

SECTION ONE – ENVIRONMENTAL REGULATIONS

CHAPTER 12: Pollution Prevention and Environmental Management Systems

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12.1 Pollution Prevention (P2)

Most of us are familiar with the old adages “waste not, want not;” “one person’s trash is another person’s treasure;” and “an ounce of prevention is worth a pound of cure.” By embracing the wisdom behind these approaches, pollution prevention (P2) encourages businesses to identify and act upon opportunities that benefit their operations, as well as workers, communities, and the environment.



This chapter briefly discusses the benefits, tools, and opportunities common to the P2 approach. It also summarizes pollution prevention assistance and incentive programs offered by the Michigan Department of Environmental Quality (DEQ).

12.1.1 What is Pollution Prevention?

Parts 143 and 145 of the Michigan Natural Resources and Environmental Protection Act, Public Act 451 of 1994, as amended (Act 451), define P2 as preventing or minimizing waste generation or the environmentally sound reuse or recycling of those wastes that cannot be prevented. In Michigan, P2 is based on voluntary, multi-media efforts that are applied where they are practical, environmentally acceptable, and economically feasible. Only after P2 has been applied or considered should waste treatment, release, or disposal technologies be used in accordance with Michigan regulations.

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Source:

www.epa.gov/waste/nonhaz/municipal/hierarchy.htm

Common examples of P2 include:

- Replacing hazardous organic solvents with non-toxic aqueous cleaners.
- Modifying manufacturing and industrial processes to eliminate the need for hazardous substances.
- Conserving and reusing process water.
- Installing green infrastructure
- Purchasing mercury-free switches, relays, lamps, or other equipment.
- Modified packaging that creates less waste.
- Deconstructing a building and reusing certain materials rather than demolition and landfilling.
- Recycling metals, solvents, oils, cardboard, wood pallets, office paper, organics, and other recyclable materials.
- Purchasing products containing less toxic, bio-based substances that result in less hazardous waste being generated.
- Purchasing products that are built for disassembly and material recovery.
- Conducting energy audits and practicing conservation.
- Using certified green products such as cleaners, glues, paints, etc. that contain less toxic materials and reduce employee exposure, asthma reactions, and odor complaints.
- Replacing standard motors, pumps, and lighting with high efficiency units.
- Stopping leaks, drips, and spills; and instituting preventive maintenance practices.
- Developing emergency response plans and procedures.

12.1.2 Why Practice Pollution Prevention?

Pollution prevention is a scientific, continuous improvement approach that often results in cost reduction, risk avoidance, and enhanced competitive advantage. P2 not only helps to meet environmental goals, but also reduces waste, improves efficiencies, saves money, reduces potential liabilities, and mitigates hazardous exposures. Unlike costly pollution control measures, P2 offers important economic, regulatory, environmental, and social benefits that may often result in a more competitive business. A facility with an effective P2 program will often:

- Reduce waste treatment, transport, and disposal costs.
- Reduce costs for energy, water, and raw materials.
- Eliminate or minimize compliance issues and associated costs.
- Reduce future liabilities through improved quality of work, environment, and employee health and safety.
- Avoid costs of accidents and spills.
- Improve production times.
- Enhance its public image and community relations.

In addition, instituting green practices and showcasing a strong environmental ethic provides a competitive edge and may open up new markets for your products to others that are concerned about environmental and health impacts.

12.1.3 Getting Started

An excellent way to get started with any P2 effort is to draw upon the many resources available through the DEQ's P2 assistance programs, projects, and initiatives. To help you develop an action plan or start a P2 program, the following is a brief description of assistance activities and incentive programs, including industry partnerships and collaborations.

- i) **Financial Assistance:** A number of DEQ financial assistance programs are available to encourage the adoption of pollution prevention within the state.
 - a) **Small Business Pollution Prevention Loan Program:** Low-interest loans of up to \$400,000 are available to small businesses of 500 employees or fewer to finance projects that eliminate or minimize the generation of waste, result in environmentally sound reuse and recycling of wastes, or conserve energy or water within their organizations.
 - b) **Non-Point Source/Stormwater Grants:** Nonpoint source (NPS) pollution is pollution caused when rain, snowmelt, or wind carry pollutants off the land and into lakes, streams, wetlands, and other water bodies. Michigan's Nonpoint Source Program provides grants to local units of government and non-profit entities to reduce nonpoint source pollution statewide. The DEQ [Grants and Loans Catalog](#) provides more information on the DEQ's financial assistance opportunities.

