State of Oregon
Department of Environmental Quality

Industrial Stormwater Advisory Committee
Meeting 14- February 15, 2011

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Subject: Technology based Copper Benchmark

Background:
At the 13th Advisory Committee meeting on January 20, 2010, DEQ presented the results of the risk based benchmark modeling for copper, lead and zinc. The model yielded very low copper discharge concentrations corresponding to a 10% risk of exceeding in-stream water quality criteria in the Willamette Basin and Eastern Oregon (i.e. discharge concentrations of 4 ug/L and 10 ug/L, respectively). The Committee expressed concerns over the ability of, not only passive, but also active stormwater treatment, to reduce copper concentrations to such low levels. Members of the committee said that active treatment does not reliably reduce copper concentrations to below 10 ug/L. In light of this, DEQ is evaluating options for copper benchmark values and appropriate triggers for corrective action responses. DEQ's goal under the new permit is to establish benchmarks and corrective action requirements that require facilities to take specific actions to improve the quality of industrial stormwater while reducing the risk of facilities conducting successive corrective actions that result is a constant "do loop".

Technologically Achievable Copper Concentration:
To increase the likelihood that facilities will succeed in meeting the copper benchmark under the new permit, DEQ is evaluating using a technologically achievable concentration to establish the copper benchmark.

To determine the appropriate technologically achievable concentration, DEQ evaluated the following information:

- The 1200-COLS discharge monitoring report (DMR) data to determine the top 10% of facilities based on average copper concentrations in their discharges. Given that the copper benchmark in the 1200-COLS permit is significantly lower (36 ug/L) than the 1200-Z permit (100 ug/L), this data may be a better reflection of best available technology that is being used to control copper.
- Media filter treatment BMP information from the International BMP Database to assess copper treatment capabilities. DEQ is considering data from these passive treatment BMPs rather than active treatment (i.e., electrocoagulation or chemical treatment system) BMPs that may not be economically feasible for many facilities.
- Achievability of Washington Department of Ecology's copper benchmark of 14 ug/L.

<u>1200-COLS Data Evaluation</u>
To evaluate BMP performance, DEQ considered how good are the best 10% of the 1200-COLS facilities doing based on current data. There are about 126 facilities with 1200-COLS permits, so the goal was to examine the performance of the best 12 or 13 facilities at reducing copper concentrations in their discharge.

In evaluating the data, DEQ discovered that some facilities stormwater copper concentrations are always very low – often mostly below detection limits. Thus, discharge concentrations at these facilities may not represent BMP performance, but rather, locations where copper is not present. To focus on facilities where copper is present, DEQ looked at facilities where the geometric mean of their sample data was greater than 20 ug/L during the first three years of the current permit. Next, DEQ looked at facilities where there was an improvement in copper concentrations during the last two years of the current permit. There were twelve facilities with a "statistically significant decrease" in concentrations (10% level).[1] These twelve facilities are the best performers (i.e., top 10%) in terms of their ability to reduce stormwater copper concentrations. If DEQ established the copper benchmark based on the performance of these facilities, the benchmark would be 54 ug/L.[2]

BMP Evaluation

An evaluation of passive media filter treatment technologies was conducted using discrete monitoring data from the International BMP Database and additional third party testing sources. Information for proprietary filtration BMPs, including data from the Environmental Technology Verification program and a boatyard study conducted by Taylor and Associates, Inc., was included in the evaluation. The data are comprised of discrete influent and effluent pairs for individual storm events. The paired data were grouped according to 25 ug/L increments of influent total copper concentrations between 0 and 100 ug/L. Influent concentrations greater than 100 ug/L were also grouped together. The average and median total copper effluent concentrations were calculated for each group. A summary of this data is shown in Table 1.

Table 1. Summary of total copper reduction capabilities of passive media filter treatment technologies.

Influent Total Copper Concentration (ug/L)			Effluent Total Copper Concentration (ug/L)		Storm Event Sample Size
Range	Average	Median	Average	Median	
< 25	13.4	13	7.19	5.30	171
25 - 50	35.1	34.1	15.1	14.5	52
50 - 75	59.5	59.5	26.3	29.5	12
75 - 100	88.1	88.6	31.8	34.0	14
> 100	278	190	51.5	42.5	22

Most of the data used for the evaluation are from transportation, commercial and urban land uses. To assess relevant total copper discharge concentrations from industrial land uses, an examination was conducted of the DMR data submitted by the facilities under the 1200-Z and 1200-COLS permits. The geometric mean was calculated for each outfall using all of the data and was not limited to the four most recently monitored storm events. The information in Table 2 shows the portion of facilities having at least 1 outfall with a total copper concentration geometric mean which is greater than the corresponding concentration. According to the information on in Table 2, very few facilities (i.e. 3.1%) have total copper geometric means which exceed 100 ug/L, the current 1200-Z benchmark. Approximately 13% of facilities have geometric means greater than 36 ug/L, the current 1200-COLS benchmark.

[1] This means we can be pretty confident that *something* is causing the decrease.

[2] The highest annual geometric mean stormwater copper concentration for the facilities was 53 ug/L based on data collected in 2009 and 2010.

Table 2. Distribution of 1200-Z and 1200-COLS permitted facilities according to the geometric mean of total copper concentrations discharged from their sites.

