Pollution Prevention and Good Housekeeping Practices for Municipal Operations

A Guide for
Lucas and Wood Counties
on Pollution Prevention Practices
for MS4 Stormwater Permits

Toledo Metropolitan Area
Council of Governments

August 2010
Updated 2013

Pollution Prevention and Good Housekeeping Practices for Municipal Operations

A Guide for Lucas and Wood County Jurisdictions with Phase II Pollution Prevention/Good Housekeeping Stormwater Permitting Requirements

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

List of Tables

List of Figures

Executive Summary

The purpose of this manual is to provide assistance to municipalities subject to stormwater permitting requirements. The Phase II Pollution Prevention/Good Housekeeping Minimum Control Measure (MCM) requires municipalities to train employees about pollution prevention practices. This manual can serve as a tool to compliment existing training programs or to help create a new training program.

Municipal employees using this manual will receive an introduction to Pollution Prevention/Good Housekeeping, learn how to begin a pollution prevention program at their facility, and receive guidance on a series of Good Housekeeping Practices (GHPs) and Best Management Practices (BMPs). A total of 19 GHPs/BMPs are included in this manual. Each practice includes a description, cost information, measurable goals (which are required for each Phase II MCM), and other information that municipal employees should know when applying these practices in their work.

We at TMACOG appreciate your consideration of this training manual to help your jurisdiction fulfill its stormwater permitting requirements. If you have any questions or would like additional Pollution Prevention/Good Housekeeping information, please feel free to contact TMACOG at (419) 241-9155.

How to Use This Manual

The manual begins with an introduction to stormwater pollutants, Good Housekeeping Practices, and Best Management Practices. The remaining portion of the manual is divided into sections by GHP/BMP. Full citations of materials are found in the "References" section and cited in the text at the end of the sentence using author-date format. Some references require the reader to consult the source material; these references will be accompanied by a note to go to the source material directly (full citations are listed in the "Additional Resources" section). Images are credited in footnotes on each page. The appendices, located at the end of the manual, contain useful materials that can be reproduced (edited, copied, and distributed) for the jurisdiction's use.

Introduction

The U.S. EPA requires Phase II municipalities to implement six Minimum Control Measures (MCMs):

1. Public Education and Outreach
2. Public Participation/Involvement
3. Illicit Discharge Detection and Elimination
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. **Pollution Prevention/Good Housekeeping**

The sixth measure, Pollution Prevention/Good Housekeeping, has three components:

- An operations and maintenance program designed to prevent or reduce stormwater runoff from municipal facilities and operations.
- A training program for municipal employees.
- Measurable goals with Best Management Practices (BMPs) to meet them. Measurable goals are expectations set by each municipality to help measure their progress and determine compliance of their stormwater program.

(Office of Water 9)

Non-structural Pollution Prevention/Good Housekeeping techniques are typically called Good Housekeeping Practices (GHPs). This manual provides municipalities with the information for common GHPs and BMPs. Each practice outlined in this manual is a way to reduce or eliminate stormwater pollution. This manual should be used only for guidance and can be tailored to your jurisdiction's regulations, resolutions, or ordinances.

Creating a Pollution Prevention/Good Housekeeping Program

Pollution Prevention/Good Housekeeping programs vary between municipalities based on specific needs. It is good for municipalities to determine what the main goal(s) will be for the program. Consider the following questions to evaluate the specific needs for the jurisdiction (adapted from the Center for Watershed Protection *Urban Subwatershed Restoration Manual No. 9*):

1. What municipal operations are conducted within the jurisdiction?
2. What stormwater pollutants are associated with these operations?
3. Who manages the operations or facilities for the jurisdiction?
4. Which facilities or operations require the most attention for stormwater management or have the most influence on water quality?
5. Are there any pollutants of concern found in the jurisdiction's streams?
6. What pollution prevention/GHPs should be implemented?
7. Do you have a point-person at each facility who will oversee the implementation of these practices?
8. How much does the program cost and what is/will be the budget for the program?
9. How should monitoring and evaluation of the program be administered?

Because different BMPs protect stormwater from different pollutants or are associated with specific municipal practices, answering these questions allows municipalities to determine which BMPs to implement and which BMPs will likely be ineffective. Ideally, all relevant BMPs would be implemented to prevent future problems from developing; this is not always practical or economical.

Common Stormwater Pollutants

Figure 1: Examples of common stormwater pollutants.[1]

Sediments are often neglected as a stormwater pollutant. Sediments, particularly from industrial and agricultural areas, may contain heavy metals, toxic residues, or bacteria. Metals and toxins accumulate in fish and harm aquatic life. Sediments also cause cloudiness (known as turbidity), which impair fish respiration and reduce light penetration affecting productivity. Large amounts of sediment reduce water depth limiting the area for wildlife to inhabit (Krantz and Kifferstein).

Numerous heavy metals are found in stormwater including mercury, arsenic copper, zinc, iron, and aluminum. Often these enter streams via sediments from street runoff because of vehicles. Fish that accumulate heavy metals pass on the metals to organisms that eat them causing fish consumption advisories for humans.

Nutrients are a significant source of stormwater pollution. Nutrients include phosphorus,

[1] Clockwise:
Moderate Resolution Imaging Spectroradiometer. 2001. National Aeronautic and Space Administration (NASA). http://en.wikipedia.org/wiki/File:Mississippi_River_Delta_and_Sediment_Plume.jpg (accessed April 5, 2010).
Gapinksi, Spencer, Orantes, Laura, Mentzel, Emily, and Gillaspie, Yoshi. 2002. Cadmium. ROCK. http://drake.marin.k12.ca.us/stuwork/ROCKwater/hev%20met/hevmet.html (accessed February 1, 2010).
Office of Water. 1995. U.S. EPA. http://www.epa.gov/nps/toolbox/print/psatlawn.pdf (accessed May 7, 2010).
Greater Greater Washington. Photo gallery. http://www.trashfreeanacostia.com/index.cgi?page=images (accessed May 6, 2010)
Jastremski, Michael. Leaves in puddle. http://openphoto.net/gallery/image.html?image_id=5463 (accessed April 5, 2010).
Warren County Public Service Project Group. 2007. Vehicle maintenance. Institute of Environmental Sciences.

nitrogen, potassium, and other chemicals found in fertilizers. Over-fertilizing lawns allows nutrients not used by grass or plants to wash into storm drains. Excess nutrients cause eutrophication to occur, which means the water body produces more plant-life than needed. Algae are a sign of eutrophication that leads to odors and fish kills. A type of blue-green algae, known as cyanobacteria, is very harmful to human health.

Road salt is applied in winter to melt snow and ice so it is safe to drive. In the spring when snow melts completely, road salt gets transported to streams. Excess chlorine in streams increases conductivity and harms fish and vegetation. There are other options for road salt with environmental benefits, but they can be more expensive. As a result, pollution from road salt is a very difficult problem to correct.

Oil in streams is usually the result of improper disposal of oils during vehicle maintenance or oil leaks from vehicles. Oil is easily noticed because of the sheen it produces on the surface of pools in streams.

Trash in streams can be harmful, but it is more of a concern to aesthetics. Trash often contains all of the aforementioned pollutants. Plastic, glass, and aluminum cans that are dumped in streams could be recycled.

Common Stormwater Polluting Activities

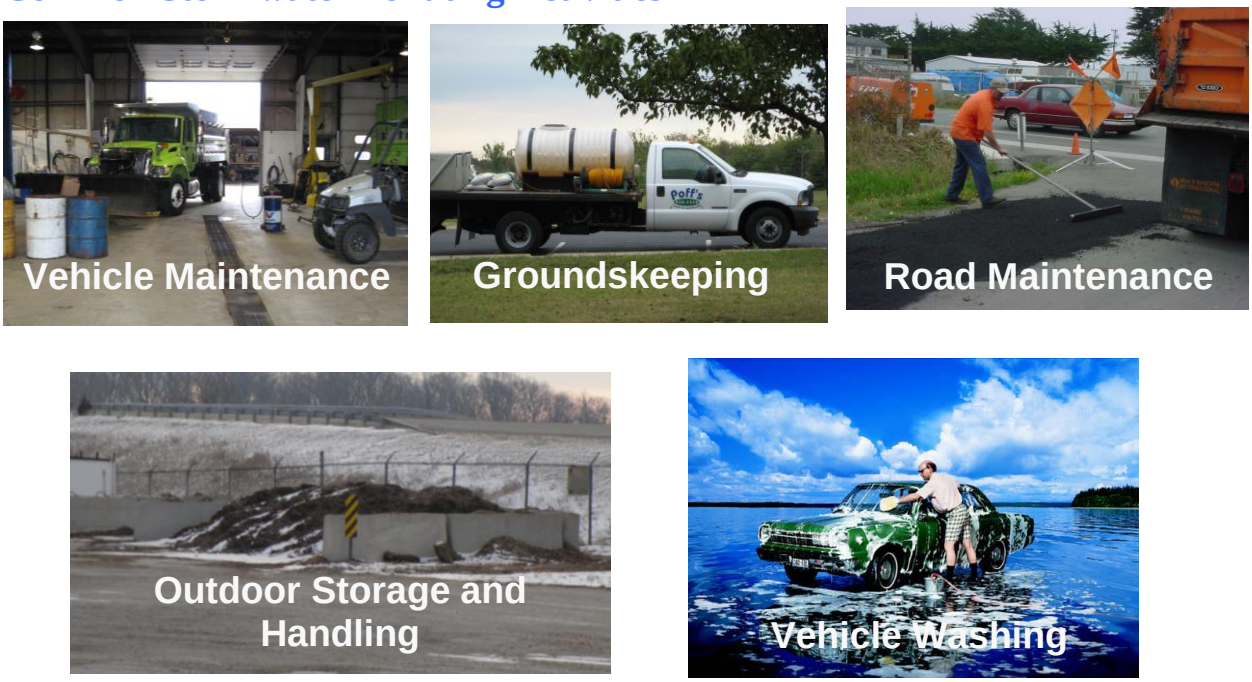


Figure 2: Examples of common stormwater polluting activities. Most municipalities perform these tasks on a regular basis and it is important that employees use pollution prevention techniques to reduce the negative environmental impacts.[2]

[2] Clockwise:
Warren County Public Service Project Group. 2007. Institute of Environmental Sciences (2 photos).

Effects of Stormwater Pollution

Figure 3: Stormwater pollution has several negative effects for jurisdictions. Pollution can reduce residents' ability to use the stream for fishing or recreation due to health concerns. Odors from algal blooms and brown, murky water due to excess sediment are other unappealing effects of pollution.[3]

San Mateo County Public Works. Patching. http://www.co.sanmateo.ca.us/vgn/images/portal/cit_611/57/51/733396478Patching.JPG.

Office of Water. 1995. U.S. EPA. http://www.epa.gov/nps/toolbox/print/psatautowash.pdf (accessed May 6, 2010).

Hensley, Ann-Drea. 2010. Outdoor storage pile. Toledo Metropolitan Area Council of Governments.

[3] Clockwise:

Jones, Adrian. 2003. Fish kill in Choptank River. IAN Image and Video Library. http://ian.umces.edu/imagelibrary/displayimage-topn-12-58.html (accessed May 11, 2010).

Andrews, Felix. 2005. Algal bloom in a village river. http://en.wikipedia.org/wiki/File:River_algae_Sichuan.jpg (accessed April 5, 2010).

Helbig, Jörg. 1991. Whitewater kayaking. http://en.wikipedia.org/wiki/File:Whitewater_kayaking_Isere.jpg (accessed April 5, 2010).

Redlands597198. 1991. No swimming sign. http://commons.wikimedia.org/wiki/File:Gosford_sign_no_swimming.jpg (accessed April 5, 2010).

Stormwater Pollution Prevention Plans

Stormwater Pollution Prevention Plans (SWPPPs) should be created for stormwater permitted municipal facilities (required for industrial permitted facilities). Note: industrial municipal operations should refer to *EPA 833-B-09-002* (U.S. EPA 2009) for guidance and construction site operators should refer to the *California Stormwater BMP Handbook* (California Stormwater Quality Association 2003).

SWPPP are divided into 5 major phases:

- **Planning and Organization:** Jurisdictions or municipal facilities should designate a point-person. This person is responsible for implementing the SWPPP for each municipal facility.
- **Assessment:** During the assessment phase, the municipality reviews each municipal facility to determine which facilities have the potential to cause stormwater pollution. A map should be created of each potentially polluting facility that includes storm drains, sensitive areas, and areas where best management practices (BMPs) should be implemented. A database, either paper or electronic, of all past spills or stormwater pollution events and stormwater quality data should be created. Electronic is the recommended format to ease reporting problems.
- **Identify BMPs:** Not all BMPs can be used at all facilities. Jurisdictions should evaluate which BMPs will be appropriate and efficient on a site-specific basis. Nearly all facilities benefit from Good Housekeeping Practices (GHPs), which are daily activities/guidelines that all employees follow to prevent stormwater pollution
- **Implementation:** Once BMPs have been chosen, these will be included in the SWPPP and implemented. At this phase, employee training is appropriate and will be necessary to ensure all facilities are able to help meet the jurisdiction's stormwater management goals.
- **Evaluation:** No program is complete without monitoring and evaluation. Monitoring the implementation of BMPs allows a jurisdiction to update and improve its stormwater management program.

(Office of Water 7; California Stormwater Quality Association 2003)

List of Common Best Management Practices (BMPs) Topics

- Alternatives to conventional products
- Chlorinated water disposal
- Employee training
- Hazardous materials storage
- Illicit discharge and illegal dumping control
- Integrated pest control
- Internal auditing
- Landscaping and lawn care
- Materials management
- Pet waste collection
- Proper automobile/equipment/vehicle maintenance
- Roadway and bridge maintenance
- Septic system controls
- Spill response and prevention
- Storm sewer system cleaning
- Street and parking lot cleaning
- Used oil recycling
- Vehicle washing
- Winter salt application and storage

Alternatives to Conventional Products

Figure 4: (left) The Design for the Environment (DfE) logo. The DfE is applied to products that the U.S. EPA deems are safer for the environment than other products. According to the EPA, over 1500 products have the DfE logo.[4]

Figure 5: (right) Green Seal™ logo. Products with this label are certified as environmentally responsible by the non-profit group.[5]

Alternative products are commonly referred to as environmentally or stormwater-friendly products because they are less hazardous than traditional products or are made from recycled/reused materials. By using the less hazardous counterparts, stormwater is protected during both use (spills are less likely to harm the environment) and disposal (products are easier to dispose of and may be able to be recycled) (Glover et. al 2008). Look for the Green Seal™, EPA's Design for the Environment logo, or other programs' seals to identify stormwater safe products.

LIMITATIONS

- Not all alternative products are equal to traditional products. Alternatives may require more "elbow-grease" or more frequent application for the same effectiveness.
- Reduction, rather than replacement, is a solution when no alternative is available.

COSTS

- Alternative products may cost more than traditional products due to availability in the market, but savings can occur because clean-up or disposal may be less expensive.
- Buying products in bulk for the entire jurisdiction (where applicable) can also reduce the cost of alternative products.

[4] United States Environmental Protection Agency (U.S. EPA). Design for the environment: An EPA partnership. http://www.epa.gov/dfe/pubs/projects/formulat/label.htm (accessed March 25, 2010).
[5] Green Seal™. http://www.greenseal.org/ (accessed December 2, 2009).

EXAMPLES OF MEASUREABLE GOALS

- Increase alternative product use by a set percentage over time.

