WATER MANAGEMENT

POLICIES

GUIDELINES

PROVINCIAL WATER QUALITY OBJECTIVES

OF THE

MINISTRY OF ENVIRONMENT AND ENERGY

JULY, 1994

Ontario

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What's New

The following changes have been incorporated in this printing of *Water Management* 1994. The **page number refers to Appendix A**, not *Water Management* proper.

If your copy of *Water Management* is not reprinted Jan 95 or later, please request a newer reprint from either of the above Branches or the Public Information Centre at 416 325-4000, or download the pdf file from:
http://www.ene.gov.on.ca under "Publications" then "Manuals and Guidelines" then "Part B: Water"

The following were approved by the Director, Standards Development Branch on 28 July 1998.

Substance	**page**	**Conc (ug/L)**	**Change**
Carbaryl		0.2	new - adoption of Canadian Water Quality Guideline
Chromium	13	Cr VI 1 Cr III 8.9	revised - adoption of Canadian Water Quality Guideline, previously 100 ug/L
Molybdenum	21	40	revised, previously 10 ug/L
N-nitrosodimethyl amine (NDMA)		15	new
Vanadium	27	6	revised, previously 7 ug/L

The following were previously approved.

Substance	**page**	**Conc (ug/L)**	**Change**
Antimony	11	20	previously 7 ug/L in the July 94 printing
Cobalt	13	0.9	revised, previously 0.6 ug/L
Dinitrotoluene, 2,6-	16	6	revised, previously 3 ug/L
Hexachlorocyclo-pentadiene	19	0.06	revised, previously 0.07 ug/L
Hexachloroethane	19	1	revised, previously 3 ug/L
Tolyltriazole	26	no change	typographic error

1.0 INTRODUCTION

1.1 Preamble

This 1994 publication contains the Ministry of Environment and Energy policies and guidelines for the management of the province's water resources. It gives direction on how to manage the quality and quantity of both surface and ground waters.

With respect to surface water quality the goal is to ensure that the water quality is satisfactory for aquatic life and recreation and that water uses which require more stringent water quality be protected on a site specific basis. The Provincial Water Quality Objectives (PWQO's) will protect aquatic life and recreation uses and policy direction is provided about how to deal with situations where water quality is better or worse than the Objectives.

Ground water quality is to be preserved to protect the greatest number of uses.

Surface and ground-water quantity is to be managed to ensure a fair sharing, conservation, and sustainability of the resource.

1.2 Background

In 1970, the Ontario Water Resources Commission (OWRC) published "Guidelines and Criteria for Water Quality Management in Ontario". It was based on the 1967 publication by the OWRC entitled "Policy Guidelines for Water Quality Control in the Province of Ontario" and introduced water quality criteria for various uses. The 1970 publication concerned itself almost exclusively with surface water quality management.

In 1978, the Ministry of the Environment substantially revised and expanded the 1970 OWRC publication to include a range of policies and implementation procedures for surface and ground water quality and quantity management. The 1978 publication was modified in 1984 by incorporating changes to the Provincial Water Quality Objectives, but the goals, policies and implementation procedures for water management remained unchanged. This 1994 publication updates the 1984 publication but maintains the original policy directions. It provides a framework for a number of detailed guidance documents which assist in the implementation of the various policies.

This publication does not contain detailed procedures on how to achieve the protection of the water resources as defined by the policies and guidelines. Instead, it provides the basis upon which the limits of the uses of the resources can be established. For example, pollutant discharge limits can be determined based on the policies for water quality and the existing physical, chemical and biological conditions of the receiving water. How these limits may be achieved is a matter of local choice or conditions and other pollutant management strategies. Implementation details are contained in numerous supporting referenced documents throughout the publication.

1.3 MOEE's Legislative Authority

The Ministry of Environment and Energy's legislative authority to manage water comes primarily from two acts, the Ontario Water Resources Act (OWRA) and the Environmental Protection Act (EPA). The OWRA, which gives the MOEE extensive powers to regulate water supply, sewage disposal and to control sources of water pollution, expressly states that for the purpose of the Act the Minister has the supervision of all surface and ground waters in Ontario. The EPA prohibits the discharge of contaminants to the natural environment, including water except where specifically permitted by a Certificate of Approval. The goals, policies, and guidelines set out in this document assist those making decisions under or related to these Acts. They give, for example, directions that assist in defining site-specific effluent limits, which then may be incorporated into Certificates of Approval or Control Orders. These control documents are issued under the authority of the legislation, and thus become legally binding and constitute the basis for compliance and enforcement actions. The policies and guidelines themselves do not have any formal legal status but, by their successful use over the years, are now seen as standard practices for water resources management.

There are many other important aspects of water management that do not fall under the jurisdiction of the MOEE, but are the responsibility of other provincial and federal jurisdictions, most notably the Ontario Ministries of Natural Resources, Health and Agriculture, Food and Rural Affairs, Conservation Authorities and the Federal Departments of Fisheries and Oceans and Environment Canada.

1.4 The Policies and Guidelines of Water Management

General

The policies and guidelines in this publication are based on important principles such as the protection, preservation, and sustainability of the province's water resources for future generations. In order to effectively implement these principles, ecosystem and watershed management, how pollutants are controlled, and the inter-relationship of air, water and land management are all important considerations.

Ecosystem Management

The ecosystem approach views the ecosystem as composed of air, water, land and living organisms, and the interactions among them. It is the basis for environmental protection and resource management. It requires consideration of the cumulative effects on the environment, the inter-dependence of air, water and living organisms, and the relationships among the environment, the economy and society. Within the context of water resource management, ecosystem management includes the physical, chemical and biological components and their inter-relationships.

Environmental Protection and Multi-Media Considerations

The water management policies and guidelines supporting Provincial Water Quality Objectives (PWQO's) are the basis for establishing acceptable limits for water quality and quantity, consistent with the protection of the aquatic ecosystem and ground-water. They are equally applicable to local site specific situations, an entire watershed, or the Great Lakes. They establish the limit or the extent to which a water resource can be used without interfering with other uses.

In setting the limits or requirements for the protection of the water resource, the protection of other media such as land and air must be considered and are taken into account in the Approvals and Environmental Assessment processes. A project may have to be altered or scaled down to achieve the appropriate protection of all media. Multi-media considerations may lead to more stringent limits compared to those needed to protect the water resource alone.

MOEE's environmental protection strategy places priority on preventing, then minimizing the creation of pollutants. When the creation of pollutants cannot be avoided, the Ministry's priority is to prevent their release to the environment and second, to minimize their release.

a) Pollution Prevention

A guiding principle for the management of pollutants is that the pollution prevention approach is far more desirable than end of pipe treatment. Pollution prevention includes practices that eliminate or reduce through conservation or more efficient use of hazardous or non-hazardous materials, energy, water, or other resources. Finding alternative production processes and chemicals, using best management practices and water conservation are preferable approaches to simply concentrating on meeting the established effluents limits through waste treatment.

b) Management of Hazardous Substances

Hazardous substances (i.e. persistent, bioaccumulative toxic substances), should be dealt with regard to their impact on the ecosystem. These hazardous properties make control on an ecosystem and multi-media (air, water, land) basis absolutely essential. The hierarchial management approach of reducing discharges to zero through banning or phasing out, or at the very least, curtailing escape to the environment as much as possible, is one of the fundamental approaches for the control of these pollutants in Ontario.

c) Municipal and Industrial Strategy for Abatement (MISA)

The limits regulations developed through the MISA program have as their goal the virtual elimination of persistent toxic substances. The effluent limits contained in these regulations generally are based on levels achievable by best available treatment technology economically achievable. These regulations represent a major and important component in the Ministry's strategy to abate pollution sources and improve the ecosystem.

Watershed Planning

Watershed planning considerations address the inter-relationships of the hydrologic regime, water use patterns and land use planning thus making watershed planning a preferred basis for water management decisions. In keeping with the ecosystem approach to water resource management, the inter-relationship of surface and ground water quality and quantity have to be recognized in water management decision making processes. For example, decisions related to Permits To Take Water should be reviewed for their potential cumulative impact on water quality.

Any activity that has the potential for affecting water quality or quantity requires close scrutiny. For example, the development of land and the resulting non-point sources of pollution have proven to have significant impact on water resources, and thus deserve careful attention. The inter-relationships of land use management and water management have to be clearly understood and considered if the principles of protection, preservation and sustainability are to be preserved.

2.0 PROVINCIAL WATER QUALITY OBJECTIVES

Provincial Water Quality Objectives (PWQO) are numerical and narrative criteria which serve as chemical and physical indicators representing a satisfactory level for surface waters (i.e. lakes and rivers) and, where it discharges to the surface, the ground water of the Province. The PWQO are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water. The Objectives for protection of recreational water uses are based on public health and aesthetic considerations.

Provincial Water Quality Objectives are intended to provide guidance in making water quality management decisions such as the designation of the surface waters of the Province which should not be further degraded. They are often used as the starting point in deriving waste effluent requirements included in Certificates of Approval and other instruments issued to regulate effluent discharges. They are used to assess ambient water quality conditions, infer use impairments, assist in assessing spills and monitoring the effectiveness of remedial actions.

The Ontario Ministry of Environment and Energy has established a comprehensive process for setting Provincial Water Quality Objectives as described in the MOEE publication "Ontario's Water Quality Objective Development Process", 1992. Reference documents providing details on the development of each PWQO are also available from MOEE.

A complete listing of the PWQO is contained in Appendix A. The PWQO listing is routinely updated to reflect new or revised Objectives.

In addition to the Provincial Water Quality Objectives, water resource managers can employ, where appropriate, a variety of other Objectives or Guidelines that relate to specific uses. The Ontario Drinking Water Objectives, published by MOEE, contains a comprehensive list of treated drinking water objectives primarily employed for the protection of public health. The Canadian Water Quality Guidelines, published for the Canadian Council of the Ministers of the Environment, contain a wide range of specific-use objectives including agricultural uses and industrial water supplies.

3.0 SURFACE WATER QUALITY MANAGEMENT

3.1 Goal

The surface waters of Ontario are put to many uses, and each use has specific water quality requirements. As a general management principle, water quality must be protected, preserved or restored to permit the greatest number of uses, based on the best interest of the people of Ontario. Water which meets the water quality requirements for the protection of aquatic life and recreation (i.e. the Provincial Water Quality Objectives) will, in most cases, be suitable for other surface water uses.