Total Copper Concentration (ug/L)	Portion of Facilities with Higher Total Copper Geometric Mean	Total Copper Concentration (ug/L)	Portion of Facilities with Higher Total Copper Geometric Mean
5	92%	55	6.6%
10	61%	60	5.7%
15	38%	65	5.0%
20	28%	70	4.4%
25	21%	75	4.4%
30	16%	80	4.1%
35	14%	85	4.0%
40	12%	90	4.0%
45	10%	95	3.5%
50	8.3%	100	3.1%

According to Table 2, a large portion of facilities discharge copper below 25 ug/L. [3] Facilities whose geometric means are below 25 ug/L have a greater likelihood of reducing their copper concentrations to a low benchmark without active treatment technologies. At the other end of the spectrum, less than 10% of facilities are discharging copper concentrations above 50 ug/L. Therefore, the influent total copper range of 25 – 50 ug/L was selected as a representative range to base potential benchmark concentrations that are achievable with passive treatment.

DEQ consider the following two options for establishing the benchmark concentration based on filtration performance abilities:

- Set the benchmark at the median effluent total copper concentration (i.e., 15 ug/L) for the 25 – 50 ug/L influent range. Selecting 15 ug/L as a benchmark may impact the 38% of facilities whose copper concentrations are above 15ug/L. Some facilities may require implementation of a passive treatment technology to adequately reduce discharge copper concentrations. However, selecting the median does not mean that facilities with influent concentrations of 50 ug/L or less will successfully meet the benchmark by treating their runoff using passive treatment.[4] According to Table 1, media filtration is capable of reducing the influent of 35 ug/L down to 15 ug/L.[5] Approximately 24% of facilities should be able to achieve 15 ug/L using passive treatment. Approximately 62% of facilities may evaluate and implement nonstructural BMPs, such as source control practices to maintain their discharges below 15 ug/L.

- Set the benchmark based on the 75th percentile of effluent concentrations for the 25 – 50 ug/L influent range, which will result in benchmark of 20 ug/L.[6] Selecting 20 ug/L as a benchmark may impact the 28% of facilities whose copper concentrations are above

[3] Approximately 79% of facilities have copper geometric means below 25 ug/L.

[4] The median value means that 50% of the monitored events corresponding to the influent range of 25 – 50 ug/L did not have effluent values below 15 ug/L (see Table 1).

[5] The 35 ug/L is based on median influent concentration for 25 – 50 ug/L influent group.

[6] The 75th percentile signifies the effluent concentration for which 75% of the monitored storm events were at or below this concentration.

20 ug/L. The media filtration evaluation results corresponding the 25 – 50 mg/L influent range shows that the 75th percentile influent is approximately 40 ug/L which corresponds to the 75th percentile effluent of 20 ug/L. Approximately 16% of facilities should be able to achieve a benchmark of 20 ug/L using passive treatment. Approximately 72% of facilities may evaluate and implement nonstructural BMPs, such as source control practices to maintain their discharges below 20 ug/L.

Under both options, a small number of facilities will have a greater challenge reducing their discharges to these low concentrations. The 8% of facilities with geometric means above the total copper influent concentration range of 25 – 50 ug/L may consider BMPs beyond an individual passive treatment system in order to meet either 15 or 20 ug/L.

> ***Feedback requested***: Based on the BMP evaluation, which copper benchmark option is appropriate (i.e., 15 or 20 ug/L)?

Washington Department of Ecology

Washington Department of Ecology adopted a total copper benchmark of 14 ug/L in its 2010 Industrial Stormwater General Permit. The copper benchmark is a water quality based benchmark based on risk-based modeling approach similar to the modeling that DEQ conducted. During permit development, Ecology believed that many facilities would need to install active stormwater treatment systems to meet the benchmark.[7] Ecology recently evaluated the monitoring results from the first year of the new permit and approximately 70% of the facilities are below the benchmark. Ecology believes that many facilities can meet the benchmark by implementing a combination of BMPs such as source control and passive treatment, but those that have high concentrations due to activities on site will likely need active treatment.

Water Quality Goal:

The water quality modeling results of 4 ug/L will serve as a water quality goal. DEQ recognizes that based on best available technologies many facilities may not reduce the copper concentrations in their discharge below 4 ug/L in one permit cycle. However, facilities must show incremental improvement in reducing pollutant concentrations in their discharge and strive to meet this lower benchmark in future iterations of the permit.

The water quality modeling results for copper were so low (4 ug/L) that the majority of the facilities would not have met the benchmark without installing active treatment BMPs. The technology based benchmark reflects what is technologically achievable for many facilities. The technology based approach allows DEQ to focus its resources on those facilities that routinely exceed the benchmark (i.e. Corrective Action Response 2) and have not installed the appropriate technologically achievable BMPs to reduce the copper concentrations in their discharge.

The quantitation limit (QL) for copper is 10 ug/L. If DEQ based the benchmark on the water quality modeling results of 4 ug/L, it will be difficult for DEQ to determine the feasibility of meeting such a low benchmark. The monitoring data is more meaningful under the technology based approach because the QL is below the benchmark.

> ***Feedback requested:*** Is it appropriate to establish a technology based copper benchmark and retain the 4 ug/L as a water quality goal for facilities to strive to meet?

[7] This determination was based on the Boatyard Stormwater Treatment Study – Final Report, March 2008.