ADDITIONAL ISSUES

Carefully research products that say they are “green” before purchasing. Some “green” products, such as alternative antifreezes (polypropylene glycol or other biodegradable antifreezes), are less toxic than the conventional forms, but are still pollutants in streams (EET Corporation). When using any chemical or organic product, spill prevention and clean-up protocols should be followed regardless of its label.

Chlorinated Water Disposal

Figure 6: Chlorinated pool. Municipal swimming pools should be drained into sanitary sewers or allowed to sit for at least one to two weeks without adding chlorine or chemicals before draining into storm drains or lawns.[6]

With around 10 million pools in the United States containing an average of 19-25 thousand gallons of water, there is the potential for millions of gallons of chlorinated pool water to be released into storm drains (Gurskis 2009). This water could have adverse affects on plants and other wildlife. There are alternatives to discharging pool water into catch basins. Creating ordinances or resolutions regarding proper discharges and providing resources, including an illicit discharge hotline, allowing temporary or permanent connections to sanitary sewers (only where applicable both legally and logistically), or information to residents about alternatives, will help reduce these illicit discharges.

LIMITATIONS

- Connecting to sanitary sewers may cause back-ups. The system must be carefully planned using permits and restrictions that residents understand (Georgia Department of Community Affairs).
- Although hotlines will aid notification of illicit discharges, it may be difficult to monitor and enforce these discharges (Office of Water 4).

COSTS

- Labor creating or using educational materials and the resources needed to distribute them.
- Follow-up on the illicit discharge hotline calls.

[6] Hopson, Steve. 2007. Deep eddy pool. http://en.wikipedia.org/wiki/File:DeepEddyPoolBySteveHopson.jpg (accessed April 5, 2010).

- The materials to mark catch basins/storm drains or manholes with stencils that say "No Dumping" or other messages.
- Some costs can be offset by including fines for illicit discharges in the ordinance/resolution.

NECESSARY EQUIPMENT

- Municipally owned pool systems will require proper equipment to pump and connect to sanitary systems or to appropriate areas.
- Door hangers may be useful tools in distributing information about proper pool water discharges.
- A webpage on illicit discharge may be added to your jurisdiction's website to allow easy access to information (Duffy).

EXAMPLES OF MEASURABLE GOALS

- Reduce illicit discharges of pool water by a set percentage.
- Distribute a set number of leaflets to residents in your jurisdiction each year.
- Mark all of the catch basins/storm drains or manholes in the jurisdiction in a reasonable number of years.

ADDITIONAL ISSUES

The main issue with preventing the discharge of chlorinated pool water into catch basins is education of residents. Many residents may not know that it is considered an illegal/illicit discharge or may not have the information about proper alternatives (Georgia Department of Community Affairs). Without education or penalties for discharging pool water into storm drains, pool owners are likely to continue the practice.

A printable newsletter about pool water disposal is available in Appendix C.

Tips to provide to residents:

- Allow water to infiltrate through grass, bioretention area or swale, or permeable surface rather than driveways or streets.
- Keep water in the pool or hot tub for at least 2 weeks without adding more chlorine. This allows the chlorine to dissipate and solids to settle.
- Do not dump solids or chlorine with pool water.
- Do not discharge on others' property.
- Follow all local ordinances (if mailing or posting this information online, make the ordinances/regulations easily accessible for residents).

(Oregon Department of Environmental Quality 1999; Office of Water 4)

Employee Training

The Pollution Prevention/Good Housekeeping minimum control measure requires that all municipal employees undergo training for pollution prevention. This training keeps employees aware of the everyday duties that they can perform during the course of their workday to improve stormwater management.

Figure 7: An employee training presentation. Training can be performed using formal presentation sessions or short training sessions throughout the year. Sample training programs and other resources are available on TMACOG's website.[7]

This training is on-going, rather than a one-time event and it is recommended that training be performed every year and when significant changes in staffing or practices occur (Office of Water 1). Many municipalities choose to develop educational materials that can be used numerous times or be edited in the future to avoid duplicating efforts. Some educational materials include:

- Pamphlets;
- Presentations (videotaped or audio taped for reusability);
- Bound training manuals;
- Shop posters; and
- Flyers attached to paystubs.

There are numerous resources from jurisdictions around the country that have developed training programs that can be used in your own jurisdiction (for more information, see Stormwater Menu of BMPs: Municipal Employee Training and Education, U.S. EPA).

[7] Boardman, Dr. Mark. 2008. City of Mason and Warren County municipal employee training session. Miami University (Ohio).

LIMITATIONS

Training materials may need to be updated as new rules/regulations are made. Training materials from outside jurisdictions may not be applicable to your jurisdiction or may contain outdated information; make sure the materials are comparable or edit them as needed. New employees will require additional training.

COSTS

The Toledo Metropolitan Area Council of Governments (TMACOG) staff estimated that a training program for Pollution Prevention/Good Housekeeping would cost around $5500 (if using new materials). These costs come from:

- Creation of educational materials (staff hours).
- Printing educational materials.
- Reserving space or equipment for training sessions (Office of Water 6).
- Fees for trainers (Office of Water 6).
- Purchasing materials from companies or other jurisdictions.

To reduce this cost, it is recommended that jurisdictions that are members of the Stormwater Coalition (SWC) take advantage of all training materials provided by the SWC and TMACOG. Training presentations and documents are provided on the TMACOG Stormwater Coalition website www.tmacog.org.

EXAMPLES OF MEASURABLE GOALS

- Hold training sessions for all municipal facilities' employees every year.
- Distribute bi-monthly paystub flyers on a specific pollution prevention topic to all employees.

Hazardous Materials Storage

Figure 8: Danger: Chemical Storage sign. "Warning" or "Danger" signs notifying employees of hazardous chemicals decrease the risk of spills because employees are reminded to take extra care when working in the area.[8]

Hazardous materials not only pose a risk to streams, but are dangerous to human beings. Storing materials properly, especially hazardous materials, is a very useful way to protect stormwater and those who work in municipal facilities. Proper storage prevents spills or at least contains any spills that may occur.

Proper storage:

- Provides sufficient aisle space, in a low traffic area.
- Uses secondary containment:
  - Containment pallets.
  - Concrete wall barriers sized slightly larger than the maximum storage capacity of the primary container.
  - Safety storage containers (when materials are safe to store this way).
  - Bins.

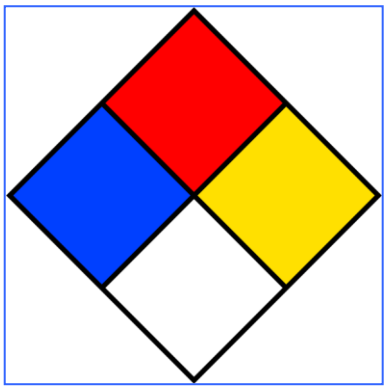


Figure 9: NFPA Diamond Rating System. The diamond rating system called the National Fire Protection Association 704 is one of several chemical labeling systems (National Fire Protection Association 2010). Each colored diamond represents a different category of danger on a scale from 0 to 4 with 4 being a severe hazard. Blue = Health. Red = Flammability. Yellow = Instability. White = Special hazards. It is useful for alerting fire fighters as it assumes fire is present for the scale.[9]

[8] Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.
[9] Denelson83. 2006. NFPA 704. http://en.wikipedia.org/wiki/File:NFPA_704.svg (accessed April 5, 2010).

- Has adequate signage:
    - Labeled with common and chemical name.
    - Date opened or stored.
    - Pen markings showing how much of the material has been used.
    - National Fire Protection Association (NFPA) hazard identification system (four diamond rating) (National Fire Protection Association 2010).
- Does not rely on unstable stacking or weak shelves.

(Georgia Department of Community Affairs; Office of Water 5)

Figure 10: The Hazardous Material Identification System. The Hazardous Material Identification System uses the same color scheme, but the rating scale can be different even for the same chemical.[10]

LIMITATIONS

The type of material being stored will affect what secondary containment you should choose. Even materials in secondary containment systems can leak and should be inspected regularly. Fire and building codes must be observed in all storage areas (Georgia Department of Community Affairs).

COSTS

Temporary containment methods (containment pallets or bins) are typically far cheaper than the cost of clean-up of hazardous materials, but initial costs can be moderate to high (Glover et. al 2008). Permanent containment methods (concrete overflow containment) typically cost more than temporary methods due to the amount of concrete needed.

EXAMPLES OF MEASURABLE GOALS

- Inspect for leaks and log all findings for facilities at least once a week (or more where required).
- Purchase secondary containment for every storage unit at each facility within a set time frame.
- Reduce the number of spills by a certain amount over time.

For more information, see Hazardous Waste Factsheets in Appendix D.

[10] Tylermenezes. 2008. HMIS color bar. http://en.wikipedia.org/wiki/File:HMIS_Color_Bar.svg (accessed April 5, 2010).

Illicit Discharge and Illegal Dumping Control

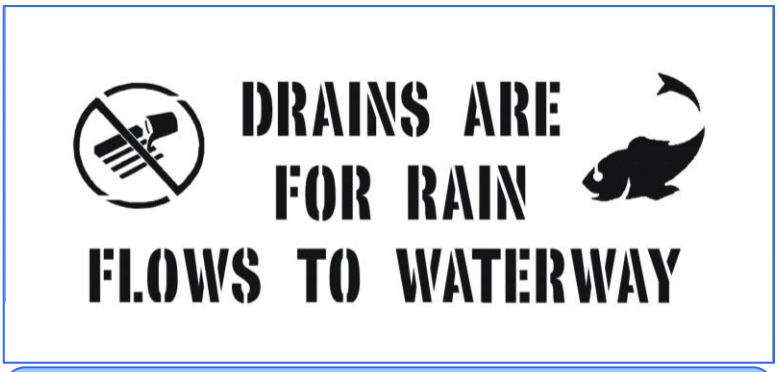


Figure 11: Example of a storm drain stencil. These stencils are painted near storm drains to remind residents not to dump into the drain.[11]

Illegal dumping control is necessary to help reduce the number of pollutants entering the storm drains, where only stormwater is supposed to go. While illegal dumping is addressed under the third minimum control measure, Illicit Discharge Detection and Elimination (IDDE), municipal employees can approach IDDE during the course of their Pollution Prevention/Good Housekeeping Activities. Involving the public in clean-up or watching for illegal dumping can help fulfill the Public Participation/Involvement measure as well. Jurisdictions should offer a way to report illegal dumping from residents, such as a hotline, website, or e-mail address (Georgia Department of Community Affairs, Nebraska DEQ).

As a municipal employee, you should look for:

- If "No Dumping" signs are present.
- Signs, stickers, or markings informing people not to dump into storm drains (Nebraska DEQ).
- Trash or debris near storm drain inlets or on roads/roadsides.
- Staining, such as from paints or fluids, leading into storm drain.
- Suspicious activities near storm drain inlets.
- Unusual odors or colored water.

Public Works employees can look for signs of pollution or dumping during maintenance. **If any spills or dumping into storm drains or streams is apparent, notify your supervisor or stormwater "point-person" contact.** Municipalities should increase awareness of stormwater issues by posting signage near high risk storm drains.

A printable newsletter about illicit discharges is available in Appendix C.

[11] Partners for Clean Streams. 2010. Storm drain stencil.

LIMITATIONS

Illegal dumping regulations need to be enforceable to have any chance of curbing behavior (Waste, Pesticides, and Toxics Division 1998), but often the person or people responsible for the dumping are not apparent. Logging locations and an estimated time frame of illegal dumping can help curb repeat dumpers. Reports from residents about illegal dumping may be unreliable.

COSTS

There is a minimal cost consideration for monitoring illegal dumping as it is easily combined with other measures or the typical duties of certain municipal employees (e.g. road maintenance employees). Clean-up costs can be significant, but labor costs can be reduced by requesting volunteers from the community to clean up non-hazardous materials, such as trash (Georgia Department of Community Affairs).

EXAMPLES OF MEASURABLE GOALS

- Reduce illegal dumping by a certain percentage.
- Post "No Dumping" signs/stickers near all environmentally sensitive areas.

ADDITIONAL ISSUES

Often, illegal dumping is a result of residents' inability to recycle or dispose of materials cheaply (Waste Pesticides and Toxics Division 1998). Consider implementing programs at low or no cost to residents who want to dispose of materials. As with other best management practices, clean-up of improperly disposed materials will frequently cost more than proper disposal.

"No dumping" storm drain stencils can help fulfill your Public Participation/Involvement requirements if you use the public in a program. Youth groups and volunteers in the area can be trained to apply stencils at a low cost to jurisdictions; youth groups/volunteers are unpaid and training is minimal. As part of the *Give Water a Hand* program, the Stormwater Coalition and Partners for Clean Streams held a storm drain stenciling program in 2005 and again in 2010 with local youth groups. Contact TMACOG or Partners for Clean Streams for more information on holding a storm drain stenciling event in your jurisdiction (http://www.partnersforcleanstreams.org).

Figure 12: Applying a storm drain stencil. Girl Scouts in the Toledo, Ohio area applying a storm drain stencil near a storm drain grate. Stencils are applied facing either the street or the sidewalk so that motorists or those using the sidewalks can read the message.[12]

[12] Blair, Cherie. 2010. Global Youth Services Day storm drain stenciling project. Partners for Clean Streams.

Integrated Pest Control

Integrated pest control (IPC) uses several techniques to remove unwanted pests on lawns and landscapes rather than the traditional use of pesticides, which can be harmful to aquatic life, even in small amounts (Pesticides: Topical and Chemical Factsheets). Insecticides (pesticides that kill insects) often remove beneficial insects along with harmful ones. Integrated pest control reduces the need for harmful pesticides in turn reducing the chance for these chemicals to end up in our waterways.

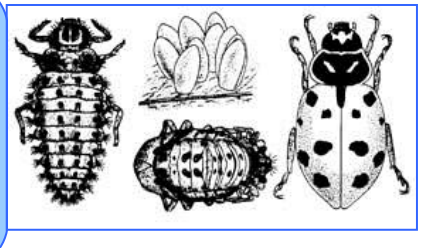


Figure 13: (left) An adult convergent lady beetle. Convergent lady beetles are an example of a beneficial insect.[13]
Figure 14: (right) Life cycle of the lady beetle.[14]

Follow the four-tiered approach.

- **Monitor pests:** Many types of weeds and insects/organisms are noxious or harmful, but some are actually beneficial to landscapes. Groundskeepers should know which organisms are pests and which are helpful prior to acting to remove them. *Removing helpful insects or plants may disrupt the balance and lead to more harmful pests or damage to plants*.
- **Set action thresholds:** Once pests have been identified, lower levels of pests may be acceptable, but higher levels may not be. Determine the level of pests that will cause economic or environmental damage to the landscape. Control the pests only after the threshold is reached.
- **Prevent:** Preventing pests in the first place is often more cost-effective than attempting to control them. It may be necessary to remove plants that draw harmful insects or remove sources of food and nutrients, including shallow pools of water or reducing the amount of fertilizers used.

Figure 15: A gypsy moth caterpillar. Gypsy moths are an example of a harmful insect that will strip trees and plants.[15]

[13] Wsiegmund. 2006. Hippodamia convergens. http://en.wikipedia.org/wiki/File:Hippodamia_convergens_08085.JPG (accessed April 8, 2010).
[14] Lyon, William F. Horticulture and crop science. http://ohioline.osu.edu//hyg-fact/2000/2002.html (accessed April 6, 2010).
[15] SB Johnny. 2004. Fifth instar larva of gypsy moth *Lymantria dispar* (L.). http://en.wikipedia.org/wiki/File:Gypsy_moth_larva.jpg (accessed April 6, 2010).

