Chapter 5

Human Health Information

Children at the beach.
Photo Credit: Liz LaPlante, US EPA.

Lake Superior Lakewide Management Plan
2006

Chapter 5 Contents

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Human Health Information

5.0 INTRODUCTION

The Lake Superior LaMP seeks to restore and protect the beneficial uses of the Great Lakes, such as safe beaches, clean drinking water, and healthy fish and wildlife populations. Awareness of the underlying causes of these beneficial use restrictions from chemical and microbial contaminants and the associated health consequences will allow public health agencies to develop societal responses protective of public health.

These beneficial uses include "Swimmability", "Fishability", and "Drinkability". Swimmability means that all beaches are open and available for public swimming. Fishability means that all fish are safe for human consumption. Drinkability means that treated drinking water is safe for human consumption.

Chemical and microbial pollutants enter the human body through three major routes: ingestion (water, food, soil), inhalation (airborne), and dermal contact (skin exposure). Within the scope of the LaMP update, exposure to pollutants through water contact will be highlighted. The major areas of health concern in the Great Lakes Basin are pollutant exposure from ingestion of contaminated fish, incidental ingestion of water while swimming along beaches, and ingestion of contaminated water.

5.1 LaMP 2004-2006 ACCOMPLISHMENTS

5.1.1 Formation of the Great Lakes Human Health Network

In 2002, the Binational Executive Committee (BEC) approved the formation of a binational human health network. The Great Lakes Human Health Network has created a forum to discuss human health issues directly related to Great Lakes water quality. The network addresses health issues related to the ecosystem of the Great Lakes Basin, including drinking and recreational water quality and fish consumption.

In order to best serve Great Lake stakeholders, the U.S. and Canada took direction from the BEC and each formed domestic networks. The U.S. network took shape in 2003 and the Canadian network took shape in 2004. In the interim, there has been communication between Health Canada and US EPA as the domestic networks were formed. The U.S. and Canadian governments plan to join networks in 2006.

The U.S. network has held regular conference calls to exchange information. The members transmit the shared information to their organizations and the communities that they serve. The network also supports the LaMP and RAP processes. Current information on the U.S. network and its work may be found at www.epa.gov/glnpo/health.html.

Current Status of the (Canada - Ontario) Great Lakes Public Health Network

Background. In an effort to reduce human health risk from contaminants in the Great Lakes Basin, federal-provincial responsibilities are laid out under the Great Lakes Water Quality Agreement (GLWQA) and formalized by the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA). To support COA, one of Health Canada's commitments is to establish and facilitate the work for a Public Health Network in the Canadian portion of the Basin.

The purpose of the Great Lakes Public Health Network (GLPHN) is to facilitate information sharing on environmental health issues amongst all levels of government and their agencies that are mandated to protect public health in the Great Lakes Basin in Ontario. This Network is expected to assist members in the delivery of their environmental health programs. It is expected that this Canadian Network will join the American equivalent, Great Lakes Human Health Network (GLHHN), in 2006, to form a binational Network whereby there is a regular exchange of environmental health information across the border.

The Medical Officers of Health (MOH), who head the 37 Ontario Public Health Units, were identified as key partners in the establishment of the domestic GLPHN. Accordingly, Health Canada's Ontario & Nunavut Region has been working closely with the Ontario Ministry of Health and Long-Term Care (MOHLTC) to expedite cooperation with the MOHs. MOHLTC involvement has been substantial, including the organization of conference calls, a letter to the MOHs from the Chief Medical Officer of Health, and the assignment of a senior official in the Public Health Division to work with Health Canada.

Following the appointment of Dr. Sheela Basrur as the new Chief Medical Officer of Health in early 2004, Health Canada's Regional Executive met with her and reconfirmed the Ministry's commitment and support to the establishment of the Network. Health Canada has also dedicated resources to moving this initiative forward.

Status. During a consultation session with Ontario Public Health Units and Medical Officers of Health in December 2003, it was agreed that a working group be struck under the leadership of Health Canada and MOHLTC to design a structure for the environmental health network and write the terms of reference for a steering committee.

To this end, Health Canada and the MOHLTC in consultation with Environment Canada, the Ontario Ministry of Environment, Windsor-Essex Health Unit, Leeds Grenville Lanark District Health Unit, and Toronto Public Health have drafted a Terms of Reference for the Steering Committee and a draft Charter for the GLPHN. In the fall of 2004, a GLPHN Steering Committee made up of representatives from Ontario Public Health Units, Health Canada, MOHLTC, Environment Canada (EC), and the Ontario Ministry of the Environment (MOE) was formed.

The Network was launched in the fall of 2005 with plans for regular conference calls on relevant topics. The first two calls addressed consumption of Great Lakes fish (including blood mercury levels among Ontario anglers and sport fish eaters) and revisions to the Air Quality Health Index.

On the first call, over 50 individuals met by teleconference including Medical Officers of Health and staff from 26 Public Health Units and representatives from the Ministry of Health and Long-Term Care, the Ministry of the Environment, Environment Canada, the Canadian Food Inspection Agency, and the U.S. Environmental Protection Agency.

Future topics that are being considered for upcoming teleconferences include Pharmaceuticals and Personal Care Products (PPCPs), Pesticides, PBDEs and flame retardants, children's health and environment, health based air quality index, environmental and occupational causes of cancer, health risks of pesticides and best practices to reduce exposure, bluegreen algae and microtoxins.

It is expected that this Canadian Network will join its American counterpart later in 2006 to form a binational Great Lakes Human Health Network, thereby facilitating the regular exchange of environmental health information across the border.

NOAA Center of Excellence for Great Lakes and Human Health

The National Oceanic and Atmospheric Administration (NOAA), along with its scientific and academic partners, announced the creation of three research centers in Washington, South Carolina, and Michigan. These centers study how humans impact the oceans and Great Lakes and how, in turn, those bodies of water can impact human health.

Each center focuses on issues such as beach safety, seafood quality, coastal pollution, and marine toxins and pathogens. The centers work with each other as well as the four new research centers established by the National Science Foundation and the National Institute of Environmental Health Sciences.

The Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor, Michigan, uses multidisciplinary research to develop technology for predicting the formation of toxic algal blooms, beach closings, and water quality in the Great Lakes Basin. The goal of the center is to use GLERL's broad scientific expertise to significantly reduce threats to human health through ecological forecasting, which uses scientific understanding and models of climate, weather, circulation patterns, hydrology, land use, and biology to predict the location and severity of toxins in the water, beach closures, and water quality conditions. Key partners include: Michigan State University, University of Michigan, Florida Institute of Oceanography, US EPA, the U.S. Geologic Survey, and the NOAA Beaufort Laboratory. Dr. Stephen Brandt, director of GLERL, is the center's director.

