

Nutrient Criteria Development Advisory Workgroup
September 26, 2005
Meeting Summary

Welcome and Introductions - Mark Fisher

How We Determined Which Reservoirs to Class as Least Impacted (Handout #1)

- Land Use - Reservoirs with 10% urban plus agriculture land use and below were considered as least impacted reservoirs
 - TCEQ - SWAP data base was used for the majority of the land use
 - USGS - National Land Cover data was used for those not in the SWAP data base.
 - Urban land use categories
 - high intensity residential
 - low intensity residential
 - urban
 - recreational grasses
 - commercial
 - industrial
 - transportation
 - Agriculture categories
 - orchards
 - vineyards
 - row crops
 - small grains
 - fallow land
- Absence of major domestic dischargers (< 1 MGD) into the reservoir, within the truncated watershed, or within a 2 hour travel time of the reservoir. Truncated watershed - stopped at upstream reservoirs.
- No increase in trophic condition
- Reservoirs were removed from the least impacted list based on first hand information that individuals provided at previous work group meetings.

How We Calculated the Criteria

- Data used in the calculations
 - Time frame - 1-1-70 to 4-31-03
 - from TRACS and USGS's NWIS data bases
 - Surface samples only
 - If more than one data point occurred on a single day, USGS averaged the values.
 - There had to be 15 data points over the period of record to calculate criteria.
 - After selecting the data, outliers were deleted
 - Criteria were calculated using 90, 95th, and 99th percent confidence intervals using a pooled two sample *t*-test.
 - More detailed information about the t-test is attached.

Statistical criteria for all reservoirs

- Criteria have been calculated for all reservoirs with sufficient data
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- USGS calculated criteria for reservoirs with 0-20% land use
- TCEQ used the created relational data base for remaining reservoirs
- Suggestion that “reference reservoir” be defined in the standards
- Davenport explained how the reference concept was useful. Allows TCEQ to explore using a least impacted reservoir to set criteria?
- To determine more impacted reservoirs TCEQ could look at reservoirs on 303(d) list. It was pointed out that if the criteria is set at a specific level, it could be too high.
- Option is still open to use Total Phosphorus (TP) as a criteria. It was pointed out that low levels of TP have increased variability.
- High variability in Chlorophyll a is an argument for the 99th criteria.
- TPWD suggested including calculations using their proposed 90% empirical methodology. May also use 50th, 75th to pick up quartiles.
- TPWD suggested that using a mean may not be appropriate since the data is skewed.
- TPWD proposal suggested 90th percentile with 20 samples. 10% above 90th - no change. If 25% exceeded 90th percentile would exceed. 10-15% above 90th - would constitute a watch list. Suggestions that 10 or 25% may not be best especially if uses are impaired at a different level.
- Suggested that data should be checked for normality. If this assumption is appropriate then use the criteria. This could be communicated to EPA to support our final criteria. Reservoirs not showing a normal distribution could be set aside and other methods used.

Assessing criteria with 5 years of sampling from the data base

Group requested to see more ecoregions with 5 year assessments against the criteria.

Eutrophication - There is a natural increase in eutrophication over time, however, TPWD pointed to Dr. Groeger’s work that nutrients increase in reservoirs, but that they level out over time.

Comparing Seasonal and Annual Criteria (Handout #2)

- in most cases there is little difference between using seasonal and annual criteria.
- Comparison of seasonality - the differences between winter and summer means for Chlorophyll *a* were plotted. The difference is minor, even longitudinally. Caddo, Lake Murval, and Lake Wright Patman of the least impacted reservoirs appear to have the greatest difference in means and may require further investigation to determine if seasonal criteria are more appropriate. It was also discussed that our artificial division into winter and summer may not be picking up seasonality.

Update on standards rule language (Handout #3)

- Discussion on which takes precedence, site-specific criteria or general criteria
- Suggestions that wording include assessment for “2 year at a minimum, but prefer 5 years worth of data”
- Discussion of setting 5 ug/L as a minimum criteria because of uncertainty of data points at these low levels and the effect of nondetects (Less than data).
 - Suggestion that <5 be addressed during the assessment and not in the criteria

- Suggestion that there are statistical ways to determine a number between 5 and 0 so that values less than 5 were not assumed to be 0 in the assessments.
- Discussion about setting 5 as an MAL type number.
- Recommendation that the 5 ug/L could be set up as it is for toxics as an “at or below” number. This may prevent antibacksliding in permitting.
- LCRA tests samples below 5 ug/L and suggested for those reservoirs where the data exists that less than 5ug/L would not be appropriate. Other reservoirs with more data may also not be restricted to the 5 ug/L.
- Discussion whether <10 would be more appropriate than 5 since TCEQ data management has determined to enter data as such. Clean Rivers pointed out that TRACS does take data less than 10.
- Whatever is used, suggestion that it be clearly defined whether MDL, MAL, etc. are used. River authorities can petition for MALs to be used.
- Appendix F
 - Include language to indicate that the value applies to phytoplankton and to the main body of the reservoir and is a mean of at least one year.
- Define main pool.

