This also has info on metals and mercury

Permitting of Dissolved Inorganics for Coal Individual Permits

As soon as we receive a renewal application ask for more effluent data for hardness, chloride, etc.

Introduction

To provide some guidance through the changes related to TDS, we are providing district staff with rule citations and methods for developing WQ-based effluent limits and other permit conditions related to dissolved solids and its constituent ions.

The toxicity of total dissolved solids is related to both the toxic effect of specific ions and the total additive effect of those ions. An example of the first effect is that effluents that have the same overall TDS concentration may have different toxicities based on the anions present – discharges that have higher sulfate concentrations are more toxic than discharges where chloride is the primary anion. The toxicity of TDS in an effluent is also related to the concentration of bicarbonate ions (water hardness). Increases in water hardness mitigate toxic effects between hardness concentrations of 100 mg/l to 500 mg/l. Hardness concentrations above 500 mg/l may add to toxicity by adding to the total ion concentration in the water.

To account for the different toxicities of different ion mixes, we have developed formula to calculate water quality criteria for sulfate and chloride based on hardness. **Usual**ly limits are set for the primary anion based on receiving water hardness, and an assumed concentration of the other **ion (Sulf**ate, being the **primary** anion in coal process wastewaters, **has criteria** that **depend** on hardness and chloride concentrations in the stream).

We must still do a WQBEL for chronic TDS

In permits where sulfate is the primary toxic component of TDS, a maximum sulfate WQBEL is used instead of a maximum TDS WQBEL.

If chloride is the primary toxic component I think we'd also do a WQBEL for chloride

Here is the formula:

Acute sulfate criterion = [-57.478+5.79(hardness) + 54.163(chloride)]*0.65. The maximum hardness used in this formula is 500 mg/l. If the receiving water hardness is >500 mg/l, use 500 mg/l in the criterion formula.

There is also a formula for chloride if we to use that.

IMZM criterion = 1276.7 mg/l + (5.508*hardness) - (1.457*chloride)

Unless the stream provides significant dilution, the acute criterion will be more restrictive than IMZM

Note that, unlike other aquatic life criteria, the IMZM for sulfate is less than two times the OMZM criterion.

Some mines will have new discharges that will have the same or very similar quality as the current discharges at a mine or discharges from other nearby surface mines they operate. In that case we should ask for the form 2C and 2D for the new outfalls based on sampling of the existing discharges. The form 2D provides some information the 2C doesn't. We also need drainage areas for each outfall to calc. an ADF.

Applications

We will be receiving either Application Form 2C or 2D for each site. Form 2C (existing sources and **those new** sources **that can pro**ject data from existing facilities) will have data for sulfate from Part V, B. of the application. Form 2D (new facilities) will require an estimate of sulfate concentrations.

With either application, we should require the facility to submit effluent data for TDS and chloride. If the facility has downstream data for hardness and chloride on the receiving water, they should submit that, too. The downstream data is used to calculate the WQS for sulfate.

I assume this means downstream data if the mine already has discharges to the stream. If it's a brand new discharge from a new mine there is no upstream of downstream yet unless the site has already been impacted by mining.

ODNR *may have* WQ data and discharge data for mines and that they *reportedly* require stream sampling results to be submitted with the mine application to ODNR. *This may be a good source of* information.

Use this data if calc. a chloride limit if chloride is the primary pollutant

Any upstream data for sulfate, TDS or metals should also be required if available. In our modeling rules, median or mean concentrations are used as back ground if data are available from the receiving water or a representative local stream. If no background data are available, we would use the 25th percentile of a reference data set, such as the Western Allegheny Plateau (WAP) Ecoregion data shown below (again, specified in our modeling rules):

	Reference Sites			Mine-affected Sites		
Percentile	Hardness	Sulfate	Chloride	Hardness	Sulfate	Chloride
10	116	25	12	120	38	8
25	**145**	**33**	**18**	**196**	**72**	**13**
50	208	53	27	281	153	24
75	258	142	40	417	360	44
95	419	259	86	948	945	126

The data for mine-affected sites should be used if there has been any mining in the HUC-12 watershed. This should cover most of the waterbodies in coal-bearing areas of the WAP. For watersheds that have not had mining discharges or surface effects in the past, the ecoregion reference site data should be used.

See my recent email about HUC 12 Watersheds

The values in this table can be presented as default values to be used in the absence of local data. If the applicant wishes to collect local data, this data may guide that decision.