- **Control:** IPC promotes control measures where abundant pesticide use is a "last resort". Mechanical removal activities, such as trapping or weeding, should be attempted prior to spraying. Sprays should be made of natural or pheromone-specific compounds before using synthetic chemicals (for a list of organic pesticides, see *An Overview of Some Common Organic Garden Pesticides*, Iannotti). If all natural methods fail, synthetic pesticides and herbicides should be limited only to the area where pests are present or where they may spread. Spraying chemicals not targeted to the specific pest(s) may kill beneficial plants or insects and cause more harm than good. These chemicals will often end up in storm drains as well.

(Adapted from the Pesticides: Topical and Chemical Factsheets, U.S. EPA)

Figure 16: Mulch. Mulch is useful to keep weeds from growing around plants and flowers.[16]

Other stormwater friendly pest control methods include:

- Mulching to prevent weeds (preferably use grass strips or rock/cement barriers around mulched areas to prevent it from being washed into stormwater).
- Fencing/netting to keep larger pests, such as rodents or birds, away from leaves or fruit.
- Removing visible insects by spraying slightly soapy water on leaves.
- Species-specific, pheromone-based insect traps.
- Diseased plants should be removed and pruning or removal equipment should be disinfected.
- Promote beneficial insects.
- Reduce pooled water through structural best management practices or add aeration to man-made ponds.

COSTS

Costs may be reduced because of the lessened need for pesticides. At first, groundskeeping employees may require additional work hours to implement these practices. Once IPM is established, maintenance costs should be similar to conventional duties.

EXAMPLES OF MEASURABLE GOALS

- Reduce the amount of pesticides found in streams by a set percentage over time.
- Reduce pesticide purchases/use by a set percentage.

[16] Red58Bill. 2009. Spring daffodils in fresh shredded mulch. http://en.wikipedia.org/wiki/File:Fresh.mulch.jpg (accessed April 6, 2010).

Internal Auditing

Figure 17: Documentation of spills and good housekeeping activities. Documentation is one of the most important aspects of Pollution Prevention/Good Housekeeping. By setting up a "Right to Know" station that includes MSDS information, spill documentation forms, and other information pertaining to Good Housekeeping, employees will be well informed of how to prevent spills and what to do if a spill does occur.[17]

Audits are the way the EPA (performed by OEPA in Ohio) gauges municipalities' compliance with their stormwater permit. Audits typically involve site visits, questioning employees for their knowledge on a subject or issue, reviewing documentation that shows what programs the municipality has participated in, and judging whether a facility is in compliance with their stormwater permit. By conducting a self audit, municipalities can be ready for the real thing.

Self audits:

- Familiarize employees with the process.
- Highlight any shortcomings in the program.
- Allow time to correct problems.
- Allow time to organize documentation.
- Require checklists and photographs to log what facilities are doing (both poorly and well).

LIMITATIONS

Internal audits will help prepare for the real audits, but there may be issues that were not considered. Be prepared for additional questions or inspections in case anything was missed during the internal audit.

[17] Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.

COSTS

Self audits cost very little to perform if every facility dedicates time throughout the permitting period (5 years) for record-keeping. One site visit takes around 1-3 hours.

EXAMPLES OF MEASURABLE GOALS

- Conduct site visits and self audits regularly (specify a time frame).
- Designate a stormwater "point-person" (usually a current employee) for each facility before the next EPA audit.

Landscaping and Lawn Care

Landscaping and lawn care practices have a significant impact on stormwater runoff. Conventional lawn care practices often include watering too frequently, over-fertilizing, and the use pesticides/herbicides to rid lawns of unwanted pests and nuisance or invasive plants. Excess nutrients and pesticides wash away during rain events or when lawns are over-watered (Stormwater Coalition 2008). The stormwater management approach to lawn care uses a variety of techniques to reduce pollution in stormwater runoff from lawns.

Figure 18: The *Viola cucullata*, also known as the blue violet, is an example of a native flowering plant. Native plants are suited to the climate of Northwest Ohio and have deeper root systems than non-native plants.[18]

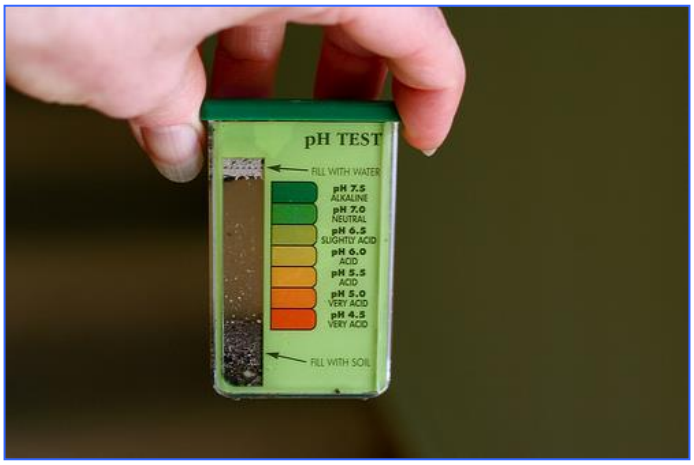


Figure 19: A pH soil test. Soil tests are critical to lawn care because plants grow best in the proper pH and nutrient levels. Often jurisdictions will apply more fertilizer than is actually needed, resulting in excess nutrients in streams.[19]

[18] Gordy-Stith, Bo. 2007. Marsh blue violet (Viola cuculatta). http://en.wikipedia.org/wiki/File:Viola_cucullata.jpg (accessed April 6, 2010).
[19] Chiot's Run. 2009. pH test of soil in flower beds. http://www.flickr.com/photos/chiotsrun/3459134327 (accessed April 6, 2010).

The recommended practices for stormwater-friendly lawn care include:

- Choose native plants. Native plants have deeper, thicker root systems than grass and are acclimated to our climate in northwest Ohio.
- Test soils. Soils often have the correct amount of nutrients and pH without needing more fertilizer (Novotney and Winer 2008). If fertilizer is needed, only use enough to correct the nutrient deficiencies.
- Mixing compost with soil during planting.
- Limit grass areas in favor of natural landscaping or pervious surfaces.
- Install water bags on trees and using rain from rain barrels to water lawns (Glover et. al 2008).
- Lay mulch at least three inches thick. This keeps soil moist, prevents weeds, and prevents soil erosion.
- Regular maintenance.
- Use organic alternatives when fertilizers (e.g. compost, plant rotation) or pesticides (i.e. spraying jalapeno water or soap on plants) are necessary.
- Fertilizers should not be used within **five feet of pavement**, within **25 feet of a catch basin**, and within **50 feet of a stream** (Novotney and Winer 2008).

(Georgia Department of Community Affairs)

LIMITATIONS

Lawns with reduced turf/grass often appear "wild" if they are not properly maintained or the public is not aware of the management practice in place (i.e. native prairie grass). Public education about the benefits of less fertilizer and pesticides and the ability to maintain a green lawn without them are critical to the success of this management practice (for a printable newsletter, see Appendix C *Fertilize Your Lawn if You Must, But Don't Fertilize the Water*, TMACOG). Safety, especially if trees or shrubs are near roadways, as well as pest control should be considered.

COSTS

Limiting the use of chemicals can reduce costs, but alternatives can be more expensive than traditional lawn care products. Homemade products like compost from food waste or mild dish soap are an inexpensive alternative to conventional fertilizer and pest control methods. Many municipalities have the ability to compost.

Educational materials for residents would include the flyers and work hours to distribute them. At around **10 cents for a sheet of three**, door hangers are an inexpensive way to educate residents and can be distributed by volunteers (Partners for Clean Streams). Note: Flyers should never be distributed into mailboxes.

NECESSARY EQUIPMENT

Composters may be needed if cheap compost is not available or cannot be made. Grass clippings, leaves, and other plant matter can be put into composters along with food waste to produce compost onsite (Novotney and Winer 2008). Organic alternatives can be used in place of chemical fertilizers/pesticides, but may require additional equipment to use.

EXAMPLES OF MEASURABLE GOALS

- Replace all chemical fertilizers and pesticides with organic alternatives.
- Purchase and distribute informational flyers to all residents in sensitive areas about stormwater friendly lawn care.
- Use tree watering bags on all young trees.
- Install compost bins at all municipal facilities.

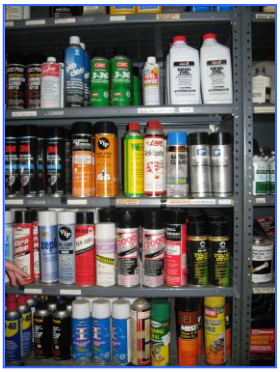
Materials Management

Figure 20: A closed dumpster. Dumpster lids should be closed when not in use.[20]

Materials management is the way chemicals, products, or other materials are chosen, purchased, stored, handled, used, and eventually disposed of. Stormwater is at a major risk of contamination from improper materials management techniques, especially during outdoor activities.

Proper storage includes:

- Labeling;
- Indoor storage where possible;
- Secondary containment – containment pallets, outer storage units, overflow barriers; and
- Hazardous materials labeling.



Proper handling and use tips:

- Do not overload pallets or handling equipment.
- Get help to carry large objects. Do not strain yourself to carry something.
- Close materials when not in use.
- Document how much product was used to help identify leaks.

Figure 21: Organizing inventory supplies will help reduce wastefulness and keep the workplace free of clutter, making it less likely for spills to occur.[21]

[20] Hensley, Ann-Drea. 2010. GHP images at Northwest Ohio facilities. Toledo Metropolitan Area Council of Governments.
[21] Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.

Proper disposal tips:

- Never dispose of products into storm drains.
- Label waste containers properly to avoid contamination with recycling bins.
- Dumpsters should have closed lids and should not be overfilled.
- Recycle products when you can. Ohio EPA maintains a list of vendors that offer recycling (for the full list of vendors, see OEPA Recyclers and Environmental Vendors).

Table 1: Traditional and alternative products. Products that have safer alternatives, produce less waste, or are less likely to cause spills.

Traditional Product	Alternative Product
Aerosols	Pump-type or non-aerosol products
Art supplies	Water-based paints/inks that do not contain metals or toxics
Batteries	Rechargeable batteries
Chemical fertilizers	Compost or limited amounts of manure
Cleaning products	GreenSeal™ products
Gasoline	Electric vehicles, such as golf carts, for onsite travel
Motor oil	Re-refined oil
Pesticides	Choose plants that keep pests away naturally; use integrated pest management (see section titled "Integrated Pest Control")

Adapted from *Water resources: A Toolkit for Local Governments*. Georgia Department of Community Affairs.

Figure 22: Materials Safety Data Sheet (MSDS) books. The MSDS information should be available to all employees. Routine review (as determined by your jurisdiction and OSHA rules) of MSDS information by the point-person should be performed. Any chemicals that could get into stormwater should be noted and caution taken when used.[22]

[22] See resource 20

LIMITATIONS

Proper materials management should always be implemented, but some management practices are more expensive or easier to use than others. Alternative products are not always available or as effective in all situations (Georgia Department of Community Affairs).

COSTS

Staff training on proper practices is the primary cost (Georgia Department of Community Affairs), but the practices themselves can be easily integrated into municipal activities. They often make work more efficient because products are easier to identify and are stored for accessibility. *Fewer spills and accidents mean fewer injuries for employees and a safer working environment.* Alternative products may increase costs, but these costs are often offset by reduced disposal fees because they are not hazardous and lower clean-up costs in the event of a spill. Lucas and Wood County Solid Waste Districts offer education programs on waste disposal to communities within their counties.

EXAMPLES OF MEASURABLE GOALS

- Provide secondary containment for all materials stored on the site.
- Hold a certain number of training sessions for employees each year and provide posters or flyers on materials management in municipal buildings.
- Replace all hazardous cleaning products by a certain date.

Pet Waste Collection

Figure 23: A pet waste collection station. Pet waste stations are essential at all parks where dogs are allowed. These stations provide waste bags and remind park patrons to pick up their pet's waste.[23]

Pet waste can be a huge problem for stormwater in public parks and in residential areas. When park patrons or residents walk their dogs, only around 60% of people pick up the waste (Georgia Department of Community Affairs, Stormwater Coalition 2008). Pet waste collection stations at parks provide collection bags (and sometimes disposable gloves) to encourage pet owners to clean up pet waste on their walks as well as a place to drop off the waste. This reduces the tendency for park patrons to leave the waste where it is made. Factsheets, such as TMACOG Stormwater Coalition's *Don't Let Your Pet Pollute* (see Appendix C), provide residents with information about the proper disposal of pet waste in their own yards (Stormwater Coalition 2008).

LIMITATIONS

Table 2: Reasons for and against picking up pet waste. Pet owners have numerous reasons why they do not pick up waste, but there are also many important reasons to do so.

Reasons for not picking waste up	Reasons for picking waste up
• Because it eventually goes away • Just because • Too much work • On edge of my property • It is in my yard • It is in the woods • Not prepared (with refuse bags) • Small dog, small waste • Sanitary reasons • Own a cat or other kind of pet • No reason • Use as fertilizer	• It's the law • Environmental reasons • Hygiene/health reasons • Neighborhood courtesy • Keep the yard clean • It should be done

Adapted from *Water resources: A Toolkit for Local Governments*. Georgia Department of Community Affairs.

[23] Warren County Public Service Project. 2007. Institute of Environmental Sciences.

- Pet waste collection stations do not guarantee that patrons will use them and will only prevent pet waste near where they are placed (Glover et al., Georgia Department of Community Affairs).
- There must be enough collection stations that are optimally located where most of the park patrons travel or near sensitive areas.
- Directions must be provided on the collection stations for park patrons who may not know how to use them.
- Stations need to be cleaned frequently by staff to avoid filling and ensure proper bag stocking, which can be difficult for parks that receive little maintenance.

COSTS

Pet waste collection units cost anywhere from $60-400 depending on the model and features. Bags can be purchased in bulk at a price of 5-20 cents per bag (Washington State Department of Ecology). Labor costs should be factored in if there is no permanent staff to install or clean the collection units.

EXAMPLES OF MEASURABLE GOALS

- Install pet waste collection units in all public parks by a set year.
- Collect a set amount of pet waste at parks.
- Reduce coliform bacteria in streams by a set percentage through pet collection stands and public education efforts.

ADDITIONAL ISSUES

- Pet waste stations can display additional signage about the Dos and Don’ts of walking pets in the park.
- Proper kitty litter disposal should be included in any factsheets or information distributed to residents.
- Pet waste clean-up may be outsourced to other companies. However, this is a very costly approach.

Proper Automobile/Equipment/Vehicle Maintenance

Figure 24: Parts washer in a vehicle maintenance facility. A parts washer should be used to clean parts that have oil or solvents on them.[24]

Proper vehicle maintenance includes:

- Performing maintenance activities indoors.
- Limiting washing in maintenance bays and never washing maintenance bay floors with doors open.
- Disposing of waste materials (antifreeze, solvents, batteries, fuels, lubricants, etc.) or parts properly.
- Recycling spent fluids (such as motor oil) where possible.
- Fueling vehicles away from catch basins and streams.
- Keeping spill clean-up materials easy to access.
- Regularly inspecting on-site vehicles for leaks.

(Glover et. al 2008; Georgia Department of Community Affairs; Kentucky Transportation Cabinet)

LIMITATIONS

- Replacing maintenance area drains that connect to storm drains with those that connect to sanitary sewers may not be economically feasible. If drains are not connected to sanitary sewers, they should be plugged.
- Drip pans or wet/dry vacuums will be required to collect fluids.
- Recycling of spent fluids may not be possible if the facility cannot use them on-site.
- Spent fluids should be treated as solid waste if they are not recycled on-site or collected by licensed EPA haulers for proper disposal (Division of Hazardous Waste Management 2006).
- Materials cannot be sold to a third party unless the municipality is classified as a marketer and follows specific requirements (Division of Hazardous Waste Management 2006).

