Illinois EPA Summary of 2005 through 2008 Algal Toxin Monitoring Efforts

2005 and 2006

- An effort was made to collect samples for algal identification at as many lake sites (and a couple of Fox River sites) as possible during the period of late August through mid-October. The number of samples collected was limited by our contract (not to exceed $10,000).

- In 2005, several samples were also collected at raw water intake sites and a finished water sample was also collected in an effort to assess the effectiveness of the treatment process on toxin removal. However, raw water concentration of microcystin was low in all samples and therefore, it is difficult to evaluate toxin removal effectiveness using these sample results.

- All samples were sent to GreenWater Laboratories in Palatka, FL for algal identification and counts. Toxin analyses were performed when algal counts and species identification warranted toxin analysis. Since toxin production is a factor of algal species present, only the toxins associated with the species present where included in the analyses on any one sample. Analyses included one or more of the following toxins: microcystins, cylindrospermopsin, anatoxin-a, and saxitoxin.

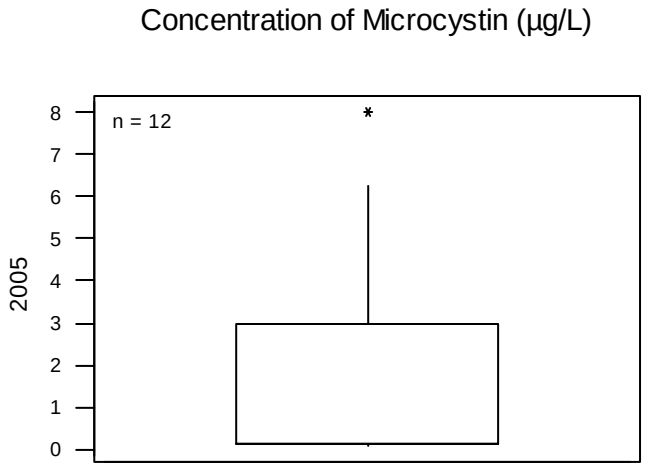
- A total of 14 samples in 2005 and 15 samples in 2006 were analyzed for toxin concentrations. Microcystin analysis was included in 12 of the samples analyzed in 2005 and in 10 of the 2006 samples.

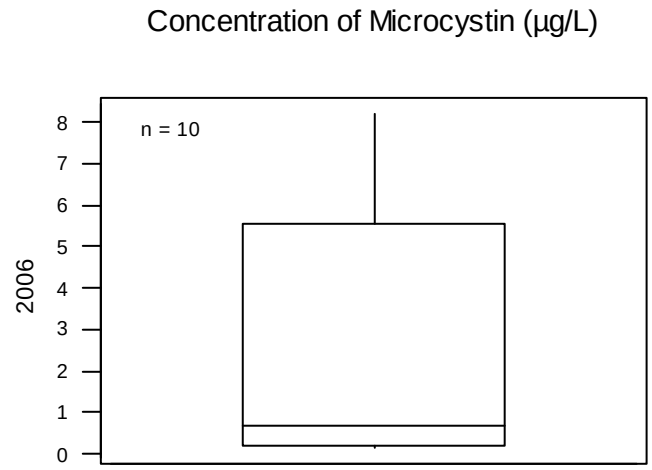
- During the two-year period, microcystin was the only toxin detected above the level of quantification. There was a single sample where anatoxin-a was detected above the detection limit, but below the level of quantification. Subsequent analyses for anatoxin-a from samples collected at the same site revealed no detectable levels of anatoxin-a. The significance of the single detection of anatoxin-a is unknown.

- Microcystin was analyzed by the enzyme linked immunosorbent assay (ELISA) method. The detection limit for microcystin was 0.15 µg/L and the limit of quantification was also 0.15 µg/L.

- Summary of microcystin results for the two-year period is as follows:

	2005	**2006**
N	12	10
Minimum	0.09 ug/L	0.15 ug/L
Maximum	8.00 ug/L	8.20 ug/L
Median	0.15 ug/L	0.7 ug/L
Average	1.78 ug/L	2.35 ug/L