For more information go to http://www.glerl.noaa.gov/res/Centers/HumanHealth/.

Children's Health Activities/Accomplishments

Children are different from adults and may be more vulnerable to environmental exposures. Consider that:

- Children's neurological, immunological, digestive, and other bodily systems are still developing and are more easily harmed;
- Children eat more food, drink more fluids, and breathe more air than adults in proportion to their body mass—their food, fluids, and air, therefore, must be safe;
- Children's behavior patterns—such as crawling and placing objects in their mouths—often result in greater exposure to environmental contaminants.

US EPA has forged partnerships and taken increasingly more steps to protect children's health from the variety of contaminants and pollutants that may affect them in the air they breathe, the water they drink, and the food they eat. We direct our efforts toward ensuring that their homes and schools are healthy and safe places where children can live and learn. Our goal is to insure that state, local and tribal governments, communities, school districts, and caregivers in the Great Lakes regions will understand the relationship between the environment and the health of children and will take action to improve the health of children by reducing risks and exposures to environmental hazards where they live and learn.

More information on children's environmental health can be found at www.epa.gov/children**.**

More information on school environmental health, including US EPA's new integrated assessment tool for school districts, Healthy School Environments Assessment Tool, can be found at www.epa.gov/schools.

Toxicity and Exposure Assessment for Children's Health (TEACH), www.epa.gov/teach, contains information pertaining to scientific literature in the field of children's environmental health for 18 chemicals or chemical groups of concern to children, which may potentially impact children's health. The goal of the TEACH project is to complement existing children's health information resources by providing a listing and summary of scientific literature applicable to children's health risks due to chemical exposure.

5.1.2 Accomplishments/Activities Related to Beaches Safe to Swim

Background. The Great Lakes Water Quality Agreement (IJC, 1994) calls for recreational waters to be substantially free from bacteria, fungi, and viruses. These microbial organisms of fecal origin have the potential to cause relatively mild illnesses (e.g., gastroenteritis) to more serious illnesses (e.g., hepatitis, typhoid fever) from a single exposure.

Lake Superior's myriad recreational activities do present opportunities for contamination to occur (i.e., swimming, water-skiing, sail-boarding, and wading). Apart from the risks of accidental injuries, the major human health concern for Lake Superior recreational waters is microbial contamination by bacteria, viruses, and protozoa (Health Canada, 1998; WHO, 1998).

To improve water quality testing at the beach and to help beach managers better inform the public when there are water quality problems, Congress passed the *Beaches Environmental Assessment and Coastal Health (BEACH) Act* in October, 2000. One of the provisions of the *BEACH Act* authorizes US EPA to award grants to eligible states, tribes, and territories to develop and implement beach monitoring and public notification programs at coastal and Great Lakes beaches.

Progress on Developing and Implementing Beach Monitoring and Notification Plans. Since passage of the *BEACH Act*, approximately $7.8 million in BEACH grants have been issued to Great Lakes states to implement beach programs, which has resulted in a significant increase in the number of monitoring and notification programs at Great Lakes beaches. All of the Lake Superior states have beach monitoring and public notification programs in place at most of their coastal beaches and at all of their high priority coastal beaches.

Following are beach program summaries for Michigan, Minnesota, Wisconsin, and Ontario.

A. Michigan's Beach Program. The Michigan Department of Environmental Quality (MDEQ) has received a total of $1,084,966 in *BEACH Act* funding since 2002 to support monitoring programs for 327 public beaches in 41 counties along the state's 3,200 miles of Great Lakes shoreline. Along Lake Superior:

- There are 40 total public Michigan beaches in nine counties.
- An estimated $32,275 (est. 12 percent of BEACH Act Fund for 2005) was distributed to monitor 21 beaches in seven counties on Lake Superior in 2005.
- Two closure events occurred at two beaches in Chippewa County totaling four days.

The monitoring of beaches in Michigan is voluntary and is conducted by the local health departments, which are required to notify various entities of the test results within 36 hours, and which may petition the Circuit Court for an injunction ordering the owners of a beach to close the beach. The MDEQ provides Clean Michigan Initiative-Clean Water Fund (CMI-CWF) and *BEACH Act* grants to the local health departments to aid in the implementation or enhancement of their beach monitoring programs. The CMI-CWF and *BEACH Act* grants are designed to fund proposals that determine and report levels of *E. coli* in the swimming areas of public beaches. The objectives of MDEQ's beach program are to:

- Assist local health departments to implement and strengthen beach monitoring programs.
- Determine whether waters of the state are safe for total body contact recreation.
- Create and maintain a statewide database.
- Compile data to determine overall water quality.
- Evaluate the effectiveness of MDEQ programs in attaining water quality standards for pathogen indicators.

Local health departments request an average of $380,000 of *BEACH Act* funds per year from the MDEQ for local beach monitoring programs for approximately 200 high-priority beaches. The *BEACH Act* allocation for Michigan provides funding to support monitoring once per week at 80 beaches for part of the summer and 100 beaches for most of the summer. In 1998, only 20

counties monitored their beaches. Since the MDEQ has been providing grants for beach monitoring, the number of counties with a beach monitoring program has risen steadily. Twenty-four counties monitored at least one of their beaches in 2000, 36 counties monitored in 2001, and 38 counties monitored in 2003 and 2004. Although no grant funding was available in 2002, monitoring was conducted in 26 counties.

All beach monitoring data are reported to and evaluated by the MDEQ. The MDEQ incorporates beach monitoring data into other water pollution prevention programs to encourage strategic improvements in water quality. Michigan's Beach Monitoring web site (http://www.deq.state.mi.us/beach/public/default.aspx) immediately provides current and historical test results for *E. coli* and beach closings/advisories as they are reported from health departments for all public beaches in Michigan. All public beaches are required to post a sign indicating whether the beach is monitored and where the results can be found.

B. Minnesota's Beach Program. The Minnesota Pollution Control Agency (MPCA) administers Minnesota's Beach Monitoring Program. The purpose of the program is to implement a consistent coastal beach water monitoring program to reduce the risk of exposure of beach users to disease-causing microorganisms in water. Approximately 58 miles of public beach and a total of 79 coastal beaches were identified along Lake Superior. Thirty-nine (39) selected beaches along Lake Superior are monitored in accordance with *BEACH Act* requirements with prompt notification to the public whenever bacteria levels exceed US EPA's established standards.

