Oil and Grease in the Portneuf River

Oil and grease analysis reveals the total concentration of a family of organic compounds including “nonvolatile hydrocarbons, vegetable oils, animal fats, waxes, soaps, greases, and related matter” (NCDWQ 2006). Free oil and grease is often visible as a rainbow-colored film on the surface of standing or running water, but some organic compounds may also exist within the water column. Visible sheens on surface water associated with a release of petroleum will be reported and corrective actions will follow Idaho Code (IDAPA 58.01.02.851.04a and .04b). Even at low concentrations like those associated from nonpoint source inputs, oil and grease may be toxic to aquatic life, reduce dissolved oxygen, and alter the usability and aesthetics of a water body (Khan et al. 2006).

Although Idaho has no statewide standard for oil and grease, several western states do have oil and grease standards (Montana, Wyoming, Utah) and the 2001 Portneuf River TMDL established an oil and grease target of 5 mg/L (see an excerpt from the 2001 TMDL on oil and grease in Appendix 1). Oregon and Washington lack a statewide standard for oil and grease, but commonly list it as a pollutant in NPDES permits.

Recent monitoring indicates that oil and grease is present in the lower Portneuf River and that concentrations commonly increase between the Edson Fichter Nature Area (EFNA) and Batiste Rd monitoring sties (Table 1). Further, the introduction of oil and grease through storm drains has been documented during or immediately following storm events (Table 2). Combined, this information indicates that the segment of the Portneuf River bounded by the EFNA and Batiste Rd monitoring stations regularly exceeds the oil and grease target established in the TMDL during both runoff and non-runoff periods. For this reason, the DEQ recommends regular and event monitoring of oil and grease to better describe background concentrations and characterize the temporal and spatial loading patterns in the lower Portneuf River.

* Oil and grease refers to n-Hexane Extractable Material [HEM] method E1664A. See a description of the method at: http://www.epa.gov/waterscience/methods/method/oil/

Table 1	**Oil and Grease (mg/L) ambient monitoring by sampling date**		
Site	24 April 2007	9 October 2007	14 January 2008
PR at Edson Fichter	4.9	1.9	*ND*
PR at Batiste Rd	7.0	8.8	*ND*

Table 2	**Oil and Grease (mg/L) storm event monitoring by sampling date**		
Site	6 June 2007	24 July 2007	2 August 2007
PR at Edson Fichter	7.5	*ND*	*ND*
Day Street Culvert	--	8.1	9.3
PR at Batiste Rd	8.9	*ND*	1.4
Blank	--	--	*ND*
6 June 2007 sampled during 24 hr rain event at approximately 12 hrs into event			

24 July 2007 sampled approx. 2 hr after brief microburst
2 August 2007 sampled approx. 1 hr after 1 to 2 hr rain event
ND indicates constituent was below detection limits of 1 mg/L (Non-detect)
-- indicates that no samples were collected at that location on a given sampling date

Other State Standards

Montana

17.30.637 GENERAL PROHIBITIONS

(1) State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will:

(b) create floating debris, scum, **a visible oil film** (or be present in concentrations at or in excess of 10 milligrams per liter), or globules of grease or other floating materials;

Oregon

No statewide standard

Utah

R317-2-7. Water Quality Standards

7.2 Narrative Standards. It shall be unlawful, and a violation of these regulations, for any person to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, **oil**, scum or other nuisances such as color, odor or taste; or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures.

Washington

No statewide standard

Wyoming

Section 29. **Oil and Grease**. In all Wyoming surface waters, substances attributable to or influenced by the activities of man shall not be present in amounts which would cause:

(a) The oil and grease content to exceed 10 mg/L;

Idaho Code for Petroleum Releases

58.02.01.851.04. Reporting and Cleanup of Above Ground Spills and Overfills. Owners and operators shall contain and immediately clean up an above ground spill or overfill of petroleum only after identifying and mitigating any fire, explosion and vapor hazards. (7-1-93)

a. An above ground spill or overfill of petroleum that results in a release that exceeds twenty-five (25) gallons or that causes a sheen on nearby surface water shall be reported to the Department within twenty-four (24) hours and owners and operators shall begin corrective action in accordance with Section 852. (7-1-93)

b. An above ground spill or overfill of petroleum that results in a release that is less than twenty-five (25) gallons and does not cause a sheen on nearby surface water shall be reported to the Department only if cleanup cannot be accomplished within twenty-four (24) hours.