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- ii) **Education and Outreach:** Educational opportunities through workshops, seminars, webinars, and conferences are regularly provided by the DEQ through partnerships with businesses, trade associations, and other groups. These events disseminate information on pollution prevention, new technologies, current regulatory requirements, and compliance assistance. For the latest available workshops, go to www.michigan.gov/deqworkshops. In addition, the DEQ, Office of Environmental Assistance, also publishes newsletters, bulletins, fact sheets, and case studies and distributes many other P2-related documents. A list of these publications is available on the DEQ Web site at www.deq.state.mi.us/pubcenter.
- iii) **Technical Assistance:** These programs focus on providing P2 information and technical assistance to companies, institutions, and communities.
 - a) Retired professionals provide on-site P2 assistance to businesses with 500 or fewer full-time employees in Michigan. Assessments are confidential, free of charge, and strictly non-regulatory. There is no obligation to implement the recommendations provided.
 - b) **Recycling Assistance:** Resources are available to assist companies in their recycling efforts.
- iv) **P2 Programs:** By participating in any of the following P2 programs, a business can receive well-deserved public recognition, customized assistance, and other benefits for P2 efforts. Website shortcuts for these programs are listed in 12.1.6 at the end of this chapter.
 - a) **Clean Corporate Citizen (C3) Program:** Regulated companies, municipalities, and institutions meeting certain environmental performance criteria can be designated as Clean Corporate Citizens. In return they receive positive public recognition and are entitled to certain regulatory benefits, such as streamlined air quality permit processing.
 - b) **Green Chemistry:** A program to promote and coordinate “green chemistry” research, development, demonstration, education, and technology transfer activities in Michigan.
 - c) **Green Communities Challenge:** This peer-to-peer network shares home-grown best practices to help Michigan communities overcome barriers on the path toward sustainability. Members can earn recognition for sustainability accomplishments and track progress by participating in the Challenge.
 - d) **Mercury Pollution Prevention Efforts:** an effort to promote the elimination of nonessential uses of mercury and provide information on the proper cleanup and disposal of mercury.
 - e) **Michigan Business Pollution Prevention Partnership (MBP3):** Open to all businesses, associations, organizations, and agencies, MBP3 is a voluntary P2 program designed to encourage businesses to initiate or expand their P2 practices. Participants receive public recognition for their efforts and involvement in a community of practice.
 - f) **Michigan Clean Marinas Program:** An alliance between the Michigan Boating Industries Association, Michigan Sea Grant College, and the DEQ to protect Michigan’s waterways through voluntary P2 efforts by businesses.

- g) **Michigan Turfgrass Environmental Stewardship Program:** This program is designed to advance P2, compliance, and environmental stewardship at golf courses, athletic fields, parks, schools, and municipal grounds, and lawn care companies. Properties are recognized for their environmental achievements and may become certified in the program.
- h) **Neighborhood Environmental Partners:** A recognition program intended to increase interaction between businesses and their neighbors, with the goal of enhancing the environment and the quality of life in the community.



12.1.4 The Pollution Prevention Plan

It has been shown that a systematic approach to planning, with measurable goals, results in effective pollution prevention. An effective P2 plan can reduce waste and costs. A good plan includes gaining full support of management, committing resources, and establishing policies that support reductions of waste, resources, water, and energy use within the company. Input from all levels of your business should be called upon to contribute P2 ideas, technical assistance, and decision-making. By following the steps outlined below, you can set the stage for a successful P2 program. A successful P2 program can help achieve goals set for compliance, environmental management plans, and sustainability efforts.

16 STEPS TO AN EFFECTIVE POLLUTION PREVENTION PLAN

- STEP 1** Get management's commitment and support.
- STEP 2** Develop a company pollution prevention policy statement.
- STEP 3** Gain ongoing, company-wide commitment.
- STEP 4** Establish a pollution prevention team.
- STEP 5** Select a pollution prevention coordinator.
- STEP 6** Establish reduction goals for: wastes, toxics, climate change, water, and energy.
- STEP 7** Establish priorities and procedures for conducting detailed assessments.
- STEP 8** Designate an assessment team.
- STEP 9** Conduct a facility-wide assessment.
- STEP 10** Identify potential pollution prevention opportunities.
- STEP 11** Perform technical and economic analyses on the potential P2 opportunities.
- STEP 12** Develop an implementation plan.
- STEP 13** Implement the selected projects.
- STEP 14** Evaluate project effectiveness annually and document results.
- STEP 15** Celebrate positive results and learn from negative results.
- STEP 16** Modify the plan as needed and select the next steps to be taken.

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- ✓ *Step 1: Get management's commitment and support.*

P2 programs are only as strong and effective as the company's internal commitment. Thus, the first and most important step is making the philosophy of pollution prevention a company priority. P2 should be incorporated into every aspect of the business, including mission and policy statements, budgeting, purchasing, design, and production. A high level manager should announce the program to employees, ask for their input in identifying areas where waste, toxics, water, and energy usage can be reduced, and seek their participation in carrying out all P2 projects.
- ✓ *Step 2: Develop a company pollution prevention policy statement.*

Putting the company's commitment in writing helps to legitimize the program with all employees and can lead to an attitude change that makes P2 efficiencies "an everyday part of doing business."
- ✓ *Step 3: Gain ongoing, company-wide commitment.*

Some companies have initiated bonuses or award programs for employees who make significant contributions or savings through P2 programs. Others find that employees derive satisfaction from being actively involved in decisions that affect their production and work-related activities.
- ✓ *Step 4: Establish a pollution prevention team.*

Once your facility establishes a clear commitment to P2, gather interested, appointed, and affected individuals for a brainstorming session (see Step 10). This group of individuals should include a cross-section from all levels of staff, including management to front-line workers in the purchasing, financial, clerical, production, maintenance, and warehousing areas.
- ✓ *Step 5: Select a pollution prevention coordinator.*

Heading the P2 team should be a Pollution Prevention Coordinator. This P2 champion is the one who coordinates the assessments, carries forward your team recommendations, and provides oversight to the implementation of projects. This person also acts as a point person for any questions, comments, or recommendations from other employees. Putting someone in charge helps ensure the program will move forward in a timely and effective manner.
- ✓ *Step 6: Establish overall reduction goals.*

