Final Report

Department of Public Infrastructure Service Building
Storm Water Pollution Prevention Plan (SWPPP)

Prepared for the:

City of Manitowoc
900 Quay Street
Manitowoc, WI 54220
WPDES General Permit No. WI-S050075-2

Prepared by:
AECOM
1555 North Rivercenter Drive
Suite 214
Milwaukee, Wisconsin 53212
T 414.944.6080
F 414.944.6081
www.aecom.com

April 2015

AECOM Project No. 60341395
Table of Contents

1.0 GENERAL INFORMATION ........................................................................................................... 1-1
  1.1 SWPPP GOALS ......................................................................................................................... 1-1
  1.2 POLLUTION PREVENTION RESPONSIBILITY ......................................................................... 1-1

2.0 INVENTORY OF POTENTIAL SOURCES OF POLLUTANTS .................................................. 2-1
  2.1 LAND COVER & DRAINAGE .................................................................................................... 2-1
     2.1.1 Building Activities ........................................................................................................... 2-1
     2.1.2 Yard Activities ............................................................................................................... 2-3
  2.2 POTENTIAL SOURCES OF CONTAMINATION ................................................................. 2-3

3.0 MEASURES AND CONTROLS ..................................................................................................... 3-1
  3.1 GOOD HOUSEKEEPING ........................................................................................................ 3-1
  3.2 PREVENTIVE MAINTENANCE ............................................................................................. 3-1
  3.3 SPILL PREVENTION, CONTROLS, AND COUNTERMEASURES ...................................... 3-1
  3.4 SEDIMENT AND EROSION CONTROL ................................................................................. 3-1
  3.5 MANAGEMENT OF RUNOFF .................................................................................................. 3-1
  3.6 NON-STORM WATER DISCHARGES .................................................................................... 3-2
  3.7 EXISTING AND RECOMMENDED CONTROL MEASURES ............................................. 3-2

Figures

Figure 1 DPI Service Building SWPPP Site Investigation ......................................................... Follows Page 1-1

Tables

Table 2-1 Land Cover Description ............................................................................................... 2-1
Table 2-2 Building Description ................................................................................................ 2-2

Appendices

Appendix A WDNR Storage Pile BMP Information (Chapters 3-5)
Appendix B Blank Quarterly Site Inspection Form
Appendix C Completed Quarterly Site Inspection Forms
1.0 GENERAL INFORMATION

Name of Facility: Department of Public Infrastructure Service Building
Facility Address: 2655 S. 35th Street, Manitowoc, WI 54220
Facility Contact/Title: Randy Junk, Operations Division Manager - Streets
Telephone Number: (920) 686-6513

The City of Manitowoc Public Infrastructure Service Building and yard is located northeast of the intersection of Viebahn Street and South 35th Street. The public infrastructure service building is used as the main garage for the City of Manitowoc. It also holds the offices for the foreman and other public infrastructure employees. The facility stores various pieces of equipment and miscellaneous materials both indoors and outdoors for use by City staff in maintaining City infrastructure. See Figure 1 for descriptions of buildings and materials stored on site. Building and yard activities are detailed later in this document. This report documents current conditions and measures that can be taken to reduce nonpoint source pollution from the public infrastructure yard operated by the City.

1.1 SWPPP Goals

The City of Manitowoc has made it a priority to reduce nonpoint source pollution to surface water and groundwater from urban storm water sources. This SWPPP is a component of comprehensive city-wide storm water management efforts to identify nonpoint source pollution loadings and investigate mitigating measures. The goals of this report are to:

- Identify potential sources of storm water and non-storm water contamination to the storm water drainage system;
- Identify current and potential additional “source area” best management practices (BMPs); and
- Identify current and potential additional “storm water treatment” type BMPs to reduce pollutants in contaminated storm water prior to discharge.

1.2 Pollution Prevention Responsibility

The Operations Division Manager - Streets is responsible for all activities on the site, including pollution prevention activities. It is part of his regular duties as Operations Division Manager - Streets to investigate potential storm water pollution problems on a daily basis. The Director of Public Infrastructure oversees the duties of the Operations Division Manager - Streets. There is also support from other divisions within the department, including the Engineering Division.
Facility List

1. Stockpile - road sand
2. Snow plow storage
3. Stone chip stockpile (short-term summer)
4. Scap metal bin, open lid - steel
5. Storage Tank
6. Covered topsoil stockpile
7. Bin - street sweeping temporary storage
8. Bin - cold asphalt
9. Used tires
10. Misc. outdoor storage - tires, iron pipe, wood etc.
11. PVC pipe
12. Concrete pipe, manhole barrels
13. Trench boxes
14. Leaf boxes
15. Misc. outdoor storage and CNG tanks
16. Pallet boxes and misc. outdoor storage
17. Sewer materials - manhole barrels, castings, covers
18. Scap metal bins, open lids - cast iron and aluminum
19. Misc. outdoor storage
20. Waste oil tank - 1,000 Gal.
21. Outdoor vehicle washing area
22. Nutrient Separating Baffle Box
23. Liquid Propane AST
24. Calcium chloride tanks
25. Sand fill stockpile
26. Crushed concrete/base stockpile
27. Gravel / stone stockpile
28. Employee parking
29. Fuel Island #1
30. UST #2 - Diesel fuel 15,000 Gal., Gasoline 15,000 Gal.
31. Fuel Island #2
32. Employee and Visitor parking
33. Fuel Island #3
34. UST #1 - Diesel fuel 10,000 Gal.
35. Road/Sand Salt Stockpile (short-term winter)
2.0 INVENTORY OF POTENTIAL SOURCES OF POLLUTANTS

The following section identifies the materials stored in each area of the facility, operations at the site, and the general interaction between areas of interest on the site.

2.1 Land Cover & Drainage

The Manitowoc public infrastructure site is approximately 11.6 acres in size. Five (5) main drainage basins exist at the facility.

1. Basin A is in the western portion of the site and ultimately drains to the storm sewer in 35th Street via surface drainage and storm sewers. The storm sewer in 35th Street drains to a manhole adjacent to the northwest section of the site, and then is conveyed east across the northern portion of the site via an 18-inch storm sewer.
2. Basin B is in the southern portion of the site and surface drains to the ditch along Viebahn Street. This runoff is ultimately collected by a storm sewer at the southeastern corner of the site, and is conveyed to the north via storm sewer in 30th Street.
3. Basin C is in the east-central portion of the site and drains via surface drainage and storm sewers to the storm sewer in 30th Street, which then drains north.
4. Basin D is in the eastern portion of the site and drains via surface drainage to the storm sewer in 30th Street, which then drains north.
5. Basin E is in the northern portion of the site and drains east via surface drainage and storm sewers to the storm sewer in 30th Street, which then drains north.

Table 2-1 lists the drainage basins, approximate amount of land cover, and conveyance type. Figure 1 identifies drainage basins, buildings, drainage structures, outdoor storage areas, structural control measures, and other relevant features. The location of storm sewers and structures is approximate.

