DISCUSSION DRAFT

Procedures for determining the appropriate expression of the Highest Attainable Condition under the Willamette Basin Variance for Municipal Wastewater Treatment Operators

After determining that a variance is justified and appropriate, the next step is to determine the requirements of the variance. The variance must include requirements to achieve the highest attainable condition during the term of the variance. The HAC may be expressed using one of three options provided in the federal regulations.[1] HAC option 1 is an alternative water body criterion. HAC options 2 and 3 express the highest achievable effluent condition and replace the water quality criterion as the target for the permit limit for the term of the variance. Although the term of the variance can be longer than five years, federal regulations specify that the HAC must be reevaluated at least every five years.

HAC option 2 is "the interim effluent condition that reflects the greatest pollutant reduction achievable." HAC option 3 is "if no additional feasible pollutant control technology can be identified, the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the state adopts the WQS variance and the adoption and implementation of a Pollutant Minimization Plan."[2] Neither option shall result in a lowering of the currently attained water quality.

The Federal Register for the proposed federal variance rule notes that the requirement to identify the HAC and to periodically re-evaluate the HAC ensures that there will be feasible progress towards attaining the designated use.[3] The federal register further explains that establishing interim requirements allows states to implement adaptive management approaches that drive progress towards meeting the designated use in a transparent and accountable manner.

DEQ determined that HAC option 1 ("the highest attainable interim condition") is not appropriate for the Willamette Mercury MDV. There is significant uncertainty about what concentrations of mercury can be attained in the Willamette Basin during the variance through point source controls, due to ongoing mercury deposition. Therefore, DEQ will express the HAC for each discharger using option 2 or 3, depending on whether there is feasible technology that would achieve significant reductions in the pollutant load for the facility as compared to current treatment and implementation of a mercury minimization program. The flow chart (Figure 1) demonstrates the process that DEQ would use to determine the appropriate HAC option for each facility covered under the Willamette Basin Mercury MDV.

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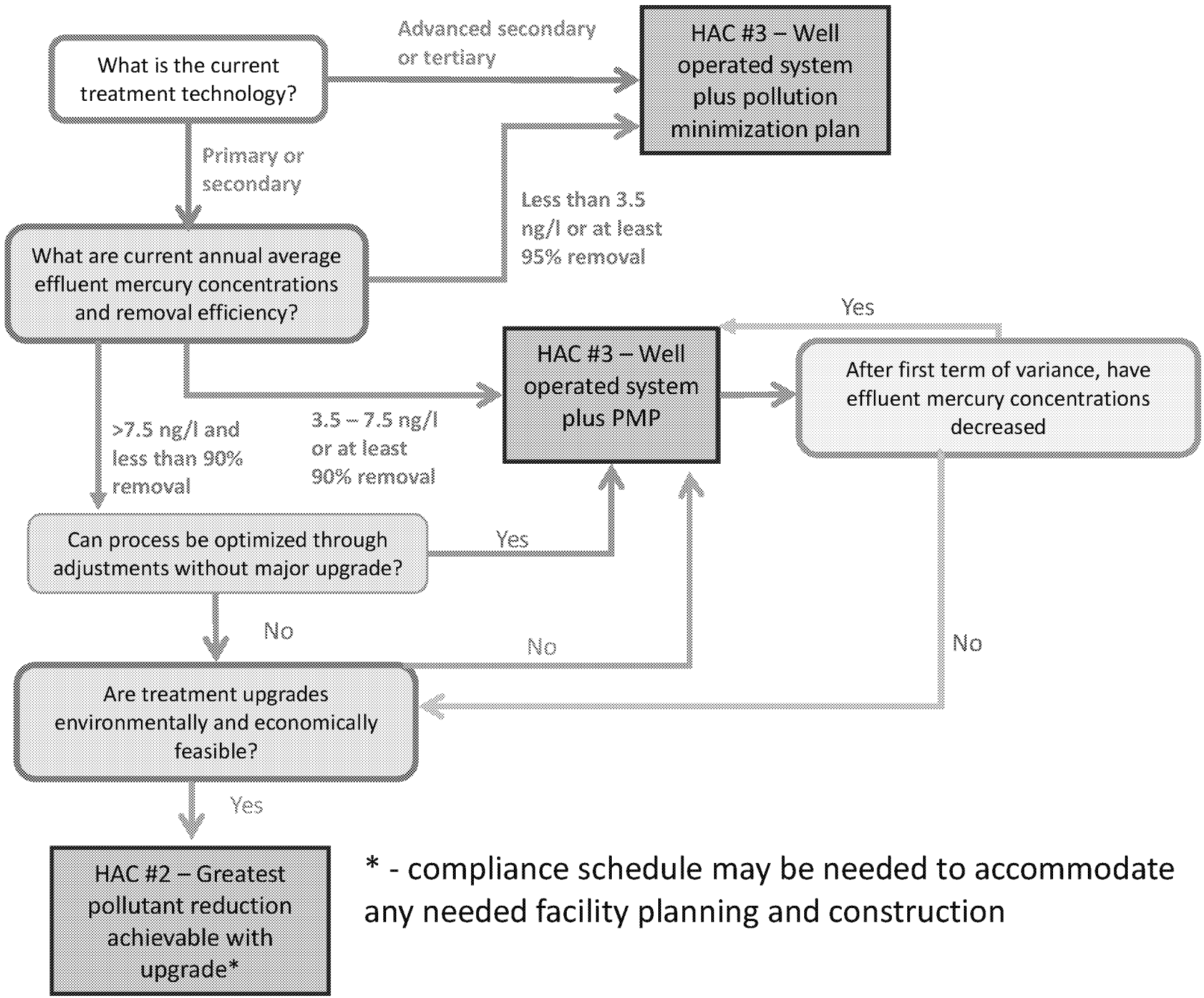
[1] 40 CFR Part 131.14(b)(1)(ii)