The first goals need to be target goals such as achieving specific energy, toxics, water, or waste reductions by a set date. Then ask what steps the company needs to take to achieve this goal. Purchasing changes are probably the easiest and most powerful means of reducing toxics that result in hazardous waste and employee exposures as well as reducing energy usage.
- ✓ *Step 7: Establish priorities and procedures for conducting more detailed assessments.*

Before conducting an assessment, you must determine what will be measured, how costs will be assessed, who should be involved, and how the assessment will proceed. Identify potential obstacles and define the means for overcoming them. These obstacles will be less likely to impede the process if there is a mechanism for addressing them as they arise.
- ✓ *Step 8: Designate a detailed assessment team(s).*

Designate a team to perform detailed assessments (or an individual if staffing is tight).

✓ *Step 9: Conduct the assessment.*

An in-depth, comprehensive assessment is critical to a successful P2 plan. Experience has shown that only after a company realizes the true costs of its wastes will it have the motivation needed for an ambitious P2 effort. Also, by assigning waste costs to specific department budgets, greater efforts to eliminate costs associated with waste are likely to occur. An in-depth waste assessment helps a business to identify:

- Sources, compositions, and the true costs of wastes.
- Potential P2 opportunities and the benefits of acting on these opportunities.
- Obstacles to implementing P2 opportunities.

For a very small business, an in-house waste assessment might consist of a visual inspection of what goes into the trash dumpster, followed by research into local opportunities for recycling cardboard, office paper, plastic packaging, and other easy-to-recycle materials. Businesses with more complex operations should perform a walking tour of the facility observing the various points of waste generation and the conditions having the potential for causing accidents, health hazards, or environmental emissions. Discussions with operational staff typically reveal additional useful information. Other sources of important information include records of waste disposal costs, environmental compliance documents, and raw materials purchase invoices. Identifying the wastes that cost the most due to volume, disposal, or toxicity have good potential for P2 efforts.

Additionally, a business can request an Integrated Assessment that identifies P2 and compliance assistance opportunities within their facility. Businesses may also wish to have an assessment conducted by a professional technical consultant to characterize wastes and perform a cost-benefit analysis of each P2 option.



If your business, institution, municipality, or organization is interested in a free, confidential, integrated assessment, contact Nathan Hude, at 517-285-7847 or HudeN@michigan.gov.

If the facility can research the topic, there may even be a 'self-audit' checklist available to identify your own areas of focus. Contact your trade associations, business forums, or others for self-checklists or guidance. Other guidance for specific industries can be found in 12.1.6 at the end of this chapter.

✓ *Step 10: Identify potential pollution prevention opportunities.*

Once the information is collected and summarized, team members should discuss possible alternatives to reduce or eliminate waste or toxic-producing or energy or resource intense processes and/or ways to recycle waste streams. An initial list of P2 opportunities can typically be developed with simple brainstorming. However, for significant gains, the team should look for examples listed in the sector resources such as those listed above.

✓ *Step 11: Perform technical and economic analyses on potential P2 opportunities.*

Based on a set of selection criteria, an examination of the technical workability of P2 opportunities should occur, followed by an evaluation of cost and environmental impacts of each opportunity. This requires consideration of all costs and benefits involved, such as

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decreases in operating costs; changes in regulatory burden; future liabilities; and improvements in productivity, worker safety, environmental protection, and quality management practices.

Projects can vary from easy to hard; inexpensive too costly. When considering costs, think in terms of return on investment and long-term impacts. A stock investment with a 10 percent return per year is considered good. Note that this would require 10 years for the stock to fully pay back that initial investment. If an investment in waste, resources, or energy reduction saves enough money to pay for itself in 5-7 years, that's better payback than the stock market! In addition, it is likely that costs for waste disposal, energy, water, and other resources will only increase over time, making the payback timeline even shorter.

The P2 team should investigate possible funding sources for those projects that require capital investment. A financial analysis of any project is helpful in requesting funding. Members of the financial departments should be included in this process. Options with the highest rate of return should be presented to management as final recommendations. For energy related projects, see the funding discussion under Section 12.1.5.d.

✓ *Step 12: Develop an implementation plan.*

With management's decision to act upon given P2 opportunities, steps to create waste, toxics, resource, water, and energy reduction actions must be designed. Financial and personnel resources must also be designated. An excellent financial resource is available from the Small Business Pollution Prevention Loan Program. Low-interest loans of up to \$400,000 are available to small businesses of 500 employees or less, for financing P2 projects.



For additional information on the loan program, contact the Environmental Assistance Center at 800-662-9278 and ask to speak to the Small Business P2 Loan Program Manager.

It is important that each step of the implementation plan be approved by the P2 team. For each step or action to be taken, clearly indicate the following:

- Action to be implemented.
- Person or persons responsible for implementation.
- Possible barriers and ways for overcoming them.
- Time for action to be completed.

✓ *Step 13: Implement the selected projects.*

Inform all employees about the selected P2 projects and begin the implementation phase. All involved employees should have a clear understanding of the purpose of the P2 project and their role in implementing it. The pollution prevention team members should lead other employees and provide guidance in the implementation process.