The state has received $816,870 in *BEACH Act* grants since 2001 to develop and implement beach monitoring and notification programs. A Beach Team comprised of state and local-level environmental and public health officials, and other interested parties, was formed to design MPCA's Beach Program. A standard sampling protocol was developed and standard advisory signs were designed based on feedback from Beach Team members and public meetings held in coastal communities. The 2005 beach season was the third full season that a consistently implemented beach-monitoring program was conducted in the coastal area of Minnesota. In 2005:

- There were 1044 monitoring visits.
- 39 sites were monitored once a week, May through October, for both *E. coli* and fecal coliform.
- 12 of the monitoring sites had one or more advisories posted during the monitoring season.
- Four of the monitored beaches were under advisory for most of July, August, September, and into October.
- 90 percent of Minnesota's Lake Superior beaches met bacteria standards more than 95 percent of the time.

MPCA has improved many aspects of its public notification process. The state has developed an exceptional interactive and informative web site (www.MNBeaches.org) which summarizes key information about beach advisories and closings. This site also provides information on beach

logistics, amenities, and local weather. E-mail notices are automatically sent to interested parties. A local phone message is continually updated with the latest advisories (218-725-7724).

Minnesota Success Stories and Current Research Projects. At all 39 Lake Superior beaches, potential sources of pollution either on the beach or nearby have been identified. These sources include storm water discharges or streams with storm water discharges into them. The city of Duluth and the Western Lake Superior Sanitary District have conducted dye testing in the sewer lines and storm water pipe tanks to eliminate them as potential sources of bacteria at the New Duluth Boat Club site on Park Point. They have also conducted a limited amount of spatial testing to determine if there is one specific point of discharge. The University of Minnesota, Duluth, has received a grant from Sea Grant to research DNA fingerprinting at two of the more polluted beaches, including the New Duluth Boat Club beach. The sources of bacteria are as yet unknown, but further investigation will take place during the 2006 monitoring season.

The principal success of MPCA's Beach Monitoring Program is the continued public awareness the advisories bring to on-going water pollution issues. Since the MPCA started monitoring 35 beaches in 2002 (39 since 2005), the level of awareness of bacterial pollution of recreational waters in the region, as well as in the state, has risen dramatically. The understanding that wastewater overflows and by-passes can have an effect on beach water quality, even a short-lived one, has led to the demand for solutions to the inflow and infiltration problems in the region. Residents and tourists are starting to realize that bacteria problems can occur in any part of the Lake Superior Basin, but that they occur with more frequency in the most urban areas and during storm events. Residents and visitors are picking up after their dogs on a more regular basis. They continue to be vocal about sewage overflows and demand that they be corrected. The coastal cities are installing large holding tanks, back-up generators, and home sump pumps to slow and/or stop storm-related sewage overflows.

C. Wisconsin's Beach Program. The Wisconsin Department of Natural Resources (WDNR) operates Wisconsin's Beach Program. Since 2001, WDNR has received $907,196 in *BEACH Act* grants to develop and implement monitoring and notification programs at beaches along Lake Michigan and Lake Superior. Passage of the *BEACH Act* has enabled WDNR to substantially increase the number of beaches it monitors, from six to 127 coastal beaches. Along Lake Superior, Ashland, Bayfield, Douglas, and Iron Counties have 200 miles of Lake Superior shoreline. Among these counties, 35 beaches are monitored.

To design its beach monitoring and notification program, WDNR formed a workgroup composed of state-level environmental and public health officials and other interested parties. Using GPS technologies, 190 beaches were identified along Lake Michigan and Lake Superior. Additional GPS data layers were added to include the location of all wastewater treatment plant outfalls along with their proximity to the beaches. Additional information was collected for each beach which evaluates the potential for impacts from storm water runoff, bather and waterfowl loads, and the location of outfalls and farms. This information was used to rank and classify beaches as high, medium, or low priority. These rankings indicate how often the beaches should be monitored to ensure that water quality conditions are safe for swimming.

WDNR's public notification and risk communication measures were developed in collaboration with the workgroup and other stakeholders, including the public. These efforts included development of signs at beaches to give notice to the public that the coastal recreational waters are not meeting, or are not expected to meet, water quality standards. These signs, which are also in Spanish and Hmong, were designed based on feedback from a beach user survey and public meetings held around the state.

Other products that were developed include: an automatic e-mail service to which the public can subscribe to receive daily updates on beach conditions; a statewide informational brochure, approximately 100,000 copies of which were distributed at local beaches, parks, and health departments; a statewide Beach Health web page (www.wibeaches.us) for collecting monitoring and advisory data and reporting up-to-date conditions at all coastal beaches; and an internal web site for local health departments to report their daily advisory and monitoring data in the format required for US EPA reporting at the end of the beach season. The Wisconsin Beach Health web site is accessible to the public and stores up-to-date monitoring data and advisory information (www.wibeaches.us).

Current Research Projects. The *BEACH Act* funding was inadequate for a comprehensive monitoring program, so other funding was sought. Several groups have been brought together to create a comprehensive monitoring and source-tracking program. These groups include: the local health departments, Northland College, University of WI-Oshkosh, and the Lake Superior Alliance. The following objectives have been pursued by this collaboration:

- Investigate any high levels of *E. coli* with additional spatial sampling to assist in identifying the source of contamination. This includes investigation of tributaries, outfalls, and other inputs to Lake Superior in proximity to the beaches. This included vertical and horizontal sampling at several beach locations.
- Recovery of *E. coli* isolates from a variety of sources so that a database could be constructed to help determine the source of *E. coli* recovered from beach water samples. Over 2,000 *E. coli* isolates have been recovered from sources such as dogs, cattle, sheep, deer, gulls, geese, human sources, and from the beaches (beach water) under study.
- Investigate the implications of sampling at different water depths: 12, 24, 36, and 48 inches.
- Utilize genetic fingerprinting techniques, antibiotic resistance patterns, and spatial sampling to determine the source of beach water *E. coli* isolates.
- Conduct watershed investigations at select locations to determine impacts on beach water quality.
- Work with local health officials to mitigate any source of *E. coli* and beach contamination so that beaches can remain open and the public health is protected. Currently there are several proposals under consideration to mitigate *E. coli* at some of the locations with elevated levels.

Successes

- Testing Lake Superior's public beaches has spurred counties to test their local inland beaches as well. Vilas and Oneida Counties in northern Wisconsin modeled their inland

beach programs after the Wisconsin Coastal Beach Program and sampled 16 beaches in the summer of 2005.

- Twenty-seven Lake Superior beaches now have baseline *E. coli* data, and beach management decisions can be based on good scientific data.
- The use of genetic testing, antibiotic resistance patterns, and spatial sampling has identified several likely sources of *E. coli*.
- Identifying potential sources of contamination has allowed the process of source mitigation to begin.
- There have been several public meetings at several locations in the Lake Superior region to bring all interested parties together to discuss water quality and beach "health" issues.