The surface water quality management goal is, therefore:

> *TO ENSURE THAT THE SURFACE WATERS OF THE PROVINCE ARE OF A QUALITY WHICH IS SATISFACTORY FOR AQUATIC LIFE AND RECREATION.*

Provincial Water Quality Objectives are useful indicators of, but not direct measurements of aquatic ecosystem health. Non-chemical factors such as the loss of habitat, sedimentation, water quantity regulation and the introduction of non-indigenous species often have profound and over-riding influences on aquatic ecosystems.

Meeting the Provincial Water Quality Objectives is the minimum requirement. Considerations such as ecosystem health, the additive effects of more than one chemical, or the protection of other uses may lead to more stringent requirements. For example, in site specific situations, where better water quality is required than that provided by the PWQO's to protect beneficial uses in a given location, the appropriate, more stringent criteria shall be applied in that location.

Ontario borders on inter-provincial and international waters, and the implications of the Province's activities must be considered in that context. For example, the Province has agreed that the Specific Water Quality Objectives contained in the Great Lakes Water Quality Agreement or more stringent Provincial objectives shall be used in environmental programs to achieve and maintain Great Lakes water quality. Also, Ontario enforces effluent requirements developed by the Federal Government for specific industrial sectors and for specific pollutants.

3.2 Policies

The following policies deal with two situations: a) where water qualify is better than the Provincial Water Quality Objectives; b) where water quality presently does not meet the Objectives. These water quality designations are made on a parameter by parameter basis and compliance or non-compliance with the Provincial Water Quality Objectives should be determined from data that adequately reflect the spatial and temporal variations of the quality of the waterbody under consideration.

3.2.1 Areas with Water Quality Better than the Objectives

Policy 1

"In areas which have water quality better than the Provincial Water Quality Objectives, water quality shall be maintained at or above the Objectives."

Although some lowering of water quality is permissible in these areas, degradation below the Provincial Water Quality Objectives will not be allowed, ensuring continuing protection of aquatic communities and recreational uses.

3.2.2 Areas with Water Quality Not Meeting the Objectives

Policy 2

"Water quality which presently does not meet the Provincial Water Quality Objectives shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the Objectives."

Evaluations of existing conditions in problem areas shall be conducted and all reasonable and practical measures shall be taken to upgrade water quality to the Provincial Water Quality Objectives. Where new or expanded discharges are proposed, no further degradation will be permitted and all practical measures shall be undertaken to upgrade water quality. However, it is recognized that, in some circumstances, it may not be technically feasible, physically possible or socially desirable to improve water quality toward the Provincial Water Quality Objectives.

Accordingly, where it is clearly demonstrated that all reasonable and practical measures to attain the Provincial Water Quality Objectives have been undertaken but where:

1) the Provincial Water Quality Objectives are not attainable because of natural background water quality; or

2) the Provincial Water Quality Objectives are not attainable because of irreversible human-induced conditions; or

3) to attain or maintain the Provincial Water Quality Objectives would result in substantial and widespread adverse economic and social impact; or

4) suitable pollution prevention techniques are not available;

then deviations from this policy may be allowed, subject to the approval of the Ministry of Environment and Energy. Detailed procedures for preparing a deviation are described in "Guideline for Handling Requests for Deviations." in the MOEE document entitled *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters* (1994).

Before approval for a deviation is granted, consideration should be given to the impact of the deviation on the mandate or concerns of other agencies and the public. Agencies such as the Ministries of Natural Resources, Health, Agriculture, Food and Rural Affairs, Conservation Authorities and the Federal Departments of Environment and Fisheries and Oceans should be consulted, where appropriate.

Where public hearings into proposals for new or expanded discharges are held under the Environmental Assessment Act or the Ontario Water Resources Act, such hearings may be utilized to consider this issue.

As a condition to granting a deviation, a periodic review should be required of the reasons leading to the deviation and an evaluation of their continued relevance.

3.3 Hazardous Substances

Hazardous substances, acting individually or in combination with other substances, can cause death, disease including cancer, behaviour abnormalities, genetic mutations, physiological malfunctions, malfunctions in reproduction or physical deformities in organisms (plants and animals, including humans) or their offspring. The consequences of contamination of the environment by hazardous substances may also include a loss of valuable species, restrictions on important socio-economic activities or a variety of irreversible ecological changes that threaten future use and enjoyment of the environment. Hazardous substances can occur in nature (e.g. mercury) or can be created by human activity (e.g. PCB). Some have been developed to meet important needs (e.g. DDT) and some are unintentional by-products of industrial activities (e.g. dioxins).

Some hazardous substances listed in Appendix B, have been banned from use in Ontario. Other candidate substances for bans, phase-outs or reductions are included in Tables 1.7 and 1.8 in the MOEE publication entitled "Candidate Substances For Bans, Phase-Outs Or Reductions - MultiMedia Revision" October 1993.

Because of their inherently hazardous nature, every effort should be made to prevent these substances from gaining access to the environment. From an environmental protection perspective, the application of pollution prevention principles, that is, avoiding the creation of the pollutants in the first place, is far more desirable than reliance on waste treatment.

The MOEE policies for the management of hazardous substances in surface waters are:

Policy 3
Prevent the release, in any concentration, of hazardous substances that have been banned.

Provincial Water Quality Objectives have been developed for many of the banned hazardous substances in Appendix B. It should be emphasized that these Objectives are not to be used for the development of new waste loadings for these substances. Rather, they provide a benchmark available to assess the environmental implications of past releases or accidental losses and remediation work.

Specific control procedures for the other hazardous substances as for example those contained in the "Candidate Substances For Bans, Phase-Outs Or Reductions" report have yet to be formulated pending further technical and socio/economic evaluations. The MOEE policy for dealing with these substances is:

Policy 4
Ensure that special measures are taken on a case by case basis to minimize the release of hazardous substances that have not been banned.

For these hazardous substances it is not appropriate to use the assimilative capacity of receiving waters and mixing zones to attenuate the treated wastes.

3.4 Mixing Zones

A mixing zone is defined as an area of water contiguous to a point source or definable diffuse source where the water quality does not comply with one or more of the Provincial Water Quality Objectives. A mixing zone is, under no circumstances, to be used as an alternative to reasonable and practical treatment. It must be designed to be as small as possible and is one factor in establishing effluent requirements.

The concept of mixing zones recognizes that the cost of treating all waste discharges to the PWQO's may not be justified. As a general principle, the dilution of such effluents, and thus the use of mixing zones, should be minimized and limited to conventional pollutants.

Policy 5
Mixing zones should be as small as possible and not interfere with beneficial uses. Mixing zones are not to be used as an alternative to reasonable and practical treatment.

Conditions within a mixing zone must not result in toxic conditions or irreparable environmental damage including risk to ecosystem integrity and human health nor interfere with water supply, recreational or other water uses.

Terms and conditions related to a mixing zone will be designated on a case-by-case basis and may be specified in Certificates of Approval, Control Orders, Requirements and Directions, or approvals to proceed under the Environmental Assessment Act. Mixing zones do not apply to discharges that have not received MOEE approval (eg. spills and illegal discharges).

A detailed description of mixing zone requirements and implementation procedures are contained in *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters* (1994).

3.5 Implementation Procedures for Effluent Requirements

Substances that impair water and sediment quality are a major environmental problem. Many of these substances are toxic to aquatic life such as fish and aquatic invertebrates, in both the water column and sediment. Others are persistent and bioaccumulative and can cause food chain effects resulting in elevated levels of contaminants in fish, wildlife, birds and people who eat fish. Substances, such as nutrients, when present in excess can upset the natural balance of an ecosystem. Still others can impair the use of the water by producing tastes and odours.

Polluting substances enter the water from many sources. Industrial and municipal discharges of wastewater, contaminated runoff from urbanized and agricultural areas, deposition of air pollutants, and lakefilling all are important sources of contaminants. Some substances, such as metals, are naturally occurring and their presence in water can be the result of natural processes.

The following are general procedures for determining effluent requirements. In general terms the directions given deal with how to define limits for wastewater discharges to surface water using the two policies for surface water quality management described in Section 3.2 as well as the policies dealing with hazardous substances, and mixing zones which are presented in sections 3.3 and 3.4, respectively. Detailed directions for setting effluent requirements are contained in the MOEE publication, *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters* (1994).

Guidelines and procedures related to the management of aquatic sediments (MOEE Policy B-1-3) and lakefilling (Policy B-1-4) are fully described in MOEE publications "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, 1993" and "Fill Quality Guidelines for Lakefilling in Ontario, 1992", respectively.

3.5.1 General Procedures for Establishing Effluent Requirements

In establishing effluent requirements for discharges to surface waters, the procedures outlined below should be followed:

1) Site-specific receiving water assessments will be conducted to assess existing conditions and determine effluent requirements based on the waste assimilative capacity of the receiver.

2) The site-specific effluent requirement, so derived, will be compared, where applicable, to appropriate federal or provincial regulations or guidelines for effluent discharges and the most stringent requirement will be applied.

3) The effluent requirement derived from the above procedures, expressed as waste loadings and/or concentrations, will be incorporated into a Certificate of Approval or other control document.

4) For existing discharges in areas where water quality is degraded and does not meet the Provincial Water Quality Objectives, the Ministry may develop a pollution control program with each discharger to meet the effluent requirement determined from the above procedures.

Through the incorporation of water quality based limits into legally enforceable control documents such as a Certificate of Approval, the policies for water quality management become enforceable. These limits most commonly are for municipal or industrial point sources, but may also be applied to cooling water, stormwater or other polluting sources.

4.0 GROUND WATER QUALITY MANAGEMENT

Ground water in Ontario is an important source of water for various uses, including domestic, public, agricultural, commercial and industrial water supplies. Ground water is often the primary source of rural and urban drinking water supplies. It is an important component of the aquatic ecosystem. Streamflow originates and is maintained in many parts of the province through sources from ground water. Ground water maintains wetland ecosystems.

For practical proposes, and with present control technology, ground water contamination, in most cases, can be considered long term once it occurs. In general, restoration of ground water quality is difficult and extremely expensive. Therefore, the emphasis of ground water management is on pollution prevention. Ontario's ground water quality management principle and implementation procedures reflect the fact that ground water differs from surface water in significant respects.

In the majority of cases, consumption by humans will be the most important use of water to be protected, but there are other ground water uses such as agriculture with specific water quality requirements which also will be protected. The protection of aquatic life is a very important consideration in cases where ground water is a component of streamflow.

Recognizing that ground water is a valuable resource supporting a variety of uses, the Ministry of Environment and Energy's policy for ground water quality management is:

Policy
To protect the quality of ground water for the greatest number of beneficial uses.

4.1 Implementation Procedures

4.1.1 Regulated Sources of Pollution

Activities with the potential to adversely affect ground water that require MOEE approval under the OWRA or EPA are wide-ranging and include water works, wastewater treatment infiltration basins, landfills, waste disposal into deep wells, spray irrigation, sludge utilization or disposal operations, septic tank systems and mine tailings.

