (2) 2005, In Press

³ “Selecting Your Own approach to P2” Robert B. Pojasek, published in Environmental Quality Management, 12 (4) 85-94, 2003 © 2003 Wiley periodicals Inc.

Figure 1: Resource Accounting Sheet

1. Describe the activity in the work step:
2. List all the support processes for this work step.

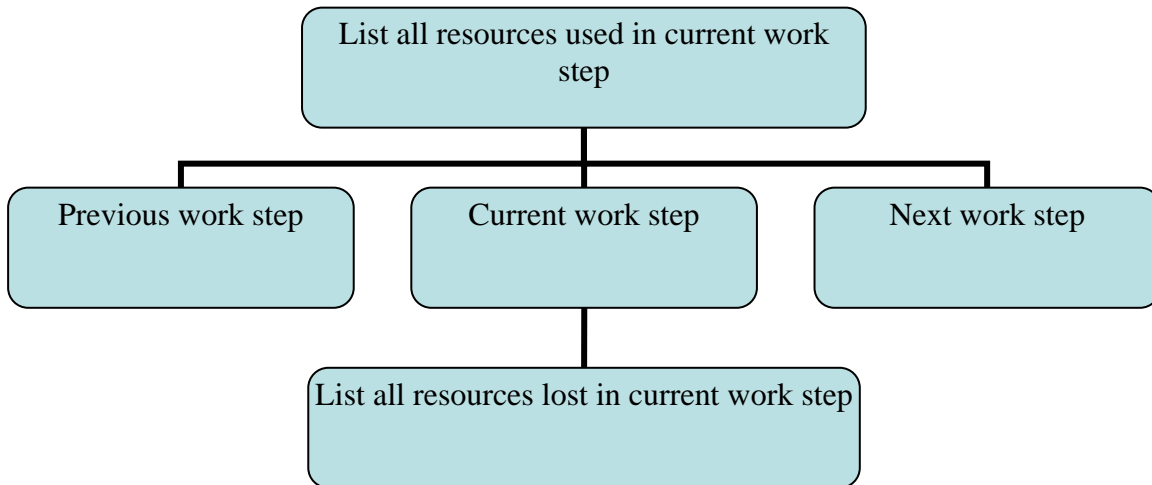
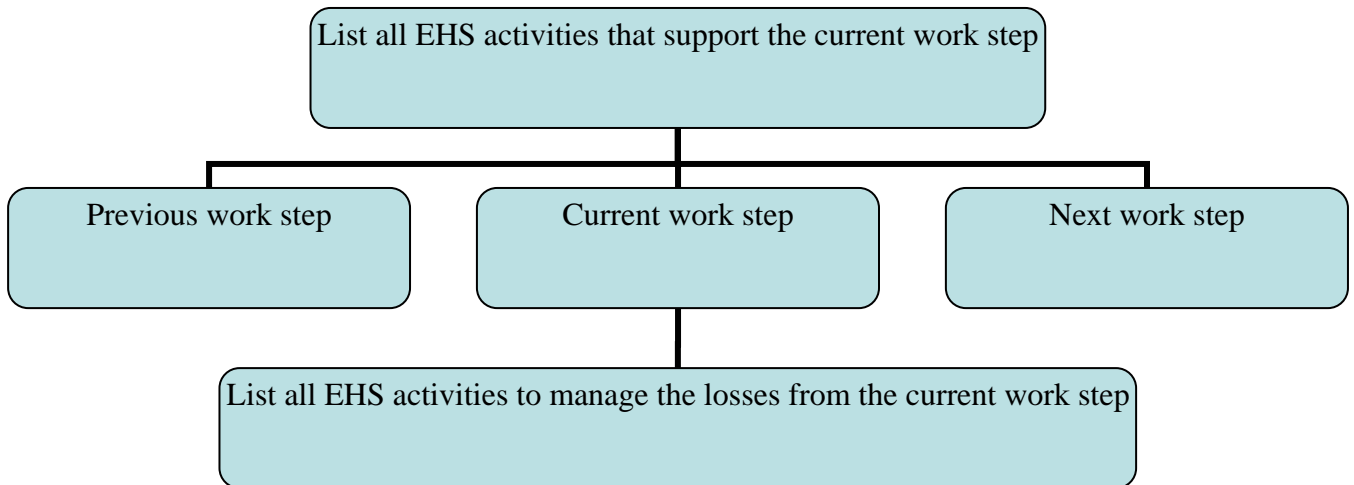


Figure 2: Activity Accounting Sheet

1. Describe the activity in the work step
2. List all actions performed to support the activities in the work step



5.2 *Eco-Mapping*

Eco-mapping is a free tool available to anyone looking to create a simple visual way to manage the environmental performance of their company. It is not anywhere near as robust as the other systems discussed, but it is not intended to be. It is well-suited to smaller companies who may be somewhat new to environmental management and easily enables employees to get involved. It does not require much in the way of training and can be done without having written procedures and instructions. It can:

- Provide a systematic method of conducting an on-site environmental review.
- Address a wide variety of environmental issues.
- Improve employee involvement and participation.
- Raise the awareness level of the entire company.
- Help identify, define and prioritize problems.