References:

Khan, S., S. Lau, M. Kayhanian, and M. K. Stenstrom. 2006. Oil and grease measurement in highway runoff—sampling time and event mean concentration. Journal of Environmental Engineering 132:415-422.

NCDWQ 2006. HEM: Oil and Grease. North Carolina Division of Water Quality. Accessed 31 January 2008 from http://h2o.enr.state.nc.us/lab/qa/documents/HEMOilandGreasepdf.pdf

Appendix 1. Excerpt from the 2001 Portneuf River TMDL

3.2.4 Oil and Grease

Target

oil and grease content not to exceed 5 mg/l

Discussion

The lower Portneuf River in vicinity of the City of Pocatello is the only stream segment that has oil and grease listed as a pollutant of concern. There was no information found as to extent to which oil and grease are affecting beneficial uses in the Portneuf River. In addition, no data were seen which would indicate amounts of oil and grease discharged into the Portneuf River. Oil and grease into the Portneuf River can come from both agricultural and urban inputs, however, Pocatello and Chubbuck are most likely the source of loads into this listed segment of stream.

To estimate the oil and grease contributed to the Portneuf River by Chubbuck and Pocatello, land use information from the cities (Surface and Wessel 1995) was entered into a model based on stormwater pollutant information from urban areas throughout the United States (Table 44). The model estimated the annual total stormwater runoff of oil and grease at 75,948 pounds (38 tons).

To determine if beneficial uses are presently being impaired by oil and grease, more data are needed. It is recommended that water quality monitoring of the Portneuf River, its tributaries, and other sources of water into the Portneuf River (e.g., stormwater drains) include analysis for oil and grease (or a derivative such as total petroleum hydrocarbons).

Load Analysis

Until more information is gathered as to whether oil and grease are affecting beneficial uses in the Portneuf River, a target concentration of oil and grease content not to exceed 5 mg/l is recommended. A limited search for water quality standards or targets for oil and greases yielded a water quality standard of 10 mg/l from the State of Wyoming (Department of Environmental Quality, State of Wyoming, internet communication). To allow for a margin of safety, the Wyoming standard was decreased by half to account for lack of data on effects of oil and grease on beneficial uses. No targets or standards for oil and grease above which an aesthetic beneficial use is impaired were unearthed.

The maximum allowable load based on a target concentration of 5 mg/l and an estimated annual flow below the area of impact of 168,003 cfs (Table 45) is about 2,268 tons per year:

5 mg/l x 168,003 cfs x 0.0027 [conversion factor to tons/yr] = 2,268 tons/year.

No information was available to estimate the load of oil and grease from other nonpoint sources and there was no indication that any point source was contributing to the load of oil and grease in the Portneuf River.

The estimated current load of 38 tons/yr is substantially less than the allowable load of 2,268 tons/yr. However, at times (e.g., an intense summer rainstorm following weeks of no rain) the estimated load may actually approach the target load. Assuming that the estimated annual load of 38 tons of oil and grease from stormwater runoff is evenly distributed throughout the year, then a three week dry spell, not unusual for July or August, would mean an accumulation of 2.2 tons of oil and grease (3 weeks ÷ 52 weeks x 38 tons) in the city. A summer storm occurred on 10 July 1998 that dropped 0.23 inches of rain at the National Weather Service (NWS) monitoring station about eight miles west of the City of Pocatello (National Weather Service, internet communication). Such a storm would produce about 11.5 million cubic feet of stormwater runoff assuming similar precipitation patterns between the monitoring station and the Pocatello-Chubbuck urban area. This would create a spike in loading to the Portneuf River as well as an increase in load capacity due to increased stream flow.

Flow information at the Pocatello USGS surface-water station from 8-15 September and 29 September-6 October 1998 (USGS, internet communication) was examined to determine an empirical relationship between stream flow and short-term precipitation. Two storm events, 10 and 30 September (recordings of 0.35 and 0.09 inches of precipitation at the NWS monitoring station, respectively [National Weather Service, internet communication]) each resulted in an increase in flow at the Pocatello USGS surface-water station of about 100 cfs. Visual inspection of the two events indicated about 85% of the increase in flow occurred in about 4.5 hours.