The treatment or elimination of pollutants from existing regulated sources is required where the polluter fails to demonstrate that such measures are impractical and unnecessary to remediate use impairment, prevent further degradation and improve water quality. Where such measures are not practicable, the Ministry may require replacement of the affected supplies.

The waste control requirements for proposed regulated sources of pollution are established on a case by case basis. Water quality degradation is controlled to protect existing and potential reasonable uses of both ground and surface waters. The MOEE may stipulate requirements for these activities related to the quality and quantity of the discharge in a Certificate of Approval.

MOEE Policy B-7, "Incorporation of the Reasonable Use Concept into the MOEE Groundwater Management Activities", contained in the MOEE Manual of Guidelines and Procedures, 1994, addresses active or proposed sources of contaminant discharges to ground water that are being permitted or regulated by the Ministry. This includes landfills, exfiltration lagoons and large subsurface disposal systems. Policy B-7 provides a procedure for determining the reasonable use of ground water and establishes limits to the amount of degradation that will be allowed such that this use will not be impaired.

4.1.2 Unregulated Sources of Contamination

There are a number of activities that do not require specific approval under the Ontario Water Resources Act or the Environmental protection Act but have the potential to contribute to ground water contamination. They include non-point source activities (i.e. crop fertilization, manure application, road deicing), salt storage areas, unlicensed and closed landfills, leaks, spills and decommissioning clean-up.

The treatment or elimination of pollution from unregulated sources will be required where it is demonstrated that such measures are practicable and necessary to correct use impairment and will prevent further degradation or improve water quality. Where such measures are not practical, the Ministry may require replacement of the affected supplies.

MOEE Policy B-9, "Guidelines for the Resolution of Groundwater Quality Interference Problems", contained in the MOEE Manual of Guidelines and Procedures, 1994, addresses the cleanup or remediation of contaminant discharges to the ground water that have not been subject to approval by the Ministry. This includes such things as spills and closed waste disposal facilities. Policy B-9 establishes the urgency of the Ministry response, an approach based on cost/benefit analysis for determining the extent or degree of cleanup and establishes the Ministry position with respect to the restoration of water supplies that have been contaminated.

5.0 WATER QUANTITY MANAGEMENT

The protection and control of water quantity is a key component of Ontario's water management strategy. Management of water quantity is needed to avoid conflicts among various users.

Water quantity and quality are closely related, inasmuch as the amount and physical characteristics of water available are an important aspect of water quality. Ground water quantity management is essential for the added reason that ground water is often an important component of streamflow.

Water quantity management in Ontario involves a combination of common law, land patent, and federal and provincial statutes. The main involvement of the Ministry of Environment and Energy in this field is through the water taking permit system under the Ontario Water Resources (OWR) Act. Specific details are contained in "Permit To Take Water Program Guidelines and Procedures Manual", MOEE, 1984.

Recognizing the many and varied uses of water, the MOEE policy for the management of water quantity is:

Policy
To ensure the fair sharing, conservation and sustainable use of the surface and ground waters of the province.

5.1 Guidelines Common to Surface and Ground Water

Many water quantity management guidelines and procedures are common to both surface and ground water and are summarized in this section. Requirements that are specific to either surface water or ground water are contained in Sections 5.2 and 5.3, respectively.

5.1.1 Permits To Take Water

Guideline
"Water takings will be controlled to prevent interference with other uses of water wherever possible and to resolve such problems if they do occur."

Under the Ontario Water Resources Act, the Ministry of the Environment and Energy administers a water permit program, under which most takings in excess of 50,000 litres in a day require authorization by means of a Permit to Take Water. This includes temporary takings such as withdrawals from a well for purposes of a pumping test.

Takings which are generally exempt from the water permit legislation, but which are found to interfere seriously with other users, can be prohibited without a permit and thus brought under the provisions of a water permit. The only exception to this provision is the taking of water by an individual for ordinary household purposes, livestock watering, and fire fighting.

An application for a water permit is reviewed in light of information concerning the availability of the supply, the use to which the water is to be put, and the effects of the proposed taking on existing uses. Permitees may be required to keep records of the withdrawals.

When evaluating the relative priority of uses in an area where there is insufficient water to meet established and new uses, the taking of water for private domestic and farm purposes is considered the most important use, generally followed by municipal water supply. The taking of water for industrial, commercial and irrigation purposes is regulated by the availability of the supply, the efficiency of use and established uses in an area. The use of water for pollution control, flood control, fire protection, recreation, wildlife preservation and the protection of habitats are also important considerations.

5.1.2 Water Quality/Quantity Inter-relationships

Guideline
"Surface and ground water withdrawals, and the discharge of water to surface water bodies will be controlled to assist in maintaining or restoring water quality for the protection of aquatic ecosystems and recreation and to provide for downstream withdrawal uses."

Water takings should be controlled to avoid water quality impairment as well as to protect withdrawal uses. Under appropriate conditions, streamflow augmentation from either surface or ground water sources may be considered as a supplementary means of maintaining water quality. Controls on land-use practices, discharges of water from urban drainage, and agricultural drainage and similar artificial discharges will be encouraged to prevent water quality degradation and to minimize any increase in peak flows.

5.1.3 Water Conservation

Guideline
"All reasonable and practical measures should be taken to conserve the quantity of surface and ground water to sustain ecosystem integrity and to maximize its availability for existing or potential uses."

In flowing well areas, appropriate management practices incorporating site-specific considerations should be undertaken to conserve ground water and thereby protect streamflows. Where a new flowing well is constructed, a flow control device must be installed in accordance with the requirements of Ontario Regulation 903.

Explicit statements respecting water conservation should be incorporated into appropriate planning documents and all parties proposing or reviewing proposed projects in such areas should ensure that appropriate conservation measures are undertaken.

5.1.4 Surface/Ground Water Quantity Inter-relationships

Guideline
" The importance of the inter-relationships between surface and ground water quantity will be taken into account in water quantity management decisions."

If the taking of water from wells causes interference with streamflow, restoration of supplies is required if serious interference with surface water uses occur.
Groundwater takings that impact streams will be allowed only after due regard to the maintenance of sufficient streamflow to protect both in-place and withdrawal uses downstream.

5.2 Additional Provisions - Surface Water Quantity Management

While the water permit legislation is designed to manage the use of water resources in the Province, riparian rights are not superseded, but may be limited in some cases by the water permit legislation.

Permits for stream takings shall contain a requirement that the taking of water be carried out in such a manner that downstream flow is not stopped or reduced to a rate that will interfere with downstream uses of water or the natural functions of the stream.
A permit for a taking from any surface waterbody shall contain a requirement that if the taking interferes with the use of water by other persons, the terms and conditions of the permit may be altered.

Other special terms and conditions relating to a taking may be stipulated on a case-by-case basis to deal with special circumstances.

When water is taken from streams which cease to flow seasonally due to natural causes, downstream flow must be maintained whenever there is an inflow. The release of water from storage to maintain downstream flow is not required when there is no inflow.

With respect to the taking of cooling water, the design and location of the water intake must be such that entrainment of fish, including larval fish and eggs, and other aquatic life is minimized.

5.3 Additional Provisions - Ground Water Quantity Management

If a ground water taking authorized by permit interferes with other water supplies obtained from any adequate sources that were in use prior to the issuance of the permit, the permittee shall restore the affected supplies or reduce the taking so as to eliminate the interference.

The free flow from a flowing well is not protected in the event of interference by another ground water taking. In the event of interference with a flowing well supply, restoration of the supply is required, provided that the well was equipped with at least a shallow-well pump having an adequate intake located in the portion of the well that is in direct hydraulic connection with the water-bearing formation. Furthermore, the well had to be capable of meeting the daily water demands on a continuous basis by a combination of its storage, water yielding and pumping capabilities, prior to interference.

The restoration of a water supply is not required in an area where a property has community water service available if the interference is caused by the construction or operation of works for the improvement and service of the community, such as municipal wells, sewers, water mains, roads and

bridges. Where interference in a water serviced area is caused by an operation not associated with a community improvement, restoration of a water supply is required.

Parties causing short-term interference with existing supplies where water service is or is not available are required to make available a temporary supply of water to those experiencing interference. This applies to interference resulting from such operations as pumping tests, excavation dewatering, and other short-term water takings.

Ground water encountered during construction projects and excavations where ground water may flow by gravity either out of the excavation or along granular trench bedding can cause serious interference with water supplies by lowering well water levels. The person whose works cause the problem may be required by notice under Section 34 of the OWR Act to stop or control the leakage or to take such measures as the notice may require, such as to restore the affected supply.

Artificial ground water recharge should be encouraged wherever practical to conserve ground water.

Protection of areas with high infiltration rates is generally a good management practice. In evaluating proposals for development in significant infiltration areas, the effects on infiltration rates and the quality of the infiltrating water should be considered.

GLOSSARY

Acute Toxicity - An adverse response, ranging from injury to death, following exposure of short duration relative to the normal lifespan of the organism.

Additive Effects - Toxic interactions of two or more substances on organisms producing a result such that the total effect approximately equals the sum of the individual effects.

Aesthetic - Dealing with those aspects of water that are perceived by the senses (e.g. taste or odour).

Assimilative Capacity - the limit of a waterbody to transform and/or incorporate substances (e.g. nutrients) by the ecosystem, such that the water quality does not degrade below a predetermined level.

Background Water Quality - The physical, chemical and/or biological conditions of a waterbody at a point upstream/up current of a polluting source. The establishment of background water quality may be based on historical data or on water quality in a similar, unaltered waterbody.

Ban - Prohibition of the use or release to the environment of specific substances judged to be particularly hazardous. Bans would normally be applied on a provincial or national basis.

Best Management Practices - (BMPs): Management procedures or structural practices designed to reduce the quanty of pollutants – e.g. contaminants, nutrients, sediments, animal wastes – washed by rain, snowmelt etc. from residential or farm lands into receiving waters, such as lakes, streams, rivers, and into groundwater.

Best Available Treatment Technology - can include, in order of preference - changes in production processes, chemical substitution, in-plant controls, best management practices, water conservation, waste treatment technologies, energy conservation.

Bioaccumulation - the process by which chemicals are amassed by organisms from water directly or through the consumption of food containing the chemicals.

Certificate of Approval (C of A) - A legal document issued, at a proponent's request, by a Designated Director of the Ministry of Environment and Energy under the authority of the Ontario Water Resources Act. C of A's may include effluent requirements and monitoring requirements.

