

Appendix R

Assessment Protocol for Great Lakes Sources (Revised 8/17/00)

Assessment Protocol for Great Lakes Sources

August 17, 2000

Introduction

Recently there has been concern over the protection of the nation's drinking water sources. This issue has been debated nationally and eventually was addressed in federal legislation. In 1996 when the federal Safe Drinking Water Act was reauthorized, legislation was added that requires source water assessments be performed on all sources of public drinking water supplies. The assessments must consider the vulnerability of these public drinking water sources. Assessments of intakes that extend into the Great Lakes present a unique challenge in determining the scope and magnitude of these assessments with limited resources. The intakes for some of these sources extend far enough into a lake to receive no effects from specific shoreline contaminant sources (except possibly air borne contaminants) while others closer to shore do. To provide guidance on how source water assessments should be performed, it will be necessary to address this very basic premise. USEPA may be able to give some assistance by providing access to data bases, developing screening methods and area wide monitoring for general contaminants, general lake responses to airborne contaminants, and other area wide general assistance.

A workgroup from the Great Lakes States has been organized to develop these parameters. This workgroup includes representatives of the Great Lakes States, water utilities with intakes on the Great Lakes, USEPA Region V and other interested parties. There should be consensus among the states and USEPA on the make up of the group. USEPA and the Region V states met on June 16, 1999 to develop a mission statement and a final draft of this protocol. The Region V states concurred on the protocol at a workgroup meeting on August 17, 2000. The following mission statement defined the intent of the workgroup.

The mission of the Great Lakes Protocol Workgroup is to develop a consensus amongst the states for a consistent procedure allowing the flexibility necessary to properly conduct source water assessments of our Great Lakes drinking water sources. This flexibility will take into account the variability of these sources and site specific concerns for determination of source sensitivity and susceptibility.

Initial Survey

An initial survey will be performed at each Great Lakes source to assess local source water impacts. Any criteria or studies that were performed to locate the intake should be reviewed. Senior operators and the plant superintendent at the treatment plant plus other local officials should be interviewed to gain knowledge of the raw water quality fluctuations. Past water quality records from files or existing data bases would need to be reviewed and also any data collected through the Information Collection Rule (ICR). Bacteriological quality, alkalinity and turbidity levels are good indicators of localized impacts. If this review indicates that only minor fluctuations occur in raw water quality

compared to the lake's background quality, the source is probably not impacted from localized contaminants and the assessment would parallel a general water quality assessment of the total lake with some consideration for potential emergency spills.

The "Great Lakes Surface Water Assessment Survey" form developed with this protocol can be utilized as a screening tool to assist in determining localized impacts. The initial survey should be used to assist with determining procedures to follow in conducting the survey. The assessment procedures will depend upon the type of local impacts, the availability and quality of local data, weather conditions, runoff, etc.

Critical Assessment Zone

To provide some continuity for assessing the Great Lakes intakes, the concept of a "Critical Assessment Zone" (CAZ) around each intake was developed. The two factors used for this zone which effect the sensitivity of Great Lakes intakes are the perpendicular distance from shore or length of the intake pipeline (L) in feet and the water depth (D) of the intake structure in feet. The shallower, near shore intakes are more sensitive to shoreline influences than the off shore, deep intakes. The factor for sensitivity (S) can be calculated by the formula:

$$L \times D = S$$

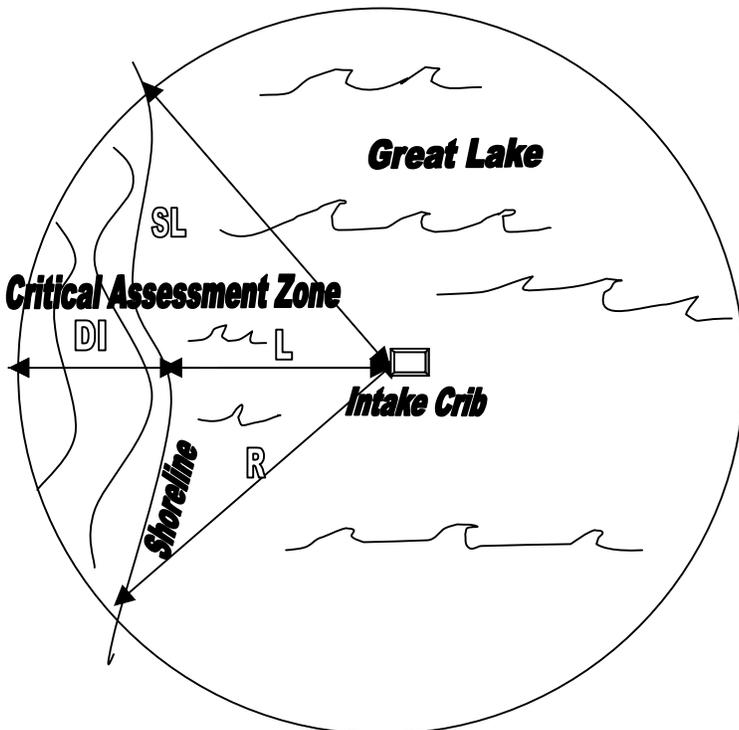
Generally, S values less than 25,000 represent highly sensitive intakes while S values greater than 125,000 indicate lower sensitivities. This degree of sensitivity can be used by the states as a tool to prioritize assessment activities and assist with the susceptibility determination after taking contaminant sources into account.