[24] Hensley, Ann-Drea. 2010. GHP images at Northwest Ohio facilities. Toledo Metropolitan Area Council of Governments.

COSTS

Recycling materials may cost more than disposing them with the proper agency. Additional practices that are not currently being used may add costs to vehicle maintenance operations. Overall, Good Housekeeping Practices (GHPs) should not add significant costs to maintenance facilities if incorporated in the regular routines (Georgia Department of Community Affairs).

NECESSARY EQUIPMENT

Clean-up equipment and proper waste storage containers are needed. Waste clean-up equipment includes:

- Absorbents for wet spills and corrosive materials,
- Brooms and dust pans/shovels for dry spills, and
- Dumpsters or waste containers with closeable lids.

EXAMPLES OF MEASURABLE GOALS

- Install a certain number of used motor oil heaters for winter to use spent motor oil.
- Achieve a set percentage reduction in solvents use.
- Hold one complete site inspection each month.

Roadway and Bridge Maintenance

Existing roads and bridges require periodic maintenance. These maintenance activities often generate stormwater pollutants such as heavy metals, sediments, solvents, oils, and fuels (Georgia Department of Community Affairs).

Here are some pollution prevention tips for road and bridge maintenance activities:

- Always sweep or vacuum dry material wastes during saw cutting, road stripe removal, or other activities that create dust/sediment.
- Use drip pans for paving machines and other equipment that may leak fluids.
- Do not apply road striping paint during windy, wet, or rainy conditions.
- If wet saws must be used:
    - Place drip pans under or watertight barriers around equipment when not in use.
    - Turn cooling water off when saw is off.
    - Protect storm drains during use.

(Novotney and Winer 2008, Georgia Department of Community Affairs)

Figure 25: A concrete saw. Concrete saws are frequently used in road maintenance activities and can be a large source of stormwater pollution if precautions are not taken.[25]

Figure 26: A yellow road stripe. Road striping is necessary for driving, but to protect stormwater, striping should only be performed on clear days with little wind.[26]

Figure 27: (left) An example of dredging near a road. **A Pollution Prevention/Good Housekeeping technique in this case would be placing a mat over nearby storm drains or temporarily berming the work area or storm drain** (putting a barrier around it).[27]

[25] Paris, Josh. 2007. A concrete saw being readied for use. http://commons.wikimedia.org/wiki/File:Concrete_saw2.jpg (accessed April 6, 2010).
[26] Tan, Sherman. 2007. A yellow road marking. http://en.wikipedia.org/wiki/File:Yellow_road_marking.jpg (accessed April 8, 2010).
[27] Warren County Public Service Project Group. 2007 Institute of Environmental Sciences.

Maintenance does provide jurisdictions an opportunity to replace less effective, conventional stormwater management practices with best management practices (BMPs). These BMPs are often referred to as *green infrastructure* or *Low Impact Development* (LID) when used in site design. Some options during maintenance or new construction include (Georgia Department of Community Affairs):

- Design roadway islands and ditches as bioretention areas or vegetated swales
- Use permeable pavement where practical and economical to do so, such as along sidewalks, strips next to curbs, street parking spaces, alleys, and other applicable locations. Parking lots can be strategically built with pervious pavements in certain sections to get the benefit of pervious pavement without significant additional costs.
- Clean scupper drains on bridges regularly.
- Remove scupper drains from bridges and retrofit with catch basins or direct outflows to bioretention areas.

Figure 28: Reynolds Road bioswale.[28]

A good resource for these and other low impact development options can be found in American Rivers' *Low Impact Development Manual for the Lower Maumee and Ottawa River Watersheds* (see Additional Resources).

LIMITATIONS

Municipalities should consider safety a priority when implementing these options. Planning and design protocols may limit the ability to implement green infrastructure in roadway maintenance or new construction (Georgia Department of Community Affairs). The characteristics of the location may also limit the options for pollution prevention designs. Maintenance on all BMPs will be required, which is true of any constructed project, even traditional methods.

[28] English, Jennifer. 2009. Defiance Soil and Water Conservation District

COSTS

Table 3: A comparison of road/parking lot surface options.

Type of Surface	Cost (per sq. ft.)*	Considerations
Asphalt	$0.50-1.00**	Replacement due to winter weather (potholes, etc.)
Grass/Gravel Pavers	$1.50-5.75	Mowing; replacing lost gravel; compaction issues
Porous Concrete	$2.00-6.50	Vacuum cleaning required
Interlocking Concrete Paver Blocks	$5.00-10.00	Vacuum cleaning required

(Paver Search, Inc. 2005)

*Price ranges in 2005 dollars.

**Does not include costs of stormwater management. Price when including stormwater controls grows to $9.50 and $11.50 per square foot of installed pavement.

Table 4: A comparison of Best Management Practice options.

Type of BMP	Cost	Considerations
Vegetative Swales	Seed: $1.00/linear ft. Sod: $4.50-$8.50/ linear ft.	Mowing required
Rain Gardens/ Bioretention Cell	Construction: $3.00/sq. ft. Design: $1.00/sq. ft. Planting: $3.00-$4.00/sq. ft. Plants: $2.50-$4.50/sq. ft. Total Cost: $11.00-$13.00/sq. ft.	Regular maintenance required
Pocket Wetlands	Excavation: $0.25 per sq. ft. Hauling: $0.25 per sq. ft. Grading: $0.36 per sq. ft. Plants: $2.00 per sq. ft. Plant Installation: $0.30 per sq. ft. Cutlet Structure: $50.00 per sq. ft.	May bring unwanted wildlife; significant maintenance required
Green Roof	***Extensive: $8-20 per sq. ft. ***Intensive: $15-25 per sq. ft.	Possible roof insurance issues; maintenance

(Glover et. al 2008)

***Source: Green Roof Installation Project, Great Lakes Water Institute.

EXAMPLES OF MEASURABLE GOALS

- Reduce use of herbicides/pesticides on roadway ditches by a certain percentage.
- Replace a percentage of bridge scupper drains.
- Convert a certain area of islands or ditches to bioretention areas.
- Replace alley conventional pavement with pervious pavement by a set year (for more information about pervious alleys, see *The Chicago Green Alley Handbook: An Action*

Guide to Create a Greener, Environmentally Sustainable Chicago, Daley and Byrne, Chicago Department of Transportation).

Septic System Controls

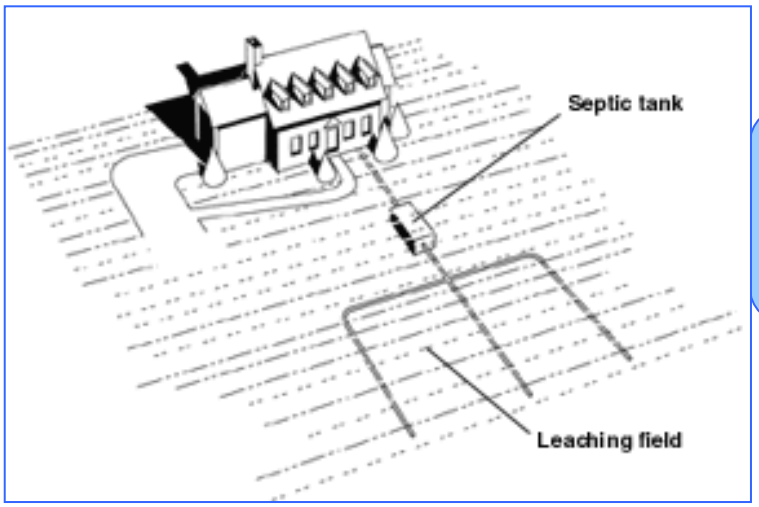


Figure 29: An example of a septic system design. Failed septic tanks can release large amounts of fecal matter and contaminants into stormwater and streams.[29]

Many jurisdictions have residents with septic systems. With septic systems, wastewater from homes flows to an underground storage unit rather than a sanitary sewer. This storage unit allows solids to settle and the liquid to filter into the soil. By creating outreach programs on Good Housekeeping Practices for residents with septic systems, the jurisdiction will help prevent septic system failures, a major source of illicit discharges into streams.

Outreach programs should educate residents on:

- Source reduction practices:
  - Water conservation indoors.
  - Roof and surface water diversion away from systems.
  - Limiting phosphates.
- Scheduling regular inspections (annually) and pumping the septic system every three years.
- What materials are appropriate to go down drains. Non-degradable materials and some household chemicals are inappropriate for septic systems.
- Drainfield safety.
  - Keep heavy equipment and vehicles off.
  - Impermeable surfaces should not be placed on top of drainfields.
- Using caution with garbage disposals as they add greatly to the amount of solids in the system.

(Georgia Department of Community Affairs)

[29] United States Geological Survey (USGS). Septic tank: Illustration shows how an underground septic tank is connected to a house and leaching field. http://commons.wikimedia.org/wiki/File:Landpeople_s_cc8.PNG (accessed April 8, 2010).

LIMITATIONS

Many residents will be unaware of the maintenance requirements for their septic system or may be unwilling to perform required inspections (Georgia Department of Community Affairs). Educational outreach programs need to inform residents on the potential dangers of failing to maintain their septic system in addition to how to do it.

COSTS

The cost of the outreach program depends on the scope (for detailed cost information, see *Water Resources: A Toolkit for Local Governments*, Georgia Department of Community Affairs). If there are staff members dedicated to the outreach program, by creating new materials or holding training sessions, the costs will be in the thousands of dollars. Jurisdictions can save on outreach programs by using existing materials and involving volunteers to distribute the information. Training sessions will incur varying costs depending on the length of the training session, the location, the parking availability, and other conditions associated with event planning. The cost of materials is the other significant cost, but this can be reduced by adding information to the jurisdiction's existing website or creating a downloadable newsletter on the topic.

EXAMPLES OF MEASURABLE GOALS

- Distribute flyers to all residents within a certain number of years.
- Provide at least two training sessions for septic tank installers each year (set this at any minimum number, but two is recommended).
- Create an ordinance/resolution limiting the amount of phosphates in detergents.

Spill Prevention and Response

Spill prevention and response is one of the most important Good Housekeeping Practices for municipal operations. In the course of daily activities, municipal employees handle, transport, load, and use products that can be harmful to our streams if they enter storm drains.

Figure 30: Hazmat crews training for spill response. Hazmat crews need to be notified when spills are hazardous or potentially hazardous to human health.[30]

Prevention:

- Maintain sufficient aisle space in storage areas.
- Stack items safely at heights where materials are easily accessible.
- When working with liquids outdoors, cover storm drains with mats or berms **prior** to beginning work.
- Do not overload pallets, shelves, transportation equipment, or yourself with materials.
- Refill materials in secondary containment or indoors.
- Installing leak detection devices, overflow controls, and diversion berms.
- Monitoring storage units for leaks, cracks, rust, or other signs of structural degradation.

(Office of Water 8)

[30] Henderson, Win. 2005. Hazmat training. Federal Emergency Management Agency (FEMA). http://commons.wikimedia.org/wiki/File:HAZMAT_training.jpg (accessed April 5, 2010).

Figure 31: (left) A containment pallet under a liquid storage unit. Containment pallets are useful in preventing slow leaks from spilling onto the floor or ground. They are not useful for large breaches in primary containers.[31]

Figure 32: (right) Concrete barrier. Concrete barriers are the ideal method for secondary containment because they contain all the liquid in the primary container(s) if designed with adequate volume.[32]

Response:

- Post signs on the spill response procedure in all municipal facilities.
    - Determine scope of spill. Is it containable by yourself or are there hazardous materials involved that require the fire department or Hazmat teams?
    - Remove the source of the spill. Plug the hole or turn off equipment.
    - Protect stormwater by containing the spill.
    - Notify necessary employees, staff, or cleanup contacts.
    - Use spill absorbents to clean up wet spills. Sweep up dry spills; never hose them!
    - Dispose of the waste responsibly.
    - Restocking used cleanup materials is an important, but often forgotten spill response practice.
    - Log the spill in your records (Office of Water 2).

(Glover et al. 2008)

LIMITATIONS

It is very important that every employee be aware of these procedures in case the stormwater point person is not available. Proper spill response programs require regular training to remind employees of safety and cleanup procedures. Holding mock spill response training sessions can prepare employees for real spills.

[31] Warren County Public Service Project Group. 2007. Institute of Environmental Sciences. See reference 31.
[32] See reference 31.

COSTS

Spill response training sessions will take time out of municipal employees' workdays. Posters or other training materials will incur some cost, which can be reduced by printing them "in-house" or using existing materials from other jurisdictions.

NECESSARY EQUIPMENT

Every municipal facility should have spill response kits in all buildings on their facility and outdoors near fueling or loading stations. A spill response kit contains:

- Absorbents
- Broom/dust pan
- Shovel
- Berms/socks
- Paper or cloth towels
- Safety goggles and gloves
- Phone numbers for appropriate cleanup authorities

Figure 33: Absorbents. Kitty litter or other absorbents should be used to clean up liquid spills. Any absorbents used to clean up hazardous materials should be treated as hazardous waste and disposed of properly.[33]

EXAMPLES OF MEASURABLE GOALS

- Hold one training session every year at each municipal facility.
- Hang "shop posters" in all municipal facilities.

ADDITIONAL ISSUES

Spill response programs should include proper documentation (Office of Water 2). When audits are performed, the EPA or auditing authority will want to know how many spills occurred on the site. They will also want to know how the spill was handled and what has been done to prevent it from happening in the future. Most jurisdictions have chosen to create a standard form for all spills that include the date, what was spilled, where it was spilled, time of spill and of cleanup completion, what caused the spill, and who cleaned up the spill (see Appendix B). This will allow your facility to update your spill response plan on a site specific basis.

[33] See reference 31.

Storm System Cleaning

Municipal storm systems need regular maintenance to work efficiently. When storm drains are clogged with larger debris, such as leaves or trash, water cannot flow through the storm drain and streets become flooded. Storm system cleaning can be performed by the municipality or by a contracted company.

Figure 34: Storm pipe cleaning using the flushing method. Storm drains and pipes should be cleaned at least once a year to remove debris that has collected in the drain.[34]

COSTS

Costs are dependent on how your jurisdiction chooses to clean the storm system. Vacuum trucks, which are the trucks necessary to suck materials from catch basins, are around $50,000 (for used trucks) to $200,000 (Georgia Department of Community Affairs). Dedicated municipal employees contribute to costs if the jurisdiction does the cleaning itself. If outside sources are used, the cost of labor per hour is around $175 (in 1997 dollars) (Georgia Department of Community Affairs). A benefits-cost analysis that considers the footage of storm sewer pipes and number of catch basins will determine which method is the most cost-effective.

Figure 35: Catch basin vacuum truck. Vacuum trucks pump materials from catch basins to be disposed of in a landfill rather than flushing it into the stream.[35]

[34] Office of Water. 2009. Storm drain system cleaning. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=102&minmeasure=6 (accessed April 8, 2010).
[35] Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.

LIMITATIONS

Accessibility is a huge issue when cleaning catch basins and storm sewers. It may be necessary to post signs informing residents of the cleaning and to limit street parking during those times (Office of Water 3). Winter months can be difficult, as well, when snow and ice are present. This can be avoided by ensuring all storm sewers are cleaned before winter weather.

EXAMPLES OF MEASURABLE GOALS

- Install catch basin inserts in a certain percentage of catch basins.
- Clean all catch basins and pipes each year.