Common Law - Law which relies for its authority on the decision of courts and is recorded in law reports as the decisions of judges along with the reasons for their decisions, as opposed to law established in a statute.

Compliance - A state achieved by adhering to the legislative and regulatory requirements of the Ontario Ministry of Environment and Energy. These requirements cover a wide range of activities, from the prevention, reduction and elimination of pollution, to the obtaining of approvals and licences, to the completion of routine paperwork and the filing of reports.

Contaminant - A substance which, once in the water, may pose a threat to the ecosystem and/or human health, as well as uses such as water supply, recreation, and aesthetic conditions.

Control Order - A document that requires the discharger to take specific action with an associated deadline. It is authorized by statute, binding upon the recipient, and directly enforceable by prosecution.

Conventional Pollutants - Traditional indicators of environmental quality including BOD, nutrients and solids.Materials defined as hazardous substances are not included in this category.

Effluent - the wastewater discharged to a receiving water body.

Effluent Limit - A legally enforceable effluent requirement.

Entrainment - The incidental capture of aquatic organisms in water being extracted (e.g. pumped) from a natural waterbody.

Flowing Well - a well in which the static water level is above ground level.

Hazardous Substances - chemicals that are persistent, bioaccumulative and extremely toxic. They including substances which, individually or in combination with other substances, can cause death, disease including cancer, behaviourial abnormalities, genetic mutations, physiological malfunctions and/or physical deformities.

Implementation Procedures - A set of activities required for the appropriate execution of a Water Management policy or guideline.

Irreversible Man-induced Conditions - An existing condition impairing water quality and/or uses caused by human activity. The actions are such that natural conditions cannot practically be restored. Examples might include removal of old-growth forest or urbanization.

Land Patent - A grant of land from the Crown under the Great Seal which may retain some interests in the land for the Crown.

Natural Background Water Quality - Chemical, physical and biological quality of a waterbody, if unaffected by human activity.

Non-indigenous - Not native or not belonging naturally to an area.

Non-point Source - A non-specific or diffuse source entering the aquatic environment. Commonly, any source that cannot be described as a point source. Usually, this type of source is not amenable to collection and, if necessary, treatment.

Objectives - Provincial Water Quality Objectives

Parameter - A measurable or quantifiable characteristic or feature of water quality.

Permit to Take Water - A permit issues by a designated Director of the Ministry of Environment and Energy, authorizing the taking of surface or ground water in excess of 50,000 litres per day as provided for under the Ontario Water Resources Act.

Permittee - The individual or group to whom a permit has been granted.

Persistence - Longevity in the environment usually expressed as half-life.

Persistent Pollutant - A substance with an environmental half-life in excess of 50 days.

Point source - A source of pollution that is discharged to the environment at a specific location. It is quantitatively and qualitatively definable.

Pollution Prevention - Any action which eliminates or reduces the creation of pollutants or waste at their source through measures such as substitution/reduction in use of a raw product, production redesign, process change, in-process recycling and/or improved maintenance and operating procedures.

Receiving Water - A waterbody to which a discharge is directed.

Remedial Actions - Actions undertaken to upgrade water quality and restore uses to a waterbody previously impaired. Initial actions are usually to eliminate or reduce the source(s) of the problem and can include physical intervention (e.g. dredging, artificial aeration, flow augmentation, etc.)

Riparian Rights - The common law rights of owners of property along a river or shore of other bodies or water. These rights include, stated generally, the right to make reasonable use of the water flowing past their land.

Streamflow Augmentation - The addition of water, often from reservoir storage or groundwater, to a river or stream to increase its base flow.

Sustainability - The utilization of a resource in a manner that the resource will be adequately protected for indefinite future use.

Surrogate - A convenient and/or practical substitute.

Toxic substance - A substance capable of producing an adverse response, ranging from injury to death, in a living organism.

Toxicity - An adverse response, ranging from injury to death, in a living organism.

Waste - any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from the activities of man which may: impair the quality of the natural environment for any use that can be made of it; cause injury or damage to property or to plant or animal life; cause harm or material discomfort to any person; adversely affect the health or impair the safety of any person; or render any property or plant or animal life unfit for use by man.

Water Conservation - Preservation of the quantity of available water through judicious use, reuse and minimal wastage.

Waste Assimilation - (See Assimilative capacity)

Watershed - The area of land drained by a river/stream and its tributaries.

APPENDIX A

PROVINCIAL WATER QUALITY OBJECTIVES

February, 1999

PREFACE

This document provides both a listing of MOEE's surface water quality criteria and supports the MOEE publication *Water Management: Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy* (1994). Questions on the contents of this document should be directed to the Environmental Standards Section, Standards Development Branch, Ministry of Environment and Energy (MOEE).

This document consolidates all current MOEE Provincial Water Quality Objectives (PWQOs) and Interim PWQOs. It contains all the current PWQOs and Interim PWQOs. **All earlier listings of PWQOs are replaced by this publication**. Users of this publication should also be aware that some earlier versions of Interim PWQOs may have been changed and that some have been withdrawn in this current publication.

With this publication, MOEE has adopted new, simplified terminology (i.e. PWQO and Interim PWQO) to replace the terminology previously in use.

As well as the PWQOs themselves, this publication provides important supporting information, including: a definition of what PWQOs are, a summary of how they are set, practical considerations associated with PWQO development, the availability of scientific rationale documents for the PWQOs, and the use and implementation of PWQOs. The document also provides information on recreational objectives, general narrative objectives, fish tissue residue criteria, and other water quality objectives and guidelines that should be considered.

ACKNOWLEDGEMENTS

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INTRODUCTION

Contaminants that impair water quality are a major environmental concern. Many of these contaminants are toxic to aquatic life such as fish and aquatic invertebrates, in both the water column and sediment. Others are persistent and/or bioaccumulative and can cause food-web effects when fish, wildlife, birds and people consume contaminated organisms. Still other contaminants may impair the human use of the water or upset the natural balance of the aquatic ecosystem.

Contaminants may enter the water from many sources. Industrial and municipal discharges of wastewater, contaminated runoff from urban and agricultural areas, deposition of air pollutants, lakefilling, leachate from landfill sites and industrial areas, and pesticide use are all important sources. Some of these contaminants are naturally occurring, and their presence in the water is the result of natural processes. Managing contaminants that impair water quality is an important component of managing the waters of the Province.

The MOEE goals, policies and guidelines for the management of the Province's water resources are outlined in *Water Management* (1994). The surface water policies require a minimum acceptable level of water quality to be defined for the waters of the Province. This defined level of water quality provides a baseline for assessing the quality of the waters of the Province and acts as a simple, surrogate measure of ecosystem health. The minimum acceptable level of water quality is represented by the Provincial Water Quality Objectives (PWQOs).

1.1 What are PWQOs?

PWQOs are numerical and narrative ambient surface water quality criteria. They are applicable to all waters of the province (e.g. lakes, rivers and streams) except in those areas specifically designated, such as areas influenced by MOEE approved point source discharges. In specific instances where groundwater is discharged to surface waters, PWQOs may also be applied to the groundwater.[1] PWQOs represent a desirable level of water quality that the MOEE strives to maintain in the surface waters of the Province. In accordance with the goals and policies in *Water Management* (1994), PWQOs are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycle during indefinite exposure to the water. The PWQOs for protection of recreational water uses are based on public health and aesthetic considerations.

The PWQOs are listed in Table 2 of this document.

[1] - Most often, groundwater is assessed using Ontario Drinking Water Objectives or appropriate agricultural guidelines, depending on the specific use for the groundwater.

1.2 **How are PWQOs Set?**

The MOEE has established a comprehensive process for setting Provincial Water Quality Objectives. This process is detailed in the MOEE publication *Ontario's Water Quality Objective Development Process* (1992). The document also describes the process used to set Interim PWQOs (described below). The process to establish ambient surface water quality criteria is a practical, but conservative method of estimating a safe concentration even when limited toxicity data are available.

1.2.1 Setting Provincial Water Quality Objectives

Through a review of the global aquatic toxicological literature, a database of the available information is established. PWQOs are established when a defined minimum information base representing the following effects is available: aquatic toxicity; bioaccumulation; and mutagenicity. The final PWQO is based on the lowest effect concentration reported for any of the above endpoints with an added safety factor. Additional information on taste and odour in water, tainting of fish flesh, impacts on wildlife and recreation, if available, is taken into consideration and may influence the final PWQO value. Draft scientific criteria documents for the development of PWQOs are distributed for international scientific peer review. Public review, as outlined in the Environmental Bill of Rights, is also sought.

1.2.2 Setting Interim Provincial Water Quality Objectives

For many substances of concern, there is insufficient toxicological information available to prepare a PWQO. In these cases, an Interim Provincial Water Quality Objective is established. To achieve a consistent approach in establishing environmental protection values for substances with limited information, a prescriptive process for setting Interim PWQOs was developed. This process parallels the PWQO setting process by employing toxicological data as well as considering bioaccumulation, mutagenicity and other factors. Generally, Interim PWQOs are developed with the intention of upgrading them to PWQO status as sufficient information becomes available. The Interim PWQO is based on the lowest effect concentration reported and an "uncertainty factor". The size of the uncertainty factor reflects the quality and quantity of data available, and the potential of the substance to bioaccumulate. Once documentation is complete to the satisfaction of MOEE staff, draft Interim PWQOs are also distributed for peer and public review as described for PWQO, above. Users of these Interim PWQOs based on draft scientific criteria development documents must employ due caution as the Interim PWQOs are subject to change based on review comments and additional data.

1.2.3 Setting Interim PWQOs to Meet Emergency Needs

Occasionally, to meet emergency needs, a numerical criterion is required for a substance that does not have a PWQO or Interim PWQO. In such cases, MOEE has an accelerated procedure using the same approach described above for setting Interim PWQOs. These Interim PWQOs are based on information derived from a search of electronic databases and the best information at hand.

Unlike full PWQOs or Interim PWQOs set in the usual manner, the Interim PWQOs set for emergency purposes are not subject to peer review or formal Ministry publication. Users of Interim PWQOs must be prepared to employ due caution in the application of these values and recognize that the values may substantially change when the Interim PWQOs set for emergency purposes are ultimately converted to PWQOs.

1.3 What are the Recreational Objectives Based on?

The Objectives for the protection of recreational water uses are based on public health and aesthetic considerations. The basis of the objectives for the protection of recreational water uses is that the use of water for swimming, bathing and other recreational activities requiring immersion of the user should not cause disease in the human user nor should use of the water cause impairments which might lead to physical injury (e.g. from poor underwater visibility) or irritation, or to loss of enjoyment of the water. The potential for harmful effects from exposure to chemical substances during recreational uses is unknown at present, but will be considered when scientific information becomes available.