✓ *Step 14: Evaluate project effectiveness and document results.*

By reviewing the program's successes and failures, managers can assess the degree to which P2 goals are being met and what the economic results have been. The comparison identifies P2 techniques that work well and those that do not. This information helps guide future P2 assessment and implementation cycles. In order to evaluate project effectiveness, a set of baseline data (gathered during the waste assessment phase/Step 9) should be used to measure progress. Periodically conduct tests to determine if and where waste and hazards have been reduced. Results should be documented. This is a good way to determine if alternative production methods are working as expected. It is also an opportunity to re-evaluate methods and make any corrections.

✓ *Step 15: Celebrate positive results and learn from negative results.*

Once the results are known, celebrate the positive steps forward. Are you purchasing less toxic materials and reducing hazardous wastes? If so, this means you're reducing the exposure to your employees as well as the disposal costs. Post the information where employees and the public can see what you're doing to save money and protect the environment as well as the health of your employees and customers. As we all know, not all new projects are successful. If you find a P2 project isn't working as expected, determine if it can be improved or if something different is indicated or if it should be shelved until new resources are available. Learn from the experience but keep working on improvements.

✓ *Step 16: Modify the plan as needed and select the next steps to be taken.*

The pollution prevention plan should evolve as the P2 program proceeds. Goals once achieved can be expanded or new goals can be set, and policies can be revised. Maintaining a viable P2 program requires continued support and involvement from management and continuing effort from everyone involved in planning and implementation. With support and enthusiasm from respected persons within the company, employees at all levels can and will want to participate. Pollution prevention can become a part of quality management practices, contributing to the company bottom line.

12.1.5 Common Pollution Prevention Opportunities and Techniques

There are several ways to increase efficiency and prevent waste in all aspects of a business. The following is a brief review of some of the most common P2 opportunities and techniques a business can use to achieve its P2 goals. For additional ideas or more in-depth information, contact the OEA at 800-662-9278.

12.1.5.a Cost Accounting

Experience has shown the most successful P2 programs are those that account for the true cost of wastes, including expenses for lost raw materials; staffing; needed paperwork and insurance; sample analyses; and storage, treatment, and disposal costs. Successful billing strategies to account for the true costs of wastes include the following approaches:

- Charge direct and indirect costs of all air, land, and water discharges to specific processes, products, or departments.
- Allocate treatment/disposal costs to operations/departments that generate the waste.
- Allocate utility costs to specific processes, products, operations, or departments.

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Once all the true costs of the various processes or products are known, you may determine if the waste, toxic substances use, resource use, and energy costs for a particular product are much larger than expected or identify the source of most of the hazardous waste. These are good areas to begin the focus of P2 efforts to reduce those costs and liabilities.

12.1.5.b Purchasing and Inventory Management

A purchasing policy on non-toxic and energy efficient alternatives can result in significant improvements, but purchasing staff need guidance on what those alternatives are. Purchasing changes are probably the easiest and most powerful means of reducing toxics that result in hazardous waste and employee exposures as well as reducing energy usage. This can also impact the companies you select to purchase from. Select suppliers or manufacturers who also exhibit your same environmental commitment. Don't forget this also opens up a market for your products.

- Order products according to need. The cost associated with the disposal of surplus hazardous materials or the resulting hazardous wastes, often exceeds the purchase price of the item or raw material. A non-toxic alternative that does not generate hazardous waste may reduce those costs, risks, and regulatory oversight.
- A coordinated material purchasing program can monitor all requests for products throughout the company or plant and implement efficient purchasing policies.
- An inventory control program can promote sharing of materials between common users, provide data on who is using extremely hazardous products, identify large volume users, locate unused caches of materials, and identify where waste reduction/material substitution options are viable. Inventory control should rotate stock on a first-in, first-out basis.

12.1.5.c Packaging, Shipping, and Containers

A second look at the transportation and product packaging that companies send and receive often leads to waste reduction without sacrificing product safety or quality.

- Request that deliveries be shipped in returnable/recyclable containers.
- Work with suppliers and customers to eliminate excess packaging.
- Increase your use of reusable shipping containers and recycled or recyclable packaging.
- Purchase products in bulk, in concentrated form, or in quantities matching process demand.
- Incorporate language into contracts specifying P2 requirements or preferences.

12.1.5.d Energy Usage and Efficiency

Energy use is often seen as a key area where, through efficiency and conservation, operating costs can be readily controlled and often significantly reduced. Energy savings can be achieved by simple changes in daily operations, maintenance practices, and worker habits, and can be implemented at little or no cost. Although more significant energy savings may involve investment in new/upgraded equipment, these simple changes typically have excellent financial returns.

The state Energy Office within the Michigan Agency for Energy provides some incentives for energy efficiency and renewable energy projects. Their information is available on-line at <http://michigan.gov/energy>.

Federal incentive programs are listed and explained on the following Web site:

<http://energytaxincentives.org/consumers/>

Most Michigan utility companies also provide a number of incentives.

Consumers Energy Rebates	www.consumersenergy.com/eeprograms
Consumers Energy –Products	www.consumersenergy.com/products
DTE Energy/MichCon	www.dteenergy.com/businessCustomers/
Indiana Michigan Power	www.encyclopedia.com/efficiency
Lansing Board of Water & Light	www.lbwl.com/energysavers/
Other Municipal Utilities	www.michigan-energy.org

Lastly, there are many financial assistance programs available to Michigan small businesses to fund energy efficiency improvements, including the rapidly emerging Property Assessed Clean Energy (PACE) programs. Other financial assistance programs include Michigan Saves, the Rural Energy for America Program (REAP), Rural Business Enterprise Grants Program, the Small Business Pollution Prevention Loan Program, and the U.S. Small Business Administration Loans and Grants Program.