[2] 40 CFR 131.14(b)(ii)(A)

3 FR Vol. 78, No. 171, September 4, 2013, p.54534

Figure 1. Proposed Process to Determine Highest Attainable Condition



* - compliance schedule may be needed to accommodate any needed facility planning and construction

Effectiveness of Mercury Minimization Plans

In many cases in the HAC process, DEQ and permitted facilities must weigh potential benefits from implementation of MMPs as compared to benefits from installing mercury treatment upgrades. While there is no definitive answer regarding the impacts of source control, available data does indicate that PMP implementation results in steady declines in mercury levels that are seen in municipal WWTF data.

DEQ analyzed a decade of mercury influent data from 72 major NPDES wastewater treatment plants Minnesota. Under the Great Lakes Initiative, these plants have implemented MMPs for at least a decade or more. These data indicate that MMPs have resulted in significant and continued reductions in mercury concentrations entering treatment systems. Between 2008 and 2017, influent total mercury concentrations decreased from an average of 180 ng/l to 70 ng/l (Figure 2).

In addition, data from the Rock Creek Advanced Wastewater Treatment Plant operated by Clean Water Services indicates decreasing mercury levels in biosolids, showing the effectiveness of their mercury reduction efforts over the last 20 years (Figure 3).

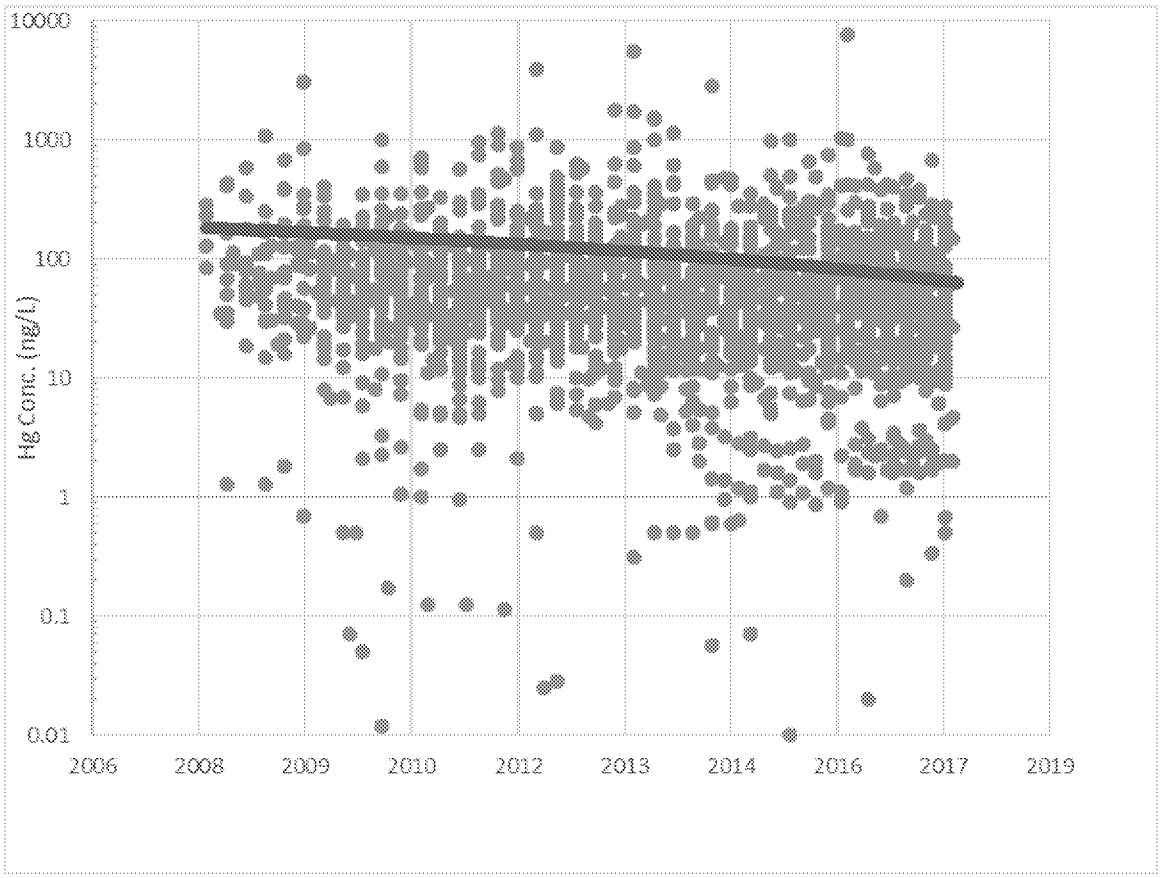
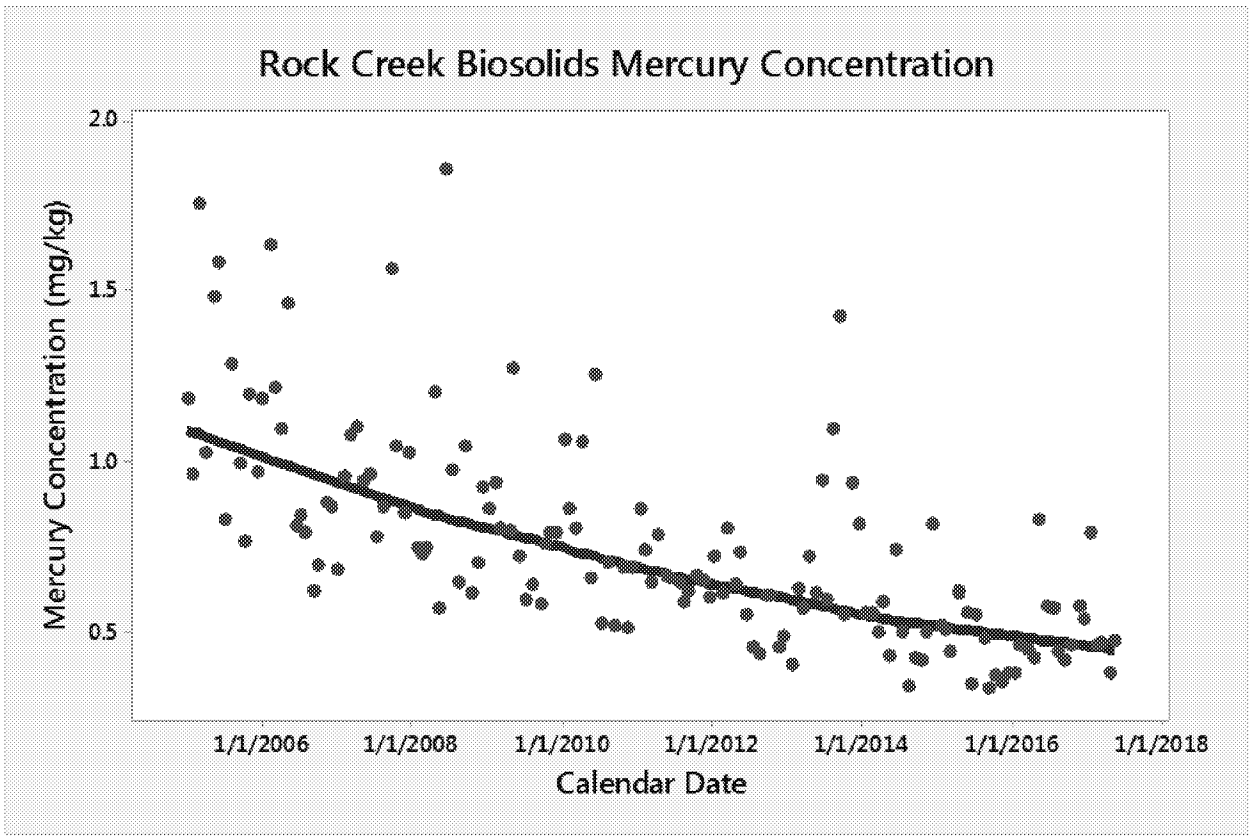


