Phosphorus Loading and Concentration Recommendations

From the
Loading and Concentration Subcommittee of the
Ohio Phosphorus Task Force

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The following recommendations are based on the best available information and represent our best scientific judgment. One of our most important recommendations is that we use an adaptive management approach to address this problem. That is, as we manage phosphorus reductions to reduce/eliminate HABs, we recommend continuing to review the targets in conjunction with HAB bloom events. This approach requires a robust monitoring program to measure progress toward loading and concentration targets and HAB reduction, and to allow us to annually evaluate and modify those targets in the future, as needed.

Our goal was to focus on the Maumee River and harmful algal blooms (HABs). By virtue of its location, its high discharges and its high loads and concentrations of total and dissolved phosphorus, we believe that the Maumee River is the dominant driving factor for algal blooms in the Western Basin of Lake Erie. We further believe that attainment of the proposed targets loads for the Maumee River would eliminate HABs, or significantly reduce HABs, in the Western Basin and Lake Erie as a whole.

In our discussions we considered the following issues.

1. Pros and cons of targets based on total and/or dissolved reactive P.
2. Pros and cons of seasonal versus annual P loads.
3. The maximum P load from the Maumee River that will not produce a HAB.
4. The minimum P concentration required to produce a HAB or the maximum P concentration that will not produce a HAB. For example, blue-green algae

need a P concentration of at least "X" to produce a bloom.

Loading Recommendations

For the Maumee River, we recommend targets for spring loads (defined as 1 March to 30 June) and annual loads (water years, 1 October to 30 September) for both total phosphorus (TP) and dissolved reactive phosphorus (DRP) based on many years of observation and models that have proved to be highly accurate. Spring P loading in particular has been shown to be highly predictive of subsequent HAB size. Note that the subcommittee would like more time to consider the utility of using flow-weighted mean concentrations as targets in place of, or in addition to, loads.

- **For TP**, we recommend a spring target not to exceed 800-1000 metric tons and an annual target of 1600-2000 metric tons. We believe achieving these targets will greatly reduce HABs and possibly eliminate them. Note that the spring target represents a 3-22% reduction from the average spring TP load for 2000-12 and a 56-65% reduction from the highest TP spring loading year—2011 (Table 1). The annual target represents a 9-27% reduction from the average annual TP load from 2000-12 and a 44-55% reduction from the highest TP loading year—2008.
- **For DRP**, we can only recommend a spring loading target at this time, which we estimate to be 150-170 metric tons. We are confident that maintaining loads within this range or less would significantly reduce HABs. This target represents a 17-27% reduction from the average spring DRP load from 2000-12 and a 60-65% reduction from the highest DRP spring loading year—2011 (Table 1).

For reference, Figure 1 shows the relative size of the blooms that were produced each year in Western Lake Erie.

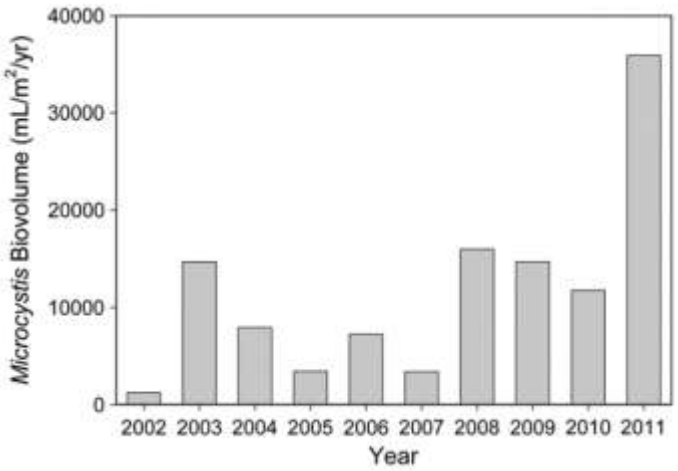
Concentration Recommendations

Concentration targets are much more challenging and require more discussion by the committee. However, we can say that a consistent/prolonged TP concentration of 50 µg/l or higher or a consistent DRP concentration of 10 µg/l or higher in a river or lake will produce a HAB. Therefore, these may be reasonable targets. However, the subcommittee would like to discuss this further as lower targets for Lake Erie could be appropriate, e.g., HABs have been observed at the majority of Western Basin sampling stations when the DRP concentration was 6 µg/l. It is also worth noting that the 50 µg/l target for TP was exceeded in the Maumee River at Waterville 100% of the time between 2004-12 and the 10 µg/l target for DRP was exceeded 76% of the time. It may be that these are reasonable targets for the river, but that a lower target is needed in the Lake.

Table 1

	Water Year total			March-June		
Year	Discharge million cubic meters	Total phosphorus metric tons	Dissolved reactive phosphorus metric tons	Discharge million cubic meters	Total phosphorus metric tons	Dissolved reactive phosphorus metric tons
2,000	3,352	1,190	202	2,374	965	152
2,001	3,770	940	260	1,910	509	108
2,002	5,957	2,100	442	2,763	1,044	173
2,003	5,764	2,240	576	3,146	1,366	301
2,004	5,439	1,810	494	2,687	976	195
2,005	5,857	2,750	613	1,254	291	79
2,006	5,150	1,790	393	1,857	572	123
2,007	7,510	3,500	822	2,356	1,014	253
2,008	**8,026**	**3,560**	**835**	3,364	1,293	260
2,009	5,075	2,160	346	3,279	1,360	210
2,010	4,648	1,530	404	3,494	1,284	317
2,011	6,229	2,780	570	**5,022**	**2,310**	**429**
2,012	6,106	2,250	607	1,010	391	63
Mean	5,606	2,200	505	2,655	1,029	205

Figure 1



Source: Bridgeman, T.B., Chaffin, J.D., and Filbrun, J.E. A novel method for tracking western Lake Erie Microcystis blooms, 2002–2011, J Great Lakes Res (2012), http://dx.doi.org/10.1016/j.jglr.2012.11.004