ADDITIONAL ISSUES

Because the process of storm system cleaning can be expensive or time consuming, it is important to know when a catch basin or piping system needs cleaning. More frequent cleaning may not provide a significant improvement in efficiency. If your jurisdiction has catch basin inserts, these may need more cleaning than traditional catch basins because they may catch sediment as well. However, these are usually efficient even with up to 80-95% of the insert clogged and they trap sediment and leaves, which clog piping systems (Glover et. al 2008).

Figure 36: Catch basin with smaller grate size to catch leaves. Catch basins have varying grate sizes. Some jurisdictions use grates with smaller holes or catch basin inserts to trap smaller debris. The drawback is they require cleaning more often for efficiency.[36]

[36] See reference 35.

Street and Parking Lot Sweeping

Regular street and parking lot sweeping (using sweeper trucks/equipment) removes debris, such as dust and pollutants, which typically end up in streams after being washed into catch basins. Sweeping should be performed at least twice a year on all roads and preferably more in areas of concern, including near streams, land use (industrial areas vs. residential) or heavily trafficked areas (Georgia Department of Community Affairs).

Figure 37: (left) A leaf collector. In the fall, leaves are a source of stormwater pollution because many residents rake their leaves into the street. Leaf collectors will remove leaves which then can be disposed of in a landfill or composted. The important factor in effective leaf pickup is to inform residents in advance to sweep their leaves close to the street, typically the right-of-way, rather than dump them into the street or burn them.[37]

Figure 38: (right) A street sweeper. Street sweeping is necessary to remove dust, dirt, and other pollutants from the street before they can enter the storm drain. The collected materials must then be treated as solid waste or hazardous waste (if hazardous materials are present).[38]

LIMITATIONS

Street sweepers cannot operate as efficiently where vehicles are parked on roads. Limits to street parking may need to be imposed during sweeping (Environmental Department, SEMCOG). The collected street sweeping materials may need to be tested for hazardous materials prior to disposal, especially in industrial areas. Note: If hazardous materials are detected, they must be treated as hazardous waste rather than solid waste. If they are not detected, treat normally as solid waste.

[37] Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.
[38] See resource 37.

COSTS

Cost is a limiting factor in street sweeping programs. Programs that are already well established may need to adjust street sweeping schedules if operation costs become too high and should consider the lifetime of street sweeping equipment. Municipalities interested in starting programs that include street sweeping equipment should expect to pay from tens of thousands of dollars for equipment and operation costs up to hundreds of thousands of dollars depending on the equipment that is purchased and the street sweeping schedule (Georgia Department of Community Affairs).

EXAMPLES OF MEASURABLE GOALS

- Implement a street sweeping program to reduce sediments in streams by a certain amount.
- Collect and dispose of a set weight or amount of street debris each year.

ADDITIONAL ISSUES

There are three types of street sweepers: mechanical, regenerative air, and vacuum filter (Glover et. al 2008). Each type has advantages and disadvantages that should be considered before purchasing. Trade journals and stormwater websites are a useful tool for determining which type to purchase based on the following criteria:

- Cost
- Lifetime of equipment (e.g. when will it need to be replaced)
- Targeted pollutants
    - Large vs. particles less than 10 microns in diameter (PM_{10}).
    - Hazardous vs. non-hazardous
- Surface types that might be swept
- Travel distance
- Travel speed and brush speed of sweeper
- Noise ordinances (time of sweeping)

(The Stormwater Manager's Resource Center 2)

A good rule of thumb is to have more than one type of sweeper in the fleet to accommodate varying road sizes and conditions.

Used Oil Generation and Recycling

Some municipal processes may result in used oil generation. Used oil is defined in Table 5. (Division of Hazardous Waste 2006). If your municipal activities generate used oil there are several options depending primarily on whether you will need to follow the used oil transporter requirements (see Table 6). You will not need to follow the used oil transporter requirements as long as you transport the oil in your own or an employee's vehicle and the amount is less than 55 gallons at a time.

Figure 39: Crushed oil can. Crushing oil cans and recycling oil filters removes excess oil from them and reduces the chance that oil will contaminate streams.[39]

Figure 40: Waste oil heater. Waste oil can be used in waste oil heaters as long as no other materials are in the oil. **Never** dump waste chemicals like antifreeze or solvents into waste oil.[40]

[39] Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.
[40] See reference 39.

Table 5: What is "used oil?" Anything listed as used oil can be combined and recycled as used oil. Materials from the "Not Used Oil" category should never be mixed with used oil unless the municipality is disposing of it as hazardous waste.

What is Used Oil?	
Used oil includes:	*Used oil does not include:*
Engine oils from vehicles and equipment	Products made from oil
Lubricating oil	Clean-up materials from oil spills
Brake fluids	Animal oils
Transmission fluid	Vegetable oils
Hydraulic fluid	Oil sludge from virgin oil storage tanks
Insulating oils	Antifreeze
Metal cutting fluids	Kerosene (unless used as lubricant)
Industrial process oils	Petroleum distillates used as solvents
Compression refrigerant oils	

Adapted from *Recycled Used Oil Management Standards*, Division of Hazardous Waste Management.

Table 6: Disposal options for used oil generators. Municipalities have several options to dispose of used oil.

Disposal options for used oil generators	Criteria
Take to a registered used oil collection site. The Ohio EPA maintains a list of used oil collectors (see References: Registered Used Oil Collection Centers).	55 gallons or less.
Take to an aggregate site or facility owned by your jurisdiction.	55 gallons or less.
Recycle with an EPA approved recycler. The Ohio EPA maintains a list of used oil recyclers (see References: Recyclers and Environmental Service Providers).	Any amount of used oil.
Burn used oil on-site for heating requirements. Oil must be used to heat facility with an on-site space heater. A maximum energy generation of 0.5 million BTUs is allowed with ventilation of gases leading outside.	Any amount of used oil.

(Division of Hazardous Waste 2006)

LIMITATIONS

Used oil recycling will be limited if materials are mixed with anything else. **Never** mix used oil with anything else other than used oil or it may be considered a hazardous waste. Recyclers and disposal authorities must be licensed. There also may be liability issues with employees using their own vehicles to transport 55 gallons or less of oil.

COSTS

Costs will depend on the amount of oil that is generated and will need to be disposed of properly. Contact the local waste hauler or recycler for their prices. It may be cheaper to purchase a waste oil heater than to pay a licensed hauler to transport oil to a recycling center. Waste oil heaters range in prices from $4000 to $10,000 (Lanair Products, LLC) with a payback period on the initial costs of about two years (Doityourself® 2010).

EXAMPLES OF MEASURABLE GOALS

- Install on-site used oil heaters at all municipal facilities that generate used oil.
- Create a campaign to inform local businesses of used oil recycling options that increase recycling by a certain percentage.

ADDITIONAL ISSUES

Used oil filters have different requirements for disposal depending on the type of oil filter. For oil filters that are non-terne plated and hot-drained, the filter (after draining for 12 hours) may be disposed of with the municipal waste as it will not be considered hazardous (Division of Hazardous Waste 2006); they can also be recycled for scrap metal (Filter Manufacturer's Council; Georgia Department of Community Affairs). Waste oil is then treated as used oil and disposed of using the aforementioned procedures.

Outreach programs will help both do-it-yourselfers and private maintenance garages dispose of used oil and filters properly (Georgia Department of Community Affairs).

Vehicle Washing

Figure 41: Vehicle washing. Vehicle washing on impervious surfaces or even lawns sends polluted water directly into the storm drain. This image represents how washing vehicles in the wrong location, such as a driveway or street, is like washing your car directly on a stream.[41]

Municipal vehicles including fire trucks, emergency vehicles, and road maintenance fleets typically have sediments, oil, road salt, or other particles on them that end up in streams when they are washed or blow off the vehicles. Soap, detergents, and vehicle/equipment cleaners are often used in the washing process. These pollutants, especially detergents, can have harmful effects on streams. For these reasons, it is necessary to protect stormwater by washing vehicles in the appropriate location.

The ideal location for washing vehicles is at a commercial vehicle wash. Commercial vehicle washes have the ability to recycle their water on-site as well as to contain water so it will not enter the storm drain. If no commercial vehicle washes are available, then vehicles should be washed indoors (that will drain to sanitary sewers) or on grass/pervious surfaces.

LIMITATIONS

Municipalities may not be able to secure an agreement with a commercial vehicle wash or be able to find car washes that will accommodate larger trucks. Equipment, such as lawn mowers,

[41] Office of Water. 1995. U.S. EPA. http://www.epa.gov/nps/toolbox/print/psatautowash.pdf (accessed May 6, 2010).

would need to be hauled to commercial vehicle washes, which adds to the costs. Furthermore, some municipal facilities do not have the ability to wash vehicles indoors because the facility either has no drains or has indoor drains that improperly lead to storm sewers (which should be closed off regardless of indoor practices).

COSTS

Costs depend on whether the jurisdiction chooses to perform vehicle washing on the site or to take vehicles to a commercial vehicle washing facility. Washing on-site will require the purchase of equipment and other associated costs (Dultmeier Sales, LLC) If ordinances/regulations allow, the municipality can also open up a municipal car wash that is open to the public and used by municipal employees (for information on how to start a municipal car wash see Additional Resources: Dultmeier Sales, LLC; Hi-Performance Wash Systems, Inc. 2010). If taken to a commercial vehicle wash, the costs will be based on the contract with the washing facility. Without a contract, individual car washes can cost up from $5-$10 per wash.

NECESSARY EQUIPMENT

If your municipality decides to do vehicle washing indoors, it will need to purchase the proper equipment. Some equipment necessary for vehicle washing:

- Sprayers (high pressure, but lower flow to save money and conserve water),
- Soap/cleaner,
- Brushes,
- Vehicle bays (unless washing in previously built facilities),
- Suction devices, and
- Hoses.

EXAMPLES OF MEASUREABLE GOALS

- Wash all vehicles on a regular schedule (e.g. weekly, bi-weekly, monthly)
- Ensure all vehicle washes occur indoors or at commercial vehicle washes by a set date (e.g. switch from washing outdoors to indoors).

Winter Salt Application and Storage

Figure 42: Road salt storage. Road salt or deicers should be stored in covered shelters with a door. **Although road salt is spread liberally on roads for safety, it is important that we limit the amount of stored road salt that enters streams.** Protecting stored road salt from the elements (wind or precipitation) saves money since very little is wasted and keeps unnecessary salt out of our streams.[42]

Figure 43: An example of a road salt spreader. Road salt spreaders should be emptied completely when not in use or at the end of the snow season, especially if stored outdoors. Excess salt in spreaders can get washed out in rains.[43]

Winter in cold climates means snow. For municipalities, that means snow removal. Snow removal typically involves the use of snow plows and road salt on roads or shovels and de-icers on sidewalks. But de-icers, especially those containing chlorine, are pollutants to our streams often resulting in fish and vegetation kills. Salts can also damage the roads themselves by causing staining.

All of these snow management choices need to be stored and used properly:

- Salt domes should always be covered and closed when not loading salt.
- Liquid de-icers should be kept in secondary containment until use.
- No excess snow removal products should be dumped or drained into storm drains.
- Salt trucks should not be overfilled and should be covered where possible. This reduces loss and saves on purchasing costs.
- Spills should be cleaned up completely.

[42] Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.
[43] See reference 42.

Table 7: The advantages and disadvantages of common snow management chemicals.

Deicer	Lowest Temperature	Cost	Environmental Impact
Calcium Chloride	-25 degrees F	Flake $290/ton, pellet $340/ton	Less salt required No cyanide Contains chlorine
Magnesium Chloride	5 degrees F	Flake $260/ton, pellet $300/ton	Least toxic deicing salt May cause tracking or discoloration
Sodium Chloride ("rock salt")	15 degrees F	$35/ton	May contain cyanide Contains chlorine
Urea (fertilizer)	20 to 25 degrees F	$280/ton	Contains excess nutrients Less Corrosive
Calcium Magnesium Acetate (CMA)	22 to 25 degrees F	$2,000/ton	Less toxic
Sand	Does not melt snow/ice	$15/ton	Accumulates in streets and streams Needs to be swept

Adapted from *Snow, Road Salt and the Chesapeake Bay*, Tom Schueler.

LIMITATIONS

Rock salt and common alternatives have trade-offs. Road salt alternatives are more expensive per ton than common rock salt, but typically do far less environmental damage. Calcium chloride and magnesium chloride also work at far lower temperatures. Salt needs to be cleaned up by a street sweeper or plow, which does not factor into the prices listed above.

COSTS

Although road salt is the cheapest material per ton, other de-icers may not need to be applied as frequently. This puts the cost per lane per mile very similar for calcium chloride and magnesium chloride. Calcium Magnesium Acetate has the highest cost, but may not cause as much damage, such as corrosion or roadside vegetation kills, as other de-icers (Georgia Department of Community Affairs).

While it may not be possible to consider the more expensive options for municipal snow removal on all roads, these options could be considered for sensitive areas or sidewalks and driveways that could be easily damaged by conventional de-icers. The costs in Table 7 do not include the social or environmental costs associated with damage to property or wildlife, which can add significantly to the total cost of the de-icer (Georgia Department of Community Affairs).

Figure 44: Brine used for road deicing. Like road salt, salt brine is a pollutant to streams and should be stored indoors or in secondary containment. Loading truck tanks with brine should be performed indoors, on grass, or away from storm drains.[44]

ADDITIONAL ISSUES

Pervious pavement has an advantage over conventional pavement in winter to remove melted snow and reduce the need for de-icers. Pervious pavement reduces the hazard of ice formation, a common side effect from snow melting and re-freezing (Ferguson 2010). It can be considered during road design as a way to reduce future road salt needs.

EXAMPLES OF MEASURABLE GOALS

- Reduce road salt contamination indicator levels (e.g. chlorine levels, conductivity, etc.) in streams by a set percentage over time.
- Replace all municipal salt with a more stormwater friendly product.

[44] See reference 42.

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APPENDICES

Pollution Prevention and Good Housekeeping Practices for Municipal Operations

Appendix A: Site Visit Checklists

The following section contains site visit checklists. Site visit checklists are a tool for municipalities to perform self-audits. The Ohio EPA may look for more or fewer items during the official audit of your jurisdiction's stormwater program. These are intended to be used as guidance only.

Parks			
Materials Storage and Handling	**YES**	**NO**	**N/A**
Fertilizers/insecticides/herbicides/pesticides/fungicides stored indoors			
Chemicals stored in original containers			
If not, are they labeled correctly? (should include all information found on original container)			
Mulch or fill dirt stored indoors or covered			
Is there an organic version of a chemical used at the parks?			
List organic products used as alternatives to chemicals:			
Grounds Maintenance	**YES**	**NO**	**N/A**
Mulch used away from storm drains			
Lawn care products used only when needed			
Do sprinkler systems have timers?			
Do young trees have tree watering bags?			
Are pet waste collection stands available for park patrons?			
How often are these collection stands maintained (e.g. bags refilled regularly)?			
Equipment Maintenance	**YES**	**NO**	**N/A**
Lawn care equipment (mowers, trimmers, shovels) hosed in grassy areas and away from storm drains			
Fueled in contained areas and away from storm drains			
Are vehicles or liquid storage tanks regularly inspected for leaks?			
How often?			