The intake's degree of sensitivity combined with information obtained from the survey form and local data such as intake construction, lake bottom characteristics, localized flow patterns, thermal effects and benthic nepheloid layers can be used to complete a sensitivity analysis. The benthic nepheloid layer is a zone of suspended sediment kept suspended by the interactions of current and sedimentation. The layer's characteristics around an intake depend on sediment density, water temperature, bottom currents and animal activity.

The following columns represent Great Lakes intakes with high, medium and low sensitivities. A CAZ is defined as the area from the intake structure to the shoreline and inland. This area includes a triangular water surface and a land area encompassed by an arc from the endpoint of the shoreline distance on either side of the on shore intake pipe location. The shoreline distance (SL) is measured in feet in both directions from the intake pipe location on shore while the distance inland (DI) in feet is determined by subtracting the submerged intake pipe length (L) from the critical assessment zone radius (R). The drawing, which follows, illustrates an example of the Critical Assessment Zone.

Note: $\sqrt{\quad}$ indicates square root of parenthesized calculations.

<u>Sensitivity Value</u>	<u>Critical Assessment Zone</u>	<u>Shoreline Distance</u>	<u>Distance Inland</u>
<25,000	3,000 foot radius	$SL = \sqrt{(3000^2 - L^2)}$	$DI = 3000 - L$
25,000-125,000	2,000 foot radius	$SL = \sqrt{(2000^2 - L^2)}$ $L > 2000; SL = 0$	$DI = 2000 - L$ $L > 2000; DI = 0$
>125,000	1,000 foot radius	$SL = \sqrt{(1000^2 - L^2)}$ $L > 1000; SL = 0$	$DI = 1000 - L$ $L > 1000; DI = 0$



Along with the sensitivity analysis, an initial inventory should be completed by a combination of a simple survey form followed by an on site interview.

Attached to this document is a survey form the states could use to conduct this interview.

Completing the Assessment

If the assessment indicates the intake is not impacted by potential shoreline contaminants, the assessment should reference general Great Lakes water quality and trends within the source water assessment area. This information has been compiled by several sources such as the U.S. EPA's Great Lakes National Program Office (GLNPO) and the Great Lakes Mass Balance Studies done by the USEPA, the States, and USGS. GLNPO has conducted water and sediment modeling activities using National Oceanic and Atmospheric Administration 5 kilometer grids which should be useful for modeling potential spill scenarios from sources such as pipelines, and for assessing tributary impacts. Another source could be the Remedial Action Plans for Great Lake Areas of

Concern and the Lakewide Management Plans. Some of these sources address contaminants brought forth by air deposition. Total Maximum Daily Loads (TMDLs) should also be referenced, if available.

For systems where the initial survey indicates a potential for shoreline impacts, the assessment becomes more difficult and site specific. The next step would be to provide a delineation of the area that contributes potential impacts through the use of local data and/or the "Critical Assessment Zone" concept. It would then be necessary to assess the impacts in the area and their relative impact on the quality and treatability of the raw water. If a river or stream that discharges into the lake near the intake causes a significant impact, a partial watershed assessment of that river or stream would be necessary. These impacts may not be continual, but may arise only as a result of certain events such as a specific wind direction and intensity, or a river or stream discharge into the lake at a certain flow level. The USEPA BASINS software and USGS SPARROW software may provide data for this determination. There may also be impacts from certain thermal or seasonal conditions. These issues are site specific and will require extensive review of the water quality records and in depth interviews with plant personnel.

If the water quality impact is due more to a general lake condition, such as proximity to a shallow bay, wind direction or localized current patterns, the degree of these impacts must be assessed. Interviews with the plant personnel with extensive experience at the plant would be essential. Once the impacts are categorized, assessments must be made for each impact. For example, if a shallow bay causes water quality impacts, these impacts should be noted along with the change in water quality anticipated and the degree and frequency of change. If the quality change results from an algae bloom, the conditions that promote the bloom should be listed, along with the resulting water quality changes and the degree and frequency of the changes. Each impact should be listed in the narrative portion of the assessment.