Basic energy efficiency steps to consider include:

- Submeter electrical energy usage for detailed information on when, how, and where electrical energy is used. Some pricing is based on time of day and peak usage. Changing or staggering startup times may save money at no cost. Knowing how and where energy is used is critical to identifying major usage in order to focus P2 efforts and gain best savings.
- Maintain equipment and the facility through an ongoing maintenance program.
 - i) Furnaces
 - ✓ Analyze flue gas and adjust the fuel-air ratio to increase efficiency.
 - ii) Process Heat, Heat Recovery, and Heat Containment
 - ✓ Enhance sensitivity of temperature control and cutoff.
 - ✓ Use flue gas waste heat to preheat combustion air.
 - iii) Process Cooling: Cooling Towers and Chillers/Refrigeration
 - ✓ Use a cooling tower instead of refrigeration when outside temperature allows.
 - ✓ Use waste heat for absorption refrigeration.
 - iv) Motors and Drives
 - ✓ Develop an ongoing motor replacement program to upgrade existing motors to high efficiency motors. Where power factor is not controlled elsewhere in the shop, choose replacement motors with high power factor.
 - ✓ Use variable speed drives to control motor speeds where varying pump or fan flows can be utilized.
 - v) Compressed Air Systems
 - ✓ Compressed air is almost always the most expensive means for performing work at a facility and should only be used when essential.
 - ✓ Establish a vigorous maintenance program and check for leaks often.
 - ✓ Operate the system at the lowest acceptable pressure.

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- vi) Electrical Power
 - ✓ De-energize excess transformer capacity and increase power factor for facilities and equipment by installing the proper combination of fixed and variable capacitance.
- vii) Heating, Ventilation, and Air Conditioning (HVAC) Equipment
 - ✓ Develop an optimal start/stop schedule for your HVAC system.
 - ✓ Use seven-day, programmable thermostats to coordinate system operations with occupancy loads.
 - ✓ Install variable air volume systems where practical.
 - ✓ Install an airside, rooftop, central, or waterside economizer to use outside air to cool the space when outside temperatures allow.
- viii) Lighting
 - ✓ Install low-mercury T-8 or T-5 fluorescent systems with electronic ballasts or LEDs (light-emitting diodes).
 - ✓ Remove two out of four tubes in fluorescent fixtures where lower light levels are acceptable. Also, disconnect the ballast that operates these tubes to save even more energy (especially magnetic ballasts). If necessary, install reflectors or higher output lamps so more light is utilized.
 - ✓ Install low-wattage, long-life, LED exit signs, or bulbs.
 - ✓ Use high-efficiency halogen, low-voltage halogen, quartz, or LED lamps where lighting quality is critical (e.g., retail displays).
 - ✓ Replace mercury vapor or other inefficient, high-intensity, discharge lighting systems with an efficient, metal halide, sodium, or other high-output fluorescent system.
 - ✓ Tailor lighting levels to the task and occupants, and increase the use of “task lighting.”
 - ✓ Rewire fixtures or use dimming controls so unnecessary lighting can be turned off.
 - ✓ Install occupancy sensors in areas of sporadic use. (Examples include supply closets and restrooms.)
 - ✓ Install light sensors near windows to shut down light sections on bright sunny days.
- ix) Office Equipment
 - ✓ When purchasing new equipment, buy Energy Star®, or higher efficiency models. Also compare the “Energy Guide” label included on many major appliances to determine the more efficient model.
 - ✓ Consider installing Energy Management software on servers to control sleep and shutdown modes of desktop computers.

12.1.5.e Solvent Substitution, Green Cleaners, and Safer Chemicals

Regulatory and cost pressures, along with worker safety and liability issues, have led to the development of alternative cleaning technologies, safer solvents, and improved cleaning and recovery equipment. In recent years, new programs have developed to certify what are ‘green’ cleaning materials and processes. Green Seal is one certification program and provides a list of certified green cleaners at www.greenseal.org/Home.aspx. Implementing safer, green cleaning technologies has become easier and often only requires purchasing materials off the shelf or from a good supplier that also provides training. Facilities that want to do their own research will need:

- A better understanding of the chemistry, mechanics, and other fundamentals of cleaning.
- A clear determination on how clean equipment or process materials truly need to be.
- A review of upstream processes/practices and how they influence the cleaning process.
- An awareness and understanding of the pros and cons of potential alternatives.
- Some degree of modification of both up- and down-stream processes and practices.
- A significant experimentation and learning period for identifying appropriate and effective alternative cleaners, optimizing cleaner concentrations and cleaning times, adjusting equipment and process operations, and modifying employee practices.