Administrative Considerations			
Stormwater Management	YES	NO	N/A
Stormwater Pollution Prevention Plan (SWPPP) created and implemented			
Spill Prevention and Response Plan created and implemented			
Point-person chosen			
Name of Point Person:			
Employees trained on spill notification process			
Good Housekeeping	YES	NO	N/A
Facilities schematics show locations of storm drains			
Sensitive areas on-site identified (nearby water sources)			
Schematics accurately reflect plumbing			
Drains in and around facility are labeled to inform employees where they drain (e.g. to storm sewer or municipal sanitary)			
Pollutant sources on-site identified			
Current BMPs requiring maintenance:			
Has a schedule for BMP maintenance been created and followed?			
Does the municipality have impounded vehicles or vehicle storage?			
Stored vehicles are inspected regularly for leaks			
Reducing/replacing Pollutants	YES	NO	N/A
Certifications on products ("green seal", "water-safe")			
Products bought in bulk for entire jurisdiction			
Use of precision measurement of chemicals			
Products bought in concentrated form			
Use of chemical products kept to a minimum			
Other Considerations	YES	NO	N/A
Personnel trained in hazardous materials			
Identified hazardous/non-hazardous materials at the facility			
Materials Safety Data Sheets (MSDS) are up to date			
Inventory is organized and up to date			
Staff notified of materials/chemicals requiring special handling, storage, and disposal			
Have less hazardous materials been considered for substitution?			
List materials here:			
Recycling of materials processed on-site			
Leak detection devices, overflow controls, and other spill prevention equipment purchased and installed			
Drains that lead to storm sewers are disconnected			
Preventative maintenance schedules are implemented			
Documentation of all Good Housekeeping Practices Used on-site			
Measureable goals for the Stormwater Pollution Prevention Plan and NPDES permit have been followed			

Materials Storage, Handling, Disposal			
Hazardous Materials On-site (List type in space if applicable)	YES	NO	N/A
Antifreeze			
Oils			
Solvents			
Brake fluid and brake pad dust			
Batteries or battery acid			
Fuel (gasoline, diesel, kerosene)			
Lubricating grease			
Other fluids:			
Labelling	YES	NO	N/A
Containers have chemical name			
Containers have common name			
Unit number or product code			
Date opened			
Expiration date			
Markings to denote hazardous content			
Storage	YES	NO	N/A
Materials stored indoors			
Hazardous waste segregated from other materials			
Sufficient aisle space between stored materials			
Materials stored away from high-traffic areas			
Materials stacked properly and in accordance with the manufacturer's directions			
Materials closed when not in use			
Spillable materials stored on pallets			
Materials stored in secondary containment where necessary			
Handling	YES	NO	N/A
Heavy materials moved using forklifts, jacks, or dollies			
Materials are scooped or poured over spill containers/pans			
When materials are used, the amount used is recorded and compared with material in storage container. (Note: this helps prevent loss as well as alert to possible leaks in containment.)			
Disposal	YES	NO	N/A
Materials stored in labeled containers prior to disposal			
Non-hazardous materials are put into closed dumpsters			
Materials recycled (see vehicle maintenance checklist for list of vehicle related recyclable materials).			
List additional recyclable materials here:			
Participation in battery exchange services			
Industrial laundry service for dirty rags, clothing			

Vehicle/Equipment Maintenance			
Spill Prevention & Cleanup:	YES	NO	N/A
Spill prevention plan			
Maintenance activities performed inside			
Are spills cleaned up immediately?			
Berms or other measures used to contain spills			
Are "dry shop" techniques used?			
Are absorbents used for spills?			
Drip pans used during maintenance			
Spill cleanup restocking schedule			
What is the schedule?			
Floor drains and sumps within the service bay areas closed			
Funnel lids used on drums for liquid waste			
Waste Reduction:	YES	NO	N/A
Solvent use kept to a minimum			
What happens to spent solvents?			
Shop uses non-chlorinated organic solvents			
Any non-hazardous cleaners			
Recycled Products:	YES	NO	N/A
Engines			
Oil			
Transmission fluid			
Antifreeze			
Hydraulic fluid			
Radiator flush water			
Fueling	YES	NO	N/A
Regular inspection for external corrosion or structural failures in aboveground tanks			
Operators do not overfill vehicles			
Piping system checked regularly			
No leaks/spills during pumping from a truck to the storage unit			
Periodic testing by qualified professionals			
Vehicle/Equipment Washing	YES	NO	N/A
Small equipment/parts washed in sinks or indoors			
Mowers/grounds maintenance equipment washed on grass and away from catch basins			
Vehicles washed indoors or at commercial car washes			
Detergents kept to a minimum during washing			
Mounted spill kits with absorbent materials and instructions near wash racks			
Parts wiped off rather than washed, when possible			
Parts drained in sinks			
Are detergent based cleaning solutions used instead of caustic solutions?			

Municipal Snow and Ice Removal			
De-icers	**YES**	**NO**	**N/A**
If de-icers are used, what is it? Type? Liquid or pellets?			
Stored indoors or covered			
Are storage units closed when de-icer is not being added or removed?			
Is the storage located outside of the flood plain?			
If rock salt is used, have alternatives been considered?			
De-icer Handling	**YES**	**NO**	**N/A**
Spreaders loaded inside the storage structure			
Systems to prevent spills during loading			
Tarps used on open salt truck beds to reduce overflow spills during use			
Spreaders loaded to a maximum of 30 cm above grate			
Spreaders calibrated and periodically checked for calibration			
Spilled materials promptly swept and returned to pile			
Excess salt returned to storage from spreader (or spreaders/trucks are stored indoor when not in use)			
Salt Brine	**YES**	**NO**	**N/A**
Can salt-laden or wash water be used for brine production (some regulations do not permit this)?			
Salt brine tanks placed above ground and protected			
Salt brine tanks regularly inspected for leaks			
Secondary containments used			
Brine production and storage areas flushed away from catch basins			
Remaining brine stored or sent to sanitary sewer (not dumped into catch basins)			
Snow Removal Practices	**YES**	**NO**	**N/A**
Is salt applied above the practicable temperature (typically 10 degrees Fahrenheit)?			
Is plowing ever performed without de-icers?			
How often and under what conditions?			
Use of sand for traction is limited			
If sand is used, is it cleaned up after use?			
Snow piles located away from streams or sensitive areas			
Local weather reports available to snow plow operators			
Is street parking limited when major snow events occur (to allow sufficient plowing space)?			
Spreaders swept before washing			
Road Salt/De-icer Management (administrative)	**YES**	**NO**	**N/A**
Are there annual damages (physical, monetary, health-related, etc.) due to salt usage?			
Are these damages factored into the cost of using road salt?			
Are any potential surface water contamination hotspots considered?			

Are these hotspots known to snow plow operators?			
Are residents informed of home snow removal Good Housekeeping Practices? (e.g. door hangers, newsletters, leaflets, etc.)			
What method is used to inform residents?			
Levels of environmental indicators (chloride levels in streams) have been measured			
Have baseline conditions of site and surrounding streams been taken?			
Are weigh-in-motion sensors used to confirm recorded amounts and track dispatches?			
Are materials used during winter season monitored and reconciled at the end of the season (to prevent losses and excess salt use)?			

Street Sweeping			
Schedule	**YES**	**NO**	**N/A**
Is there a regular street-sweeping schedule?			
What is the minimum number of times every road is swept each year?			
Sweeping performed during low traffic times (e.g. midnight-6am)			
Sweeping performed before rain or snow events			
Sweeping performed after road salt/sand applications if excess materials are used			
Equipment	**YES**	**NO**	**N/A**
What kind of street sweeping equipment is used?			
How many tons (or pounds) of debris is collected each year?			
Location	**YES**	**NO**	**N/A**
Do street sweeping schedules take into account noise ordinances and decibel output of the equipment?			
Are industrial or highly trafficked areas swept more often?			
Are there any potential risks to surface waters on the street-sweeping route?			
List areas with potential risks:			

Fire Department or Police Department			
Accident Clean-up	YES	NO	N/A
Hazmat notification process known by all employees			
Spills are contained (liquids) or covered (solids) to prevent spreading			
Berms or mats used to cover storm drains if water is used to hose area			
Towed vehicles are checked for leaking fluids			
Hazardous Materials and Spills	YES	NO	N/A
Materials Safety Data Sheets (MSDS) up-to-date and accurate			
Hazardous chemicals stored and labeled properly			
Is there an emergency action plan for spills?			
Washing and maintenance of vehicles performed indoors			
If outside, washing performed on grass and away from catch basins			
Fueling	YES	NO	N/A
No overfilling performed			
Spill response kits near fueling station			
Waste Management	YES	NO	N/A
Appropriate receptacles for both hazardous and non-hazardous waste			
Cleaning procedures of receptacles is followed			
Disposal of liquid waste in closed containers			

Checklist References

Agriculture Center. 2009. Vehicle and equipment maintenance and repair. U.S. EPA. http://www.epa.gov/oecaagct/tveh.html (last updated November 18, 2009) (accessed January 25, 2010)

Audubon International. 2006. Maintenance facility BMPs – a self-assessment checklist. http://www.audubonintenational.org/PDFs/Maintenance%20Facility%20BMP%20Checklist.pdf

California Department of Toxic Substances Control. Pollution prevention opportunities checklist for vehicle maintenance activities. http://www.dtsc.ca.gov/PollutionPrevention/VSR/upload/P2_FLY_VSR_opp_checklist.pdf

Warren County Public Service Project Group. 2007. Institute of Environmental Sciences.

Appendix B: Spill Response Forms

Documenting spills is an important part of Pollution Prevention/Good Housekeeping so it is recommended that you use a spill response form for every major or hazardous spill. This section contains two options that jurisdictions may use to document spills and spill response.

Option 1

Instructions: Complete for any type of petroleum product or hazardous materials/waste spill or incident. Complete for large spills of non-hazardous materials. Place completed form in spill report folder.

1. Personnel Involved in Spill Reporting:

Name and Title of Person Responsible for Spill Response: _____

Phone Number: _____

2. General Spill Information:

Common Name of Spilled Substance: _____

Chemical Name of Spilled Substance: _____

Quantity Spilled (Estimate): _____

Describe Concentration of Material (Estimate): _____

Date of Spill: _____/_____/_____

Time Spill Started: _____ AM _____ PM Time Spill Ended: _____ AM _____ PM

3. Spill Location:

Street Address or Location on Property: _____

Weather Conditions: _____

If Spilled Near Water, Name of Water Body (if ditch or culvert, identify the water body that the structure discharges to):

_____

4. Actions taken:

To Contain Spill or Impact of Incident: _____

To Cleanup Spill or Recover from Incident: _____

To Remove Cleanup Material: _____

To Document Disposal: _____

To Prevent Reoccurrence: _____

5. Reporting the Spill:

List all agencies contacted; include names, dates, and phone numbers for people you spoke with:

_____

_____

6. Person Responsible for Managing Termination/Closure of Incident or Spill:

Name and Phone: _____

Address and Fax: _____

7. Additional Notes/Information (if necessary):

Option 2

Spill Incident or Report Form

Instructions: Complete for petroleum product or hazardous materials/waste spill or incident and large non-hazardous spills. Place completed form in spill report folder.

A. Name & Title of Person Responsible for Spill Response:

_____

Phone number:

_____

B. Spill Location (street address or location on property):

_____

If spilled near water, name water body or discharge location:

_____

_____

_____

C. *General Spill Information*

Common Name of Spilled Substance:

_____

_____

Chemical Name of Spilled Substance:

_____

_____

Quantity Spilled (estimate): _____

Date of Spill: _____/_____/_____

Time Spill Started: _____AM _____PM

D. *Actions Taken*

To Contain Spill or Impact of Incident:

_____

To Cleanup Spill or Recover from Incident:

_____

To Remove Cleanup Material:

_____

To Document Disposal:

_____

To Prevent Reoccurrence:

_____

E. List all agencies contacted; include names, dates, and phone numbers for people you spoke with:

_____

_____

_____

Appendix C: TMACOG Stormwater Coalition Newsletters

STORMWATER COALITION

The Stormwater Coalition is a committee of the Toledo Metropolitan Area Council of Governments (419.241.9155). The coalition is composed of the following members:

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Association of General Contractors of Northwest Ohio
(419.241.3601)

Home Builders Association
(419.473.2507)

Ohio Department of Transportation
(419.373.4433)

Don't Let Your Pet Pollute

Pet waste left on the street or lawn does not just go away. It is often washed into storm drains, ditches, streams, rivers, and then into Lake Erie. Kitty litter dumped outside can also be washed into drains and end up in the lake. Since stormwater is not treated, bacteria in pet waste can end up in rivers and Lake Erie from which we get our drinking water.

Why You Should Pick Up After Your Pet

- Cleaning up after a cat or dog is something we can all do to keep our water safe for fishing and swimming.
- Pet waste is not good lawn fertilizer; the bacteria in waste does more harm than good.
- Proper disposal of waste can prevent the spread of harmful bacteria and viruses from animals to humans.
- Organic matter in pet waste can degrade water quality. The decay of waste uses up dissolved oxygen and releases ammonia. This process can kill fish and other aquatic life.

What You Can Do

- Pick up pet waste from your yard. No one wants to play or eat outside in a yard fouled with pet waste. Simple scooping tools make this job easy.
- Carry disposable bags while walking your dog so you can pick up and dispose of waste properly.
- Encourage your neighbors and other pet owners to be responsible. Support projects that share information about pet waste and make pet waste pick up easier.

How Do You Dispose of Pet Waste Properly

- The ideal solution is to pick up after your dog and flush the waste in a toilet. That way the waste is treated before water returns to rivers and lakes.
- You can also put animal waste in your trash bin. Dispose of waste in the bag you collect it in. Just tie the bag tightly to avoid a spill.

What You Should Not Do

- Do not put pet waste in a catch basin, storm drain, or in the street.
- Do not add pet waste to a compost bin. The compost pile will not get warm enough to kill disease-causing organisms.
- Do not use pet waste as lawn or garden fertilizer.

Remember, stormwater is not treated and goes directly into ditches, rivers, and lakes. We can all help protect our water supply by being careful about what gets in the stormwater system.

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(419.473.2507)
Ohio Department of Transportation
(419.373.4433)
Property Rights Coalition
(419.241.4677)

Fertilize Your Lawn if You Must, But Don't Fertilize the Water

The Toledo Metropolitan Area Council of Governments (TMACOG) and the Stormwater Coalition remind people that fertilizer should be applied to lawns sparingly and caringly. And it should stay on your lawn and not get into the storm sewer system where it affects our streams and lakes.

A little care will save you money and will also protect streams and lakes.

First, use only as much fertilizer as you need. A simple soil test will tell you if you need to add nutrients. If you do want to fertilize, use a no- or low-phosphorus fertilizer, and select a slow release fertilizer where at least half of the nitrogen is water insoluble.

Then, don't let your fertilizer wash away into the storm sewers where it will end up in streams and lakes. If we get a rain right after you fertilize, you'll watch your investment flow right to the storm sewers, and fertilizer does not belong in the water supply. Do use a broom to sweep excess or spilled fertilizer off the sidewalks and back onto your lawn, don't use a hose that will wash fertilizer into the street and then into sewers.

Excess amounts of nitrogen and phosphorus can cause blooms of algae in our lakes and streams. Some algae is natural and is part of the food chain, but overgrowth of algae forms mats of goo that clog water inlets and block sunlight to the water. And as algae decay they use up oxygen in the water that fish, frogs, and other wildlife need.

There are ways to keep a lawn green and healthy that are 100 percent free and ecologically sound. When you mow, leave the grass at least 3 inches tall, and leave the clippings on the lawn. Grass clippings will quickly breakdown and enrich the soil. You can also make your own organic fertilizer in a home compost bin. Kitchen waste like vegetable peels and eggshells, combined with leaves and grass clippings will create a rich compost that will keep a lawn or garden healthy and growing.

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Storm Drains are for Rain, Not Paint

Spring cleaning season is upon us. As you go through your basement hauling out items that you want to dispose of, separate things that can go in the regular trash (landfill) from materials that should go to a hazardous waste facility. And don't throw or wash anything down a storm drain.