D. Ontario's Beach Program. Ontario Public Health Units, who are responsible for the monitoring of Ontario public beaches, collect, document, and house detailed data on the beaches they monitor, including: a beach pollution survey or similar report, either historical, or done at the beginning of the bathing season, to include information on potential sources of contamination impacting the bathing beach area; *E. coli* data; beach postings data; and additional information on beach conditions on the day of monitoring (rain, winds, temperature, visibility, etc.). Ontario beaches are posted with warnings of possible health risks when elevated *Escherichia coli (E.coli)* densities are present. The recreational water quality guideline of 100 *E. coli* per 100 mL of water is set jointly by the provincial ministries of Environment and Health. *E. coli* are bacteria present in the droppings of virtually all warm-blooded animals and are the indicator bacteria for fecal contamination of surface waters. Generally, it is up to the Medical Officer of Health (MOH) for the local Health Unit to decide when a beach should be posted. Once a beach has been posted for elevated *E coli* levels, more frequent water samples are taken by the Health Unit. Beach Postings are removed after *E. coli* levels decrease to acceptable levels. The Ontario Ministry of the Environment has a historic database that identifies total annual beach postings for public beaches in Ontario from 1988 onward. Although a comprehensive database is not available, there are estimated to be more than 16 beaches on the Canadian side of Lake Superior. During 2005, at least three were closed for more than 10 percent of the time (see Addendum 5-A).

SOLEC staff are working with the Ontario Public Health Units and MOH to develop a central clearinghouse for beach postings/sampling data called SWMRS (seasonal water monitoring and reporting system) for use by Environment Canada and partners.

5.1.3 Accomplishments/Activities Related to Drinking Water

Background. Access to clean drinking water is essential to good health. The waters of the Great Lakes and surrounding areas are a primary source of drinking water for people who live in the Great Lakes basin. The average adult drinks about 1.5 liters of water a day.

Communities across the Great Lakes use basin water for drinking, bathing, and other household uses. This water is obtained from a variety of suppliers, both public and private. Public suppliers provide water, which is drawn from either surface water sources (including Great Lakes and/or surrounding waters), groundwater sources, or from a combination of these sources. For private suppliers, a large portion of permanent and seasonal residents use private water supply systems, water is drawn from wells or surface water sources (Health Canada 1998b). Therefore, health

effects could be serious if high levels of some contaminants are present (Health Canada, 1993, 1997).

A variety of contaminants can adversely impact drinking water, including micro-organisms (e.g. bacteria, viruses, and protozoa such as Cryptosporidium), chemical contaminants (including naturally occurring chemicals and anthropogenic [synthetic] chemicals), and radiological contaminants – including naturally occurring inorganic and radioactive materials (IJC, 1996, Health Canada, 1997, Lake Erie, LaMP 1999, OME 2000). Some contaminants of raw water supplies, such as aluminum, arsenic, copper, and lead, can be both naturally occurring and/or result from human activities. Other contaminants, such as household chemicals, personal care products, pharmaceuticals, industrial products, urban storm water runoff, fertilizers, human and animal waste, nitrate (from fertilizers and sewage), and pesticides may also end up in raw water supplies (US EPA, 1999b, Health Canada, 1998b, Kolpin et al, 2002).

Sampling for Chemical and Biological Contaminants

Under the authority of the Safe Drinking Water Act (SDWA), US EPA sets standards for approximately 90 contaminants in drinking water. The categories of contaminants include:

- Microbial contaminants, such as bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, which can occur naturally or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- Pesticides and herbicides, which may come from a variety of sources such as agriculture, storm water runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.
- Radioactive contaminants, which can be naturally occurring or be the result of oil and gas production and mining activities.

For each of these contaminants, US EPA sets standards, which may take the form of a legal limit, called a maximum contaminant level, or a treatment technique, which requires a certain treatment. Water that meets these standards is safe to drink, although people with severely compromised immune systems and children may still be affected due to their increased sensitivity.

Under the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) water systems using a surface water source serving 10,000 or more people are required to monitor their source water for *E. coli, Cyptosporidium*, and turbidity for two years beginning in October of 2006. Water systems using a surface water source serving fewer than 10,000 people are required to monitor their source water for *E. coli* for one year beginning in October of 2008, and also monitor *Cyptosporidium* for two years if they exceed the *E. coli* trigger level. Depending on the level of *Cyptosporidium* in source water, systems are assigned bin categories that dictate the number of additional logs of *Cyptosporidium* protection they must provide beyond 2 log removal

already required by the Interim Enhanced Surface Water Treatment Rule, and Long Term 1 Enhanced Surface Water Treatment Rule. Systems can use any combination of listed source, pre-filtration, treatment performance, additional filtration, and inactivation tools to provide the additional logs of *Cyptosporidium* protection.

For a more detailed description, or for more information about how standards are set, or for additional information about US EPA's Office of Ground Water and Drinking Water, go to http://www.epa.gov/safewater/. For the list of contaminants which are evaluated by the local water suppliers, go to http://www.epa.gov/safewater/mcl.html#mcls.

Route of Exposure and Associated Adverse Health Effects from Exposure to Contaminated Drinking Water

In Canada and the U.S., community water suppliers deliver high quality drinking water to millions of people every day, and a network of government agencies are in place to ensure the safety of public drinking water supplies (OGWDW 1999a). Although our drinking water is safer today than ever, problems can, and do, occur, although they are relatively rare. Localized outbreaks of water-borne disease have been linked to contamination by bacteria or viruses, probably from human or animal waste (US EPA, 1999b).

Some individuals or groups, particularly children and the elderly, may be more sensitive to contaminants in drinking water than the average person (Health Canada, 1993). Although drinking water quality guidelines are for the general population, they are based on health effects observed in the most sensitive subgroup of the population (e.g. lead and children).

Microbial contamination of drinking water can pose a potential public health risk in terms of acute outbreaks of disease. The illnesses associated with contaminated drinking water are mainly of a gastro-intestinal nature, although some pathogens are capable of causing severe and life-threatening illness (Health Canada 1995a). In most communities, drinking water is treated to remove contaminants before being piped to consumers. Municipal water supplies contaminated with microbial agents have been largely eliminated by adding chlorine or other disinfectants. By treating drinking water, we have virtually eliminated diseases such as typhoid and cholera. Although other disinfectants are available, chlorine still tends to be the treatment of choice. When used with multiple barrier systems (i.e. coagulation, flocculation, sedimentation, filtration), chlorine is effective against virtually all-infective agents. (US EPA and Government of Canada, 1995; Health Canada, 1993, 1997, and 1998b).