Eco-mapping originated in France and is slowly spreading throughout Europe, where environmental management standards are becoming prevalent.

6.0 Incentives

Incentives are critical to the success of any regulatory program, whether those incentives are internal or external. Attempts to develop incentives that do not require legislative changes have proven problematic.

Market-based or economic incentives can be defined as aspects of laws or regulations that provide financial rewards for polluting less and impose costs of various types for polluting more, thus imposing the impetus for polluters to pollute less. The incentives recommended in Section 2.0 above here are mostly geared toward financial rewards for polluting less. PPRC's Environmental Incentives Topic Hub may provide additional useful information on why and how to offer incentives.

<http://www.pprc.org/hubs/toc.cfm?hub=1003&subsec=7&nav=7>

There is also some monetary savings incentive inherent in the environmental performance rating model discussed in section 7.0.

7.0 Environmental Performance Rating

A program with some intriguing application for P2 is the Washington State Department of Labor and Industries (L&I) Worker's Compensation Insurance Program. This program is designed to provide health care coverage and lost wage replacement for workers who suffer injuries while on the job.

L&I's goal is to produce fair insurance rates which reflect the hazardous nature of each industry. Businesses pay premiums based on the degree of hazard their workers are exposed to. For example, employers engaged in industries such as metal fabrication will tend to pay higher insurance rates than employers engaged in retail store operations.

L&I develops a base rate, which is the average price for all employers in the classification. Only a few employers pay the base rate. Most employers pay a modified rate, based on their claims history, using an experience factor. The experience factor considers both the number of claims as well as the severity of claims, although severity is the major factor. For example, an employer with 12 claims requiring first aid only will have a lower experience factor than another employer with one claim for a back injury that required surgery, physical rehabilitation, lost wages and a permanent partial disability. In general though, employers with few claims will pay less than employers in the same classification who have many claims.

Labor and Industries also calculates the experience factor by comparing your accident costs to the average costs of other companies having the same classification as your business. An experience factor greater than 1.0 indicates a business has had higher than average claim costs. A factor lower than 1.0 shows a business has had lower than average claim costs. New businesses usually start out with a factor of 1.0 until they become experience rated.

An effective alternative to the standard worker's comp program is L&I's Retrospective Rating Program (Retro). Enrolling in Retro does not change the way a company's experience factor and rates are set, or how they pay premiums to the department. Retro is an optional financial incentive program offered by Labor and Industries to help qualifying employers reduce their industrial insurance costs. Employers can enroll on their own or in a group plan sponsored by a trade association or professional organization. Employers may receive premium refunds or they may be assessed additional premium based on their performance.

There are several benefits to membership in a group retro plan, which have historically outperformed employers enrolled on their own. For one, refunds possible for employers in group plans may be much higher than what they could achieve on their own, given the same level of risk. Another potential advantage of group Retro is the spreading of risk within the group. If a group member has a bad claim year, they may still get a refund if the group as a whole has done well. This depends on the group, as some group retro plans offer refunds only to those who perform better than average.

Many groups are very active in promoting accident prevention and claims management by group members. Some provide direct claims management help. Some even contract with a third party administrator to manage their group's claims. This is important, as each claim will affect an employers experience factor for three years (see table below). Claims management can enhance the group Retro performance, and may result in members seeing their own experience factor and industrial insurance rates improve over time.

A claim will affect the experience rating and premium rates for three years	
A claim with a date of injury between	Will affect the premiums for calendar years
July 1, 2002 and June 30, 2003	2005, 2006, 2007
July 1, 2003 and June 30, 2004	2006, 2007, 2008
July 1, 2004 and June 30, 2005	2007, 2008, 2009

Perhaps the best benefit for all involved is the fact that Retro groups tend to be very good at policing their own members. In addition to providing prevention programs, Retro groups also review their member's performance annually. Those members who perform below group average on a regular basis are coerced into improving their performance. Expulsion from the Retro group has occurred in cases where improvement was

8.0 Mentoring

Environmental mentoring is a partnership between two or more peers where one voluntarily shares recognized environmental experience with other entity(ies) having similar issues or challenges.