<table>
<thead>
<tr>
<th>BASIN ID</th>
<th>LAND COVER (ACRES)</th>
<th>TOTAL (Acres)</th>
<th>OFF-SITE CONVEYANCE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open Space</td>
<td>Roof</td>
<td>Gravel</td>
</tr>
<tr>
<td>A</td>
<td>0.8</td>
<td>0.7</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>1.1</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>0.1</td>
<td>1.1</td>
<td>0.9</td>
</tr>
<tr>
<td>D</td>
<td>0.1</td>
<td>&lt; 0.1</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>E</td>
<td>0.2</td>
<td>0.1</td>
<td>1.4</td>
</tr>
<tr>
<td>Total</td>
<td>2.3</td>
<td>2.0</td>
<td>2.3</td>
</tr>
</tbody>
</table>

2.1.1 Building Activities

Table 2-2 summarizes each building's approximate size, drainage method, and materials found in each building. Figure 1 shows the general location of buildings and materials stored in the yard. Building activities are discussed in the section following Table 2-2.
TABLE 2-2
Building Description

<table>
<thead>
<tr>
<th>BUILDING</th>
<th>ROOF AREA (SQ. FT.)</th>
<th>DRAINAGE</th>
<th>USE/MATERIALS STORED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main DPI Building</td>
<td>51,000</td>
<td>Roof drains to storm sewer; floor drains to sanitary sewer</td>
<td>Vehicle storage indoors nightly, vehicle washing with internal drains to sanitary sewer, employee offices, employee locker room, battery storage in exposition proof room, oil and fluid storage use, oil dry and oil spill kit is available.</td>
</tr>
<tr>
<td>Transit Maintenance Building</td>
<td>17,800</td>
<td>Roof drains to storm sewer; floor drains to sanitary sewer</td>
<td>Transit vehicle maintenance, large wash bay, below grade maintenance pit without stored fluids, enclosed paint spraying booth, oil and fluid storage use, oil dry is available.</td>
</tr>
<tr>
<td>Salt Storage Building</td>
<td>2,300</td>
<td>Roof drains directly to yard surface, eventually offsite via storm sewer and overland surface runoff; no floor drains</td>
<td>Building is used for road salt storage</td>
</tr>
<tr>
<td>Cold Storage Building #1</td>
<td>6,400</td>
<td>Roof drains directly to yard surface, eventually offsite via storm sewer and overland surface runoff; no floor drains</td>
<td>DPI equipment storage, tar sealant, misc. barrels storage for testing prior to disposal.</td>
</tr>
<tr>
<td>Cold Storage Buildings #2, 3, 4, 5</td>
<td>#2 – 6,300 #3 – 2,400 #4 – 1,000 #5 – 400</td>
<td>Roofs drain directly to yard surface and offsite via storm sewer and overland surface runoff; no floor drains</td>
<td>DPI equipment and materials storage, oil dry available, swept as needed.</td>
</tr>
</tbody>
</table>

General Building activities are as follows:

- **Main DPI Building**: The main DPI building contains three (3) general areas: 1) DPI offices, 2) vehicle storage, and 3) maintenance area.
  1. **DPI offices** – The office area of the building includes a reception/front desk and general employee office area, locker room, break area, and shower/bathroom facilities.
  2. **Vehicle Storage** – The garage vehicle storage area stores equipment and vehicles, including a designed indoor wash facility near the north wall of the building. The interior of the vehicle storage area drains to sanitary sewer floor drains. The floor of the garage is washed down as needed and the drain grates are periodically pulled and inspected for maintenance and cleaned out as needed.
  3. **Maintenance Area** – The maintenance area of the building is the center for all routine maintenance of vehicles and equipment. The building contains an explosion proof room that houses bulk oil and other maintenance fluid related products that are made available through a hose system to the maintenance area. Oil spill kits are available as needed to soak up spills and any leaks are collected and properly disposed of as needed. Waste oil is drained through a pipe system to an external 1,000 gallon double walled tank that is immediately outside of the building. There is a fill line on the tank that is periodically...
checked by staff as well as an outside contractor who periodically pumps out the tank as needed. The floor is swept as needed. Floor drains are connected to the sanitary sewer system. Materials for the vehicle storage and maintenance areas are generally loaded and unloaded inside of the building. If materials are unloaded outside of the building for some reason, DPI staff will forklift the materials to the proper location.

- Transit Maintenance Building: Directly adjacent to the DPI building is the transit maintenance building. For funding reasons the transit maintenance building is essentially a completely separate operational area. Transit buses and other related equipment is maintained within this building. Buses are washed in a designated internal wash area connected to the sanitary sewer system. Maintenance bays and areas drain to the sanitary sewer system. Floor drain grates are periodically pulled and inspected for maintenance and cleaned out as needed. This building also contains an explosion proof room that houses bulk oil and other maintenance fluid related products that are made available through a hose system to the maintenance area. Oil dry is available as needed to soak up spills and any leaks are collected and properly disposed of as needed. The floor is swept as needed.

- Salt Storage Building: The salt storage building is used for roadway salt storage only. The building has no internal drains and no maintenance is conducted in the building.

- Cold Storage Building #1: This building is located on the northwest area of the DPI yard. It contains miscellaneous equipment and materials, including roadway tar (Crafco boxes). Several barrels of miscellaneous fluids are located in the building. DPI is in the process of having the materials/fluids tested and disposed of as needed. There are no floor drains in the building and no maintenance is conducted in the building. Oil dry is available as needed to soak up spills and any leaks. Used oil dry is collected and disposed of, ultimately taken to a landfill with other solid waste. The floor is swept as needed.

- Cold Storage Buildings #2, 3, 4, and 5: This series of buildings are located on the southeast area of the DPI yard. The buildings house a variety of materials and equipment. None of the buildings have any internal drains and there is no maintenance conducted in any of the buildings. Oil dry is available as needed to soak up spill and leaks and is collected and properly disposed of as needed. The floors are swept as needed.

2.1.2 Yard Activities

Various items and materials are stored within the yard area, such as equipment, raw material (e.g. asphalt, sand, gravel, soil), pipes, manhole frames and covers, propane/gas, etc.

Vehicles also use the lot to drive in and pick up and drop off material or items. If materials for use in the Main DPI Building or other internal parts of the facility are unloaded outside for some reason, DPI staff will forklift the materials to the proper location.

No maintenance is conducted in the yard area; however, there is currently an active outdoor wash area on the north wall of the vehicle storage building.

Residents do not have access to the public infrastructure yard; only Public Infrastructure employees have access. The west side of the lot contains employee and public parking areas as well as the fuel island areas. A second parking area is also located immediately east of the building inside the gate.

2.2 Potential Sources of Contamination

Based on discussions with City staff and a site inspection of the facility, the most likely sources of non-point pollution are as follows:
- **Fuel Islands**: There are three (3) fuel islands on site. They are shown in Figure 1. These facilities serve city vehicles, which need a pass to access the pumps. Fuel is stored in two (2) sets of underground storage tanks (USTs). UST #1 holds up to 10,000 gallons of diesel fuel. UST #2 holds up to 15,000 gallons of diesel fuel and 15,000 gallons of gasoline. The tanks have fuel monitoring stations in the building with alarms. The fuel islands have automatic shutoff switches and emergency shutoff on the building wall along with fire extinguishers. As required with the USTs, regular reporting is completed.

- **Waste Oil Tank**: There is a 1,000 gallon above-ground waste oil tank on the north side of the main building. The tank is double-walled. The amount of waste oil is monitored by a fill indicator located in the building. An outside contractor picks up waste oil from the tanks as needed. There is potential that waste oil could spill during filling and emptying the tank. Oil spill kits with absorbent socks/pads and oil dry product are available on site.

- **Container Drums**: There are some old container drums on site. A cursory inspection indicates that they are empty. Old drums have the potential to leak over time and leach material that could mix with runoff.

- **Outdoor Vehicle Wash Area**: Vehicle washing occurs both inside and outside the DPI main building. Wash water inside the building drains internally to the sanitary sewer. Wash water from the outside area surface drains to a storm inlet and then to a Nutrient Separating Baffle Box™ treatment device before draining off site.

- **Calcium Chloride Tanks**: Calcium chloride, used for ice management on roads in the winter and dust control in the summer, is stored in tanks on site. The tanks could leak, or spills could occur during loading and unloading of the product.

- **Material Storage Area**: Materials are stored in the northern and eastern portions of the site. Loose material storage piles could be potential sources of contamination and include road sand stockpile, temporary sand/salt mixture stockpile, crushed asphalt stockpile, gravel/clear stone stockpile, sand stockpile, and dirt stockpile. Their locations are shown in Figure 1. These stockpiles do not have any containment facilities. Loose materials could erode and run off during a large rain event. Both the north and east areas have a gravel surface. Stockpile materials could accumulate in open areas between stockpiles and be carried off with runoff during large rain events.
3.0 MEASURES AND CONTROLS

3.1 Good Housekeeping

In general, the interior of all buildings appear to be maintained in a clean and orderly manner. If necessary the garage is washed down (to internal floor drains connected to the sanitary sewer) and the maintenance area is swept and picked up to keep the interior clean and minimize the tracking of materials. Outdoor storage is segregated into like materials and generally kept orderly. Sand and other materials can build up on the paved areas of the facility, and the yard is periodically swept.