In general, pollution prevention opportunities for solvent cleaning processes include:

- i) Using alternative cleaning technologies such as:
 - ✓ Aqueous and semi-aqueous cleaning processes.
 - ✓ Thermal and steam cleaning processes.
 - ✓ Abrasive blasting using dry ice, baking soda, starch, plastic, and other media.
 - ✓ Supercritical carbon dioxide solvent cleaning.
- ii) Using alternative/less hazardous solvents with low vapor pressure, low toxicity, or non-ozone-depleting characteristics such as lactic acid, dimethyl esters, DMSO, n-methyl pyrrolidone, glycol ethers, terpenes, soybean, and other bio-based solvents. Web sites that may be useful to identify alternative solvents include:
 - Clean Gredients list of solvents: www.cleangredients.org
 - Clean Production Action's 'Green Screen for Safer Chemicals' program is a guide for decision making towards the use of the least hazardous materials: www.cleanproduction.org/Greenscreen.php
 - U.S. EPA Safer Choice: www.epa.gov/saferchoice
- iii) Extending solution life by pre-cleaning, using in-line filtration, countercurrent flows, reducing drag-out and evaporative losses, and removing sludge and surface oils/scum.
- iv) Reclaiming/recycling spent solvents using distillation, filtration and vapor recovery equipment, and off-site recycling services.
- v) Evaluating and modifying upstream processes and practices, solvent handling/storage practices, and employee practices for reducing solvent waste generation.

12.1.5.f Water

Water usage and wastewater discharge treatment entail substantial costs for many businesses and manufacturers. By metering water usage and regularly taking inventory of all water users, companies can reduce a major operating expense and reduce the demands on wastewater treatment facilities. Reducing water usage, generally also saves energy as it need to be pumped. Funding for some water efficiency steps may be provided by your local utility (Section 12.1.5.d). Reducing water usage also reduces the water bills as well as the amount of wastewater that requires costly treatment.

- Cleaning Systems: Replace high-volume hoses with high-pressure, low-volume cleaning systems.

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- **Cooling Towers:** Install or replace conductivity controllers on cooling towers to reduce the amount of blowdown water wasted. A medical supplier replaced a controller on an existing tower and reduced their annual water usage by 34 percent or over 437,000 gallons. Reuse treated wastewater for cooling water. Reuse cooling tower blowdown waters for: cleaning air scrubbers; landscaping (determine if mineral concentrations are acceptable); etc.
- **Equipment:** Purchase water efficient equipment and appliances including cafeteria dish washers, laundry washing machines, dual flush toilets, waterless urinals, etc. See the U.S. EPA's WaterSense Web site at: www.epa.gov/WaterSense/
- **Graywater:** Separate out graywater from treatment waters and sanitary wastes so they can be reused in other non-potable applications such as irrigation or toilet flushing during expansions, renovations or new construction.
- **Landscaping:** Use native plantings to reduce or eliminate potable water use for irrigation or reuse storm water, treated wastewater, etc.
- **Conduct irrigation system audit or inspection.** Routinely maintain the system.
- **Non-contact Cooling Water:** Once through non-contact cooling water should be replaced by a closed-loop cooling water system.
- **Rinsing:** Use countercurrent rinsing and equip all hoses with shut-off nozzles.
- **Storm water reuse:** Capture storm water and use it for irrigation, toilets or non-critical process usage.
- **Valves:** Install automatic shut-off valves on equipment to stop water flow when not in use.
- **Wastewater Reuse:** Investigate the reuse of treated wastewater for separately supplied, non-potable uses. This could include: cleaning air scrubbers; floor washing; fire response supply (confirm this is acceptable with related regulatory staff); landscaping; toilets; etc.
- **Water Demand:** Determine if the need for the water usage is critical or could be reduced or eliminated.
- **Water Treatment Costs:** Determine if the pollutants that require expensive treatment could be eliminated from the wastewater sources rather than do expensive treatment.

12.1.5.g By-Product Synergy

By-Product Synergy (BPS) is the matching of under-valued waste or by-product streams from one facility with potential users at another facility to create new revenues or savings with potential social and environmental benefits. The resulting collaborative network creates new revenues, cost savings, energy conservation, reductions in the need for virgin-source materials, and reductions in waste and pollution, including climate-changing emissions. These are quantifiable benefits to the environment, economy and communities (US Business Council for Sustainable Development).



If you are interested in pursuing a BPS solution for one of your by-product streams, please contact the DEQ's Environmental Assistance Center at 800-662-9278.

12.1.5.h Life Cycle Thinking, Greenhouse Gases, and Sustainability

Life cycle thinking is a product management system that helps companies minimize the environmental and social burdens associated with their product and supply chain during its entire life cycle. It is designed to assist in decision-making at all levels regarding product development, production, procurement, and final disposal. Life Cycle Thinking offers companies the possibility to examine a range of key impact categories and indicators, such as materials extraction, water use, and embodied energy, thus assessing the environmental and social impacts of a specific product.

In recent decades, life cycle thinking continues to set the stage and provide consistent data for product life cycle management systems that document and track such environmental impacts as acidification, eutrophication and global warming potentials.

- UNEP and SETAC- Life Cycle Initiative: www.lifecycleinitiative.org/
- Circular Economy: www.circulareconomy.com/

For example, the reduction of greenhouse gas (GHG) emissions reflects a direct impact on climate change potential. The carbon footprint is a measure of how domestic, commercial, and social activities are affecting the environment in terms of the amount of greenhouse gases produced per year, measured in tons of carbon dioxide, a well-documented GHG. (Global Footprint Network: www.footprintnetwork.org/)

The above activities are now providing a systematic approach to sustainable development, a concept first coined in 1987. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- The concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

Source: Our Common Future, U.N. World Commission, Gro Harlem Brundtland Oslo, 20 March 1987

12.1.5.i Community Outreach

Community outreach is the practice of conducting local public awareness activities through targeted community interaction. Successful community outreach focuses on an issue relevant to the community and acknowledges the community's challenges in addressing the issue.