In the case of Ecology's EMS alternative and P2 plans, there may be companies that have already implemented lean or quality systems, or used process mapping, and integrated these into their EMS or P2 Plan. For those experienced companies, some may be willing and interested in sharing their learnings and expertise with others just starting out in the P2 or EMS requirements per Ecology. An EMS or P2 plan, and carrying out the objectives of the plans can require significant resources and a steep "learning curve". Some organizations, especially those on tight budgets, are unable to invest or dedicate resources to such efforts without assistance. Environmental mentoring is an effective tool for bridging this resource gap.

The role of the mentor is to facilitate learning through instructing, coaching, modeling, and advising. Mentees learn how others achieve successes. A few of the benefits for both parties are leveraged resources, and exposure to new ideas, knowledge, and best practices. The mentor also gains positive recognition as an environmental leader. Ecology could also devise an enticement or added incentive for mentor companies in the context of some of the incentive opportunities below.

If such an infrastructure to be developed, brief mentor training may be necessary to establish protocols for conflict of interest, proprietary information, and liability issues.

The PPRC Environmental Mentoring Topic Hub highlights some of the major issues and opportunities for fostering mentoring relationships keyed around environmental performance. (<http://www.pprc.org/hubs/toc.cfm?hub=1002&subsec=7&nav=7>)

9.0 Measurement

The axiom “what doesn’t get measured doesn’t get managed” has been bandied about so often that it sometimes loses its impact. This is unfortunate because it is as true today as it ever was. This factor, coupled with the increasing effort nationwide to gather environmental outcome data, suggests that any EMS, whether a lean hybrid, Baldrige hybrid, or process mapping effort, should have quantifiable measurements as one reporting goal. What follows is the table of outcome measures as defined by the NPPR and P2RX Results Task Force.

Table 1: Outcome Measures

Category	Definition	Metric	Unit of Measure
Reduced Operating Costs *	Financial savings derived from the outcome of implementing a P2 activity (including materials, labor, energy, machinery, administrative, waste management, or other process costs)	Dollars	Dollars/year
Non hazardous materials	Process input supplies and feed stocks that are not toxic or hazardous. Examples include packaging, building materials, aqueous cleaners, etc.	Materials Reduced	Pounds/year
Hazardous Materials	Process input supplies and feedstocks that are toxic or hazardous. Examples include chemicals, solvents, pesticides, etc.	Hazardous Materials Reduced (Includes reduction from more hazardous to less hazardous)	Pounds/year
Hazardous Wastes	State and/or federally listed hazardous or toxic wastes or wastes meeting the criteria for ignitability, toxicity, corrosivity or reactivity.	Hazardous Waste Reduced (include in-process recycle)	Pounds/year

Table 1 (Continued)			
Category	Definition	Metric	Unit of Measure
Air Emissions (includes mobile sources)	The release of any of the following: Toxic air emissions (includes CAA 112b HAP, TRI, and others) VOC's (carbon based compounds which are photo-chemically reactive (may be some double counting of HAP within VOC) Nitrogen Oxides Sulfur Oxides Carbon Dioxide PM Other air emissions not included above	Air Emissions Reduced	Pounds/year
Solid Waste	Wastes other than RCRA hazardous wastes	Solid Waste Reduced	Pounds/year
Energy	Energy is any source providing usable power	Energy Reduced	Specific to energy type such as therms or kwh
Green Energy	Energy produced from renewable sources such as solar, wind, geothermal, low-impact hydro, and biomass	Energy Generated Energy Purchased	Specific to energy type such as therms or kilowatt hours
Water Use	Incoming raw water, from outside sources, for operations, facility use and grounds maintenance.	Gallons of Water Reduced	Gallons/year
Water Pollution (includes point sources, nonpoint sources, and stormwater)	Quantity of pollutant discharged (for example, BOD, COD, toxics, nutrients, TSS, contaminants in stormwater and pathogens. Includes discharges to sewer systems, septic systems, injection wells, ground water, etc.)	Pounds Reduced	Pounds per Year