The Recreational Objectives are listed alphabetically in Table 2 of this document. Specific recreational objectives are available for: Aesthetics, pH, Water Clarity and *Escherichia coli* (for ease of use, *E. coli* is cross-referenced under the headings Bacteria, Microbiology, Public Health Considerations, and Swimming and Bathing).

1.4 What are some of the Practical Considerations Associated with PWQOs & Interim PWQOs?

PWQOs and Interim PWQOs are conservative estimates of a level of water quality which is fully protective of all aspects of aquatic life. As such, they are often used as surrogates for assessing aquatic ecosystem health. For example, exceeding PWQOs may indicate that environmental conditions are degraded or impaired for supporting aquatic life. Since direct measurements of ecosystem health are also desirable, MOEE, in cooperation with other agencies, is investigating the development of biological indicators that more directly assess ecosystem health or status.

The PWQOs and Interim PWQOs are set for individual chemicals or homologous groups of chemicals and, for the most part, do not account for joint toxicity (i.e. additive, synergistic or antagonistic effects) resulting when a mixture of hazardous substances is present in a waterbody. Toxicity of mixtures is a complex area which has not yet been fully evaluated by the MOEE. Water quality managers should consider that waters with a quality at or near the Objectives for several parameters may not afford adequate protection to aquatic life. In these situations, joint toxicity models may be of some use. Alternatively, the empirical approach of monitoring the toxicity of whole effluent or receiving water samples, as well as bioassessment, may be useful in assessing the joint toxicity of complex mixtures.

PWQOs and Interim PWQOs do not take into account analytical limits, treatability or removal potential, socio-economic factors, background concentrations, or potential transport of

contaminants among air, water and soil. These factors are considered in the policies found in *Water Management* (1994), in the supporting implementation procedures for *Water Management* (1994), and in the site-specific application of PWQOs by environmental managers familiar with local conditions. Detailed implementation procedures related to point-source discharge requirements are found in the MOEE publication *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters* (1994).

1.5 Where can Details on the Rationale for the PWQOs and Interim PWQOs be Found?

Each PWQO has been set on the basis of a review of the available toxicological information base. These reviews are available in the form of a scientific criteria document for individual chemicals or groups of chemicals. Supporting discussions on the establishment of some older PWQOs have been taken from several sources and are compiled into a single document, available from the Ministry of the Environment and Energy, entitled: *Rationale for the Establishment of Ontario's Provincial Water Quality Objectives* (1979). Several of the Interim PWQOs have published scientific criteria development documents available for them. These documents can be obtained by contacting the Environmental Standards Section, Standards Development Branch of MOEE.

1.6 How are PWQOs and Interim PWQOs Used?

PWQOs and Interim PWQOs are intended to provide guidance in making water quality management decisions such as the designation of the surface waters of the Province which should not be further degraded. They are often used as the starting point in deriving waste effluent requirements included in Certificates of Approval and other instruments issued to regulate effluent discharges. They are also used to assess ambient water quality conditions, infer use impairments and assist in assessing spills. Although PWQOs and Interim PWQOs are not legal standards *per se*, they are employed as the starting point in the establishment of acceptable wastewater loading limits on a site-specific basis. These loading limits, once they are incorporated in Certificates of Approval or other similar instruments, are legally enforceable.

Users of PWQOs and Interim PWQOs are occasionally faced with situations where the application of PWQOs and Interim PWQOs is problematic. Typical of these problems are things like: PWQOs below analytical detection limits; unavailability of analytical methods; PWQOs that are more stringent than background concentrations, including waterbodies with apparently healthy aquatic communities; and, determining natural background levels (defining background).

In addition to MOEE policies which assist in dealing with many of these situations (see *Water Management*, 1994), there are a number of assessment and management options used by MOEE staff to deal with these problems. Some examples of these include: whole effluent toxicity testing, using aquatic toxicity data for screening discharges, applying site-specific guidance for nutrients and metals, and biomonitoring studies.

Suggestions and advice on the these techniques can be obtained by contacting the Environmental Standards Section, Standards Development Branch, MOEE.

1.7 What are the General Narrative Objectives for the Protection of Water Quality?

Narrative objectives have been developed for the general protection of aquatic resources. They are subjective requirements which ensure that the waters of the province are free from certain human-induced objectionable conditions. The narrative objectives assist in managing contaminants which may cause undesirable conditions, but which may be difficult to quantify or to identify as specific chemical compounds. The General Narrative Objectives can be found in Table 1.

1.8 What are Fish Tissue Residue Criteria?

Fish tissue residue criteria are used for assessing the significance of contaminant residues in fish tissues to fish populations and to wildlife consumers of fish (for example, birds such as osprey and eagle). At concentrations above the criteria, the contaminated fish tissue becomes increasingly unacceptable as a food source. These criteria are aimed at minimizing effects for those contaminants which are biomagnified through the food-web. Currently, values for mercury and DDT are available for the protection of fish-consuming birds and, in the case of mercury, aquatic life. Additional fish tissue residue criteria should be available in the future.

MOEE's Fish Tissue Residue Criteria are found in Table 3 of this document.

Fish tissue residue criteria for the protection of human consumers of sport fish are presented in the *Guide to Eating Ontario Sport Fish*. The current edition is 1993-94. These guidelines are based on human health consumption limits developed by Health Canada.

Information on the *Guide to Eating Ontario Sport Fish* and guidelines for specific contaminants can be obtained from the MOEE Environmental Monitoring and Reporting Branch at (416) 314-7886.

1.9 Are there Other Objectives and Guidelines that Should be Considered?

In addition to the PWQOs and Interim PWQOs, water resource managers can employ, where appropriate, a variety of other objectives or guidelines for assessing water quality that relate to specific uses. They include:

1.91 Ontario Drinking Water Objectives

The primary purpose of the Ontario Drinking Water Objectives is for the protection of public health. The Ontario Drinking Water Objectives are normally applied to treated drinking water supplies. Any water intended for human consumption should not contain any disease-causing organisms or hazardous concentrations of toxic chemicals or radioactive substances. Aesthetic considerations may also provide a basis for drinking water objectives since the water should be pleasant to drink. Temperature, taste, odour, turbidity and colour are also important in achieving waters which are aesthetically acceptable.

Other aspects of drinking water quality such as corrosiveness, tendency to form encrustations and excessive soap consumption should be controlled on the basis of economic considerations because of their effects on the distribution system and/or the intended domestic and industrial use of water.

The Ontario Drinking Water Objectives are contained in the MOEE publication *Ontario Drinking Water Objectives* (Revised, 1994). A complete description of the application of Ontario's drinking water requirements is contained in that publication.

Ontario Drinking Water Objectives (Revised, 1994) and *Appendix A - Provincial Water Quality Objectives* (1994) are companion documents. The former contains **treated drinking water objectives**, the latter **ambient surface water quality objectives**. Care should be taken not to confuse the two types of objectives or their use.

All waterbodies (lakes, rivers, or any other surface waters) may be subject to contamination by disease-causing organisms. Consequently, the MOEE recommends that no surface water is considered safe for consumption without prior treatment, including disinfection.

1.9.2 Canadian Water Quality Guidelines (including Agricultural Uses)

The Canadian Water Quality Guidelines were developed in response to a recommendation of the Canadian Council of Resource and Environment Ministers (CCREM) now known as the Canadian Council of Ministers of the Environment (CCME). These guidelines provide basic scientific information about the effects of water quality parameters on a wide variety of uses including: raw water for drinking water supply, recreational water quality and aesthetics, freshwater aquatic life, agricultural uses and industrial water supplies. Resource managers may wish to use this information and the comprehensive supporting text to complement or augment the Provincial Water Quality Objectives and Interim Objectives, and the Ontario Drinking Water Objectives. In particular, for agricultural and industrial water supply, the Canadian Water Quality Guidelines for those uses should be consulted.

1.9.3 Sediment Quality Management Guidelines

Contaminated sediment is a major environmental problem that can seriously impair the health and well-being of benthic organisms, bottom-dwelling fish and, affect predatory fish, wildlife and humans through the food-web. The Ontario MOEE recognizes the need to understand and effectively manage contaminated sediments. To that end, a comprehensive document *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*, (1993) provides a management plan composed of Sediment Quality Guidelines and procedures for the application of the Guidelines. The publication also details the protocol employed for setting the Guidelines.

1.9.4 Great Lakes Water Quality Agreement

The Canada-U.S. Great Lakes Water Quality Agreement (GLWQA - 1987) serves as the principle vehicle for ensuring a co-ordinated, binational approach to solving problems with Great Lakes water quality. The GLWQA contains specific water quality objectives which should be considered in assessing the water quality of the Great Lakes.

1.10 **Where Both a PWQO and an Interim PWQO Exist**

In five instances, both a PWQO and an Interim PWQO are provided for the same substance (i.e. arsenic, cadmium, copper, lead and zinc). In all five cases, the Interim PWQOs are based on **draft** scientific criteria development documents currently under development. While the existence of two values for the same substance may cause some implementation concerns, MOEE believes that it is better to provide the latest information available while awaiting full approval of the updated PWQO. The existing, approved PWQO can be applied in most situations; however, where a greater level of aquatic protection is appropriate, the more stringent Interim PWQO may be used, subject to the discretion of MOEE staff. At the very least, discharge proponents should be aware of the possibility of future requirements becoming more stringent, as these Interim PWQOs are formally approved as PWQOs by MOEE.

References

CCME. 1987-93. Canadian Water Quality Guidelines. Canadian Council of Ministers of the Environment.

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MOEE. 1994. Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters. Ontario Ministry of Environment and Energy.