Good business and community partnerships are essential to successful outreach initiatives. These partnerships should be intentionally reciprocal interactions in which both partners share equally in the rewards and challenges of the partnership. By serving as sponsors, volunteers, fund-raisers, or educators, local businesses can help make their communities better places to live and work.

The DEQ recognizes the importance of these outreach efforts and values businesses and their community partners who have worked together to improve the environment in their community. Visit the Neighborhood Environmental Partners Program Web site for information (under Project Tools) on getting started in with your environmental community outreach efforts.

12.2 Environmental Management Systems

12.2.1 What is an Environmental Management System (EMS)?

An EMS is one of several structured management tools designed to provide a consistent approach to the activities, products and services that are within your control and influence. The EMS helps identify, control, and monitor the activities at your facility that could impact the environment. It is a system that encourages your facility to incorporate environmental issues into everyday operations at all functions and levels. An EMS provides you with a structure for overseeing your programs. It does not, however, tell you what to manage. You make the decisions on what to manage based on your business needs, your resources, and your identification of significant activities. The idea is to integrate all of your environmental responsibilities into the daily decision making and overall management of operations at your facility to increase effectiveness and efficiency.

Several countries originally developed the idea of EMS to improve environmental performance, to create a more “level playing ground” in the world market, to provide a competitive advantage, and to give credibility to environmental programs. An EMS is practical for a wide variety of operations including small businesses, large industry, educational institutions, and government agencies.

There is no one type of EMS, but there are standards or formats that you can follow in developing your system. The most well-known and widely used EMS standard in the U.S. is the ISO 14001 standard. The International Organization for Standardization (ISO), consisting of representatives from industry, government, non-governmental organizations, and other entities, finalized the ISO 14001 EMS standard in September 1996, updated in November 2004, and most recently in September 2015. The intent of this standard is to produce a single framework for any EMS that can accommodate varied applications all over the world. It is a standard that is harmonizing environmental management practices and requirements around the globe. All EMS standards have the same basic components, which are identified below:

ISO 14001 Environmental Standard

Environmental Policy and Scope

Environmental Planning

- Identifying Aspects and Impacts
- Significance Ranking
- Setting Objectives and Targets
- Environmental Management Programs (EMPs)

Implementation and Operation

- Roles, Responsibilities, Time Frames
- Training and Competence, Communication
- Controls and Documentation
- Emergency Preparedness

Monitoring and Measurement

- Evaluation of Compliance
- Dealing with Non-conformances
- Corrective and Preventative Actions
- Records
- EMS Audit Program and Procedures



Implementation of an EMS does not substitute for compliance with regulations but can improve your compliance record and help you address issues that are not covered by regulation. In short, environmental management is an ongoing improvement process propelled by the desire to comply with regulations and operate cost effectively. Fully developing and integrating an EMS into your day-to-day management processes and operations is a more effective way of doing business.

12.2.2 What is a Responsible Care Management System?

The Responsible Care 14001 and the Responsible Care Management System (RCMS) are business tools developed by the American Chemistry Council. The original version of the Responsible Care standard has been in place since late 1980s. Both Responsible Care systems go beyond the scope of a typical Environmental Management System. An ISO 14001 Environmental Management System typically does not include off-property activities, employee health and safety, and consideration and engagement of the local community and stakeholders. In addition to these elements, Responsible Care also considers the environmental risks associated with suppliers and distributors and security. Both versions are comprehensive environmental, health, safety and security performance improvement initiatives.

12.2.3 What are the Benefits of an Environmental Management System?

Developing and implementing an EMS for your Michigan business can help improve the triple bottom line of your operation; economic, environmental, and social. It can also help you qualify for Clean Corporate Citizen (C3) designation. By bringing environmental factors into daily business decisions, implementation of an EMS helps accomplish the following:

- ✓ **Reduce costs** – Facilities that have implemented an EMS show improved operating efficiency by focusing on important issues, developing standard procedures, and increasing employee training. Most companies have reported reduced costs through the systematic process of identifying potential risks and impacts. Some facilities have earned favorable status on financial indexes based on their reduced legal liability, reduced likelihood of catastrophic occurrences, and improved environmental and social responsibility.
- ✓ **Assume a competitive advantage** – There is an expanding “green” market in the world. Consumers and manufacturers are giving preference to products from environmentally responsible suppliers. An EMS can help obtain that “green” image. Several larger companies in the U.S., especially in the automotive and electronic fields, have mature systems and are now requiring (or strongly encouraging) that their suppliers implement an EMS.
- ✓ **Improved image with stakeholders** – An EMS can improve your image and give credibility to your environmental programs. Your local politicians, environmental regulators, and community groups see development of an EMS as an indication of a good corporate citizen and the willingness to go beyond compliance. Accordingly, they will recognize and reward these efforts.
- ✓ **Enhance regulatory compliance** – An EMS can help improve regulatory compliance and reduce liabilities associated with noncompliance. The adoption of procedures and work instructions and additional training programs typically adds consistency and stability to business operations. It enables improved control over potential impacts and helps anticipate and control upsets.