References

- Barwick, K. et al., *Facility Pollution Prevention Planning Requirements: An Overview of State Program Requirements*, NPPR Facility Planning Workgroup, 1997
- Baldrige National Quality Program, *Criteria for Performance Excellence*, NIST, 2005 version
- BSI, *Environmental Management Systems-ISO 14001*, BSI Group, 2005
- CERES. *Sustainability Reporting Guidance*, Pilot Draft, Facility Reporting Project, 2005
<http://www.facilityreporting.org/documents/PilotTestDraft/FRP%20Guidance-%20Pilot%20version.pdf>
- Doppelt, B. *Overcoming the Seven Sustainability Blunders*, *The Systems Thinker* Vol. 14, No. 5, 2003
- BRT Environment Task Force, *A Benchmarking Study of Pollution Prevention Planning: Best Practices, Issues and Implications for Public Policy*, The Business Roundtable, 1998
- Engel-Cox, J., & Fowler, K. *Pollution Prevention Opportunity Assessments for Research & Development Laboratories*. 1999.
<http://www.battelle.org/bookstore/BookTemplate.aspx?ISBN=1-57477-070-5>.
- ECOS, *Survey of State Support for Environmental Programs and Recommendations for Improved Effectiveness*, Environmental Council of the States, 2004
- EVMS Subcommittee, *The External Value Environmental Management System Voluntary Guidance*, Multi-State Working Group, 2004
- Greer, L. and Van Löben Sels, C. *When Pollution Prevention Meets the Bottom Line*
- Green Zia Environmental Excellence Program, New Mexico Environmental Department.
http://www.nmenv.state.nm.us/Green_Zia_website/
- GRI, *Sustainability Reporting Guidelines*, Global Reporting Initiative, 2002
- Hamner, B. *Managing for Sustainability Using Performance Management Systems*, Hamner and Associates LLC, 2005
- Heinz-Werner Engel. *Eco-Mapping Tool*. International Network for Environmental Management. 1998. http://www.inem.org/htdocs/toolkit/tools2_4_1_1.html.
- Hitchcock, D. and Atwood, D. *Developing Effective Systems for Managing Sustainability*, Axis Performance Advisors, 2001

Hitchcock D., and Atwood, D., *Embedding Sustainability into Your EMS*, Axis Performance Advisors, 2001

Kunz, D., *Measuring Sustainability in the Manufacturing Process: Incorporating the Next Step Principles into Rejuvenation, Inc.'s Environmental Management System*, Oregon Department of Environmental Quality, 1999

Langenwaller, G. *After Lean – What?*, Zero Waste Alliance, 2005

Northeast Pollution Prevention Roundtable, *Pollution Prevention Metrics Menu*, NEWMOA, 1999

Oklahoma's Environmental Performance and Recognition Program.
<http://www.deq.state.ok.us/CSDnew/EPRP/>

Pollution Prevention Division-OPPT, *Integrating Green Purchasing Into Your Environmental Management System*, USEPA, 2005

Pollution Prevention Division-OPPT, *Alternate Text for Image Map: Continuum of P2 Performance Measures*, USEPA, 2002

Pojasek, R. Pojasek and Associates. *Mapping Information Flow through the Production Process*, Wiley Periodicals, Inc., 2004

Pojasek. *Environmental Quality Management*, 15 (2) 2005, In Press

Pojasek. *Selecting Your Own Approach to P2*, Wiley Periodicals, Inc., 2003

Pojasek. *Lean, Six Sigma and the Systems Approach: Management Initiatives for Process Improvement*, Wiley Periodicals, Inc., 2003

Pojasek. *Creating a Value-Added, Performance Driven Environmental Management System*, Wiley Periodicals, Inc., 2002

Poppendieck, M. *Principles of Lean Thinking*, Poppendieck.LLC, 2002

PPRC. Environmental Mentoring Topic Hub
<http://www.pprc.org/hubs/toc.cfm?hub=1002&subsec=7&nav=7>

PPRC. Environmental Incentives Topic Hub
<http://www.pprc.org/hubs/toc.cfm?hub=1003&subsec=7&nav=7>

Rohm, H. *A Balancing Act*, Performance Measurement in Action, Volume 2, Issue 2

Ross and Associates Environmental Consulting, Ltd, *Pursuing Perfection: Case Studies Examining Lean Manufacturing Strategies, Pollution Prevention and Environmental Regulatory Management Implications*, USEPA, 2000

Ross and Associates Environmental Consulting, Ltd, *Lean Manufacturing and the Environment*, USEPA, 2003

Saba White Paper, *Regulatory Compliance: Maturing Your Organization Toward Competitive advantage*, SABA, 2003

Smith, R. Jr., *Profit Centers in Industrial Ecology*, Greenwood Publishing Group, Inc, 1998

Snyder, L. *Are Management –Based Regulations Effective?: Evidence from State Pollution Prevention Programs*, Harvard University, John F. Kennedy School of Government, 2003

Tenney, H. *A Comparison of Voluntary and Mandatory State Pollution Prevention Program Achievements*, Tufts University, 2000

Washington State Department of Ecology, *Summary of The Washington State Hazardous Waste Management Plan and Solid Waste Management Plan*, 2004