Table 1 - General Narrative Objectives

All waters shall be free from contaminating levels of substances and materials attributable to human activities which in themselves or in combination with other factors can:	• **Settle to form objectionable deposits;**
	• **Float as debris, scum or oil or other matter to form nuisances;**
	• **Produce objectionable colour, odour, taste or turbidity;**
	• **Injure, are toxic to, or produce adverse physiological or behavioral responses in humans, animals or plants; or**
	• **Enhance the production of undesirable aquatic life or result in the dominance of nuisance species.**

TABLE 2 - Table of PWQOs and Interim PWQOs

Acetamide, N-(2-Hydroxyphenyl) CAS No. 614-80-2	**30 μg/L (Interim PWQO)[a]**
Acetanilide CAS No. 103-84-4	**100 μg/L (Interim PWQO)[a]**
Acrolein CAS No. 107-02-8	**0.03 μg/L (Interim PWQO)[a]**
Aesthetics CAS No. NA	**PWQO[1]:** **Water used for swimming, bathing and other recreational activities should be aesthetically pleasing. The water should be devoid of debris, oil, scum and any substance which would produce an objectionable deposit, colour, odour, taste or turbidity.**
Aldrin/Dieldrin CAS No. aldrin 309-00-2; dieldrin 60-57-1	**0.001 μg/L (PWQO)[1]** ● PWQO is for the sum of the concentrations of aldrin and dieldrin in water.
Alkalinity CAS No. NA	**PWQO[1]:** **Alkalinity should not be decreased by more than 25% of the natural concentration.**
Aluminum CAS No. 7429-90-5	**Interim PWQO[4]:** ***● At pH 4.5 to 5.5 the Interim PWQO is 15 μg/L based on inorganic monomeric aluminum measured in clay-free samples.** **● At pH >5.5 to 6.5, no condition should be permitted which would increase the acid soluble inorganic aluminum concentration in clay-free samples to more than 10% above natural background concentrations for waters representative of that geological area of the Province that are unaffected by man-made inputs.** ***● At pH >6.5 to 9.0, the Interim PWQO is 75 μg/L based on total aluminum measured in clay-free samples.** * **If natural background aluminum concentrations in water bodies unaffected by man-made inputs are greater than the numerical Interim PWQO (above), no condition is permitted that would increase the aluminum concentration in clay-free samples by more than 10% of the natural background level.** **Note: pH values of <6.5 and >8.5 are outside the range considered acceptable by the PWQO for pH.** See the *Scientific Criteria Document for Development of Provincial Water Quality Objectives and Guidelines - Aluminum* for a discussion of analytical procedures.
Aminoazobenzene, 4- CAS No. 60-09-3	**0.8 μg/L (Interim PWQO)[a]**
Aminoethyl piperazine CAS No. 140-31-8	**2400 μg/L (Interim PWQO)[a]**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Ammonia (un-ionized) 20 μg/L (PWQO)[1]

CAS No. 7664-41-7

- The percentages of un-ionized ammonia (NH_3) in aqueous ammonia solution for different temperature and pH conditions are listed in the table below. For example, at 20°C and pH of 8.0, a total ammonia concentration of 500 μg/L would give an un-ionized ammonia concentration of 500 x 3.8/100 = 19 μg/L which is less than the un-ionized ammonia Objective of 20 μg/L.

The table below is taken from Emerson *et al.* 1975[11] but percentages are rounded to two significant figures. The equations given by Emerson *et al.* may be used to interpolate values between those given in the table:

$f = 1/(10^{pKa-pH} + 1)$, where f is the fraction of NH_3

$pKa = 0.09018 + 2729.92/T$, where T = ambient water temperature in Kelvin (K = °C + 273.16)

Results should be converted to percent and rounded to two significant figures. Extrapolations should not be made beyond the ranges of the table.

Note: Under certain temperature and pH conditions, the total ammonia criteria for the protection of aquatic life may be less stringent than the criteria for other beneficial uses (e.g. public water supply).

Percent NH_3 in aqueous ammonia solutions for 0-30 °C and pH 6-10

Temp.	pH								
°C	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
0	.0083	.026	.083	.26	.82	2.6	7.6	21.	45.
1	.0090	.028	.090	.28	.89	2.8	8.3	22.	47.
2	.0098	.031	.098	.31	.97	3.0	8.9	24.	49.
3	.011	.034	.11	.34	1.1	3.3	9.6	25.	52.
4	.012	.036	.12	.36	1.1	3.5	10.	27.	54.
5	.013	.040	.13	.39	1.2	3.8	11.	28.	56.
6	.014	.043	.14	.43	1.3	4.1	12.	30.	58.
7	.015	.046	.15	.46	1.5	4.4	13.	32.	60.
8	.016	.050	.16	.50	1.6	4.8	14.	34.	61.
9	.017	.054	.17	.54	1.7	5.2	15.	35.	63.
10	.019	.059	.19	.59	1.8	5.6	16.	37.	65.
11	.020	.064	.20	.63	2.0	6.0	17.	39.	67.
12	.022	.069	.22	.68	2.1	6.4	18.	41.	69.
13	.024	.074	.24	.74	2.3	6.9	19.	43.	70.
14	.025	.080	.25	.80	2.5	7.4	20.	45.	72.
15	.027	.087	.27	.86	2.7	8.0	22.	46.	73.
16	.030	.093	.29	.93	2.9	8.5	23.	48.	75.
17	.032	.10	.32	1.0	3.1	9.1	24.	50.	76.
18	.034	.11	.34	1.1	3.3	9.8	26.	52.	77.
19	.037	.11	.37	1.2	3.6	11.	27.	54.	79.
20	.040	.13	.40	1.2	3.8	11.	28.	56.	80.
21	.043	.14	.43	1.3	4.1	12.	30.	58.	81.
22	.046	.15	.46	1.4	4.4	13.	32.	59.	82.
23	.049	.16	.49	1.5	4.7	14.	33.	61.	83.
24	.053	.17	.53	1.7	5.0	14.	35.	63.	84.
25	.057	.18	.57	1.8	5.4	15.	36.	64.	85.
26	.061	.19	.61	1.9	5.8	16.	38.	66.	86.
27	.065	.21	.65	2.0	6.2	17.	40.	67.	87.
28	.070	.22	.70	2.2	6.6	18.	41.	69.	88.
29	.075	.24	.75	2.3	7.0	19.	43.	70.	88.
30	.081	.25	.80	2.5	7.5	20.	45.	72.	89.

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Aniline CAS No. 62-53-3	**2 μg/L (Interim PWQO)[15]**
Anthracene CAS No. 120-12-7	**0.0008 μg/L (Interim PWQO)[a]**
Antimony CAS No. 7440-36-0	**20 μg/L (Interim PWQO)[14]**
Arsenic CAS No. 7440-38-2	**100 μg/L (PWQO)[1]**
Arsenic (revised) *CAS No. 7440-38-2*	***5 μg/L (Interim PWQO)[b]*** *(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)*
Bacteria	**See *Escherichia coli***
Benzaldehyde CAS No. 100-52-7	**0.09 μg/L (Interim PWQO)[a]**
Benz[a]anthracene CAS No. 56-55-3	**0.0004 μg/L (Interim PWQO)[a]**
Benzene CAS No. 71-43-2	**100 μg/L (Interim PWQO)[b]**
Benzidine CAS No. 92-87-5	**20 μg/L (Interim PWQO)[a]**
Benzothiazole CAS No. 95-16-9	**100 μg/L (Interim PWQO)[a]**
Benzo[g,h,i]perylene CAS No. 191-24-2	**0.00002 μg/L (Interim PWQO)[a]**
Benzo[k]fluoranthene CAS No. 207-08-9	**0.0002 μg/L (Interim PWQO)[a]**
Benzyl alcohol CAS No. 100-51-6	**8 μg/L (Interim PWQO)[a]**
Beryllium CAS No. 7440-41-7	**PWQO[1]:**

Hardness as $CaCO_3$ (mg/L)	**PWQO (μg/L)**
< 75	**11**
> 75	**1100**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Biphenyl CAS No. 92-52-4	**0.2 μg/L (Interim PWQO)[a]**
Bisphenol A CAS No. 80-05-7	**5 μg/L (Interim PWQO)[a]** • synonym - 4,4'-isopropylidenediphenol
Bis(2-chloroethyl) ether CAS No. 111-44-4	**200 μg/L (Interim PWQO)[a]**
Boron CAS No. 7440-42-8	**200 μg/L (Interim PWQO)[a]**
Bromodichloro-methane CAS No. 75-27-4	**200 μg/L (Interim PWQO)[a]**
Bromoform CAS No. 75-25-2	**60 μg/L (Interim PWQO)[a]**
Bromomethane CAS No. 74-83-9	**0.9 μg/L (Interim PWQO)[a]** • synonym - methyl bromide
Bromophenyl phenyl ether, 4- CAS No. 101-55-3	**0.05 μg/L (Interim PWQO)[a]**
Butanal CAS No. 123-72-8	**10 μg/L (Interim PWQO)[a]**
Butyl benzyl phthalate CAS No. 85-68-7	**0.2 μg/L (Interim PWQO)[a]**
Cadmium CAS No. 7440-43-9	**0.2 μg/L (PWQO)**
Cadmium (revised) *CAS No. 7440-43-9*	***Interim PWQO[b]:*** *(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)*

Hardness as $CaCO_3$ (mg/L)	***Interim PWQO (μg/L)***
0 - 100	***0.1***
> 100	***0.5***

Camphene CAS No. 79-92-5	**2 μg/L (Interim PWQO)[a]**
Carbaryl CAS No. 63-25-2	**0.2 μg/L (PWQO)[18]** • adopted Canadian Water Quality Guideline

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Chlordane CAS No. 57-74-9	**0.06 μg/L (PWQO)[1]**
Chlorine CAS No. 7782-50-5	**2 μg/L (PWQO)[1]** • Total residual chlorine, as measured by the amperometric (or equivalent) method.
Chlorobenzene CAS No. 108-90-7	**15 μg/L (PWQO)[2]** • common synonym monochlorobenzene
Chlorodibromo-methane CAS No. 124-48-1	**40 μg/L (Interim PWQO)[a]**
Chloromethane CAS No. 74-87-3	**700 μg/L (Interim PWQO)[a]** • synonym - methyl chloride
Chloronaphthalene, 1- CAS No. 90-13-1	**0.1 μg/L (Interim PWQO)[a]**
Chloronaphthalene, 2- CAS No. 91-58-7	**0.2 μg/L (Interim PWQO)[a]**
Chlorophenyl phenyl ether, 4- CAS No. 7005-72-3	**0.05 μg/L (Interim PWQO)[a]**
Chlorpyrifos CAS No. 2921-88-2	**0.001 μg/L (PWQO)[1]** • common synonym - Dursban
Chloro-3-methyl phenol, 4- CAS No. 59-50-7	**3 μg/L (Interim PWQO)[a]**
Chromium CAS No. 7440-47-3	**1 μg/L (PWQO)[18] for hexavalent chromium (Cr VI)** **8.9 μg/L (PWQO)[18] for trivalent chromium (Cr III)** • adopted Canadian Water Quality Guidelines
Chrysene CAS No. 218-01-9	**0.0001 μg/L (Interim PWQO)[a]**
Cineole CAS No. 470-82-6	**100 μg/L (Interim PWQO)[a]**
Cobalt CAS No. 7440-48-4	**0.9 μg/L (PWQO)[16]**
Copper CAS No. 7440-50-8	**5 μg/L (PWQO)[1]**

copper revised - see next page

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Copper (revised)
CAS No. 7440-50-8

Interim PWQO[b]: *(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)*

Hardness as $CaCO_3$ (mg/L)	*Interim PWQO (μg/L)*
0 - 20	*1*
> 20	*5*

Cresol,
m- CAS No. 108-39-4
o- CAS No. 95-48-7
p- CAS No. 106-44-5

1 μg/L (Interim PWQO)[b]
- can be applied to all three isomers
- common synonym - methylphenol

Cyanide
CAS No. 57-12-5

5 μg/L (PWQO)[1]
- PWQO is for free cyanide in an unfiltered water sample.

