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Log Yard Leachate 101

Stu Spencer, Senior Researcher, Fibre Supply

Introduction

Recently, many forest companies, especially those located on the BC coast, have become interested in the possible danger that the runoff from log accumulations (log yards) may pose to the local flora and fauna and, ultimately, to humans. This info note attempts to put together practical information about how harmful runoff from log yards is created, how it can be prevented and give a brief overview of mitigation options. In creating this info note, a literature review was completed and a list of useful documents can be found near the end.

What is leachate?

The formal definition of a leachate is: “any liquid that, in the course of passing through matter, extracts soluble or suspended solids, or any other component of the material through which it has passed”. In simple terms, leachates are chemicals or substances, such as sediment, that seep or “leach” into water. Leachate can be harmful to plants and animals in high concentrations and should be prevented or mitigated in industrial settings as much as possible. In many jurisdictions, it is required by law to manage leachate risk.

What causes leachates to form?

In forestry terms, leachates are caused by the interaction between wood, or more often, woody debris and water.

What are the sources of harmful leachate?

The most likely locations for leachate to occur in forestry based operations are:

- Log yards or log accumulations
- Wood waste or bark piles (See Figure 1)
- Log sortyards
- In-woods chipping sites
- Residue grinding sites

Figure 1. Leachates accumulated in water at the base of a debris pile

Harmful runoff can also be generated by interaction between petroleum products found on machinery or from the dissolution of galvanized roofing (not included in the scope of this info note).

Harmful Runoff Constituents

The most common leachates to occur in log yards and other woody biomass accumulations are:

- **Phenols** – Originate from the decomposition of heartwood and bark. High concentrations of phenols can be toxic to wildlife and plants.
- **Resin Acids** –Originate from the decomposition of bark. Can be toxic in the parts per million range.
- **Tannins and Lignin** – Originate from bark. Tannins and lignin cause a yellowish brown colour in water with a strong woody taste and odour.

- **Suspended solids** - Are fine inorganics such as clay and silt that are incorporated into water by erosion or transported into yards by trucks (i.e. mud stuck to logs and trucks).

What are the variables influencing the volume and toxicity of leachates?

- **Site location** – Sites located in regions with high annual precipitation (e.g., wetter coastal areas in BC) have the natural tendency to create more leachate than a dry inland site (i.e., more water to interact with wood and debris creates the potential for more leachate)
- **Yard size** – Simply put, larger yards generally store more logs, therefore there is a higher potential for leachate. (See Figure 2)

Figure 2. Example of log yard in Alberta

- **Tree species** – Not all tree species create the same levels and types of leachates. Trembling aspen (*Populus tremuloides*) and Douglas-fir (*Pseudotsuga menzieseii*) are two species known to create the highest levels of toxic leachates.
- **Water contact with wood and debris** – Uncovered material has the potential to create more leachate than covered debris. Also, storing wood and debris in low areas (such as wet depressions, rock pits seepages) with the potential for standing water can cause significant leachate creation.
- **Storage period** – In general, the longer the material is exposed to moisture, the higher the potential for leachates to form as well as larger volumes of leachate produced.
- **Particle size** – Woody materials with a small particle size (such as hog fuel or chips) are more prone to leachate creation due to a larger surface area available for contact with moisture.

Under what regulations does leachate management fall?

- **Federal**
  - Fisheries Act – administered by the Department of Fisheries and Oceans
    - Section 35 (habitat protection)
    - Section 36 (pollution prevention)
- **Provincial**
  - BC - Waste Management Act - provides authority for lead agencies to require permits or approval for waste management.
  - Others – consult local regulations
- **Local or Community**
  - Local regulations vary throughout the country. Managers should check with their local government for direction.

How can leachate be prevented or controlled?

Log yard managers should attempt to prevent the creation of leachates.

Prevention is usually cheaper than mitigation in the long run, although it may not always be possible in locations where storage sites are limited. Many of the methods listed below complement each other and are not stand-alone options.

- **Segregation** – involves diverting water away from storage areas to prevent debris-water interaction. (See Figure 3)
  - **Berms** – built up areas to contain wood and debris within a controlled area**. (**e.g., to keep debris from falling down a bank and into a stream).
  - **Ditches** – used correctly, can divert water away from woody material before leachates can occur.
  - **Slope Management** - like berms and ditches, positioning slope angles the yard away from debris or into treatment areas.
  - **Covering** – storage of wood or debris under covered areas can prevent the wood-water interaction. Tarping of piled woody materials can also achieve the same effect.

Figure 3. Segregated debris accumulation in coastal BC.

- **Paving** – although paving can be an expensive capital investment, it can be useful in directing leachate into mitigation structures and prevent leachate from moving through soils and into groundwater. (see Figure 4)

Figure 4. Loader collecting debris on paved dryland sort

- **Particle size management** – adopting a just-in-time system for comminution (grinding and chipping) of debris will help minimize the amount of leachate produced by reducing the amount of surface area available for debris water interaction (i.e., leaving pieces larger reduces wood-water interaction). (See Figure 5)

Figure 5. Piled debris that will be comminuted just before use.

How can leachates be mitigated?

Although managers can try to prevent leachate creation, sometimes it is impossible to avert it. In such cases, there are several mitigation techniques and structures that can be implemented. The following list outlines some of the leachate treatment systems.

Less Expensive Systems

- **Retention ponds** - structures designed to collect runoff, prevent storm surges and erosion. Ponds allow sediment and pollutants to settle.
- **Aeration lagoons** – similar to retention ponds but incorporate an aeration system to promote biological oxidation.
- **Artificial wetlands** – similar to retention ponds but incorporate plants and bacteria to act as a bio filter.
- **Oil/water separators** – system with a series of pools which allow clean water to pass near the bottom of the pool, but petroleum products, which float, are trapped on the surface where they can be easily collected.

More expensive systems

- **Activated sludge systems** – systems which use microorganisms to break down leachates into less harmful components (CO2, water). Pulp mills utilize these systems to break down waste products but can be expensive to implement and require large amounts of space to construct.
- **Chitosan purification** – a system which utilizes a compound found in chitin (i.e., insect shells, crustacean shells) to purify leachates through a process known as chelation (bonding of ions and molecules to metal ions). Although effective, these systems can be very expensive to build.

Summary

Leachates are caused by interaction between woody material and water. Therefore, it is most efficient to prevent or minimize that interaction. There are a variety of techniques that can be implemented to achieve that goal. In the event that leachate *is* created, there are also a number of mitigating procedures that can be employed. However, these procedures are usually expensive and difficult to execute.

Helpful documents

1. Mitigation of Fisheries Impacts from the Use and Disposal of Wood Residue in British Columbia and the Yukon. Canadian Technical Report of Fisheries and Aquatic Sciences 2296. (1999)
2. Guidebook: Environmentally Sustainable Log Handling Facilities in British Columbia. Report prepared for Fisheries and Oceans Canada, Pacific and Yukon Region, Habitat and Enhancement Branch by G3 Consulting Ltd., Burnaby BC. 72 pp. + appendices. (2003)
3. Dryland Log Sorting Operations Best Management Practices. BC Ministry of Environment – West Coast Region Environmental Protection Division. (2013)