3.2 Preventive Maintenance

Fueling island areas and associated controls are inspected regularly. Any required maintenance is conducted as needed.

Vehicles are maintained to keep them in good working order and to minimize leakage of fluids.

3.3 Spill Prevention, Controls, and Countermeasures

Sources of potential contamination associated with petroleum products appear to be managed appropriately. Vehicles and equipment are maintained indoors and kept in good condition to minimize leaks. Spills are minimized or prevented by keeping bulk oil in appropriate storage areas inside of the building. The building drains to the sanitary sewer system and the likelihood of a spill or leak from bulk storage areas or equipment maintenance activities entering the storm sewer system is very low. Delivery hoses are periodically inspected for leaks and replaced as needed. Used oil is collected in an area where the oil is poured into a 1,000 gallon double walled AST. The AST has a fill height indicator that is periodically checked by both DPI staff and the contractor and emptied as needed.

Fueling areas and systems (pipes/pumps) are served by USTs that have appropriate monitoring, controls, and shutoff features. These systems are maintained and inspected as required. DPI staff receives appropriate training on the use of the fueling facilities.

If a leak or minor spill occurs, DPI staff is trained to use oil spill kits with absorbent materials which are available in several locations throughout the facility to collect the oil and then sweep it up and properly dispose of it. In the event of a significant spill that cannot be handled by DPI staff, the fire department would be called in to assist.

3.4 Sediment and Erosion Control

Outdoor storage areas are segregated into like materials and loose material storage piles are generally placed away from close proximity to inlets or other storm water conveyance features with the exception of the material piles immediately near the drainage ditch on the southeast area of the facility.

Sediment could be transported from outdoor storage piles or from surface areas that have gravel or paved land cover. Sediment has been known to accumulate on paved surfaces away from storage piles. There is also evidence of erosion occurring in a ditch directly east of the salt storage building where runoff leaves the site. The lot is periodically swept. Potential control measures are discussed below.

3.5 Management of Runoff

Several inlets to the storm drain system are located throughout the facility. In addition, the drainage ditch on the southeast area of the facility receives off-site runoff from an area to the south as well as from within the property, exiting at the eastern limits of the property. Some limited grass buffer areas exist along the perimeter of the facility. No designed detention/treatment areas exist. However, a Nutrient Separating
Baffle Box™ was installed in-line with storm sewer draining the area just north of the Main DPI Building in the vehicle washing area. Also, two hanging traps were retro-fitted to catch-basin inlets near fueling areas.

3.6 Non-Storm Water Discharges

A non-storm water discharge includes wash water associated with the outdoor wash area on the north wall of the vehicle storage building, which can sheet flow the wash water overland to a drain and Nutrient Separating Baffle Box™.

3.7 Existing and Recommended Control Measures

- **Fuel Islands**: Runoff or spills near the fuel islands can drain to an open inlet or off site. The City has retrofitted the two (2) existing inlets into catch basins with hanging trap flow regulators. The catch basins are cleaned semi-annually. Hanging trap flow regulators were installed in catch basins during retrofitting to "trap" small quantities of oil, grease, and other floatables entering the catch basin from entering the storm sewer network.

- **Outdoor Vehicle Washing Area**: The outdoor vehicle washing area has been retrofitted with a storm drain and Nutrient Separating Baffle Box™ by Suntree Technologies Inc.® before outletting to the larger storm sewer system. This is designed to prevent potentially contaminated runoff and wash water from entering the storm sewer system and running offsite. The Nutrient Separating Baffle Box™ can capture Total Suspended Solids (TSS), sediment, debris, organic material, hydrocarbons, and trash. Vehicles are also washed indoors where wash water drains to the sanitary sewer system. The outdoor washing area is available for washing vehicles too large to wash inside or for other reasons.

- **Runoff Erosion**: As described earlier, erosion occurs in a ditch directly east of the salt storage building where runoff leaves the site. **It is recommended that either the ditch be regraded and stabilized, or in an effort to provide a better water quality solution, install a sedimentation device at this location to trap sediment and TSS before leaving the site.** The device could be a large engineered concrete structure or small wet detention basin with sufficient sump depth and sediment storage to provide a high degree of treatment depending on the ultimate space allocated. Installing a ditch on the east end of the facility along 30th Street and directing the water to the new treatment device would reduce concerns over sediment tracked on the paved areas as this would then be intercepted and filtered by the swale and further treated at the new sedimentation device. Depending on the depth of the storm sewer along the north side of the property, the sewer may be able to be redirected towards this sediment device (either through discharge to the new swale or a low flow storm sewer) and result in treating the entire parcel and some of the surrounding area. Properly designed, this would count towards a portion of the required 40 percent TSS reduction required by the WDNR. They anticipate addressing this issue by October, 2017.

- **Outdoor Storage Piles**

  - In general, areas are generally segregated into like materials and generally kept orderly.
  - Where loose materials are stockpiles, containment bins, roof or cover material could be provided to reduce the risk of material being dispersed. Loose materials and sediment could be carried from the storage areas that have gravel land cover.
  - Additional Storage Pile BMP information is available through the Wisconsin Department of Natural Resources (see Appendix A).
  - Some storage piles are positioned closely to the open ditch on site. **It is recommended that these be better separated to avoid overflow of materials or wash off of sediment from direct rainfall contact or overland runoff. Separation can be accomplished by installing three sided concrete block containment areas or a**
single row of blocks to intercept solids, or other methods. This would still be beneficial even if a sedimentation device is installed at the east end of the ditch to reduce cleaning frequency. The City anticipates addressing the issue by October, 2017.

- **Quarterly Inspections:** The site specific inspection form for key areas should be completed quarterly (see Appendix B). Completed inspection forms should be added to Appendix C. These inspections should include a review of the following items (other items should be added as needed):
  
  o Overall site for litter and debris not associated with normal operations
  o Overall site for erosion and sediment buildup
  o Inspection of snow storage area(s) for debris after snow melt (reseed areas as needed)
  o Inspection of storage pile areas (no erosion/wash off from the site)
  o Inspection of salt storage area (no migration of salt from storage building)
  o Inspection of fuel island area
  o Inspection of inlets and any treatment swales/devices (e.g. Nutrient Separating Baffle Box and hanging traps)
  o Inspections will be conducted by the Operations Division Manager - Streets and submitted to the Engineering Division annually for submittal to the WDNR with their annual report
APPENDIX A

WDNR Storage Pile BMP Information
(Chapters 3 – 5)
CHAPTER 3: SALT

TYPICAL PILE CONFIGURATION AND LOCATIONS

Salt is used for deicing, industrial activities, and chemical processing. Many storage piles are along the waterfront, as one of the major modes of transportation is by water. Smaller piles are created inland as the salt is trucked closer to points of use. Storage pile sizes can range from several tons to tens of thousands of tons. Approximately 30 million tons of dry salt is produced each year in the United States and Canada. The single largest use is road deicing salt which accounts for 13 million tons per year (Salt Institute, 1987). While the focus of this chapter will be on road deicing salt, some of the management practices may be used for outside storage of other types of salt where applicable.

POLLUTANTS

Salt used for highway deicing is composed of more than 95 percent sodium chloride (NaCl) as specified in ASTM D 632-94, Standard Specification for Sodium Chloride. Road or deicing salts are generally NaCl and calcium chloride (CaCl). (Other road deicing materials can contain up to 95 percent sand.) Deicing salt also may contain anticaking and freeze protectant additives such as ferric ferrocyanide (or prussian blue) and sodium ferrocyanide (yellow prussiate of soda or YPS). YPS is approved in food grade salt at 13 parts per million. YPS is added to deicing salt at concentrations typically ranging from 20 to 100 parts per million.