Cyclohexanamine
CAS No. 108-91-8

50 μg/L (Interim PWQO)[a]
- common synonym - cyclohexylamine

Cyclohexanol
CAS No. 108-93-0

1000 μg/L (Interim PWQO)[a]

2,4-D (BEE)
CAS No. 1929-73-3

4 μg/L (PWQO)[1]
- chemical name 2,4-dichlorophenoxyacetic acid - (2-butoxyethyl) ester

Dalapon
CAS No. 75-99-0

110 μg/L (PWQO)[1]

DDT & metabolites
CAS No. 50-29-3

0.003 μg/L (PWQO)[1]
- PWQO is for the sum of DDT, DDD (CAS No. 72-54-8) and DDE (CAS No. 72-55-9)

Dehydroabietic acid (DHA)
CAS No. 1740-19-8

Interim PWQO[5]: See Resin Acids

Diazinon
CAS No. 333-41-5

0.08 μg/L (PWQO)[1]

Dibenzofuran
CAS No. 132-64-9

0.3 μg/L (Interim PWQO)[a]

Dibenz[a,h]anthracene
CAS No. 53-70-3

0.002 μg/L (Interim PWQO)[a]

Dibutylamine
CAS No. 111-92-2

8 μg/L (Interim PWQO)[a]

Dibutylphthalate
CAS No. 84-74-2

4 μg/L (PWQO)[1]
- common synonym - di-*n*-butylphthalate

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Dicamba CAS No. 1918-00-9	**200 μg/L (PWQO)[1]**
Dichlorobenzene, 1,2- CAS No. 95-50-1	**2.5 μg/L (PWQO)[2]**
Dichlorobenzene, 1,3- CAS No. 541-73-1	**2.5 μg/L (PWQO)[2]**
Dichlorobenzene, 1,4- CAS No. 106-46-7	**4 μg/L (PWQO)[2]**
Dichlorobenzidine, 3,3'- CAS No. 91-94-1	**0.6 μg/L (Interim PWQO)[a]**
Dichlorobut-3-ene, 1,2- CAS No. 760-23-6	**10 μg/L (Interim PWQO)[a]**
Dichloroethane, 1,1- CAS No. 75-34-3	**200 μg/L (Interim PWQO)[6]**
Dichloroethane, 1,2- CAS No. 107-06-2	**100 μg/L (Interim PWQO)[6]**
Dichloroethylene, 1,1- CAS No. 75-35-4	**40 μg/L (Interim PWQO)[6]**
Dichloroethylene, 1,2- CAS No. cis - 156-59-2, trans - 156-60-5	**200 μg/L (Interim PWQO)[6]** • Interim PWQO applies to both the cis & trans 1,2-dichloroethylene.
Dichloroguaiacol, 4,5- CAS No. 2460-49-3	**6 μg/L (Interim PWQO)[a]**
Dichlorophenols CAS No. various	**0.2 μg/L (PWQO)[3]** • PWQO can be applied to all 6 isomers: 2,3-, 2,4-, 2,5-, 2,6-, 3,4-, 3,5-dichlorophenol
Dichloropropane, 1,2- CAS No. 78-87-5	**0.7 μg/L (Interim PWQO)[a]**
Dichloropropylene, trans-1,3 CAS No. 10061-02-6	**7 μg/L (Interim PWQO)[a]**
Dieldrin/Aldrin	**See Aldrin/Dieldrin**
Diethylene glycol CAS No. 111-46-6	**11000 μg/L (Interim PWQO)[a]**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Diethylhexylphthalate CAS No. 117-81-7	**0.6 μg/L (PWQO)[1]** • common synonyms bis-2-ethylhexylphthalate, dioctylphthalate
Diethyl-*m*-toluamide, N,N- CAS No. 134-62-3	**200 μg/L (Interim PWQO)[a]** • synonym - DEET
Dimethyl disulphide CAS No. 624-92-0	**0.2 μg/L (Interim PWQO)[a]**
Dimethylamine CAS No. 124-40-3	**3 μg/L (Interim PWQO)[a]**
Dimethylbenzylamine CAS No. 103-83-3	**40 μg/L (Interim PWQO)[a]**
Dimethylformamide, N,N- CAS No. 68-12-2	**5000 μg/L (Interim PWQO)[a]**
Dimethylnaphthalene, 1,3- CAS No.575-41-7	**0.09 μg/L (Interim PWQO)[b]** • When a mixture of dimethylnaphthalenes is found, the most restrictive Interim PWQO of 0.02 μg/L should apply.
Dimethylnaphthalene, 2,6- CAS No. 581-42-0	**0.02 μg/L (Interim PWQO)[b]**
Dimethylphenol, 2,4- CAS No. 105-67-9	**10 μg/L (Interim PWQO)[b]**
Dimethylphenol, 2,6- CAS No. 576-26-1	**8 μg/L (Interim PWQO)[b]**
Dimethylphenol, 3,4- CAS No. 95-65-8	**20 μg/L (Interim PWQO)[b]**
Dinitrobenzene, *m*- CAS No. 99-65-0	**1 μg/L (Interim PWQO)[b]**
Dinitrobenzene, *o*- CAS No. 528-29-0	**1 μg/L (Interim PWQO)[b]**
Dinitrobenzene, *p*- CAS No. 100-25-4	**2 μg/L (Interim PWQO)[b]**
Dinitrotoluene, 2,4- CAS No. 121-14-2	**4 μg/L (Interim PWQO)[17]**
Dinitrotoluene, 2,6- CAS No. 606-20-2	**6 μg/L (Interim PWQO)[17]**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Dinitro-*o*-cresol, 4,6-
CAS No. 534-52-1

0.2 μg/L (Interim PWQO)[b]

Dioxane, 1,4-
CAS No. 123-91-1

20 μg/L (Interim PWQO)[a]

Diphenyl ether
CAS No. 101-84-8

0.03 μg/L (Interim PWQO)[a]

Diphenylamine
CAS No. 122-39-4

3 μg/L (Interim PWQO)[a]

- synonym - N,N-diphenylamine

Diphenylhydrazine, 1,2-
CAS No. 122-66-7

0.3 μg/L (Interim PWQO)[a]

- synonym - hydrazobenzene

Diquat
CAS No. 2764-72-9

0.5 μg/L (PWQO)[1]

Dissolved gases
CAS No. NA

PWQO[1]: **To protect aquatic organisms, the total dissolved gas concentrations in water should not exceed 110 percent of the saturation value for gases at the existing atmospheric and hydrostatic pressures.**

Dissolved oxygen
CAS No. NA

PWQO[1]: **Dissolved oxygen concentrations should not be less than the values specified below for cold water biota (e.g. salmonid fish communities) and warm water biota (e.g. centrarchid fish communities):**

Dissolved Oxygen Concentration				
Temperature	Cold Water Biota		Warm Water Biota	
°C	% Saturation	mg/L	% Saturation	mg/L
0	54	8	47	7
5	54	7	47	6
10	54	6	47	5
15	54	6	47	5
20	57	5	47	4
25	63	5	48	4

In waters inhabited by sensitive biological communities, or in situations where additional physical or chemical stressors are operating, more stringent criteria may be required. For example, a sensitive species such as lake trout may require more specific water quality objectives.

In some hypolimnetic waters, dissolved oxygen is naturally lower than the concentrations specified in the above table. Such a condition should not be altered by adding oxygen-demanding materials causing a depletion of oxygen.

Diuron
CAS No. 330-54-1

1.6 μg/L (PWQO)[1]

Divinyl benzene
CAS No. 1321-74-0

8 μg/L (Interim PWQO)[a]

Di-*n*-butylamine
CAS No. 111-92-2

8 μg/L (Interim PWQO)[a]

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a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Di-*n*-butyltin CAS No. 683-18-1	**0.08 μg/L (Interim PWQO)[12]**
Di-*t*-butyl-4-methylphenol, 2,6- CAS No. 128-37-0	**0.2 μg/L (Interim PWQO)[a]**
Endosulfan CAS No. 115-29-7	**0.003 μg/L (PWQO)[1]** • PWQO is for the sum of two isomers - alpha Endosulfan (I) and beta Endosulfan (II)
Endrin CAS No. 72-20-8	**0.002 μg/L (PWQO)[1]**
Escherichia coli CAS No. NA	**100 *E. coli* per 100 mL** (based on a geometric mean of at least 5 samples) • Based on a recreational water quality guideline published by the Ontario Ministry of Health in 1992. This Ministry of Health guideline was specifically intended for application by the local Medical Officer of Health to swimming and bathing beaches. It is based upon a geometric mean of levels of *E. coli* determined from a minimum of 5 samples per site taken within a given swimming area and collected within a one month period. If the geometric mean *E. coli* level for the sample series at a given site exceeds 100 per 100 mL, the site should be considered unsuitable for swimming and bathing. *E. coli* was selected for the guideline because studies have determined that, among bacteria of the coliform group, *E. coli* is the most suitable and specific indicator of fecal contamination. An analytical test with a high degree of specificity for *E. coli* regardless of water sample source, requiring no confirmation procedures, and which produces results in 21 hours has been developed and adopted by both the Ministry of Health, and Ministry of Environment and Energy laboratories. Where testing indicates sewage or fecal contamination, a site-specific judgement must be made as to the severity of the problem and the appropriate course of action. As of May 1, 1994, MOEE staff have been advised to base all **new** compliance, enforcement and monitoring activities on the *E. coli* test. Some water managers may find it necessary to continue testing for fecal coliforms or total coliforms. For example, where testing at a long term water quality monitoring station requires a continuous record of results using either the fecal or total coliform test to monitor trends in water quality. As a benchmark for the long term monitoring results, the former objectives for fecal coliforms and total coliforms are referenced for your information. For fecal coliforms the objective was a 100 counts per 100 ml (based on a geometric mean density for a series of water samples). For total coliforms the objective was 1000 counts per 100 ml (based on a geometric mean density for a series of water samples).
Ethanolamine CAS No. 141-43-5	**200 μg/L (Interim PWQO)[a]** • synonym - 2-aminoethanol
Ethylbenzene CAS No. 100-41-4	**8 μg/L (Interim PWQO)[9]**
Ethylene diamine CAS No. 107-15-3	**0.1 μg/L (Interim PWQO)[a]**
Ethylene dibromide CAS No. 106-93-4	**5 μg/L (Interim PWQO)[a]**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Ethylene glycol CAS No. 107-21-1	**2000 μg/L (Interim PWQO)[a]**
Ethylene thiourea CAS No. 96-45-7	**60 μg/L (Interim PWQO)[a]**
Eugenol CAS No. 97-53-0	**30 μg/L (Interim PWQO)[a]**
Fenthion CAS No. 55-38-9	**0.006 μg/L (PWQO)[1]**
Fluoranthene CAS No. 206-44-0	**0.0008 μg/L (Interim PWQO)[a]**
Fluorene CAS No. 86-73-7	**0.2 μg/L (Interim PWQO)[a]**
Formaldehyde CAS No. 50-00-0	**0.8 μg/L (Interim PWQO)[a]**
Furfuryl alcohol CAS No. 98-00-0	**1 μg/L (Interim PWQO)[a]**
Guaiacol CAS No. 90-05-1	**1 μg/L (Interim PWQO)[a]** • synonym - 2-methoxyphenol
Guthion CAS No. 86-50-0	**0.005 μg/L (PWQO)[1]**
Heptachlor & CAS No. 76-44-8 **Heptachlor epoxide** CAS No. 1024-57-3	**0.001 μg/L (PWQO)[1]** • sum of heptachlor and heptachlor epoxide
Hexachlorobenzene CAS No. 118-74-1	**0.0065 μg/L (PWQO)[2]**
Hexachlorobutadiene CAS No. 87-68-3	**0.009 μg/L (Interim PWQO)[b]**
Hexachlorocyclo-pentadiene CAS No. 77-47-4	**0.06 μg/L (Interim PWQO)**
Hexachloroethane CAS No. 67-72-1	**1 μg/L (Interim PWQO)[b]**
Hydrogen sulphide CAS No. 7783-06-4	**2 μg/L (PWQO)[1]** • **undissociated hydrogen sulphide**
Hydroxybiphenyl, 2- CAS No. 90-43-7	**6 μg/L (Interim PWQO)[a]**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Iodine — **100 μg/L (Interim PWQO)[a]**
CAS No. 7553-56-2