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- ✓ **Improve environmental performance** – The systematic identification of potential environmental impacts and continual improvement goals lead to more efficient business operations. Achieving these goals will ultimately lead to improved performance, a cleaner environment, and a sustainable community.

12.2.4 What are the Stages of Environmental Management System Development?

Typically, an EMS undergoes three states of maturity:

- 1) In the years 0 – 2, the EMS is **developed and implemented (internal value systems)**
 - a. Large changes are typically avoided in these years
 - b. Tends to be re-active, often focusing on “end-of-pipe” controls
 - c. Staff strive to fully understand ISO 14001 (or other) requirements
 - d. The system focuses on learning how to communicate to stakeholders
 - e. It establishes what and how to disclose information to the public
 - f. It tends to be driven by one person (typically the EH & S leader)
 - g. There is limited involvement and/or buy-in
 - h. Determination of significant aspects and hazards is often complex and time consuming
 - i. Management provides resources, but their involvement is minimal
 - j. Very simple metrics are used to report results toward goals
- 2) The years 2 – 5 can be described as **deployment**
 - a. Linkages within the system are strengthened
 - b. EMSs are in conformance with standard requirements
 - c. Benefits (social, environmental, financial) are demonstrated
 - d. Alignment with other requirements and systems becomes integrated (quality, health, safety, security, environmental, purchasing, etc.)
 - e. Consistent metric systems for reporting are developed to measure results and trends
 - f. It moves away from a one-person driven system to include a cross-functional team
 - g. Objective and targets tend to be modest
 - h. Corrective and preventative action processes tend to be weak
 - i. Communication and reporting systems are being refined
 - j. Cultural change is starting
- 3) Five+ years the EMS is **mature or an external value system**
 - a. Stakeholders are involved with EMS review
 - b. The organization achieves and maintains high levels of performance
 - c. Value is demonstrated
 - d. Efficiency through process improvements is a primary activity
 - e. Inclusion of collected data in strategic planning takes place
 - f. Corrective and preventive action processes are well established
 - g. Objectives and targets are “stretch” goals
 - h. There is a high level of management involvement
 - i. The management system serves as a launch pad for new initiatives
 - j. Metrics are well established and support business goals
 - k. Employees are held accountable for performance
 - l. Management is committed to environmental protection (including the allocation of resources and time and the assignment of responsibility)

WHERE TO GO FOR HELP

SUBJECT: Pollution Prevention (P2) Program Assistance

CONTACT: DEQ, Pollution Prevention and Stewardship
800-662-9278
www.michigan.gov/p2

P2 General Resource Web sites

The following Web sites are great for researching any P2 topic:

- Great Lakes Regional Pollution Prevention Roundtable (www.glrppr.org/)
- P2RX – Pollution Prevention Resource Exchange (www.p2rx.org/)
- U.S. EPA Industry Sector Profiles at nepis.epa.gov (search “Sector Notebook”)

Common Resource Web Sites

Common Program Web site	Web Address
Brownfield Programs	www.michigan.gov/deqbrownfields
Electronic Waste	www.michigan.gov/electronicwaste
Energy	www.michigan.gov/energyoffice
Environmental Education	www.michigan.gov/environmentaled
Grants & Loans	www.michigan.gov/deqgrantsandloans
Green Chemistry	www.michigan.gov/greenchemistry
Green Construction & Recycling	www.michigan.gov/deqconstruction
Integrated Assessment Program	www.michigan.gov/p2
Marinas	www.miseagrant.umich.edu
Mercury P2	www.michigan.gov/mercuryp2
Neighborhood Environmental Partners	www.michigan.gov/deqnep
Nonpoint Source Pollution Grants	www.michigan.gov/nps
P2 & Stewardship	www.michigan.gov/p2
P2 Community	www.michigan.gov/p2community
P2 Small Business Loans	www.michigan.gov/p2loan
Recycling Contacts	www.michigan.gov/deqrecyclingcontacts
Stewardship Programs	www.michigan.gov/p2
Turfgrass Stewardship	www.mtesp.org
Events and Training Opportunities	www.michigan.gov/deqevents

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SUBJECT: EMS Development/Michigan's Clean Corporate Citizen (C3) Program

CONTACT: DEQ, Pollution Prevention and Stewardship
800-662-9278 | www.michigan.gov/deqc3

SUBJECT: EMS Standards

CONTACT: American National Standards Institute (ANSI)
212-342-4900 | www.ansi.org

SUBJECT: EMS Standards

CONTACT: Registrar Accreditation Board (RAB)
888-722-2440 | www.anab.org

SUBJECT: Organizations

CONTACT: U.S. Environmental Protection Agency (U.S. EPA)
www.epa.gov

The Global Reporting Initiative
www.globalreporting.org

SUBJECT: Responsible Care Management Systems

CONTACT: www.responsiblecare-us.com

American Chemistry Council
www.americanchemistry.com
www.responsiblecare-us.com

U.S. Department of Labor's Occupational Safety and Health Administration
OSHA Compliance Assistance <http://stats.bls.gov/iif/home.htm> Bureau of
Labor Statistics

American Chemistry Council
www.americanchemistry.com

U.S. Department of Labor's Occupational Safety and Health Administration
OSHA Compliance Assistance <http://stats.bls.gov/iif/home.htm> Bureau of
Labor Statistics

U.S. DOT Hazardous Materials Transportation Statistics
<http://phmsa.dot.gov/hazmat/library/data-stats>