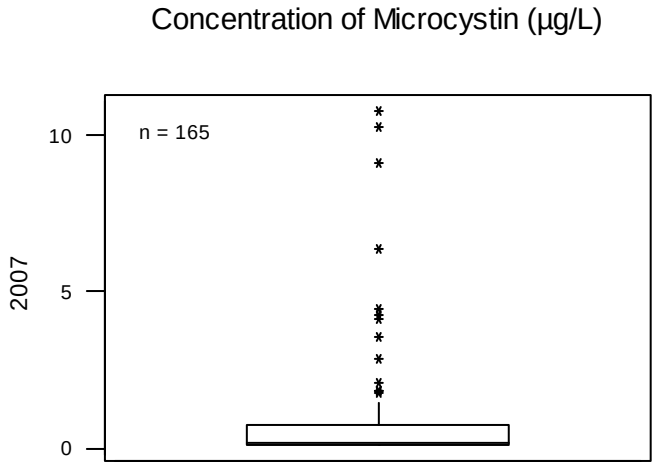
2007 and 2008

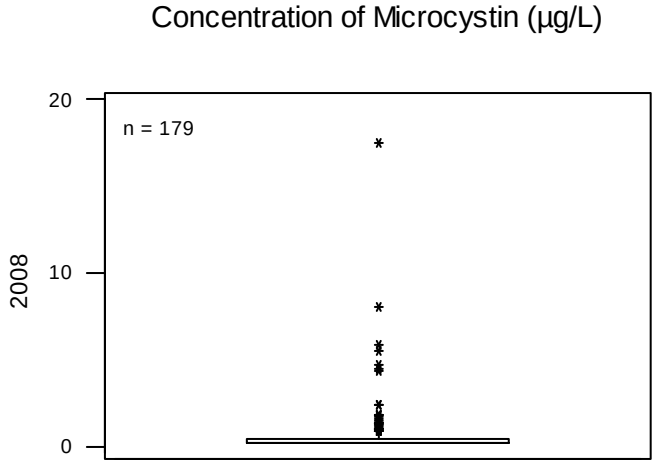
- In 2007 and 2008, a different approach was used to collect and analyze samples for algal toxins. Samples were collected at public access points in lakes that were part of the Ambient Lake Monitoring Program in those perspective years. Samples were not sent for phytoplankton identification and enumeration before toxin analysis was performed. Samples were collected and analyzed for microcystin only.

- Samples were sent to Eric O'Brien at Iowa DNR in Iowa City, IA. Analyses were performed using the ELISA method. The detection limit was 0.15 µg/L.

- One hundred sixty-five samples were analyzed for microcystin in 2007 and in 2008, there were 179 samples. A summary of the results for the two years is presented below:

	2007	2008
N	165	179
Minimum	0.12 ug/L	0.15 ug/L
Maximum	10.77 ug/L	17.47 ug/L
Median	0.20 ug/L	0.15 ug/L
Average	0.75 ug/L	0.64 ug/L
% non-detects	44%	57%





World Health Organization (WHO) Guidelines:

- A provisional drinking water guideline value for microcystin-LR is 1 µg/L (WHO 1998).

- Guidelines for recreational exposure include three risk levels (WHO 2003).

  MILD/LOW
  20,000 cyanobacterial cells/mL, dominated by microcystin-producing taxa Expected microcystin level: 2-4 ug/L (up to 10 if highly toxic strain) Effects more likely to be due to the irritative or allergenic effects of other cyanobacterial compounds, rather than toxin effects
  Action: Post on-site risk advisory signs, inform relevant authorities

  MODERATE
  100,000 cells/mL
  Expected microcystin level: 20ug/L (levels could be double if Planktothrix agardhii is dominant) Increased probability of irritative/allergenic symptoms Children or susceptible adults may be at risk if water is ingested while recreating. Scums may begin to form
  Action: Watch for scums, restrict bathing and further investigate hazard, post on-site advisory signs, inform relevant authorities

  HIGH
  Cyanobacterial scums; 10 million cells/mL (potentially 100 million cells/mL if wind-concentrated along shore)
  Expected microcystin level: 2,000 ug/L (20,000 ug/L in concentrated scums) Potential for lethal exposure exists
  Action: Immediate action to prevent contact with scums, possible prohibition of swimming and other water-contact activities, public health follow-up investigation, inform relevant authorities

Conclusions:

1. Out of the 366 total number of samples analyzed during 2005 through 2008, almost half (49.5%) had non-detectable levels of microcystin. The highest percentage of non-detects was seen in 2008 where 57 percent of the samples analyzed had non-detectable levels of microcystin.

2. None of the samples analyzed in 2005 through 2008 had microcystin concentrations in the moderate or high risk categories. Of the 366 samples analyzed, 182 samples, or almost half of the samples analyzed (49.7%) had detectable levels of microcystin considered to be in the low risk category (less than 10 µg/L). The greatest number of samples with detectable levels of microcystin (55%) was in 2007. The significance of this finding is unknown. The long-term health effects due to chronic exposure to microcystins are unknown.

3. There were only 3 samples (0.8%) of the total number of samples analyzed where the microcystin concentration fell in between the low to moderate risk categories. The highest concentration of microcystin detected during this study was 17.47 µg/L. That concentration was observed from a sample collected on 9/18/2008 at West Frankfort Old (RNP).

4. Preliminary observations suggest that the risk of adverse health effects due to acute exposure to microcystins in Illinois surface waters was low during the years of 2005 through 2008. However, the fact that almost half (49.7%) of the samples analyzed had detectable levels of microcystin should not be overlooked. These findings suggest that algal species capable of producing microcystins are present in Illinois surface waters and given the right conditions, blooms of these species could produce toxins in higher concentrations. It should also be noted that the concentration of algal toxin present in any given algal bloom varies considerably, both spatially and temporally. Therefore, it is not clear from this study whether the microcystin concentrations were low due to factors related to the sampling protocol used (sampling was mostly limited to lakes in the ALMP, 3X during July - October) or due to the fact that microcystin concentration was actually low in Illinois surface waters during the study period.