Government Actions to Protect Public Health

Ontario Source Water Protection. The *Clean Water Act* was introduced in the Ontario legislature in December 2005 (and is currently under review) to address the recommendations from the Walkerton Inquiry which pertain to the protection of drinking water sources. Justice O'Connor's Inquiry report recommends that "Drinking water sources should be protected by developing watershed-based source protection plans. Source protection plans should be required for all watersheds in Ontario" (D.R. O'Connor 2002). The report also recommends that "The Ministry of the Environment should ensure that draft source protection plans are prepared

through an inclusive process of local consultation. Where appropriate, this process should be managed by conservation authorities" (D.R. O'Connor 2002, see also http://www.ene.gov.on.ca/water.htm). This is being implemented on Lake Superior by the Lakehead Region Conservation Authority and the Sault Ste Marie Region Conservation Authority. Additional information on the Ontario *Clean Water Act* can be found at http://www.ene.gov.on.ca/envision/water/cwa.htm.

Source Water Assessment and Protection Program Status. The *Safe Drinking Water Act Amendments of 1996* established the Source Water Assessment and Protection Program (SWAP) to help States locate and identify existing and potential threats to the quality of public drinking water for the purpose of fostering local efforts to benefit and protect the resource. States are responsible for assessing the condition of source water for all public water systems within their borders. Each assessment must include a delineation of the source water area for each public water system, an inventory of potential contaminant sources, a determination of the system's susceptibility to contamination from those sources, and must be made available to the public. Assessments are intended to be a useful tool in helping water system develop plans and implement measures to protect their water source.

Minnesota, Wisconsin, Illinois, and Michigan have completed all assessments. The focus of this program has now shifted to using the assessments to encourage States and local water utilities to develop source water protection plans and implement protection measures. US EPA and the States will be working to establish partnerships with volunteer and nonprofit organizations, and integrate source water protection with other regulatory programs in order to achieve results.

Long Term Objectives: By 2011, 80 percent of the community water systems will be substantially implementing source water protection plans.

More information on this program is available at the following Internet address http://www.epa.gov/OGWDW/protect/protect.html.

Water Quality Tracking. A key action was set in the *2002 Great Lakes Strategy* that, "Beginning in 2002, the US Environmental Protection Agency (US EPA), in cooperation with local utilities, will track water quality at the intake points of selected drinking water treatment plans around the Lakes. Findings will be reported to the public through the biennial State of the Lakes Ecosystem Conference (SOLEC) State of the Lakes report." See http://www.epa.gov/glnpo/gls/gls04.html.

For 1999-2001, the US EPA has examined data provided by 41 public water systems in the Great Lakes Basin and by the U.S. Safe Drinking Water Information System. Specifically, US EPA has evaluated various contaminants, including the following:

- Atrazine, an agricultural pesticide;
- Nitrate and nitrite, which are naturally occurring nutrients found at high levels in fertilizers; and
- Total coliforms, *E. coli*, *Giardia*, and *Cryptosporidium*, which are microorganisms that may contaminate water supplies after sewage spills.

US EPA has also examined the turbidity, taste, odor, and organic carbon content of drinking water supplies to assess any other potential health issues. Of the public water systems evaluated between 1999 and 2001, none exceeded drinking water standards for atrazine, and only one exceeded drinking water standards for nitrate and nitrite after treatment. However, atrazine, nitrate, and nitrite are detected at elevated levels in the Great Lakes, which indicates that advanced treatment technologies prevent the entry of significant concentrations of these contaminants from entering drinking water systems. For total coliform and *E. coli*, only one violation of drinking water standards occurred between 1999 and 2001 in the Great Lakes Basin. Finally, public water systems rarely have problems with turbidity, taste, odor, or organic carbon content.

For 2002-2003, the US EPA has examined data in annual Consumer Confidence Report/Water Quality Reports (CC/WQRs) for 57 public water systems' in the Great Lakes Basin for operational year 2002 (2003 when available) and in the U.S. Safe Drinking Water Information System. U.S Water Treatment Plants (WTPs) are required to provide an annual CC/WQR to their customers which includes information on source water type, the water treatment process, contaminants detected in finished water, any violations, and other relevant information. Specifically, US EPA has evaluated the same contaminants and other parameters to assess any other potential health issues described above. The U.S. Safe Drinking Water Information System was used as a means to verify violation information presented in the CC/WQRs and to provide other relevant information, where CC/WQRs were not available.

Of the public water systems evaluated between 2002 and 2003, none exceeded drinking water standards. Organic carbon was detected in finished water from WTPs using all source types (Great Lake, rivers, small lakes/reservoirs, and groundwater) except those using Lake Huron and Lake Superior source water.

The Ontario Drinking Water Surveillance Program (DWSP) is a voluntary program operated by the Ministry of the Environment (MOE) in cooperation with municipalities to gather scientific data on drinking water quality in Ontario. From 2000 to the end of 2002, 179 municipal drinking-water systems were collecting samples for the program. Laboratory analyses are provided by the MOE and the Ministry of Labour.

Summaries and detailed reports for the 179 municipal drinking-water systems that were monitored from 2000 to 2002 are provided on a web site (http://www.ene.gov.on.ca/envision/water/dwsp/0002/index.htm) as part of the Ontario government's commitment to make information about drinking water readily available to the public. Results showed that 99.8 percent of the tests performed for chemical, physical, and radiological parameters in treated drinking water and water in the distribution systems indicated non-adverse water quality conditions. Tests for microbiological organisms, such as *Escherichia coli (E. coli*), are performed routinely by each drinking-water system and were not monitored by the DWSP.

Over 555,300 inorganic, organic, and radiological tests were performed on raw water, treated drinking water, and water in the distribution systems. Of the over 121,700 tests for chemical,

physical, and radiological parameters in treated drinking water and water in the distribution systems, over 121,500 test results met the health-related Ontario Drinking Water Objectives / Standards. One hundred and ninety test results exceeded a health-related objective / standard. The health-related objective / standard for atrazine plus N-dealkylated metabolites, chloramines, fluoride, lead, N–nitrosodimethylamine (NDMA), nitrates, selenium, total trihalomethanes, and turbidity were exceeded on at least one occasion at 35 municipal drinking-water systems for the 2000 to 2002 monitoring period. In addition, of the 3,950 tests reported for free and combined chlorine residuals, over 3,930 test results were above the minimum criteria for disinfectant residuals. Sixteen test results, at nine municipal drinking-water systems, were below the minimum criteria for disinfectant residuals resulting in adverse water quality.