Contaminants may be carried from the salt piles via wind or stormwater which can dislodge or dissolve the salt. These contaminants may be carried to surface waters or infiltrate into the groundwater. It is possible for rainfall to reduce an uncovered salt storage pile at a rate of 1/4 percent per annual inch of precipitation. That equates to the loss of up to 25 tons per year from 500 tons of exposed salt. This amount could contaminate 15 million gallons of...
water to the suggested 250 mg/liter chloride level set for drinking water and can raise the sodium levels to the threshold level of 20 mg/l in 120 million gallons of water (the maximum concentration recommended by the American Heart Association for patients on low sodium diets) (Schueller, 1992 and Salt Institute, 1995). Chlorides can also harm freshwater organisms and vegetation by increasing the level of salinity in surface water.

Salt leachate is very soluble and therefore easily carried from the salt pile. An estimated 20 percent of the rise in chloride levels in the Great Lakes is due to the use of salt as a deicing agent; eight percent of the annual sodium input into the Cambridge Reservoir in Massachusetts is attributed to salt leaching from salt storage facilities (Schueller, 1992, Fritsche, 1992).

**SOURCE AREA CONTROLS**

Source area controls are those that prevent pollution from occurring at the source. They can range from elimination of use of a product to better control over the exposure of the product from rainfall. The following controls are suggestions for use if the storage pile is a source of stormwater contamination.

**Reduce Amount of Salt Used**

Reducing the amount of salt used should obviously reduce the amount of salt that is potentially exposed to stormwater. This would require industries to find alternative substances or reduce the amount used in manufacturing, chemical processing and food preparation. Reducing the amount of road salt used would entail putting less on roads for deicing or finding a substitute deicer. Electronic applicator controls on trucks have been shown to be more efficient for deicing salt application than mechanical systems.

Substitute deicers include calcium magnesium acetate. The calcium and magnesium ions' mobility in soil are limited, and the acetate anion is much less mobile in soil than the chlorine ion, thereby reducing the potential for groundwater contamination. There may, however, be biological oxygen demand associated with acetate
breakdown. Calcium magnesium acetate works best as a deicer if applied before snow accumulates in any amount. CaCl or NaCl work better on packed snow and ice, (Fritzsche, 1992). However, more of the substitute deicers may be needed to achieve the same level of melting action as NaCl provides.

**Reduce Amount of Salt Stored**

The amount of salt potentially exposed to stormwater can be reduced by keeping inventories as low as possible without reducing the pile to below needed levels. Delivery by water transportation may require that the pile be built up enough to supply salt when water routes are impassable and to have enough on hand for an unusually severe winter. Proper planning will help keep inventories at an adequate level without stockpiling unneeded amounts.

**Enclosing the Salt Pile**

The State of Wisconsin requires that all salt piles must be covered or enclosed and placed on an impervious pad so that neither precipitation, stormwater runoff, nor wind comes in contact with the stored salt and carries it away. In addition, the salt pile may not be any closer than 50 feet (laterally) from any surface water. These are requirements of the Wisconsin Department of Transportation (WI Chap. Trans 277) and the Wisconsin Department of Natural Resources (WI Chap. NR 216). Chloride and sand mixtures that are 95 percent or more untreated sand by weight are exempt from these requirements.

Prompt and effective covering of the stockpile as well as proper cover system management and maintenance prevents salt loss due to precipitation. These factors also minimize material handling problems resulting from wet or caked salt. The following guidelines for pads, berms, buildings and tarps should be considered when designing a cover system for a salt pile.

**Pads and Berms**

- Impervious pads should be at least 2 1/2 inches thick and set on a compacted gravel base (Richardson, 1974). Asphalt or concrete pads can be used.
Asphalt pads should have a surface sealant applied to prevent infiltration.

- Concrete pads should be high quality, air entrained, and should have the concrete coated with linseed oil, asphaltic type coatings, or other coatings to make them impermeable (Schueller, 1992).

- The pad should have adequate slope to allow water to drain away from the center (Salt Institute, 1987). Placement of salt on the stockpile should begin at the high end of the sloped pad and proceed toward the low end. When removing salt from the stockpile, equipment should work from the low end toward the high end. Any precipitation or brine runoff from the site should be disposed or discharged according to applicable regulatory requirements. (Salt Institute, 1995)

- The salt storage area should be designed to prevent stormwater from flowing onto the pile. This can be accomplished by placing walls or berms on the upslope sides of the salt pile area in order to direct stormwater around the storage area. The downgradient side can also be constructed with a berm which allows vehicle access to the pile.

- The surface sealant applied to the pad should also be applied to the junction of the pad and berm. A seal should also be placed between any walls and the pad to prevent water from entering the pile below the bottom of the wall.

**Salt Storage Buildings**

The Salt Institute feels that small stockpiles of salt (a few tons up to 3,000 tons - typically used by winter maintenance agencies) are best protected by ground level sheds or buildings. If the ends of the building do not have doors, a cover should be placed over the exposed salt or a tarp hung over the opening. Door openings should be a minimum of 20 feet wide. Buildings range from domes with conveyor systems to simple pole buildings. Many facilities
are converted garages or were sheds originally used for another purpose. The Salt Institute encourages looking around for an existing building which will suit your needs before building a new structure.

**Tarps**

If a tarp is used to cover the salt it should meet the following requirements:

- The tarp should be impermeable or water resistant.
- The ends should be secured with tie downs.
- The seams should be watertight.
- The tarp should completely cover the salt and be brought over the top of the berm or wall surrounding the salt pile.
- The salt pile should only be exposed at the working face - i.e., uncovered only while salt is being added or removed and open only to minimum dimensions necessary.
- The covering should be regularly inspected, repaired, and maintained to conform to the above requirements.
- Tarp ends should be tied down or anchored to secure them against wind and to completely cover the salt pile. Suggested tie downs include timbers, railroad ties, sand bags, tires or polycord nets. The anchors should be lashed together and placed uniformly over the pile.
- Tarp seams should be sewn together as adhesive tape does not always hold well.
- Tarps can be made of polyethylene, polypropylene, hypalon, polyurethane foam or water resistant canvas. Typically polyethylene used for covering.
salt stockpiles is 12 millimeters or greater in thickness (NASC, 1993).

Costs to cover salt stockpiles depend on economies of scale and local site specific conditions. Estimates used by Salt Institute member-companies in 1991 suggest nonstructural, temporary covering costs as high $1.00 per ton for stockpiles of 2500 tons and $0.70 to $1.00 per ton for stockpiles of 5,000 tons. The cost of domes as estimated by EPA in 1991 (Federal Regulations, August 16, 1991) ranged from $30,000 for a small dome to $100,000 for a large dome. (Large domes are categorized by EPA as those holding up to 5,000 tons of salt). This placed EPA's estimated price for storage per ton between $70 to $80 for the small domes and approximately $18 per ton for the larger domes. However, the Salt Institute estimated the costs of a 5,000 ton structural salt dome can exceed $175,000 or about a minimum of $34 per ton of salt.

Pile Configuration

Salt piles built in windrow or sugarloaf shapes enhance tarp stability. These shape also facilitates tarp covering and uncovering (NASC, 1993). Where applicable, the crown at the top of the pile should be between 4 - 10 feet in width. This crown should be sloped down gradient about 1% to 2% toward the working face so that stormwater is not allowed to accumulate on the crown. The slope of the stockpile sides and ends should be maintained to preserve the 32 degree natural angle of repose for bulk salt. (Salt Institute, personal correspondence, 1995).

Keeping the Pile Intact and the Area Swept

Keeping the pile intact and the area swept reduces the amount of salt that is exposed to stormwater. The area should be inspected every time the pile is added to or reduced. All spilled salt should be cleaned up immediately and the pile recovered if a tarp is used.