Figure 2. *Influent Data from Major Wastewater Treatment Plants in Minnesota. Source: Minnesota Pollution Control Agency*



Decreasing influent levels don't fully correlate with mercury levels in the treated effluent. However, minimization efforts do appear to lead to decreasing mercury levels in effluent over time. As a result, for most facilities, DEQ would prefer to focus efforts on less expensive minimization efforts where feasible, rather than ask wastewater treatment facilities to engage in environmentally and economically costly upgrades. At the same time, DEQ recognizes that there may be cases where treatment is the more effective option to reduce mercury. These considerations are incorporated into the HAC process, as described in the general guidelines below.

1. **Are there additional treatment technologies that are feasible and would result in additional mercury reductions as compared to MMP implementation?**

If there is no feasible technological upgrade that would significantly reduce mercury loads in a discharger's effluent, HAC option 3 is appropriate. If technologically feasible upgrades could result in additional mercury removal, it still may be the case that MMP implementation would result in similar reductions at a lower cost and lower environmental impact. In this case, HAC option 3 would still be the preferred option. Finally, if treatment upgrades would result in greater mercury reductions than MMP implementation, DEQ would need to work with the facility to determine if such reductions are economically and environmentally feasible. If they are not, HAC option 3 is still the appropriate expression. If treatment upgrades are economically and

environmentally feasible, DEQ would utilize HAC option 2, likely with a compliance schedule to accommodate the time for facility planning and construction of the treatment upgrade.

For wastewater treatment facilities, tertiary and advanced secondary treatment technologies result in the lowest concentration of mercury in effluent. Other treatment technologies, such as reverse osmosis or granular activated carbon, which might result in lower mercury concentrations, have not been demonstrated to work at the scale of a municipal wastewater treatment system and are therefore not feasible.

Data from Oregon and other states indicate that advanced secondary and tertiary technologies result in an average annual effluent concentration of 1-3 ng/l total mercury and remove approximately 96-98% of total mercury found in influent. Non-advanced secondary systems in Oregon operated by major facilities discharge effluent with average annual concentrations ranging from 1.2 – 8 ng/l and usually remove 90-98% of influent mercury.

Available data on MMP implementation indicates that source reduction activities can reduce influent concentrations of mercury by 50% or more. Although such reductions aren't fully correlated with effluent reductions, it makes sense in most cases to allow facilities to engage in MMP implementation to see if such efforts result in lower effluent mercury concentrations. DEQ has determined that PMP implementation is preferred for any facility with average effluent mercury concentrations of 7.5 ng/l or below or that have removed at least 90% of mercury from their influent before discharge. However, if such facilities do not show that effluent mercury concentrations decrease with PMP implementation, DEQ would work with the facility to examine the feasibility of treatment upgrades.

DEQ will use the following guidelines for determining whether a facility will be given permit conditions based on HAC option 3 or do additional evaluation to determine if treatment upgrades are feasible.

Facilities with advanced secondary or tertiary treatment

If a municipal wastewater treatment facility has already installed advanced secondary or tertiary treatment, there are no feasible technological upgrades that can achieve greater mercury reduction at this time. For such facilities, HAC option 3 will apply. They will be expected to treat mercury to the level currently achievable based on their effluent data, and implement or continue implementing an MMP.