The MOE has developed new rules to ensure that information about drinking water testing is disclosed to the public on a regular basis. These new rules came into effect on August 26, 2000, with the implementation of the *Drinking Water Protection Regulation for Larger Waterworks* (Ontario Reg. 459/00). As of June 1, 2003, under the *Safe Drinking Water Act*, the Drinking-Water Systems Regulation (Ontario Reg. 170/03) came into effect, superceding Ontario Reg. 459/00.

Prior to Ontario Reg. 459/00, standard DWSP practice was to inform the operating authority and the MOE district manager with a DWSP "Alert Notification" when a health-related objective was exceeded. It was the responsibility of the operating authority to address the issue and to notify the local Medical Officer of Health. DWSP analytical results were also sent to the operating authority when the analyses were completed.

The Drinking-Water Systems Regulation stipulates that the owner of a water treatment or distribution system is required to ensure that notice is given to the local Medical Officer of Health and to the MOE if a parameter does not meet the Maximum Acceptable Concentration (MAC) or Interim Maximum Acceptable Concentration (IMAC) of the Ontario Drinking Water Quality Standards (ODWQS) (Ontario Reg. 169/03), or if a test result indicates adverse water quality. The Medical Officer of Health, through the *Health Protection and Promotion Act* (Chapter 10, Part 3, Sections 10, 11, 12, and 13) has the authority to judge if drinking water is safe for human consumption.

ODWQS are the provincial standards of drinking water quality, most of which have been adopted from the Canadian drinking water quality guidelines established by the Federal-Provincial-Territorial Committee on Drinking Water. The guidelines are derived from risk assessment based exposure limits as modified by a risk management process incorporating review of the geographic scope and prevalence of the contaminant, available technology to remove it and associated costs. Several provinces, including Ontario, also set unique limits for parameters specific to their provincial drinking water quality.

Comprehensive compliance inspections are performed annually by the MOE at all municipal drinking-water systems. Where necessary, MOE staff issue Provincial Officer Orders that direct owners and operators of municipal drinking-water systems as to what must be done to bring their supplies into compliance. Ministry staff follow up to ensure compliance with all Orders.

For further information on drinking water testing done by individual municipalities as required by the Drinking Water Systems Regulation, including drinking water annual reports, readers are urged to contact the municipality.

Parasites. Parasites such as *Giardia* and *Cryptosporidium* (the most common source of which is animal feces), which are resistant to common disinfection practices, may pass through water treatment filtration and disinfection processes in sufficient numbers to cause health problems (Health Canada 1998a).

For example, in 1993, Milwaukee, Wisconsin, experienced a widespread outbreak of Cryptosporidiosis that affected over 400,000 residents, causing severe diarrhea, nausea, stomach cramps, and other symptoms. While most people recovered without treatment, the outbreak contributed to the deaths of at least 100 people already ill with AIDS-related illnesses, cancer, or other maladies. The outbreak was caused by *Cryptosporidium* oocysts that passed through the filtration system of one of the city's two water-treatment plants (WI DNR 1994, WI DNR 1998, Health Canada 1997).

Boiling water is the best method for killing *Cryptosporidium* and other harmful microorganisms in emergency situations (Health Canada 1997), and "Boil Water" orders are generally the standard public health protection method when drinking water is found to be contaminated. Since the Milwaukee outbreak, US EPA has strengthened treatment requirements and standards for public water supplies using surface water. Health Canada, in collaboration with the provinces, is currently developing a drinking water guideline for *Giardia* and *Cryptosporidium*, is reviewing its turbidity guideline, and recently published a document titled "Guidance for Issuing and Rescinding Boil Water Advisories" (November 1998, revised March 1999), as a tool for health and environment authorities who must make the decisions concerning boil water advisories.

Drinking Water Academy. Established by the US EPA Office of Ground Water and Drinking Water, the Drinking Water Academy (DWA) is a long-term training initiative whose primary goal is to expand US EPA, State, and Tribal capabilities to implement the 1996 *Amendments to the Safe Drinking Water Act* (SDWA). In addition to providing classroom and web-based training, the DWA is a resource for training materials pertaining to SDWA implementation. The DWA website is at http://www.epa.gov/safewater/dwa.html.

Drinking Water Security Education Materials. The US EPA has recently developed a collection of useful education and resource materials on drinking water security. The information includes resources on emergency preparedness, drinking water security, and law enforcement information. All materials can be found at http://www.epa.gov/safewater/security/flyers/index.html.

Emerging Issues

Water Infrastructure Security. Under both the *Safe Drinking Water Act* (SDWA) and the *Clean Water Act* (CWA), US EPA works closely with partner organizations — other government agencies, and water utilities and associations (both drinking water and wastewater) to ensure clean and safe water. Industry and government are also working cooperatively to improve drinking water and wastewater security. Building on and supporting long-established relationships with our partners, US EPA helps the water sector to: (1) understand and utilize the best scientific information and technologies for water security; (2) support assessment of utilities (i.e., vulnerabilities to possible attack); (3) take action to improve security; and (4) respond effectively and efficiently in the event that an incident occurs.

This commitment is outlined in US EPA's Strategic Plan for Homeland Security.

A number of actions are underway to:

- Support development of tools, training, and technical assistance for small and medium drinking water, and wastewater utilities; and
- Promote information sharing, and research on water security.

Public Health Security and Bioterrorism Preparedness and Response Act of 2002. Drinking water utilities today find themselves facing new responsibilities. While their mission has always been to deliver a dependable and safe supply of water to their customers, the challenges inherent in achieving that mission have expanded to include security and counter-terrorism. In the *Public Health Security and Bioterrorism Preparedness and Response Act of 2002*, Congress recognizes the need for drinking water systems to undertake a more comprehensive view of water safety and security. The Act amends the *Safe Drinking Water Act* and specifies actions community water systems and the U.S. Environmental Protection Agency must take to improve the security of the nation's drinking water infrastructure.

5.1.4 Accomplishments Related to Communication to the Public

Because it has been shown that people who engage in recreational water sports have a higher incidence of symptomatic illnesses, it has become increasingly more important to make the public aware of the potential health hazards that are associated with recreational waters. Recent progress has been made on the national and local levels to provide the public with useful tools that can provide needed information regarding the use of recreational waters. At the national level, the following public communication tools are available:

- BEACH Watch. This web site (www.epa.gov/OST/beaches) contains information about US EPA's BEACH Program, including grants, US EPA's reference and technical documents including US EPA's *Before You Go to the Beach* brochure, upcoming meetings and events, conference proceedings, and links to local beach programs. The web site also provides access to BEACON (Beach Advisory and Closing On-line Notification), US EPA's national beach water quality database.