In addition to inspections after loading, the site should be regularly inspected and cleaned as necessary.
Loading and Unloading Concerns

Operators should take care during loading and unloading to avoid spilling salt as it is being transferred onto the pile or into the truck. Salt unloaded from a boat or ship can easily be spilled into the water. Conveyor systems and buckets should be set up to eliminate this spillage.

Conveyors should be designed to prevent salt spillage. The speed of conveyors can also be controlled to reduce dust.

Chutes or booms can be used at the end of the conveyor to direct salt onto the pile and to reduce dust generation. The boom should be placed as close to the pile as possible as salt is being unloaded.

If a bucket is used, the bucket should be as close to the top of the pile as possible before the salt is emptied onto the pile.

All loading and unloading should be done within the pad area when possible (NASC, 1993).

Trucks beds should be covered with a tarp prior to departure from the salt storage area (NASC, 1993).

The working face of the storage pile should be maintained perpendicular to the long axis of the pile by loading alternately left/right and right/left. (Salt Institute, 1995).

Chunks of salt formed as the crust of the pile breaks up should be crushed and blended into the pile daily and not allowed to accumulate. (Salt Institute, 1995).

Vehicle Maintenance

Fluids from equipment operation and maintenance activities also contribute to stormwater contamination on a salt storage site. Any vehicle maintenance that has the potential to result in loss of fluids or solvents should be done indoors and on an impervious pad. Any spills should be immediately cleaned up. Properly dispose of all fluids and solvents.
Routine maintenance of vehicles will minimize many accidental spills of fluid due to hose breaks and related leaks.

Vehicle washing should be done in an area where the wash water can be treated or kept from discharging into a water body.

TREATMENT PRACTICES

Brine Collection and Control

Stormwater runoff or brine from salt storage activities should be disposed or discharged in accordance with state and local regulatory requirements. One option is to spray it back onto the pile during dry seasons. It may also be applied to spreader loads prior to street application (Salt Institute, 1987 and 1995).

If the brine cannot be recycled or reused, proper disposal methods should be followed. In Wisconsin, interim chloride toxicity values recommended for use are 788 milligrams/liter for acute toxicity and 399 milligrams/liter for chronic toxicity.
Bibliography


Chapter Trans 277 - Wisconsin Department of Transportation Regulations No. 384, Highway Salt Storage Requirements, December 1987.


Salt Institute, Personnel Correspondence, Bruce Bertram, Technical Director, 1995.

Schueller, Michelle, Bulk Storage Pile Contamination of Stormwater: Concerns and Recommendations for Wisconsin, Wisconsin Department of Natural Resources, April, 1992.


**NOTE:** The authors wish to thank Bruce Bertram of the Salt Institute for his very detailed and very helpful review of the draft of this document. Many of his comments and insights were used in preparing the final version of this chapter.
CHAPTER 4: SNOW DISPOSAL

TYPICAL PILE CONFIGURATIONS AND LOCATIONS

As snow accumulates throughout the winter in urban areas, it is at times collected and deposited at sites away from high traffic and congested areas. The snow is dumped on open land sites or occasionally into surface waters.

The size of snow storage piles will vary with the size of the urban area and the amount of snowfall received. The disposal sites are normally located as close as possible to the areas from which the snow is removed in order to keep transportation costs low. Open lots, parks, unused parking lots, rivers, lakes, streams, wetlands, and ponds have all been used as disposal sites.

POLLUTANTS

Plowed or dumped snow may contain chlorides, sodium, lead, cadmium, zinc, chromium, oil and grease, sediments, bacteria, nitrates, litter and debris. The amount and types of pollutants will vary with traffic density and will depend on how quickly snow is removed from the streets.

Chlorides, sodium, and sediments are contributed to snow by the use of road salt and sand on streets in order to reduce traffic accidents. It has been estimated that after each snow storm, 1,000 pounds of road salt is applied to each mile of two lane road. Oil and grease, lead, cadmium, zinc and chromium are from automobiles. Pet wastes contribute bacteria and nitrates, and litter and debris originate from a number of sources. Snow left on city streets for any length of time takes on a gritty black appearance which is evidence of the many types of pollutants it contains.
Chloride levels in dumped snow have been found to range from 6 mg/l to 2250 mg/l. Interim chloride toxicity values recommended for use in Wisconsin are 788 milligrams/liter and 399 milligrams/liter for acute and chronic toxicity, respectively. Chlorides form a saline layer along the bottom of lakes that can prevent normal mixing. This can lead to reduced oxygen levels in the bottom waters and increased nutrient release from the sediments. These added nutrients may stimulate plant growth. Increased chloride levels may also result in the release of mercury from contaminated sediments (Schreiber, 1986).

Chlorides readily move through the soil and can enter the groundwater as stockpiled snow melts. The groundwater enforcement standard for chlorides in Wisconsin is 250 mg/l. Some wells in Wisconsin have become contaminated above the drinking water standard for chlorides with the source documented as road salt use (Schreiber, 1986).

Sodium levels in stock piled and dumped snow have ranged from 7 mg/l to 220 mg/l (Seaway Port Authority). Increased sodium concentrations may prevent mixing of waters in lakes (as do increased chloride concentrations) and result in increased nutrient release from sediments. High concentrations of sodium and chloride lead to deterioration of soil structure, resulting in decreased permeability, loss of vegetation, and increased erosion (Schreiber, 1986).

Sediment, primarily sand from road salt and sand mixtures, is also a contaminant of concern in snow. One New England state found that an average of 358 cubic yards of sand was deposited every year on a snow dumping site (Vermont ECD). One study measured total suspended sediments (TSS) at concentrations as high as 2,250 mg/l (Pierstorff). Wisconsin state effluent limits set maximum levels of TSS at 50 mg/l at a number of facilities. Sand can have a blanketing effect on lakes and streams, smothering fish spawning areas, and vegetation. Snow dumping in surface waters in Ontario has been curtailed because of the amount of sediment in snow (O'Brien).

Lead levels have ranged from 0.9 mg/l to 9.8 mg/l in dumped snow, cadmium levels from 0.01 to 0.14 mg/l, and chromium levels from 0.05 to 16 mg/l. (Pierstorff, 1980). These amounts would exceed Wisconsin groundwater standards and the lead and chromium levels
would exceed acute toxicity criteria effluent discharge limits for some surface waters in Wisconsin. Lead is usually found in an insoluble form in snow and is attached to particulate matter; therefore, there is little potential for groundwater contamination. It can, however, accumulate in the soil, thus impairing the structure and changing soil fertility (Schreiber, 1986). Heavy metals can also build up in the tissues of aquatic plants and animals and subsequently accumulate in animals that consume them. Possible effects of heavy metals include liver and kidney damage, tumors, birth defects, brain damage, lung and respiratory concerns, learning disabilities, and neurological damage (Schueller, 1992).

Oil and grease concentrations in dumped snow have ranged from 1.3 mg/l to 28 mg/l. (Pierstorff, 1980). Daily maximum effluent standards established at some facilities in Wisconsin have limits for oil and grease at 20 mg/l. Oil and grease can contribute polycyclic aromatic hydrocarbons to surface waters and cause an oil sheen to appear on the surface of the water.

The visual impression of snow dumping is also a problem. No one likes to see a truckload of dirty snow being dumped into the local river or stream. The general public associates this with pollutants being added to the stream (Vermont ECD).

**SOURCE AREA CONTROLS**

**Reduce Contaminants in Snow**

The first source area control which should be considered is to reduce the amount of contaminants in snow. This can be done by plowing more frequently and reducing the amount of road salt used, reducing vehicle miles traveled by encouraging the use of public transportation and ride sharing, and removing snow from roadways within 48 hours to reduce the contaminant load in the collected snow. Decreasing plowing and reducing the amount of salt used should never be done at the risk of public safety.