Discharge Limits

Limits for TDS are calculated in the same way as other WQBELs for TDS. You can use either the WLA spreadsheet, or calculate the limits by hand. The inputs for this allocation are:

WQS = 1500 mg/l

Could ask Kelly to help with these low flows like we've done in the past.

Annual 7Q10 flow – from USGS low-flow book or other reference (another discharger's WLA, for example). Remember to incorporate the % of effluent flow used in the allocation (the spreadsheet does this automatically) – [OAC 3745-2-05(A)(2)].

If discharge is dependent on precipitation, the effluent flow should be calc. as we've done in the past using the drainage area and annual average rainfall divided by 365 and assuming 80% runoff using the Excel spreadsheet.

Effluent flow – "a reasonable measure of average flow" [OAC 3745-2-05(A)(4)(b)]. We normally use an upper bound of the average flow. Measures of this flow might be either the maximum 30-day average flow from the application, the 95th percentile of reported monthly average flows, or for new discharges, a design average flow.

Upstream concentrations of pollutants – Combine any upstream data reported by the applicant with any applicable data available from OEPA surveys or compliance samplings. The upstream concentration for the WLA is the 50th percentile if N≥10, or the mean if N is less than 10 samples. [OAC 3745-2-05(A)(3)]. If no representative data exists for a particular receiving water use data from: (1) an adjacent stream; or (2) background water quality data for the ecoregion or from the background water quality report. If data from (2) is used, the background concentration will be the 25th percentile of the data. [OAC 3745-2-04(E)(1)(b)].

Limits for sulfate need to be calculated by hand at the moment; criteria are not in the WLA spreadsheet yet. The downstream WQS are calculated from the downstream data. Measures

of hardness and chloride need to be calculated using the 50th percentile for N≥10, or the mean if N is less than 10 samples.[OAC 3745-2-04(E)(1) – This rule addresses only hardness, but it is reasonable to apply it to chloride as well]. If no representative data exists for a particular receiving water use 25th percentile data from the WAP Ecoregion in the table above.

Use effluent hardness and chloride if the discharge makes up most all flow in the stream

Effluent data may be used in this calculation only if the pond or other treatment system represents the headwater of the stream.

Effluent flows for sulfate and metals should be the same as those used in the TDS WLA.

Critical flows should be used in the WLA calculation, as provided in our modeling rules, as a default. For sulfate maximum criteria, use the 1Q10 flow. For metals and other pollutants, the critical flows are:

You can "dilute" to meet WQ based effluent limits. After meeting tech. based limits, the discharge could combine with site runoff in another settling pond (including sanitary) so WQ based limits are met at end of pipe before the stream.

If the discharge may not meet standards and there is dilution, there may be an opportunity to store the runoff or other mine discharges and release when stream flows are adequate. This will require storage and stream flow measurement and appropriate permit monitoring requirements and conditions.

Average aquatic life: 7Q10 (except ammonia-N: 30Q10)

Maximum aquatic life: 1Q10 (except ammonia-N: 7Q10)

Human Health and Agricultural Water Supply: Harmonic mean

These outfalls may not discharge at critical flows. If the discharge does not occur to the head of a stream, WLAs and permit conditions can be structured to reflect alternate dilutions. In this case, a minimum stream flow needs to be defined, and the permit written to prohibit discharges at flows less than the defined stream flow (similar to permit conditions for controlled lagoon types of sewage treatment plants). All WLAs would be calculated using this alternate dilution; all reasonable potential determinations and permit conditions would be based on this alternate dilution unless a critical flow WLA yields a higher WLA.

Note that the mixing zone ban applies to allocations for mercury and other bioaccumulative chemicals of concern (BCCs). WLAs and any needed limits for mercury must be based on WQS at the discharge point.

Monitoring

Process discharges should be monitored for other components of TDS at a quarterly frequency. These include sodium, calcium, magnesium, hardness and chloride. For existing discharges, or new dischargers using Form 2C, the permit should also contain monitoring requirements for selenium, low-level mercury and any other metals that are listed in Group 4 or Group 5 of the WLA hazard assessment. For new dischargers using Form 2D, the permit should include monitoring for all priority pollutant metals at least annually (selenium and mercury should be at least quarterly).

From the WLA spreadsheet.

We may want to also get some downstream hardness and chloride monitoring in the permit to help in future permit development.