- Annual Great Lakes Beach Association (GLBA) Conference. The GLBA is comprised of members from U.S. states, Environment Canada, local environmental and public health agencies, and several universities and NGOs. The GLBA's mission is the pursuit of healthy beach water conditions in the Great Lakes area. Since 2001, the GLBA has held beach conferences annually to bring together beach managers, scientists, and agency officials to exchange information on improving recreational water quality. The next conference is planned for October 2006, in New York. For more information, see www.great-lakes.net/glba/.

- BEACHNET. BEACHNET is an email discussion list that seeks to facilitate communication among people interested in the improvement of recreational beach water quality in the Great Lakes Basin. The listserv is sponsored by the GLBA and is hosted by the Great Lakes Information Network (GLIN). Both the GLBA and the listserv are open to anyone interested in improving beach water quality, understanding bacterial contamination, developing better ways to detect and monitor pollution, or monitoring and assuring beach visitors' health. There are currently several hundred subscribers to BEACHNET (http://www.great-lakes.net/glba/beachnet.html).

- BeachCast**.** This web site (http://www.glc.org/announce/03/07beachcast.html) provides Great Lakes beach goers with access to information on Great Lakes beach conditions, including health advisories, water temperature, wave heights, monitoring data, and more. BeachCast is a service of the Great Lakes Commission and its GLIN.

Adoption of Bacteria Criteria that Meet National Standards. One of the provisions of the *BEACH Act* required coastal and Great Lakes states to adopt for their coastal recreation waters, by April 10, 2004, water quality criteria for pathogens or pathogen indicators as protective as US EPA's 1986 water quality criteria for bacteria. The *BEACH Act* further directed US EPA to propose and promulgate such standards for states that did not do so.

US EPA worked collaboratively with all the states and territories that contain coastal recreation waters to identify their existing water quality standards, review them for consistency with the *BEACH Act* requirements, and determine what steps were needed to meet the *BEACH Act* requirements. On November 16, 2004, US EPA published in the Federal Register a final rule that promulgated water quality standards for states and territories that had not yet adopted water quality criteria for bacteria that were as protective of human health as US EPA's 1986 bacteria criteria. Information about the promulgation can be found online at www.epa.gov/waterscience/beaches/bacteria-rule.htm.

5.1.5 Accomplishments/Activities Related to Fish Consumption Advisories and Contaminants in Fish

United States. The *Council of Great Lakes Governors' Toxics Agreement of 1986* established the goal of common fish consumption advisories on the Great Lakes. The Council's Fish Consumption Advisory Task Force, with representation from each of the eight Great Lakes states, was assigned the task of developing a single method for assessing risks and issuing fish consumption advisories. The Task Force developed the "*Protocol for a Uniform Great Lakes*

Sport Fish Consumption Advisory," which addressed polychlorinated biphenyl (PCB)-based fish advisories for the Great Lakes. In September 1993, the Protocol was submitted to the Council of Great Lakes Governors. Although the Task Force disbanded, the health departments of the Great Lakes states formed a consortium, which over the past decade collaborated on research projects and maintained the relationships begun by the Task Force.

Mercury is a ubiquitous contaminant in fish. All the Great Lakes states issue fish consumption advice based on mercury levels in fish. The issuing of the FDA/US EPA national mercury fish consumption advisory underscored the need for a consistent approach for issuing advisories. The Protocol has been instrumental in providing a common fish advisory methodology and communication structure for Great Lakes states. The states periodically coordinate communication strategies, joint outreach campaigns, and advisory awareness evaluation projects. These efforts have only addressed PCB and other halogenated organic fish contaminants. There has been no mechanism to advance a coordinated mercury communication strategy in the Great Lakes states. The Consortium sought and received a small grant from the US EPA to develop a mercury addendum to the 1993 Protocol. Consumption advisory program staff from state health and environmental agencies in the Great Lakes Basin developed a draft mercury addendum in 2005.

Canada. The *2005-2006 Guide to Eating Ontario Sport Fish* is substantially different from previous editions. It now contains important information on consumption of sport fish from Ontario waters for both the general population and the sensitive populations of women of child-bearing age and children under age 15. This is the result of long-term epidemiological studies on mercury intake which have found developmental effects in young children at levels lower than previously thought. Since there is no evidence of any adverse effects on adults at similarly low levels, Health Canada provides two health protection guidelines, which have been incorporated into the Guide. Health Canada has also revised health protection guidelines for PCBs and dioxins (including dioxins, furans, and dioxin-like PCBs). These revised guidelines have increased the proportion of fish under advisory in Lake Superior and changed the relative importance of the contaminants causing restrictions. Whereas toxaphene previously had caused the majority of consumption restrictions (71 percent), dioxins (65 percent) and PCBs (25 percent) are now responsible for the majority of the restrictions.

For more information on the *2005-2006 Guide to Eating Ontario Sport Fish*, go to http://www.ene.gov.on.ca/envision/guide/.

Emerging Contaminants. Although there are advisories in the United States for a total of 39 chemical contaminants, most advisories in Lake Superior have involved five primary contaminants: mercury, PCBs, chlordane, dioxins, and toxaphene. Emerging contaminants, summarized in the Chemical Chapter, Chapter 4, in fish will likely result in advisories also. To better understand the presence of some emerging contaminants in fish, the Great Lakes National Program Office's Great Lakes Fish Monitoring Program (GLFMP) recently added polybrominated diphenyl ethers (PBDEs) to its annual basin-wide monitoring program. In addition, the GLFMP has instituted a program to identify and monitor for a specified list of emerging contaminants in fish, such as polychlorinated naphthalenes (PCNs) and perfluorooctane sulfonate (PFOS), over one sampling year. The GLFMP steering committee will

rely upon the Great Lakes Binational Toxic Strategy and LaMP teams to create a list of additional emerging contaminants to be included in this additional year of monitoring. Examples of additional analytes are perfluorinated compounds, musk fragrances, alkylphenol ethoxylates (APEs), pharmaceuticals and other personal care products (pseudopersistence), other flame retardants, etc.

5.2 CHALLENGES AND NEXT STEPS FOR 2006 TO 2008

- Implement actions outlined in the Great Lakes Regional Collaboration's Coastal Health Strategy.
- Reduce pathogen levels in all recreational waters.
- Improve beach monitoring and public notification.

Addendum 5-A presents information on Lake Superior Basin beach closings.

5.3 INFORMATION

The web links listed below provide reference material for information cited in this chapter.