Vermont's "smart salting" program calculates salt application rates using infrared sensors on trucks to measure winter pavement temperatures, which are typically 7 to 40 degrees F warmer than the air. When the pavement is so cold (about -6 degrees F) that salt would be inefficient, crews apply sand or other abrasives. Sand is
frequently mixed with salt to help embed the sand into colder surfaces and increase friction. Overall, state transportation crews have found that applying salt and sand in frequent doses during a snowfall, versus "waiting out the storm" achieves the best results. They are using 25 percent less salt and sand than in previous years (WNDR brochure, 1995).

Once these source area reduction practices are put into place, the next step to consider is how best to dispose of the snow that will be collected. Land disposal is the preferred option over direct dumping into surface waters. Direct disposal of snow into surface waters should only be done in emergency situations.

**Land Disposal**

Land disposal of snow offers a number of options over snow dumping directly into a surface water.

- Refuse and litter can easily be collected after the snow has melted.
- Sediments build up on land rather than in lakes and streams.
- Contaminants that tend to cling to soil can be filtered out.
- There is less potential for a concentrated dose of contaminants entering lakes and streams. The contaminants gradually seep into the soil or are carried downslope as the snow melts (Schreiber, 1986).

The land disposal site must be carefully chosen. The best disposal sites are those that drain to a detention basin which captures meltwater pollutants. The potential for surface and groundwater contamination must be evaluated at each disposal site. The soil texture should be fine grained to allow for the capture of metals and prevent chlorides from seeping into the groundwater. Fine grained soils will allow for more overland flow vs. infiltration as the snow gradually melts.
Areas of fractured bedrock should also be avoided as these areas can serve as direct conduits of pollutants to the groundwater.

The site should also be located at least 1,000 feet from any private well and down gradient from any wells or groundwater recharge areas (such as gravel pits) and preferably near groundwater discharge areas (Schreiber, 1986 and Vermont ECD).

Wetland areas should also be avoided to prevent surface water contamination and damage to wildlife and wetland vegetation.

Sanitary landfills should not be used for snow disposal as the added moisture can accelerate the movement of leachate from the landfill (Schreiber, 1986 and WDNR Brochure, 1995).

**Site Selection Criteria**

The following factors should be considered when selecting a site:

- The site should be far enough away from surface waters to allow for slow dispersal of snow as it melts. This will allow for capture of most sediments and pollutants and result in a gradual release of any remaining contaminants to the surface waters. A minimum setback of 150 feet is recommended.

- If the site is located in a floodplain, it should not contribute to the potential for flooding.

- Runoff rates should be estimated and a site selected that allows for the receiving water’s ability to absorb the amount of runoff and pollutants entering it at any given time. Site selection should also take into account downstream uses of the surface water.

- The alternate and future uses of the site should be known. Human exposure to contaminants remaining on the site after the snow melts should be avoided. Therefore, recreation areas should not be used for snow disposal.
The site should be easily accessible to the trucks hauling the snow. This will reduce the potential for haulers to dispose of snow at sites other than the approved sites.

Noise should also be considered. Residents do not appreciate numerous trucks driving up and down residential streets.

Visual impacts should also be considered and consequently residential areas avoided (Schreiber, 1986).

**Site Maintenance**

Once a site is selected, the runoff needs to be controlled and the site maintained. The following site preparation and maintenance practices should be followed:

- A sediment barrier or trap should be constructed. This could consist of a detention basin, berm, silt fence or staked hay bales. For example, a coarse gravel berm down gradient of the dumped snow will slow and disperse flow and trap sediments and debris.

- Vegetation should be well established and maintained at the site during the growing season. This will help capture pollutants and prevent soil erosion.

- All litter and debris should be removed from the site after the snow melts. A fence should also be erected to capture windblown litter if this is a problem during the period when snow is melting.

- Sediment should also be removed or evenly dispersed over the site to allow for capture by the vegetation. This will also prevent heavy sediment buildup from smothering vegetation (Schreiber, 1986, Vermont ECD).
Surface Water Disposal

Surface water disposal should only be done in emergency situations or when a suitable land disposal site is not available. All attempts should be made to find a proper land disposal site before surface water disposal is considered. If surface water disposal is considered, only major rivers should be used and water quality standards should be maintained.

Before dumping snow into surface waters, state laws should be checked. Most states require permits to discharge waste material, pollutants or any substance into waters of the state. Most states do allow for surface water disposal of snow on a case-by-case basis during emergency situations. Permission must be obtained from the state.

If surface water disposal is chosen, only clean snow should be dumped. Clean snow is that which has been removed from streets within 48 hours after the snowfall.

The Vermont ECD describes heavily contaminated snow as snow that is:

- Subject to moderate to large traffic volumes
- From downtown areas
- Heavily or frequently sanded or salted
- From large parking lots (> 25 spaces or 1/2 acre)

Snow from such areas should not be dumped directly into surface waters even if collected within 48 hours after the snowfall.
Bibliography


Schueller, Michelle, Bulk Storage Pile Contamination of Stormwater: Concerns and Recommendations for Wisconsin, Wisconsin Department of Natural Resources, April, 1992.


Vermont - Snow Dumping and Vermont's Water Resources Environmental Conservation Department-Water Quality Division, undated.

"Where to go With the Snow" - Snow Treatment and Disposal guidance for Municipalities", WDNR Publication WR-154, REV 95.
CHAPTER 5: WOOD

(INCLUDES LOG STORAGE, SAWDUST, BARK, AND WOOD PROCESSING FACILITIES)

TYPICAL PILE CONFIGURATION AND LOCATIONS

As logs are removed from the forest, they are stored in piles in the forest or placed in intermediate storage locations. The logs are eventually transported to wood processing facilities. At the wood processing facilities (sawmills and pulp and paper manufactures), the logs are again stored for short periods of time. Often times the logs are sprayed with water while in storage at the sawmill. This spraying reduces the likelihood of checking and cracking and softens the bark for easier removal. Checking and cracking can reduce the shear strength of the wood, results in product wastage, and also provides access to insects. At times, insecticides are added to the spray water if there is an insect problem on site.

Once on site at the wood processing facility, the logs are eventually debarked and then cut or chipped, depending upon the eventual use of the wood. The debarking process results in large amounts of bark debris. The cutting and chipping processes leave behind piles of sawdust. The bark and sawdust is either stored at the wood processing facility, burned for fuel or placed in trucks and sold to other facilities. Bark chips and sawdust are also occasionally sold or given away for landscaping purposes.

POLLUTANTS

Logs, bark, and sawdust stored outside have been shown to contribute a number of pollutants to surface waters and groundwater. These pollutants include biochemical oxygen demand (BOD), chemical oxygen demand (COD), fecal coliform bacteria, phenols, tannic acid, total suspended solids (TSS), and hydrogen sulfide.
BOD and COD are associated with decaying organic materials. These types of materials lower the oxygen available in surface waters, making less available for aquatic life. Wood chips, bark, and sawdust are all materials that contribute to increased BOD and COD. BOD values reaching 500 and 800 mg/l have been measured in stormwater at wood processing facilities and at 2600 mg/l in lab leachate experiments (personal correspondence, MPCA, and Goudey, 1992).

Fecal coliform bacteria levels as high as 23,000 counts/ml have been measured at wood processing sites (personal correspondence, WDNR). Treatment plant limits are set at between 200 and 400 counts/ml. Fecal coliform bacteria are indicators of fecal matter present and can be associated with disease carrying bacteria and viruses.

Phenols are a skin irritant and can cause toxicity via ingestion, inhalation, or absorption. Phenols have been found in concentrations up to 30 mg/l in aspen leachate. This concentration is considered toxic by one author (Goudey, 1992). Human threshold criteria (the maximum concentration set to protect humans and aquatic life from adverse effects) for phenols are set at 2.7 mg/l by the Wisconsin Department of Natural Resources. Phenols are mainly associated with poplar and willow. The sapwood and heartwood appear to be the major sources of the phenols, with the bark and rootwood containing smaller amounts (Sharif, 1989).