If the impact results from a discharge on the shoreline, runoff from the shoreline, local tributary or location of a facility near the intake, these potential impacts should be listed and assessed. It may be necessary to delineate an additional area extending beyond the CAZ, determine the impacts in this area and then assess these impacts. This could become complex depending upon the shoreline assessment. If the impact were from runoff, it would first have to be assessed to determine the degree of impact due to the volume and concentration of contaminants in the runoff. Is the runoff significant? If it were, the potential makeup of the runoff would need to be assessed. For example, is the runoff from farmland? If so, the time of the year would be critical. If it were urban runoff, the types of commercial and industrial establishments in the area would be important. These assessments will be complex and must be designed so they can be altered and expanded, as more information becomes available. The assessment must be dynamic in nature and be designed to be expanded in the future.

Many bays and tributary mouths in urban or industrialized areas hold deposits of sediment contaminated by metals and organic toxicants. Records of EPA and State environmental management agencies, as well as the U.S. Army Corps of Engineers Harbor Dredging Programs should be evaluated to determine whether an increase in turbidity due to material suspended in such sites might pose a risk.

Wind direction, thermal effects and local current patterns affect many intakes. The affects may be due to a shallow bay, or proximity to a shallow bay, where the bottom sediments are resuspended into the intake water column or it may direct shoreline runoff over the intake. These impacts can be surveyed by delineating an additional area that contributes water to the general area and checking the potential contaminants in the area. Extensive interviews with plant personnel and review of historical records will be necessary. Once the impact has been determined, the assessment of the impact must be made.

Remote sensing, including aerial photography and satellite imagery, can be extremely revealing both in analyzing a history of events and near real time tracking of tributary and nearshore phenomena. Three-dimensional hydraulic models can be valuable tools for use in areas where they have been developed.

To complete the assessment, the susceptibility determination should include a general map of the area, the sensitivity analysis, delineation of the contributing areas, and listing of the locations of the various contaminant sources.

Before public release of the completed assessment, it should be reviewed with the water supplier for agreement of its contents.

Spill Assessments

Large volumes of materials are transported on the Great Lakes by shipping. Some of these materials are toxic in nature and are subject to accidental spillage during transit and loading. Ships also pose potential risks to intakes through accidental spills of fuel and lubricants. When doing vulnerability assessments of the intakes, this traffic should be considered. If ships pass in close proximity to an intake, or if there is a nearby commercial loading facility or harbor, procedures should be established by the water supplier to react to spills from these ships. It would not be possible to predict many specific contaminants from general shipping, but proximity of a particular industry serviced at a local harbor would indicate heightened risk potentials for specific products or supplies. Procedures could be developed for reaction to families of contaminants, such as volatile organic chemicals, pesticides, etc. Previous spills in the vicinity, if any, should be reviewed and assessed. The water supplier should have a contingency plan for guidance in an emergency.

Spills along lakeshores or connecting river shorelines should also be assessed along with potential spills from pipelines, docking facilities, railroad lines, etc. For example, there are numerous chemical plants along the St. Clair River, which connects Lake Huron to Lake St. Clair. These potential sites should first be identified and located on a map if the initial survey indicates there may be impacts from these areas. Procedures then should be developed for assessing and reacting to these types of emergencies. Where possible on the connecting rivers, modeling of the river flows could be used to assess potential impacts on intakes. In these cases, the specific contaminant would normally be known and this information could be used in the assessment.

For intakes located close to the lake shore lines, again the areas that could significantly impact the intake should be delineated. Potential spill sources in these areas such as

industries; disposal facilities, highways, railroads; pipelines, etc. should be located, mapped and assessed. Depending upon the type of potential risk, the specific contaminant may be identifiable, but this may not always be the case. These spills should be considered differently from the routine discharges that may exist. A spill is a unique event, and emergency reaction would be necessary to deal with the potential impact.

Surveys of fixed facilities, pipelines, highway and rail corridors and shipping routes have generally been completed and may be obtained by contacting the local emergency planning committee or the area planning committee. These two groups should have inventories of oil and hazardous materials at fixed facilities and along transportation routes.

Potential Treatment Impacts

The impacts from treatments at the intake should also be included in the assessments. Continual treatment for zebra mussels may cause development of other impacts on the finished water quality. Short-term treatments or impacts such as intake cleaning, dredging, construction, etc should also be included in the assessment.

Summary

An outline of the general methodology to be used for Great Lakes intakes should be a main part of the source water assessment program for states in the Great Lakes Region. Due to the unique nature of each intake, each assessment will be site specific. Assessments of the Great Lakes water quality in general have been done by various agencies and these efforts should be referenced not duplicated. The site-specific assessments, if done in close cooperation with the treatment plants and local surface water protection agencies, become valuable tools to future operations and planning.