Facilities with primary or secondary treatment with average effluent mercury concentrations equal to or less than 3.5 ng/l or percent removal of at least 95%

Some treatment facilities employing non-advanced secondary treatment systems treat effluent to mercury levels similar to those running advanced treatment. DEQ does not expect significant mercury reductions for such facilities if they install more advanced treatment systems. If a treatment facility, regardless of the technology being employed,

provides data showing that annual average mercury concentrations are at or below 3.5 ng/l or above 95% percent removal of mercury from influent, HAC option 3 will apply. Such facilities will be expected to treat mercury to the level currently achievable based on their effluent data, and implement or continue implementing an MMP. DEQ will re-evaluate these results of their actions and the HAC after 5 years to determine if source reduction is lowering of mercury levels.

Facilities with annual average mercury effluent concentrations ranging from 3.5 to 7.5 ng/l or percent removal ranging from 90-95%

For facilities that are not able to achieve effluent mercury concentrations similar to advanced systems, but are still treating mercury to fairly low levels, it makes sense to allow time to see if source control measures (MMPs) result in lower mercury concentrations. If average influent mercury levels are greater than 100, it is reasonable to expect that the facility can achieve reductions through the MMP. This is a less expensive measure than treatment upgrades and may result in similar mercury reductions. Thus, for any facilities showing average mercury concentrations ranging from 3.5 to 7.5 ng/l or removing 90-95% of mercury from their influent, HAC Option 3 would be appropriate. However, if source reduction efforts and a well-operated treatment system do not result in mercury reductions, DEQ would ask such facilities to evaluate the feasibility of upgrades.

Facilities with annual average mercury effluent concentrations greater than 7.5 ng/l and percent removal lower than 90%

DEQ has determined that any facility with annual average effluent mercury concentrations greater than 7.5 ng/l and percent removal less than 90% may obtain greater mercury reduction through treatment upgrades compared to source reduction. However, before DEQ requires any treatment upgrade, such facilities should determine if current treatment could be modified in some way to obtain additional mercury removal. If such is the case, HAC Option 2 is appropriate. As part of variance requirements, DEQ would ask the facility to implement a PMP. In addition, DEQ require the operator to engage in a facility review to determine how treatment with the current technology could be optimized or whether additional controls are feasible. While this review is being completed, DEQ would grant the operator a variance reflecting HAC Option 3 (current treatment and MMP implementation) based on data. Once treatment is optimized, DEQ would re-evaluate the highest attainable condition with data from optimized operations.

If there aren't opportunities for optimizing current treatment, or if optimization is not resulting in mercury reductions, DEQ would work with the facility to determine if additional treatment is environmentally or economically feasible, as described below.

Is additional treatment environmentally or economically feasible?

If a treatment upgrade is likely to reduce mercury at a facility more than MMP implementation, DEQ would then examine the environmental and economic feasibility of installing the upgrade. Many variances look at economic and environmental feasibility

separately. In the case of the Willamette Basin mercury MDV, DEQ has concluded that it makes the most sense to examine these two considerations together as multiple lines of evidence. DEQ proposes this approach because the mercury load that could be reduced from WWTFs is a very small portion of the total load to the Willamette River basin. Additional treatment would likely have little if any measurable impact on mercury concentrations in the river and in fish. Thus, DEQ feels like it makes sense to examine environmental and economic impacts simultaneously to determine if the benefit from removing mercury through treatment (rather than source reduction) outweighs the extra cost and environmental degradation that could occur from additional treatment.

Considerations would include:

- Environmental costs of the upgrade.
- Economic cost of the upgrade with respect to median household income.
- Amount of load reduction achieved with upgrades compared to what may be achieved through an MMP in consideration of environmental and economic costs.

Determination of environmental feasibility

Justification factor 3 of federal rules state that variances can be justified if, "Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or *would cause more environmental damage to correct than to leave in place*." (Emphasis added) If a treatment upgrade is technologically feasible, DEQ will then evaluate whether that treatment process would cause more environmental harm than "leaving the pollution in place," which in this case would mean achieving reductions through an MMP. For the MDV, additional treatment would, at most, likely reduce mercury by no more than a few nanograms per liter of effluent and likely would not result in a measurable change in water quality in the Willamette Basin, given the small portion that point sources contribute to the river. Thus, it's important to compare these reductions to potential environmental risks associated with upgrading treatment.