Items that need special handling include electronic waste, household hazardous waste, and tires. Examples of electronic waste are any kind of batteries and any appliances with circuit boards including phones, cameras, computers and accessories, and also CDs, and cassette and VHS tapes. Household hazardous waste includes gasoline, all vehicle fluids, fertilizer, fire extinguishers, fluorescent bulbs, and oil-based paints and stains.

For a more complete list of hazardous waste products, go to your county website. The Lucas County Sustainability Commission (http://www.lucascountygreen.com/recycling.html) provides recycling links to county and city programs, as well as nonprofits that accept recyclables. It includes Keep Toledo/Lucas County Beautiful, which provides a detailed recycling guide. Also see these frequently asked question links:

- http://www.lucascountygreen.com/recyclingfaq.html
- http://www.lucascountygreen.com/hazardousfaq.html

In Wood County, go to http://www.wcswmd.org/newrecycling.htm or call 419.354.9297. The Wood County website has a household recycling directory, including hazardous and electronic waste and also a calendar showing recycling events in different communities.

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End of Season Pool and Hot Tub Draining

You've spent the summer barbequing, swimming and appreciating Ohio's abundant natural resources and now it's time to pack up the last picnic, send the kids off to school and close the backyard pool. Many pool owners don't know that draining pool water directly to the storm sewer can harm local creeks, rivers and lakes and the fish and wildlife that live in them. This is because pool water contains chlorine, copper, and filter backwash that, when discharged to a storm sewer, runs directly to ditches and streams without being treated.

Discharging chlorinated water through your sanitary drain is the best option because this allows the water to be treated before it enters natural water bodies. In most cases, the sewer rate is based on water use when you filled the pool, so you will not be charged an additional fee. On the other hand, you could incur fines for improperly draining pool water to the storm sewer. If your only option is to drain pool water to a storm sewer, use the steps below to avoid fines and make sure that your end of season pool maintenance does not harm our local waterways.

Step 1: Rest water. Let water sit for two weeks after the last chemical treatment to allow chlorine to break down and leave the water. Allow suspended solids to settle out of the water by keeping swimmers out of the pool for a week prior to draining. The water should not appear murky once suspended solids are settled out. Skim all leaves and algae from the water's surface.

Step 2: Test water. Before draining, water should be near neutral (pH6.5-8.5) and free of chlorine, bromine and algaecides before discharging. Test kits are available at pool supply stores.

Step 3: Use water for irrigation. As much as you can, allow water to infiltrate through grass, gardens, or other permeable surfaces. You can use a hose to evenly distribute and direct water. Stop draining when lawn and vegetation are saturated and water begins to pond. Do not allow water to drain onto your neighbor's property.

Step 4: Drain remaining water. After saturating grass and other vegetation, the remaining de-chlorinated pool water can be drained directly to the storm drain. To prevent soil erosion, make sure that water does not flow over bare soil. Only clear water should be flowing into storm drain. Settled solid materials should be properly disposed of in regular trash or compost and should not be discharged with pool water.

Step 5: Properly store chemicals. To avoid stormwater pollution and injury all chemicals should be sealed and stored off the ground away from potential moisture and water. Follow all storage instructions provided on bottles. When time comes to dispose of chemicals, contact your county hazardous waste disposal facility.

Appendix D:
Hazardous Waste Disposal Factsheet

HAZARDOUS WASTE DISPOSAL FACT SHEET

Hazardous wastes must be identified and disposed of properly. Any materials used to absorb or contain hazardous waste, such as kitty litter/absorbents or rags, must be disposed of following the hazardous waste regulations. **Hazardous wastes, including materials used to absorb hazardous material spills, cannot be disposed of in the regular trash.**

ROUTINE CLEANUPS

- **DIESEL FUEL, TRANSMISSION FLUID, HYDRAULIC FLUID, OR UNUSED ANTIFREEZE**
  Should be collected and placed into drums or other suitable containers, a waste characterization sheet should be completed for disposal at a landfill or removal by a certified contractor. Before placing materials into drums, contact the Division of Solid Waste for appropriate container requirements for disposal at Hoffman Road Landfill.

- **GASOLINE, USED OIL, OR USED ANTIFREEZE**
  Should also be collected and placed into drums or other appropriate container. In addition, samples should be collected and submitted for analytical testing to determine if the material is a hazardous or non-hazardous waste.

IDENTIFYING HAZARDOUS WASTE

- If your waste appears on any one of the lists published in Ohio's hazardous waste regulations, it may be a hazardous waste when disposed. These hazardous waste lists are published in the Ohio Administrative Code (OAC), rules 3745-51-31 through 3745-51-33. There are four different types of listed wastes. Each waste on the list is assigned a hazardous waste code. For additional information refer to *How to Determine if a Material is Considered Hazardous* (page D-5).

- If you find that your waste does not appear on the F, K, P or U lists in Ohio EPA's rules, your waste may still be regulated if it exhibits a hazardous characteristic. In the rules there are four characteristics that could cause a waste to be regulated as hazardous. For additional information refer to *Method 1: Identifying Hazardous Waste* (page D-6).

COMMON HAZARDOUS WASTE MATERIALS

- Oil (due to metals and halogenated/non-halogenated solvents)
- Gasoline (due to benzene or BTEX: benzene, toluene, ethyl benzene, and xylene)
- Mercury- and lead-containing materials (e.g. electronics)
- Pesticides
- Lead-acid batteries
- Caustics
- Used-parts Solvents
- Spent coolants/anti-freeze (due to heavy metals)

Common Hazrdous Waste and their Waste Codes

Description of Waste	EPA Waste Code(s)
Spent cleaning or degreasing solvents (e.g., xylene, acetone, MEK, toluene, benzene, methanol). Still bottoms	F003, F004, F005, D001, D018, D035
Spent halogenated cleaning or degreasing solvents (e.g., methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, trichloroethylene).Still bottoms	F001, F002, D019, D039, D040
Old paint, paint booth filters	D001, D035, D006, D007, D008
Mineral spirits or stoddard solvent, solvent wipers	D001
Spent acids or caustics	D002
Fluorescent bulbs containing mercury*	D009
Dry cleaning waste and filters	F001, F002, D019
Printing wastes	D001, D002, D011
Lab chemicals	D, F, P, U codes possible
Metal plating wastes	F007, F008, F009, F010, F011, F012, F019, D007, D008

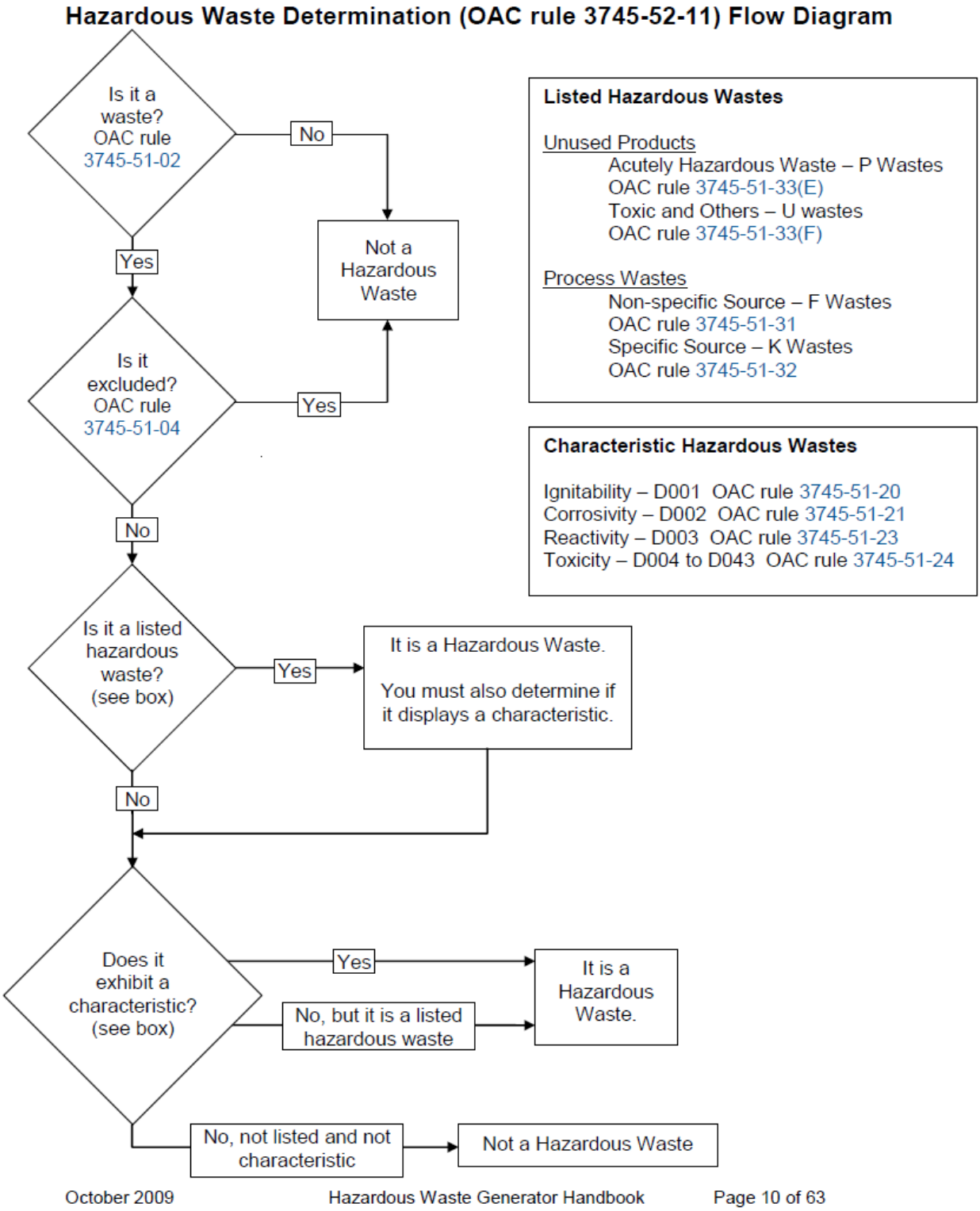
** Waste fluorescent lights, pesticides, mercury-containing thermostats and batteries can all be managed as universal waste. For more information on universal wastes see* ***www.epa.ohio.gov/dhwm/universalwaste.aspx***.

Generator Requirement Summary Table			
Generator Requirements and OAC reference	**Generator Category**		
	CESQG	**SQG**	**LQG**
Monthly Generation 3745-52-34	≤ 1 kg acute hazardous waste ≤ 100 kg hazardous waste	> 100 kg and < 1,000 kg hazardous waste	> 1 kg acute hazardous waste ≥ 1,000 kg hazardous waste
Total Accumulation On-site 3745-52-34	≤ 1 kg acute hazardous waste ≤ 1,000 kg hazardous waste	> 100 kg and < 6,000 kg hazardous waste	> 1 kg acute hazardous waste ≥ 6,000 kg hazardous waste
Hazardous Waste Determination 3745-52-11	Required through process knowledge or analysis (**documentation required**)	Required through process knowledge or analysis (**documentation required**)	Required through process knowledge or analysis (**documentation required**)
EPA ID Number 3745-52-12	No applicable requirement	Required	Required
Accumulation Time 3745-51-05 3745-52-34	None 3745-51-05	180 days or 270 if the TSDF is > 200 miles away (30 day extension also available) 3745-52-34(D) to (F)	90 days (30 day extension also available) 3745-52-34(A)
Generator Treatment 3745-52-34	Permissible on-site but must follow LQG requirements	Can treat hazardous waste on-site for up to 180 days	Can treat hazardous waste on-site for up to 90 days
Satellite Accumulation 3745-52-34	No applicable requirement	Up to 55 gallons of non-acute or 1 quart of acutely hazardous waste at or near the point of generation	Up to 55 gallons of non-acute or 1 quart of acutely hazardous waste at or near the point of generation
Container Management 3745-66-70 to 77	No applicable requirement	Good condition compatible with waste labeled as hazardous waste maintain aisle space and lids conduct weekly inspections label accumulation start date (unless a satellite accumulation area)	Good condition compatible with waste labeled as hazardous waste maintain aisle space and lids subparts AA, BB and CC apply conduct weekly inspections label accumulation start date (unless a satellite accumulation area)
Tank Management 3745-66-90 to 99 and 3745-66-101	No applicable requirement	Good condition compatible with waste labeled as hazardous waste accumulation start date tracked daily inspections 3745-66-101	Good condition compatible with waste labeled as hazardous waste accumulation start date tracked daily inspections subparts AA, BB and CC apply secondary containment is required

Hazardous Waste Generator Requirement Summary Table			
Generator Requirements and OAC reference	**Generator Category**		
	CESQG	**SQG**	**LQG**
Pre-Transport Requirements 3745-52-30 to 33	No applicable requirement	Packaging Labeling Marking Placarding	Packaging Labeling Marking Placarding
Personnel Training 3745-65-16	No applicable requirement	All employees must be thoroughly familiar with proper waste handling and emergency procedures, relevant to their responsibilities 3745-52-34(D)(5)(c)	Required with annual refresher
Emergency Equipment 3745-65-30 to 37	No applicable requirement	Internal communication or alarm system Telephone or two-way radio Fire, spill control and decontamination equipment	Internal communication or alarm system Telephone or two-way radio Fire, spill control and decontamination equipment
Emergency Procedures & Contingency Plan 3745-65-51 to 56	No applicable requirement	Written plans are not required. Emergency procedures required 3745-52-34(D)(5)(d)	Written contingency plan and emergency procedures required
Recordkeeping 3745-52-40	Records of waste evaluation	Manifests LDR notification Exception reports Waste evaluation (kept on-site for at least 3 years)	Manifests LDR notification Exception reports Training records Annual reports Waste evaluation (kept on-site for at least 3 years)
Manifesting 3745-52-20 to 23	No applicable requirement	Required	Required
Exception Reports 3745-52-42	No applicable requirement	Notify and send a copy to Ohio EPA within 60 days	Contact the transporter and/or destination facility within 35 days and send report to Ohio EPA within 45 days
Land Disposal Restriction Determination 3745-270-07	No applicable requirement	Determine if waste must be treated before it can be land disposed (or write on manifest that a determination has not been made)	Determine if waste must be treated before it can be land disposed (or write on manifest that a determination has not been made)
Land Disposal Restriction Notification 3745-270-07	No applicable requirement	One-time written notice to each TSDF receiving your hazardous waste	One-time written notice to each TSDF receiving your hazardous waste
Annual Reports 3745-52-41	No applicable requirement	No applicable requirement	Required by March 1st

Source: http://epa.ohio.gov/portals/32/pdf/gen_handbook.pdf

How to Determine if a Material is Considered Hazardous:



Source: http://epa.ohio.gov/portals/32/pdf/gen_handbook.pdf

Method 1: Identifying Hazardous Waste

Appendix to rule 3745-51-30 of the Administrative Code

Basis for Listing Hazardous Waste

EPA hazardous waste No.	Hazardous constituents for which listed
F001	Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, carbon tetrachloride, chlorinated fluorocarbons.
F002	Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, chlorobenzene, ~~1,1,2-trichloro-1,2,2-trichfluoroethane~~ 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane.
F003	N.A.
F004	Cresols and cresylic acid, nitrobenzene.
F005	Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, 2-ethoxyethanol, benzene, 2-nitropropane.
F006	Cadmium, hexavalent chromium, nickel, cyanide (complexed).
F007	Cyanide (salts).
F008	Cyanide (salts).
F009	Cyanide (salts).
F010	Cyanide (salts).
F011	Cyanide (salts).
F012	Cyanide (complexed).
F019	Hexavalent chromium, cyanide (complexed).
F020	Tetra- and pentachlorodibenzo-p-dioxins; tetra and pentachlorodi-benzofurans; tri- and tetrachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine and other salts.
F021	Penta- and hexachlorodibenzo-p-dioxins; penta- and hexachlorodibenzofurans; pentachlorophenol and its derivatives.
F022	Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans.
F023	Tetra-, and pentachlorodibenzo-p-dioxins; tetra- and pentachlorodibenzofurans; tri- and tetrachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine and other salts.