Washington State Department of Ecology, *Beyond Waste Issue Paper-Pollution Prevention Planning*, 2003

Washington State Department of Ecology, *Beyond Waste Implementation Status Report*, 2005

Washington State Quality Award. <http://www.wsqa.net/>

Womack, J. and Jones, T. *Lean Consumption*, Harvard Business Review, 2005

Womack, J. and Jones, D. *Lean Thinking*, Simon and Schuster, 1996

Appendix A – Comparison of Capabilities of EMS to Lean, Quality, and Systems Tools

EMS Components	Lean Manufacturing	Quality Management Systems	Mapping & Systems
Addresses source reduction-establishes P2 as preferred approach	Indirectly (seeks to eliminate waste through value stream identification)	Indirectly (through value creation process and performance improvement)	Yes
Waste recycled or treated if not amenable to P2	No	Indirectly (through social responsibility)	Indirectly
Available to the public	No	No	No
Communicated to employees	Yes	Yes	Yes
Management commitment to implement policies and periodically evaluate EMS	Yes	Yes	Yes
Continuous improvement established as part of system	Yes	Yes	Yes
Establishes and maintains objectives and targets consistent with P2 policies	Indirectly	Yes	Yes
Defines roles and responsibilities for implementing objectives	Indirectly	Yes	Yes
Provides for employee training, awareness and involvement in P2	Indirectly	Indirectly	Indirectly
Commitment to conduct periodic assessment, especially of P2 criteria	Indirectly	Indirectly	Yes
Annual performance report	No	Indirectly	No

Appendix B – Example of Adding Checkboxes to P2Plan Documentation

Excerpt from Page 13 of Ecology’s P2 Planning Guidance (Actual):

List your numeric performance goals for the categories in the table. The first four goals in the shaded area are required, the other six are optional. Note you are recording five year goals, not annual goals. See “help” for specific examples.

Five-Year Numeric Performance Goals

(Fill out this year’s column only)

(Read [Help](#) before filling out)

Goals for the 5-year life of this plan.	2005	2006	2007	2008	2009
Hazardous Substance Use Reduction (lbs)					
Hazardous Waste Reduction (lbs)					
Hazardous Waste Recycling (lbs)					
On-Site Hazardous Waste Treatment (lbs)					
Wastewater Reduction (gal)					
Energy Conservation (kwh)					
Cost Savings (\$)					
Air Emissions Reduction (lbs)					
Solid Waste Reduction (lbs)					
CO2 Emissions Reduction (lbs)					

Describe any goals....(etc.)

(Appendix B Continued on next page)

Appendix B (Continued)

Proposed Addition:

List your numeric performance goals for the categories in the table. The first four goals in the shaded area are required, the other six are optional. Note you are recording five year goals, not annual goals. See “help” for specific examples.

Five-Year Numeric Performance Goals

(Fill out this year's column only)

(Read **Help** before filling out)

Goals for the 5-year life of this plan.	2005	2006	2007	2008	2009
Hazardous Substance Use Reduction (lbs)					
Hazardous Waste Reduction (lbs)					
Hazardous Waste Recycling (lbs)					
On-Site Hazardous Waste Treatment (lbs)					
Wastewater Reduction (gal)					
Energy Conservation (kwh)					
Cost Savings (\$)					
Air Emissions Reduction (lbs)					
Solid Waste Reduction (lbs)					
CO2 Emissions Reduction (lbs)					

For the first four categories in the table, and any optional categories for which numerical goals are documented in the above table, (excluding cost savings), note any P2 strategies you plan to use in achieving these reductions.

Goals	Strategies To be Used in Achieving Goals									
	Process Mapping & Characterization	Process Control Technologies	Green Procurement	Chemical or Inventory Management System	Material Tracking	Lean Manufacturing	Quality Management	Design for Environment	Supply Chain Management	Other
Hazardous Substance Use Reduction	9	9	9	9	9	9	9	9	9	9
Hazardous Waste Reduction	9	9	9	9	9	9	9	9	9	9
Hazardous Waste Recycling	9	9	9	9	9	9	9	9	9	9
On-Site Hazardous Waste Treatment	9	9	9	9	9	9	9	9	9	9
Wastewater Reduction	9	9	9	9	9	9	9	9	9	9
Energy Conservation	9	9	9	9	9	9	9	9	9	9
Air Emissions Reduction	9	9	9	9	9	9	9	9	9	9
Solid Waste Reduction	9	9	9	9	9	9	9	9	9	9
CO2 Emissions Reduction	9	9	9	9	9	9	9	9	9	9

Describe any goals....(etc.)