Hydrogen sulfide was also found in log leachate at levels of 5 mg/l. This was considered toxic by the author of one study (Pacific Northwest Pollution Control Council, 1971). Hydrogen sulfide is toxic by inhalation and is an irritant to eyes and mucous membranes.

Laboratory leachate studies have produced various results in terms of log leachate toxicity. Schaumburg (1970 and 1973) found that ponderosa pine, hemlock, and older Douglas fir leachate was not acutely toxic to salmon and trout fry. Schaumburg, along with Schuytina (1976), also concluded that leachate from log sections without bark were more toxic than comparable sections with bark intact. Schuytina's studies in 1976 also found that 96-hour bioassay tests of Douglas fir, hemlock, and ponderosa pine log leachate did not result in mortalities to trout fry in 100 percent solutions.
Schuytina and Atkinson (1971) found, however, that younger Douglas fir (< 50 years) leachate was somewhat toxic to salmon fry. The Pacific Northwest Pollution Control Council (1971) and Atkinson (1971) concluded that leachate from older fir logs and ponderosa pine produced no toxicity during a 96-hour bioassay test, but that serious water quality problems could result if runoff from log storage facilities is discharged into small streams.

Power (1988) concluded that log leachate from pine and spruce can be acutely toxic to salmon eggs and fry, caddis fly larvae, and mayfly nymphs. Power also concluded that log leachate resulted in decreased zooplankton density in surface waters and therefore, a reduction in food availability for fry. Goudey (1992) concluded that aspen leachate was very toxic to all forms of aquatic life. Goudey's lab test showed that aspen log leachate concentrations of one to two percent of full strength were median acutely toxic for rainbow trout and daphnia. Goudey states in his 1992 study that one ton of aspen wood can potentially release enough leachate to render one million liters of water acutely toxic to trout. Sproul (1969), concluded that COD values he observed in leached organic matter from logs were high enough to render receiving water useless as a fish habitat. He observed COD values between 180 and 3700 mg/l.

Sproul also observed pH values of 3.5 to 4.6 standard units (s.u.) in log leachates. These are below generally accepted discharge limits of between 6 to 9. Suspended solids values from log leachate in Sproul's studies ranged between 5 to 120 mg/l. Sproul also concluded that groundwater supplies should not be developed in areas where bark has been placed on pervious ground.

Several studies concluded that log leachate results in decreased numbers of benthic organisms (O'Claire, 1988 and Pacific Northwest Pollution Control Council, 1971). These studies also concluded that bottom deposits of wood debris create physical barriers to the healthy development of benthic communities.

Aesthetics are also a concern of log leachate and storage pile runoff. Some log leachate produces a dark brown color (associated with tannic acid) in surface waters. Although many surface waters are naturally brown in color, runoff from log storage facilities, which is noticeably darker than the surface water, is not aesthetically pleasing to citizens who notice the discharge. There
may also be floatables associated with discharge from some log and wood storage facilities. Most states do not allow any floatables or any noticeable color in discharges from permitted facilities.

Logs with bark intact tend to release less soluble organic matter and color than those with bark removed, although it appears that bark contributes most of the color producing substances (Sproul, 1968 and Graham, 1969).

EPA has set water quality discharge limits for various logging operations. These limits presently do not apply to material storage area runoff. These limits are included in this discussion however, as they give an indication of the quality of discharge EPA is requiring of some log yard operations. Discharges from wet storage areas and hydraulic barking operations have a limit of zero discharge of debris and a pH range of 6 to 9 s.u.. Wet storage areas are defined as the storage of logs or roundwood before or after removal of bark in self-contained bodies of water or storage of logs or roundwood on land where water is sprayed or deposited intentionally on the logs. Debris is defined by EPA as woody material such as bark, twigs, branches, heart wood, or sap wood that will not pass through a 2.54 cm (1.0 inch) diameter round opening and is present in the discharge from a wet storage facility. Debris is defined in this manual as any waste left from logs, logging operations or wood processing activities.

Log washing operations (where water is applied under pressure to remove dirt) have a federal limit of 50 mg/l suspended solids, and a pH of 6 to 9 s.u.. Performance standards for new sources (new operations after 1983) have a zero discharge limit.
Federal effluent limitations from mechanical barking operations are set at the following:

<table>
<thead>
<tr>
<th></th>
<th>Maximum Daily</th>
<th>30-Day Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD₃</td>
<td>0.09 pd/cu. ft. of product</td>
<td>0.03 pd/cu. ft. of product</td>
</tr>
<tr>
<td>TSS</td>
<td>0.43 pd/cu. ft. of product</td>
<td>0.144 pd/cu. ft. of product</td>
</tr>
<tr>
<td>pH</td>
<td>6 - 9 s. u.</td>
<td>6 - 9 s. u.</td>
</tr>
</tbody>
</table>

**Insecticides**

Insecticides and fungicides are, at times, sprayed on the logs to prevent damage to the wood. It is unknown if they are used in large enough amounts to cause water quality problems.

**SOURCE AREA CONTROLS**

Source area controls are those that prevent pollution from occurring at the source. They can range from elimination of the use of a product to better control over the exposure of the product to stormwater. Many of the pollutants associated with log storage and wood processing facilities can be controlled with source area controls. Sediment and debris control can go a long way toward reducing total suspended solids, BOD, COD, floatables and other pollutants associated with wood chips, bark and sawdust. The following source area controls are suggested for use if the wood processing facility needs to control stormwater pollutants.

**Proper Disposal of Wood Waste**

Control of log processing material (bark, chips, and sawdust) can eliminate most of the storm water pollutants associated with these materials. If these types of materials do not come in contact with storm water, they will not contribute pollutants to storm water discharges. Many wood processing facilities are able to keep bark, sawdust, and wood chips to a minimum at their site by selling or
giving away the waste material. There are many markets for various types of wood waste. Keeping the yard clear of wood debris by properly disposing of the waste material can really help to reduce stormwater pollutant loading. See Appendix Four for a list of facilities in Wisconsin which take or buy wood waste.

**Sediment Control in the Yard**

Log storage yards generally have exposed soil. The yards are usually cleared and leveled to create easy access for unloading and moving of logs. Heavy equipment moving around the yards creates ruts and can track sediment from the yard. If the logs are sprayed, the soil is generally kept moist and can even be washed away if the spray is heavy. Rain can also easily wash away exposed sediment in heavily used yards.

The following practices will help control sediment loss from log yards:

- The log storage area can be kept gravelled to prevent sediment from being discharged and tracked off the storage yard site.
- A pervious base will allow the spray water to infiltrate to some extent and the gravel will help control sediment loss.
- In some areas in the yard, an impervious base will help control sediment. This practice does, however, create more runoff and can be broken up by the use of heavy of machinery.
- Geotextile fabric can be placed under gravel in heavy traffic areas to help keep a firm base and control sediment loss.

**Vegetated Buffer Strips**

Strips or areas of vegetation around the storage yards can also be used to infiltrate uncontaminated stormwater before it reaches the yard or storage area. A vegetated strip will also slow down water flowing from the yard and material storage areas and capture some of the sediment and debris. Sediment controls in the yard, such as
spreading gravel to stabilize the soil, should also be used, as most vegetated buffer strips will not be able to handle large sediment loads.

Facilities that have heavy loads of debris and sediment being washed off site may need to consider the use of two filter strips to capture these loads. Heavy sediment and debris loads may build up and eventually smother the vegetation. If two filter strips are used, one can be scraped and rebuilt when it is no longer capturing sediment and debris and the second one can be used while the first one is getting re-established.

**Berms or Diversion Structures**

A berm around the yard or material storage areas can be used to keep uncontaminated stormwater from flowing into the log and material storage areas. The upslope sides of such areas should be bermed in order to direct uncontaminated stormwater safely off site or to infiltration areas. Berms placed downslope of the yard or material storage areas can also be used to help slow down and capture yard runoff. Downslope berms can be graded with a ramp for machinery access. If soil is used for the berm, it should be covered in vegetation to keep it intact and prevent the berm from eroding.