Using the above empirical relationship, then the stormwater runoff from a storm producing 0.23 inches would contribute about 600 cfs to the river both above and below the Pocatello gage ([11,571,013 ft^3 of stormwater runoff x 0.85] ÷ [4.5 hours x 3600 seconds/hour] = 607 cfs). Adding this flow to a late summer low flow at the Tyhee USGS surface-water station of 136 cfs (July 1990 [USGS water resources data]) yields a total flow of 743 cfs. A target load for oil and grease at this flow is 1.9 tons/4.5 hours (743 cfs x 5 mg/l x 0.000112 [conversion factor to tons/hr] x 4.5 hours = 1.87 tons/4.5 hours). Assuming that 90% of the 2.2 tons of accumulated oil and grease is delivered to the river within the 4.5 hour period, then the input of 2.0 tons of oil and grease would exceed the 4.5 hour load of 1.9 tons at a target of 5 mg/l. Assuming runoff from the storm entered the Portneuf River within 24 hours, the 1.9 ton load of oil and grease would not exceed the daily target of 3.6 tons (11,571,013 ft^3 of stormwater runoff ÷ [24 hours x 3600 seconds/hour] = 134 cfs; [134 cfs + 136 cfs] x 5 mg/l x 0.0027 = 3.6 tons).

The loading analysis indicates that conditions could be such that the target load capacity could be exceeded on a short term basis. Until such time that data indicate otherwise, it is recommended that there be no increase in the present input of oil and grease into the Portneuf River.

Margin of Safety

The input of oil and grease into the Portneuf River and its effect on water quality is unknown. The Wyoming standard was decreased by half, from 10 mg/l to 5 mg/l, as a margin of safety to account for the lack of data on the effects of oil and grease on beneficial uses.

Data Gaps

Numerous assumptions were part of the foregoing scenario - an indication that much more information is needed on oil and grease in the Portneuf River. In addition, there was no accounting for effect of the soon-to-be-online engineered wetlands for treating storm water runoff in the City of Pocatello. Data should be collected to determine if there is a load of oil and grease into the river, and what, if any, impact such a load is having on beneficial uses.

Table 44. Estimated total suspended solids and oil and grease loads from stormwater runoff from the Pocatello-Chubbuck urban area (land use information from Surface and Wessel 1995; modeling done by Todd Maguire, Division of Environmental Quality).

Land use categories	Land use area (acres)	Percent impervious	Runoff coefficient (Rv)	Avg annual precipitation (in/yr)	Fraction of avg annual precipitation available for runoff	Annual storm runoff calculated avg volume (ft3/yr)	Event mean concentration (mg/l)		Annual pollutant loads (lbs)	
							Total suspended solids	Oil & grease	Total suspended solids	Oil & grease
Residential										
Low density	3,370	20	0.23	12.0	0.90	30,387,020	67	1.7	127,144	3,226
Medium density	1,161	30	0.32	12.0	0.90	14,565,070	67	1.7	60,942	1,546
High density	561	60	0.59	12.0	0.90	12,976,132	67	1.7	54,294	1,378
Commercial	761	90	0.86	12.0	0.90	25,657,450	159	9	254,767	14,421
Industrial	833	80	0.77	12.0	0.90	25,145,838	150	3	235,554	4,711
Public	4,318	50	0.50	12.0	0.90	84,641,436	159	9	840,451	47,573
Recreation	20,237	20	0.38	12.0	0.90	301,481,112	200	0.1	3,765,499	1,883
Transportation	1,606	80	0.77	12.0	0.90	48,480,450	140	0	423,865	1,211
Total	32,847					543,334,509			5,762,516	75,948

Table 45. Estimated monthly load and target load of oil and grease in the Portneuf River.

	Month												
	January	February	March	April	May	June	July	August	September	October	November	December	Total
Mean flow (cfs)*	501	561	682	659	552	287	194	283	338	457	507	506	5,527
Total monthly flow	15,531	15,848	21,142	19,770	17,112	8,610	6,014	8,773	10,140	14,167	15,210	15,686	168,003
Target load (tons)	210	214	285	267	231	116	81	118	137	191	205	212	2,268
Estimated load (tons)**	3	3	3	3	3	3	3	3	3	3	3	3	38

*USGS Tyhee surface-water station, Water Years 1985-1994

**total load of 38 tons of oil and grease from stormwater runoff equally divided between the 12 months