Correlations between TN and TP and Chlorophyll *a*

- Some reservoirs individually do show correlations using multivariate analysis per USGS, others do not
- At an ecoregion level there is more correlation and more at a state level
- Annual means show more correlation.
- Question about how this would be used.
 - in permitting if loading was higher
 - may be used to assess loading and its impact
 - use it to relate nutrients to Chlorophyll *a*
 - allow chlorophyll *a* to be tracked
 - EPA requested that if states use a response variable that they be able to relate it to nutrients
 - allow us to move to using models instead of rough correlations
 - TCEQ has to have a way to relate chlorophyll *a* to impacts

Models

Models were discussed

- models are used in permitting decision. Look at the DO models for examples and the change of models over time.
- Models can look into impacts on chlorophyll *a*
- If criteria are set for the reservoirs, the model would have to look at the entire reservoir and screen it.

Rooted plants need to be addressed if only in the narrative criteria. Suggestion that any impairment could be addressed in the 303(d) list. The process could determine whether nutrients were the underlying cause. TCEQ assumed that the narrative criteria could take care of this.

Subjects for future workgroup meetings

- Include 5yr assessments for other reservoirs - put this information on the web site.

- provide empirical criteria using TPWD methodology - include in 5yr assessment table
- Look into providing e-mail notification through TMDL and LouAnn Jones
- More info on Richard Kiesling's (USGS) table for TP and Chlorophyll *a* correlations - put this table on the web site.
- Consider using all data versus only the main pool data
- Include information on nutrient modeling. Include
 - Availability
 - Cost
- The "how" of implementation
- Main pool vs. other stations
- Rule language. Include language on attainment.

Next meeting

Mid January

Texas Commission on Environmental Quality

Development of Chloride, Sulfate, Total Dissolved Solids
and Nutrient Criteria in the
Texas Surface Water Quality Standards

Currently these criteria are developed from ambient data for each individual segment within a river basin. From time to time the criteria may be recalculated to reflect the expanding data base. If recalculations are performed care must be taken to ensure that a pollution source is not responsible for increased concentrations of these parameters. The actual criteria are derived by a formula which utilizes the arithmetic mean, standard deviation and Student's *t* value for the number of data values used for each calculation. Water quality standards attainment is evaluated as an assessment period mean of at least ten samples taken on different dates not to exceed the derived criterion. The assessment period must be at least one year.

The calculation is based on the minimum value for the assessment period mean TDS, chloride, sulfate, or nutrient would have to attain such that a Student's *t* test would reject the null hypothesis that the assessment period mean and the mean of the baseline data were drawn from the same population with a probability of 0.05 (one-tailed). Assumes assessment period mean is based on at least ten samples and the variances of the baseline data set and data used for calculating the assessment period mean are the same.

Calculated as follows:

$$\text{Criterion} = \bar{x}_1 + t_{(1)(0.05)}(s_{\bar{x}_1 - \bar{x}_2})$$

Where: criterion = the value the assessment period mean should not exceed

\bar{x}_1 = mean of the baseline data set

$t_{(1)(0.05)}$ = critical value of the *t* distribution where $\alpha = 0.05$ one tailed at $n + 10$ degrees of freedom

$s_{\bar{x}_1 - \bar{x}_2}$ = standard error for the difference of two means

$$= \sqrt{(s_p^2/n_1 + s_p^2/n_2)}$$

Where: n_1 = number of samples in baseline data set

$n_2 = 10$ = number of samples used to calculate assessment period mean

$$s_p^2 = 2(s^2(n_1 - 1))/(n_1 + 2)$$

s = standard deviation of the baseline data

Reference: Moore, D. S. and G. P. McCabe. 1993. The pooled two-sample *t* procedures. pp 542-549. *In* Introduction to the practice of statistics. W. H. Freeman and Company, New York.

Nutrient Criteria Development Advisory Work Group

Attendee List

September 26, 2005

Austin, Texas

Terry Wilson	Sabine River Authority
William Guinn	El Paso Water Utilities
Larry Koenig	TCEQ/TMDL
Gayle Haecker	Brazos River Authority
Kay Barnes	Brazos River Authority
Jim Davenport	TCEQ
Mark Fisher	TCEQ
John Ellis	Brazos River Authority
Chris Pasch	APAI
Peggy Glass	APAI
Ken Kramer	Sierra Club
Charles Bayer	TCEQ
Alicia Reinmund	LCRA
Larry Hauck	TIAER
Richard Ess	TSSWCB
Clyde Bohmfalk	TCEQ
John Taylor	TPWD
Gail Rothe	TCEQ
Robert Adams	CH2M Hill
Pat Radloff	TPWD
Randy Palachek	Parsons
Allison Woodall	TCEQ
Allen White	USFWS
Richard Kiesling	USGS