EPA hazardous waste No.	Hazardous constituents for which listed
F024	Chloromethane, dichloromethane, trichloromethane, carbon tetrachloride, chloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, rans-1-2-dichloroethylene, 1,1-dichloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethylene, 1,1,1,2-tetra-chloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethylene, pentachloroethane, hexachloroethane, allyl chloride (3-chloropropene), dichloropropane, dichloropropene, 2-chloro-1,3-butadiene, hexachloro-1,3-butadiene, hexachlorocyclopentadiene, hexachlorocyclohexane, benzene, chlorbenzene, dichlorobenzenes, 1,2,4-trichlorobenzene, tetrachlorobenzene, pentachlorobenzene, hexachlorobenzene, toluene, naphthalene.
F025	Chloromethane; dichloromethane; trichloromethane; carbon tetrachloride; chloroethylene; 1,1-dichloroethane; 1,2-dichloroethane; trans-1,2-dichloroethylene; 1,1-dichloroethylene; 1,1,1-trichloroethane; 1,1,2-trichloroethane; trichloroethylene; 1,1,1,2-tetrachloroethane; 1,1,2,2-tetrachloroethane; tetrachloroethylene; pentachloroethane; hexachloroethane; allyl chloride (3-chloropropene); dichloropropane; dichloropropene; 2-chloro-1,3-butadiene; hexachloro-1,3-butadiene; hexachlorocyclopentadiene; benzene; chlorobenzene; dichlorobenzene; 1,2,4-trichlorobenzene; tetrachlorobenzene; pentachlorobenzene; hexachlorobenzene; toluene; naphthalene.
F026	Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans.
F027	Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans; tri-, tetra-, and pentachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine and other salts.
F028	Tetra-, penta-, and hexachlorodibenzo-p-dioxins; tetra-, penta-, and hexachlorodibenzofurans; tri-, tetra-, and pentachlorophenols and their chlorophenoxy derivative acids, esters, ethers, amine and other salts.
F032	Benz(a)anthracene, benzo(a)pyrene, dibenz(a,h)-anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, arsenic, chromium, tetra-, penta-, hexa-, heptachlorodibenzo-p-dioxins, tetra-, penta-, hexa-, heptachlorodibenzofurans.
F034	Benz(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, arsenic, chromium.
F035	Arsenic, chromium, lead.
F037	Benzene, benzo(a)pyrene, chrysene, lead, chromium.
F038	Benzene, benzo(a)pyrene, chrysene, lead, chromium.
F039	All constituents for which treatment standards are specified for multi-source leachate (wastewaters and nonwastewaters) under the table in rule 3745-270-40 of the Administrative Code.

EPA hazardous waste No.	Hazardous constituents for which listed
K001	Pentachlorophenol, phenol, 2-chlorophenol, p-chloro-m-cresol, 2,4-dimethylphenyl, 2,4-dinitrophenol, trichlorophenols, tetrachlorophenols, 2,4-dinitrophenol, creosote, chrysene, naphthalene, fluoranthene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benz(a)anthracene, dibenz(a)anthracene, acenaphthalene.
K002	Hexavalent chromium, lead
K003	Hexavalent chromium, lead.
K004	Hexavalent chromium.
K005	Hexavalent chromium, lead.
K006	Hexavalent chromium.
K007	Cyanide (complexed), hexavalent chromium.
K008	Hexavalent chromium.
K009	Chloroform, formaldehyde, methylene chloride, methyl chloride, paraldehyde, formic acid.
K010	Chloroform, formaldehyde, methylene chloride, methyl chloride, paraldehyde, formic acid, chloroacetaldehyde.
K011	Acrylonitrile, acetonitrile, hydrocyanic acid.
K013	Hydrocyanic acid, acrylonitrile, acetonitrile.
K014	Acetonitrile, acrylamide.
K015	Benzyl chloride, chlorobenzene, toluene, benzotrichloride.
K016	Hexachlorobenzene, hexachlorobutadiene, carbon tetrachloride, hexachloroethane, perchloroethylene.
K017	Epichlorohydrin, chloroethers [bis(chloromethyl) ether and bis(2-chloroethyl) ethers], trichloropropane, dichloropropanols.
K018	1,2-dichloroethane, trichloroethylene, hexachlorobutadiene, hexachlorobenzene.
K019	Ethylene dichloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, tetrachloroethanes (1,1,2,2-tetrachloroethane and 1,1,1,2-tetrachloroethane), trichloroethylene, tetrachloroethylene, carbon tetrachloride, chloroform, vinyl chloride, vinylidene chloride.
K020	Ethylene dichloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, tetrachloroethanes (1,1,2,2-tetrachloroethane and 1,1,1,2-tetrachloroethane), trichloroethylene, tetrachloroethylene, carbon tetrachloride, chloroform, vinyl chloride, vinylidene chloride.
K021	Antimony, carbon tetrachloride, chloroform.
K022	Phenol, tars (polycyclic aromatic hydrocarbons).
K023	Phthalic anhydride, maleic anhydride.

EPA hazardous waste No.	Hazardous constituents for which listed
K024	Phthalic anhydride, 1,4-naphthoquinone.
K025	Meta-dinitrobenzene, 2,4-dinitrotoluene.
K026	Paraldehyde, pyridines, 2-picoline.
K027	Toluene diisocyanate, toluene-2, 4-diamine.
K028	1,1,1-trichloroethane, vinyl chloride.
K029	1,2-dichloroethane, 1,1,1-trichloroethane, vinyl chloride, vinylidene chloride, chloroform.
K030	Hexachlorobenzene, hexachlorobutadiene, hexachloroethane, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, ethylene dichloride.
K031	Arsenic.
K032	Hexachlorocyclopentadiene.
K033	Hexachlorocyclopentadiene.
K034	Hexachlorocyclopentadiene.
K035	Creosote, chrysene, naphthalene, fluoranthene benzo(b) fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd) pyrene, benzo(a)anthracene, dibenzo(a)anthracene, acenaphthalene.
K036	Toluene, phosphorodithioic and phosphorothioic acid esters.
K037	Toluene, phosphorodithioic and phosphorothioic acid esters.
K038	Phorate, formaldehyde, phosphorodithioic and phosphorothioic acid esters.
K039	Phosphorodithioic and phosphorothioic acid esters.
K040	Phorate, formaldehyde, phosphorodithioic and phosphorothioic acid esters.
K041	Toxaphene.
K042	Hexachlorobenzene, ortho-dichlorobenzene.
K043	2,4-dichlorophenol, 2,6-dichlorophenol, 2,4,6-trichlorophenol.
K044	N.A.
K045	N.A.
K046	Lead.
K047	N.A.
K048	Hexavalent chromium, lead.
K049	Hexavalent chromium, lead.
K050	Hexavalent chromium.
K051	Hexavalent chromium, lead.

EPA hazardous waste No.	Hazardous constituents for which listed
K052	Lead.
K060	Cyanide, naphthalene, phenolic compounds, arsenic.
K061	Hexavalent chromium, lead, cadmium.
K062	Hexavalent chromium, lead.
K064	Lead, cadmium.
K065	Lead, cadmium.
K066	Lead, cadmium.
K069	Hexavalent chromium, lead, cadmium.
K071	Mercury.
K073	Chloroform, carbon tetrachloride, hexachloroethane, trichloroethane, tetrachloroethylene, dichloroethylene, 1,1,2,2-tetrachloroethane.
K083	Aniline, diphenylamine, nitrobenzene, phenylenediamine.
K084	Arsenic.
K085	Benzene, dichlorobenzenes, trichlorobenzenes, tetrachlorobenzenes, pentachlorobenzene, hexachlorobenzene, benzyl chloride.
K086	Lead, hexavalent chromium.
K087	Phenol, naphthalene.
K088	Cyanide (complexes).
K090	Chromium.
K091	Chromium.
K093	Phthalic anhydride, maleic anhydride.
K094	Phthalic anhydride.
K095	1,1,2-trichloroethane, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane.
K096	1,2-dichloroethane, 1,1,1-trichloroethane, 1,1,2-trichloroethane.
K097	Chlordane, heptachlor.
K098	Toxaphene.
K099	2,4-dichlorophenol, 2,4,6-trichlorophenol.
K100	Hexavalent chromium, lead, cadmium.
K101	Arsenic.
K102	Arsenic.
K103	Aniline, nitrobenzene, phenylenediamine.

EPA hazardous waste No.	Hazardous constituents for which listed
K104	Aniline, benzene, diphenylamine, nitrobenzene, phenylenediamine.
K105	Benzene, monochlorobenzene, dichlorobenzenes, 2,4,6-trichlorophenol.
K106	Mercury.
K107	1,1-Dimethylhydrazine (UDMH).
K108	1,1-Dimethylhydrazine (UDMH).
K109	1,1-Dimethylhydrazine (UDMH).
K110	1,1-Dimethylhydrazine (UDMH).
K111	2,4-Dinitrotoluene.
K112	2,4-Toluenediamine, o-toluidine, p-toluidine, aniline.
K113	2,4-Toluenediamine, o-toluidine, p-toluidine, aniline.
K114	2,4-Toluenediamine, o-toluidine, p-toluidine.
K115	2,4-Toluenediamine.
K116	Carbon tetrachloride, tetrachloroethylene, chloroform, phosgene.
K117	Ethylene dibromide.
K118	Ethylene dibromide.
K123	Ethylene thiourea.
K124	Ethylene thiourea.
K125	Ethylene thiourea.
K126	Ethylene thiourea.
K131	Dimethyl sulfate, methyl bromide.
K132	Methyl bromide.
K136	Ethylene dibromide.
K141	Benzene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indenol(1,2,3-cd)pyrene.
K142	Benzene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indenol(1,2,3-cd)pyrene.
K143	Benzene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene.
K144	Benzene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene.
K145	Benzene, benz(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, naphthalene.
K147	Benzene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indenol(1,2,3-cd)pyrene.

EPA hazardous waste No.	Hazardous constituents for which listed
K148	Benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indenol(1,2,3-cd)pyrene.
K149	Benzotrichloride, benzyl chloride, chloroform, chloromethane, chlorobenzene, 1,4-dichlorobenzene, hexachlorobenzene, pentachlorobenzene, 1,2,4,5-tetrachlorobenzene, toluene.
K150	Carbon tetrachloride, chloroform, chloromethane, 1,4-dichlorobenzene, hexachlorobenzene, pentachlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,1,2,2-tetrachloroethane, tetrachloroethylene, 1,2,4-trichlorobenzene.
K151	Benzene, carbon tetrachloride, chloroform, hexachlorobenzene, pentachlorobenzene, toluene, 1,2,4,5-tetrachlorobenzene, tetrachloroethylene.
K156	Benomyl, carbaryl, carbendazim, carbofuran, carbosulfan, formaldehyde, methylene chloride, triethylamine.
K157	Carbon tetrachloride, formaldehyde, methyl chloride, methylene chloride, pyridine, triethylamine.
K158	Benomyl, carbendazim, carbofuran, carbosulfan, chloroform, methylene chloride.
K159	Benzene, butylate eptc, molinate, pebulate, vernaolate.
K161	Antimony, arsenic, metam-sodium, ziram.
K169	Benzene.
K170	Benzo(a)pyrene, dibenz(a,h)anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, 3-methylcholanthrene, 7,12-dimethylbenz(a)anthracene.
K171	Benzene, arsenic.
K172	Benzene, arsenic.
K174	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-HpCDD), 1,2,3,4,6,7,8-heptachlorodibenzofuran (1,2,3,4,6,7,8-HpCDF), 1,2,3,4,7,8,9-heptachlorodibenzofuran (1,2,3,6,7,8,9-HpCDF), HxCDDs (all hexachlorodibenzo-p-dioxins), HxCDFs (all hexachlorodibenzofurans), PeCDDs (all pentachlorodibenzo-p-dioxins), OCDD (1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin), OCDF (1,2,3,4,6,7,8,9-octachlorodibenzofuran), PeCDFs (all pentachlorodibenzofurans), TCDDs (all tetrachlorodibenzo-p-dioxins), TCDFs (all tetrachlorodibenzofurans).
K175	Mercury.
K176	Arsenic, lead.
K177	Antimony.
K178	Thallium.

EPA hazardous waste No.	Hazardous constituents for which listed
K181	Aniline, o-anisidine, 4-chloroaniline, p-cresidine, 2,4-dimethylaniline, 1,2-phenylenediamine, 1,3-phenylenediamine

N.A. Waste is hazardous because it fails the test for the characteristic of ignitability, corrosivity, or reactivity.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, federal rules, and federal statutory provisions referenced in this rule, see rule 3745-50-11 of the Administrative Code titled "Incorporated by reference."]

Source: Ohio Administrative Code 3745-51-30

Method 2: Identifying Hazardous Waste

Characteristic Hazardous Waste Descriptions	
Hazardous Characteristic	**Description**
Ignitability:	The waste is a liquid and has a flash point of less than 140 degrees F (60 degrees C) or could catch fire under certain circumstances. Examples include: solvents, mineral spirits and paint waste. Ignitable hazardous wastes are assigned the EPA hazardous waste code of D001.
Corrosivity:	The pH of the liquid waste is very low (two or less) or very high (12.5 or greater). Or, the waste can corrode metal. Examples include: acids or alkali cleaning baths and battery acid. Corrosive hazardous wastes are assigned the EPA hazardous waste code of D002.
Reactivity:	The waste is unstable, reacts violently, explodes or produces toxic vapors under certain conditions. Examples: cyanide or sulfide wastes and peroxides. Reactive hazardous wastes are assigned the EPA hazardous waste code of D003.
Toxicity:	The waste has specific toxic contaminants present in high enough concentrations to be harmful to humans or the environment. The toxic contaminants and their threshold levels are included in Ohio's hazardous waste regulations (OAC rule 3745-51-24). Examples include wastes that contain heavy metals (e.g., lead, chromium, mercury, cadmium) or certain chemicals (e.g., benzene, MEK, pesticides). Toxic hazardous wastes are assigned the EPA hazardous waste codes of D004 through D043, depending on the contaminant(s) present.

Additional Resources

Regulations:

- Ohio Administrative Code 3745-52-11 (Hazardous waste determination)
  http://codes.ohio.gov/oac/3745-52-11

- Lists of Hazardous Waste – Ohio Administrative Code 3745-51-30
  http://epa.ohio.gov/portals/32/oac_rules/51-30.pdf

- Exclusions to the HW rules:
  http://www.epa.ohio.gov/portals/32/oac_rules/51-04.pdf

- Hazardous Waste Generator Handbook
  http://epa.ohio.gov/portals/32/pdf/gen_handbook.pdf

Factsheets:

- *Identifying Your Hazardous Waste*
  http://www.epa.ohio.gov/portals/41/sb/publications/identifyingwaste.pdf

- *Fluorescent Lamps: What You Should Know*
  http://www.epa.state.oh.us/portals/32/pdf/LampGuidance.pdf

- The Regulation of Used Oil: An Overview for Ohio Businesses Who Generate Used Oil
  http://www.epa.ohio.gov/LinkClick.aspx?fileticket=XEg%2fu%2bpZGaM%3d&tabid=3923

OEPA Contact for more information (at the Northwest District Office):

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