Environmental impacts of wastewater treatment can include additional energy consumption and associated greenhouse gas emissions and the need to dispose of additional waste. HDR estimated that upgrading a system from conventional secondary treatment to a membrane filtration and granulated active carbon facility would more than double daily energy demand; upgrading to a membrane filtration and reverse osmosis system would quadruple daily energy demand. [4] Upgrading from secondary to tertiary treatment can double energy consumption.[5] It also will increase generation of waste that would need to be land applied or disposed of in a landfill.

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4 Treatment Technology Review and Assessment, Association of Washington Businesses, HDR, Dec. 2013.

5 Kenway, S.J., A. Priestley, S. Cook, S. Seo, M. Inman, A. Gregory and M. Hall. 2008. Energy Use in the Provision and Consumption of Urban Water in Australia and New Zealand. Water Services Association of Australia.

The Colorado Department of Public Health and the Environment has developed an "Other Consequences Test" to determine the environmental feasibility of pollution control alternatives for variances.[6] In their discussion of this test, they cite a finding by their commission that this test weighs and balances "the tradeoffs between the environmental damage caused by (in this case) exceedance of effluent limits with the environmental damage caused by meeting those effluent limits."

In the case of the mercury MDV, DEQ would compare the environmental damage of upgrading pollution control technology to the environmental damage of keeping and optimizing the current treatment technology and implementing an MMP. Unlike economic impacts, there is no clear threshold for determining whether the environmental impacts of treatment outweigh the environmental impacts of leaving small amounts of mercury in effluent and implementing an MMP. For each permit, DEQ will ensure that it states its evaluation for any analysis of trying to compare treatment options. DEQ proposes that it will present environmental impacts in a table included in the permit fact sheet. An example is below. Thus, while any decision is based on best professional judgment, DEQ can ensure that it documents the facts and reasoning that leads to its decision.

Treatment Option	Estimated mercury effluent conc.	Estimated annual mass load savings	Energy costs (compared to current technology)	GHG and other emissions	**Disposal impacts (compared to current technology)**	**Other impacts**
Current treatment	8 ng/l	0	No change	No change	None	
Current treatment plus MMP	5 ng/l	4.1 grams	No change	No change	No change	
Advanced secondary	3 ng/l	6.9 grams	XX Mwh/year	XX lbs. CO2	Additional disposal to landfill	

Determination of economic feasibility

For this question, DEQ will work the discharger to determine whether it is economically feasible to upgrade treatment to reduce mercury. EPA has developed draft guidance[7] on

6 Colorado Water Quality Control Commission. 2013. "Policy 13-1. Interim Guidance for Implementation of Discharger Specific Variances Provisions, Regulation #31, Section 31.7(4)."
7 U.S. EPA Office of Water. 1995. Interim Economic Guidance for Water Quality Standards. EPA 823-B-95-002.

determining economic feasibility of treatment; however, it addresses a different question: whether treatment sufficient to meet the water quality standard would result in widespread and substantial economic harm. In this case, DEQ has already concluded that the criterion is not attainable in the water body due to human-caused sources of pollution which cannot be remedied. Nevertheless, EPA's guidance provides a useful starting point to determine if treatment upgrades are economically feasible for a municipality. In summary, EPA's guidance asks municipalities to determine the effect that a treatment upgrade will have on median household of the community. If the upgrade will result in a cost to households equal or greater than 2% of MHI, a secondary test is applied. This secondary test looks at debt, socioeconomic and financial indicators to determine if the economic impacts of the upgrade are substantial.

NPDES dischargers contribute only a small portion of the total mercury load to the Willamette. Any treatment upgrades will not result in meeting an effluent limit based on the criterion. It is likely that any treatment upgrade will not result in a measurable decrease in mercury concentrations in the receiving water or anywhere downstream. Moreover, source reduction efforts will result in at least some lowering of mercury in effluent. As a result, DEQ proposes that treatment upgrades that result in an increased cost to households greater than 1% of MHI are likely not worthwhile to implement, given environmental costs of upgrade. Thus, any facility that finds that a treatment upgrade will cost more than this level will be placed in HAC Option 3. If treatment upgrades would result in an increased cost of less than 1%, DEQ would find that HAC Option 2 would apply and the highest attainable condition would be an estimate of pollutant reductions that are achievable with the expanded technology. DEQ would establish a compliance schedule to allow the facility time to install an upgrade and would include interim effluent limits for the facility based on the current treatment system. Once the upgrade is constructed and in operation, DEQ would then apply new effluent limits based on facilities with similar treatment.