**Collection of Debris and Yard Material**

As logs are removed from the yard for processing, the areas on which they were stored can be cleaned. Loose bark and wood should be picked up. A small tractor with a blade can be used to lightly scrape the site. If the wood debris and bark has very little soil in it, it can be chipped and included in other bark debris. If there is a significant amount of soil, the material may be composted. A state permit may be required for the compost pile. The compost pile should be constructed and operated so as to avoid groundwater and surface water contamination. The compost pile can be placed on a pad with runoff collected and sprayed back onto the compost pile. Compost material can also be used for residential and commercial landscape purposes. Potential users are local forestry personnel or garden clubs.
Larger log yards may choose to use debris sorters. These are machines that use screens of varying sizes to sift the log yard debris and sort it into piles for various uses. The woody debris can be used for fuel or for landscaping purposes. The grit and rocky material can be placed back in the yard. These types of sorting mechanisms can get very expensive. Some facilities rent them from local contractors or hire a contractor to come to the site periodically.

**Detention Basins**

A combination of a basin with a screen and a filter strip can also be used to capture heavy sediment and debris loads. Runoff can be directed into the basin, and debris and sediment removed via settling or screening. The discharge is then directed to a filter strip for infiltration. The basin must be periodically cleaned. The captured material can be composted or screen sorted. Recovered wood debris can be used as fuel and the soil placed back in the log yard and stabilized with gravel. The excess water can be recycled and used for log spraying operations or sprayed on vegetated areas. The spray should be applied at a rate which prevents runoff.

**Collection of Bark**

Each wood processing facility should have a plan to properly dispose of bark. Bark can then either be chipped or left in strips to be used for fuel or sold to other wood processing facilities. The bark should be placed directly in trucks for transportation to the facility which is buying the bark or utilized.

If used on site, the bark can be moved by covered conveyors to the appropriate point on site or placed in trucks and transported to an indoor or covered facility on site. If it is necessary to store bark or bark chips uncovered outside, the storage site should be appropriately bermed. Berm should be placed to keep uncontaminated stormwater from flowing across the bark storage area. Stormwater that comes in contact with the bark can be collected and the debris and sediment removed before it is allowed to discharge off the site. This can be done using infiltration areas or a settling pond. The runoff can also be recycled and used for site spraying operations.
Collection of Sawdust

As sawdust is generated, it should be bagged or placed under cover. Sawdust can be used as a fuel on site. If used on site it should be transported under cover to the appropriate location. This can be done using covered conveyors or trucks. If sold to another facility, it should be bagged indoors or placed in a covered truck for transportation.

Stormwater discharge permit requirements generally do not allow a discharge of floatables from the site. It is difficult and expensive to remove sawdust from runoff and it is difficult to remove finely spread sawdust from the yard. The best solution is to keep it from coming in contact with stormwater.

Proper Storage of Wood Chips

At some facilities wood chips are brought on site and used as the main material in the facility's operation. At other sites, wood chips are generated in the facility's operation and subsequently sold. At either type of facility, wood chips should be properly handled to avoid contamination of stormwater. As with sawdust, it is recommended that wood chips be kept under cover or indoors. Stormwater discharge permits do not allow any discharge of floatables. If wood chips get into the stormwater, they should be removed before the stormwater can be discharged from site.

Following are several methods for covering wood chips:

- Placing a roof over the wood chip pile and placing berms around the pile. This prevents rain from falling on the pile and prevents uncontaminated stormwater from flowing onto the pile.

- Containing the wood chips in a building such as a pole shed or dome. Covered conveyors could be used to move the wood chips to the appropriate location.
Placing the wood chips directly into a covered truck for later use on site or to be sold to another facility

**Loading and Unloading Concerns**

A great deal of dust and spillage can take place when sawdust or chips are bagged, conveyed, or loaded onto a truck. The following practices should be considered when sawdust or wood chips are processed or loaded:

- Sawdust should be bagged indoors in order for dust to be contained. After bagging operations, the dust should be swept up and proper disposal methods followed.

- If dust is generated when loading trucks, the truck should be tarped and a chute or boom used to place the sawdust or chips in the truck.

- The area should be swept after the truck is loaded in order to clean up any spilled debris.

**Minimizing Use of Insecticides**

If insecticides are sprayed on the logs to prevent insect damage, the amount use should be kept to the minimum possible. Care should be taken to spray only the areas necessary and to prevent spillage and excess spraying. When insecticides are used, an analysis of runoff should be done to determine the amounts that are in stormwater as it leaves the site.

**Vehicle Maintenance and Washing**

Fluids from vehicle maintenance activities and broken hoses also contribute to stormwater contamination on site. Any vehicle maintenance that has the potential to result in the loss of fluids or solvents should be done indoors and on an impervious pad. Any spills should be immediately cleaned up. Properly dispose of all fluids and solvents.
Routine maintenance of vehicles will prevent many accidental spills due to hose breaks and fluid loss. Hoses should be checked routinely and replaced when necessary.

Vehicle washing should be done in an area where the wash water can be treated or kept from discharging into a water body.

See Appendix One for proper disposal of vehicle wash water.
Log Yard Debris Sorters

The following are several contacts for information on log yard debris sorters. The listing is not an endorsement for these firms or individuals, but simply several sources the author was able to collect.

RECOVERY SYSTEMS TECHNOLOGY INC.
BOTHWELL, WA
1-800-75WASTE

MARK DOTY
BEAVER TOWN, OR
503-643-9023

CLARKS SHEET METAL
EUGENE, OR
503-343-3395

PHIL MITCHELL
WEYERHAUSER
TACOMA, WA
206-924-2555
Bibliography


Kiefer, William, Wisconsin Department of Natural Resources, personal correspondence.


Schaumburg, Frank D., and Sheridan Atkinson, "Biochemical Oxygen Demand and Toxicity Associated with Log Leachates", Dept. of Civil Engineering, Oregon State University, Coe Valley, Oregon, presented at Western Division of American Fisheries Society meeting, August 1970.


APPENDIX B

Blank Quarterly Site Inspection Form
CITY OF MANITOWOC
PUBLIC INFRASTRUCTURE YARD
QUARTERLY SITE INSPECTION CHECKLIST

Quarterly site inspections are performed to evaluate the effectiveness of controlling storm water contamination and to identify any additional measures that can be feasibly implemented. The Public Infrastructure Yard Storm Water Pollution Prevention Plan identified the following areas for inspection:

1. Inspect site drainage conditions. Things to look for include the following:
   - Inspect the site for possible erosion problems.
   - Determine if drainage off the Property has changed. Are there any new areas of ponding or streaming?

2. Check for any potential pollution sources. These sources may include the following:
   - Inspect the outdoor material storage areas. Is there any indication of oils or greases in the areas?
   - If there is any standing water at the time of inspection with sheens, sludge, foam, etc?
   - Are there signs of erosion or sediment transport into inlets or off site from storage areas?
   - Is there any litter or debris not associated with normal operations (such as from snow storage)?
   - Inspect all areas of the Property for signs of spills (oil, resins, etc.) or other contaminants.
   - Inspect the fuel island pump hoses for cracking or other signs of wear.

3. Inspect catch basins. Things to look for include the following:
   - Check sediment buildup and schedule for cleaning if necessary (sump should be no more than 40% full).
   - Inspect Nutrient Separating Baffle Box and hanging traps for proper functioning and any needed maintenance or cleaning.
   - Check for floating oils and greases. Suction off floating material if necessary.

4. Other observations – take note of anything else at the Property that may be of significance to the Storm Water Pollution Prevention Plan.

Signed: ___________________________  Printed Name: ___________________________
Title: ___________________________  Date: ___________________________

T:\Josh Accola\Manitowoc SWPPPs\Attachments\DPI Site\Appendix B\DPISiteInspChklst.doc  April 2015
APPENDIX C

Completed Quarterly Site Inspection Forms