Government Action to Protect the Public Health

Monitoring

Contaminants evaluated by local water suppliers
http://www.epa.gov/safewater/mcl.html#mcls

Source Water Assessment Program
http://www.epa.gov/safewater/protect/assessment.html#Anchor-Source-11481

Water Quality Tracking
http://www.epa.gov/glnpo/gls/gls04.html

Research

Office of Research & Development's Water Supply and Water Resources Division
http://www.epa.gov/ORD/NRMRL/wswrd/research.htm

Communication Outreach

Drinking Water Academy
http://www.epa.gov/safewater/dwa.html

Drinking Water Security Education Materials
http://www.epa.gov/safewater/security/flyers/index.html

Remedial Action

Drinking Water State Revolving Fund
http://www.epa.gov/safewater/dwsrf.html

Emerging Issues

Water Infrastructure Security
http://www.epa.gov/safewater/security/index.html

Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants
http://toxics.usgs.gov/regional/emc.html

Lake Superior States' Beach Web Pages

MI: www.michigan.gov/deq/1,1607,7-135-3313_3686_3730---C1,00.html
MN: www.pca.state.mn.us/water/beaches/
WI: www.dnr.state.wi.us/org/water/wm/wqs/beaches/

Great Lakes Sea Grant

Great Lakes Sea Grant Network, http://www.greatlakesseagrant.org/
Michigan Sea Grant, http://www.miseagrant.umich.edu/
Minnesota Sea Grant, http://www.seagrant.umn.edu/
Wisconsin Sea Grant, http://www.seagrant.wisc.edu/

US EPA

US EPA's BEACH Watch home page including links to the *BEACH Act*, the *National Beach Guidance and Required Performance Criteria for Grants*, US EPA's national beach water quality database, and technical and reference documents.
http://www.epa.gov/waterscience/beaches/

US EPA Great Lakes National Program Office
http://www.epa.gov/glnpo/

US EPA's *Report to Congress: Impacts and Control of CSOs and SSOs* (delivered August 26, 2004)
http://cfpub.epa.gov/npdes/cso/cpolicy_report2004.cfm

Great Lakes Monitoring – The Swimmability Index
http://www.epa.gov/glnpo/glindicators/water/beachb.html

Great Lakes Strategy 2002 – A Plan for the New Millennium
http://www.epa.gov/grtlakes/gls/gls04.html

BEACON – Beach Advisory and Closing On-line Notification
http://oaspub.epa.gov/beacon/beacon_national_page.main

Other Web Sites

Great Lakes Water Institute – Bacterial Genetics Research Lab
http://www.uwm.edu/Dept/GLWI/ecoli/

Great Lakes Beach Association
http://www.great-lakes.net/glba/

Great Lakes Information Network (GLIN)
http://www.great-lakes.net/

Great Lakes Beach Association Annual Proceedings 2005
http://www.great-lakes.net/glba/2005conference.html

Beaches in the Great Lakes Region
http://www.great-lakes.net/tourism/rec/beach.html#new

Center for Disease Control - Healthy Swimming
http://www.cdc.gov/healthyswimming/

Great Lakes BeachCast – Great Lakes Beach Information (many links from this site)
http://www.great-lakes.net/beachcast/nr_moreinfo.html

Great Lakes Research Consortium
http://www.esf.edu/glrc/

NOAA Great Lakes Environmental Research Laboratory (GLERL)
Center of Excellence for Great Lakes and Human Health
http://www.glerl.noaa.gov/res/Centers/HumanHealth/

USGS Great Lakes Science Center
http://www.glsc.usgs.gov/

Great Lakes Commission
http://www.glc.org/

International Joint Commission
http://www.ijc.org/

Council of Great Lakes Research Managers – Great Lakes-St. Lawrence Research Inventory
http://ri.ijc.org

Great Lakes Protection Fund
http://www.glpf.org/

International Association for Great Lakes Research
http://www.iaglr.org/

Lake Superior Duluth Streams
www.DuluthStreams.org

5.4 ADDITIONAL INFORMATION

A collection of additional useful resources (journal articles, publications, published abstracts, and technical reports) has been compiled below for future use.

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ADDENDUM 5-A:
LAKE SUPERIOR BASIN BEACH CLOSINGS

Beach managers across the basin assess beach quality as part of their daily activities. The State of the Lakes Ecosystem Conference (SOLEC) assesses the beach manager's data to evaluate the amount of beach closings, swim advisories, and posting days.

Ecosystem Objective

Waters used for recreational activities involving body contact should be substantially free from pathogens, including bacteria, parasites, and viruses, that may harm human health. As the surrogate indicator, *E. coli* levels should not exceed national, state, and/or provincial standards set for recreational waters.

Seven beaches in the U.S. and three in Canada in Lake Superior have been closed more than 10 percent of the swimming season (June, July, and August). Table 5-1 presents information on the seven U.S. beaches, and Table 5-2 presents information on the three Canadian beaches. For more information, see the *Draft State of the Great Lakes Report 2005* at http://www.solecregistration.ca/en/reports/greatlakesreport.asp.

Table 5-1. U.S. Lake Superior Beaches That are Closed More than 10 percent of the Swimming Season

County	Waterbody	Beach ID	Beach Name	Number of Days Posted	State Priority Ranking Tiers	Times Monitored Per Week	Causes Reported for Postings
St. Louis	Great Lakes	MN524952	LS St. Louis Bay, Pk Pt Boat Club/14th St., Duluth	35	T1	Twice	Unknown
St. Louis	Great Lakes	MN591851	LS Pk Pt, Southworth Marsh, Duluth	58	T1	Twice	Unknown/ Storm
St. Louis	Great Lakes	MN801949	LS St. Louis Bay, Pk Pt/20th Hearding Is., Duluth	65	T1	Twice	Unknown
Douglas	Great Lakes	WI545475	Amnicon River Beach	13	T3	Once	Unknown
Douglas	Great Lakes	WI573145	Wisconsin Point Beach #3	11	T3	Once	Unknown
Douglas	Great Lakes	WI750300	Brule River State Forest Beach #2	15	T3	Once	Unknown
Douglas	Great Lakes	WI888427	Wisconsin Point Beach #1	32	T2	Twice	Unknown

Table 5-2. Canadian Lake Superior Beaches Closed More than 10 percent of the Swimming Season during 2005*

Municipality	Waterbody	Beach Name	Number of Days Posted**	Times Monitored Per Week	Causes Suspected for Postings
Thunder Bay	Current River	Boulevard Lake - Sunnyside	10	Twice	Bird droppings suspected
Sault Ste. Marie	St. Marys River	Kinsmen (Hiawatha) Park	10	Twice	Unknown
Sault Ste. Marie	St. Marys River	Centennial Park (Pumpkin Point)	12	Twice	Unknown

* Swimming season calculated as 92 days from June 1 through August 31.
** Based on public postings from the local Health Unit.