Sediment Chemistry.

The ultimate repository of all that enters the Crystal Lake Watershed is the Lake and the bottom of the Lake. Water is deposited as rain or snow directly on the Lake or indirectly on the land that flows over the land or under the land surface into the Lake. Any sediment (solid particulate) or soluble components in this water also end up in the Lake. Just how the individual components are distributed depends upon their physical properties. Certain components will volatilize from the Lake surface and enter the atmosphere. Other components will be transformed if they are biologically degraded or chemically precipitated (converted from soluble to insoluble forms). Any solid particulate matter, be it inorganic precipitates, like calcium carbonate, or organic particulates, like phytoplankton (algae), eventually, slowly but surely, settles to the bottom of the Lake and becomes part of the overlying sediment.

The MI Department of Environmental Quality has embarked on a program to monitor sediment chemistry with several specific objectives: (1) Determine the chemical character of sediments in waters of the state, and whether sediment contaminant levels are changing over time, (2) Identify priority locations for sediment remediation activities in Michigan, (3) Determine background sediment chemical character of waters of the state, (4) Determine whether new chemicals are accumulating in sediments, and (5) Evaluate the overall effectiveness of the NPDES permit program in reducing contaminant levels in sediments. The sediment chemistry element consists of two components in combination to provide data necessary to achieve these objectives. These include: inland lake trends, and watershed surveys.

For the inland lake trends component, approximately 30 lakes will be assessed over several years. Crystal Lake in Montcalm Co. and Crystal Lake in Benzie Co. are among the lakes selected. Sediment samples are being analyzed for total mercury, trace metals (cadmium, chromium, copper, lead, nickel, zinc), total PCBs, and organochlorine pesticides, such as DDT. Inland lake trend data are summarized in annual trend reports produced by researchers at Michigan State University and reviewed and approved by DEQ-SWQD. Sediment samples collected as part of the watershed surveys are analyzed for a variety of parameters, based on local conditions and known/suspected sources. Data collected as part of the 5-year watershed surveys are summarized in watershed reports, and are entered into the U.S. EPA STORET database.

During the summer of 2001, samples of sediment were collected from the bottom of Crystal Lake at the central deepwater region. A chronological history of Crystal Lake over several centuries was described by this sediment core as dated by Pb-210, a radioactive isotope. The dramatic event of the lowering of Crystal Lake in 1873 (the Tragedy of Crystal Lake) was very evident 130 years after the fact. A significant layer of sand reflecting the historical influx of a considerable amount of sand when the Lake was abruptly lowered by twenty feet as a result of an ill-conceived plan to float saw logs to Lake Michigan. Sediment cores were analyzed in more detail for various chemical elements. Pore water (the free water between the sediment particles) and the solid sediment itself were analyzed for some twenty chemical elements (As, Al, Ba, Ca, Cd, Cu, Fe, K, Mg, Mn, Mo, Pb, Sr, Ti, V, U, Zn) and selected pesticides. Different elements are indicative of either natural and/or anthropogenic (manmade) influences.

For further information: the Lake Michigan Mass Balance www.epa.gov/glnpo.lmmb; the Integrated Atmospheric Deposition Network www.epa.gov/glnpo/air/IADN90/iadn90.pdf; and the Michigan Fish Advisory www.michigan.gov/documents/FishAdvisory03_67354_7.pdf

The U.S. EPA "Green Book" - Nonattainment Areas for Criteria Pollutants is found at http://www.epa.gov/oar/oaqps/greenbk/index.html

Results of the Crystal Lake component of the MSU Inland Lakes Project were summarized by doctoral candidate, Sharon Yohn at the 2003 Annual Meeting of the CLWF. Overall, the chemical elements in the sediments of Crystal Lake are at or below levels of other NW MI lakes. They are also well below levels of concern for potential environmental or human health effects. Overall, the core analyses reflect the slow, but inevitable natural aging of the Lake and the impact of a developing population.
For further information on sediment chemistry:
www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-32365--,00.html;
for detailed analyses and illustrations: www.cevl.msu.edu/~long/projects/inlakes.htm