Iron — **300 μg/L (PWQO)[1]**
CAS No. 7439-89-6

Isopropyl alcohol — **300 μg/L (Interim PWQO)[a]**
CAS No. 67-63-0

Lead
CAS No. 7439-92-1

PWQO[1]:

Alkalinity as $CaCO_3$ (mg/L)	**PWQO (μg/L)**
< 20	**5**
20 to 40	**10**
40 to 80	**20**
> 80	**25**

Lead (revised)
CAS No. 7439-92-1

Interim PWQO[b]: ***(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)***

Hardness as $CaCO_3$ (mg/L)	***Interim PWQO (μg/L)***
< 30	***1***
30 to 80	***3***
> 80	***5***

Limonene — **4 μg/L (Interim PWQO)[a]**
CAS No. 138-86-3

Lindane — **0.01 μg/L (PWQO)[1]**
CAS No. 58-89-9
- chemical name: gamma - 1,2,3,4,5,6-hexachlorocyclohexane

Malathion — **0.1 μg/L (PWQO)[1]**
CAS No. 121-75-5

Mercury — **0.2 μg/L (PWQO)[1]**
CAS No. 7439-97-6
- **in a filtered water sample**

Methanol — **200 μg/L (Interim PWQO)[a]**
CAS No. 67-56-1

Methoxychlor — **0.04 μg/L (PWQO)[1]**
CAS No. 74-43-5

Methyl ethyl ketone — **400 μg/L (Interim PWQO)[a]**
CAS No. 78-93-3

Methylene chloride — **100 μg/L (Interim PWQO)[a]**
CAS No. 75-09-2
- common synonym - dichloromethane

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Methylnaphthalene, 1- CAS No. 90-12-0	**2 μg/L (Interim PWQO)[b]**
Methylnaphthalene, 2- CAS No. 91-57-6	**2 μg/L (Interim PWQO)[b]**
Methyl-2-pentanol, 4- CAS No. 108-11-2	**600 μg/L (Interim PWQO)[a]**
Methyl-*t*-butyl ether (MTBE) CAS No. 1634-04-4	**200 μg/L (Interim PWQO)[a]**
Metolachlor CAS No. 51218-45-2	**3 μg/L (Interim PWQO)[a]**
Microbiology CAS No. NA	**See *Escherichia coli***
Mirex (Dechlorane) CAS No. 2385-85-5	**0.001 μg/L (PWQO)[1]**
Molybdenum CAS No. 7439-98-7	**40 μg/L (Interim PWQO)[19]**
Monochlorophenols CAS No. 25167-80-0	**7 μg/L (PWQO)[3]** • PWQO can be applied to all 3 individual isomers: 2-, 3-, and 4-chlorophenol
Monomethylamine CAS No. 74-89-5	**50 μg/L (PWQO)[a]**
Morpholine CAS No. 110-91-8	**4 μg/L (Interim PWQO)[a]**
Naphthalene CAS No. 91-20-3	**7 μg/L (Interim PWQO)[a]**
Nickel CAS No. 7440-02-0	**25 μg/L (PWQO)[1]**
Nitrobenzene CAS No. 98-95-3	**0.02 μg/L (Interim PWQO)[b]**
Nitronaphthalene, 1- CAS No. 86-57-7	**4 μg/L (Interim PWQO)[a]**
Nitrophenol, 2- CAS No. 88-75-5	**0.5 μg/L (Interim PWQO)[b]**
Nitrophenol, 3- CAS No. 554-84-7	**20 μg/L (Interim PWQO)[b]**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Nitrophenol, 4- CAS No. 100-02-7	**50 μg/L (Interim PWQO)[b]**
Nitrosodimethylamine, N- CAS No. 62-75-9	**15 μg/L (Interim PWQO)[21]** • NDMA
Nitrosodiphenylamine, N- CAS No. 86-30-6	**7 μg/L (Interim PWQO)[a]**
Nitrosomorpholine, N- CAS No. 59-89-2	**0.9 μg/L (Interim PWQO)[a]** • synonym - 4-nitrosomorpholine
Nonyl phenol CAS No. 25154-52-3	**0.04 μg/L (Interim PWQO)[a]**
Oil & Grease CAS No. NA	**PWQO[1]:** **Oil or petrochemicals should not be present in concentrations that:** **- can be detected as a visible film, sheen, or discolouration on the surface;** **- can be detected by odour;** **- can cause tainting of edible aquatic organisms;** **- can form deposits on shorelines and bottom sediments that are detectable by sight or odour, or are deleterious to resident aquatic organisms.**
Oleic acid CAS No. 112-80-1	**1 μg/L (Interim PWQO)[a]**
Parathion CAS No. 56-38-2	**0.008 μg/L (PWQO)[1]**
Pentachlorobenzene CAS No. 608-93-5	**0.03 μg/L (PWQO)[2]**
Pentachlorophenol CAS No. 87-86-5	**0.5 μg/L (PWQO)[3]**
Perylene CAS No. 198-55-0	**0.00007 μg/L (Interim PWQO)[a]**
pH CAS No. NA	**PWQO[1]:** **The pH should be maintained within the range of 6.5 - 8.5** • **to protect aquatic life; and** • **both alkaline and acid waters may cause irritation to anyone using the water for recreational purposes.**
Phenanthrene CAS No. 85-01-8	**0.03 μg/L (Interim PWQO)[a]**
Phenol CAS No. 108-95-2	**5 μg/L (Interim PWQO)[b]** • common synonym - monohydroxybenzene

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Phenols CAS No. 64743-03-9	**1 μg/L (PWQO)[1]** • Determined by the total reactive phenols test - the 4-AAP (4-amino-antipyrine) test. • This objective should be used primarily as a screening tool. • The isomer specific PWQOs for various phenolics should be employed where possible.
Phenylxylylethane CAS No. 6196-95-8	**0.02 μg/L (Interim PWQO)[a]**
Phosphorus, total CAS No. 7723-14-0	**Interim PWQO[1]:** **Current scientific evidence is insufficient to develop a firm Objective at this time. Accordingly, the following phosphorus concentrations should be considered as general guidelines which should be supplemented by site-specific studies:** **To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 μg/L;** **A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 μg/L or less. This should apply to all lakes naturally below this value;** **Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 30 μg/L.**
Phthalates, other CAS No. various	**0.2 μg/L (PWQO)[1]** • some other phthalates included are: diethylphthalate (DEP - CAS No. 84-66-2), dimethylphthalate (CAS No. 131-11-3) • see PWQOs for dibutylphthalate and diethylhexylphthalate
Polychlorinated biphenyls (Total PCBs) CAS No. various	**0.001 μg/L (PWQO)[1]** Includes: Aroclor 1016 - (CAS No.) 12674-11-2; Aroclor 1221 - 11104-28-2; Aroclor 1232 - 11141-16-5; Aroclor 1242 - 53469-21-9; Aroclor 1248 - 12672-29-6; Aroclor 1254 - 11097-69-1; Aroclor 1260 - 11096-82-5
Polychlorinated naphthalenes CAS No. various	**0.0002 μg/L (Interim PWQO)[a]**
Propyl diphenyl CAS No. 25640-78-2	**0.1 μg/L (Interim PWQO)[a]**
Propylene glycol, 1,2- CAS No. 57-55-6	**44000 μg/L (Interim PWQO)[a]**
Propylene glycol, 1,3- CAS No. 504-63-2	**10000 μg/L (Interim PWQO)[a]**
Public health considerations	**See *Escherichia coli***
Pyrethrum CAS No. 8003-34-7	**0.01 μg/L (PWQO)[1]**
Quinoline CAS No. 91-22-5	**10 μg/L (Interim PWQO)[a]**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Radionuclides

CAS No. various

PWQO[8]:

Radiation exposure should be kept as low as reasonably achievable, economic and social factors being taken into account.

The Provincial Water Quality Objectives for radionuclides are based on drinking water requirements, which are derived from dose-response relationships as recommended by the International Commission on Radiological Protection (ICRP) in Publication 26.

The Objectives are as follows:

Radionuclide**	Provincial Water Quality Objective*** (Becquerels/Litre)
^{137}Cesium	50
^{131}Iodine	10
^{226}Radium	1
^{90}Strontium	10
Tritium	7000

*** The radionuclide objectives are based on the total concentration in an unfiltered water sample.**

**** If two or more radionuclides affecting the same organ or tissue are found to be present, the following relationship based on ICRP Publication 26 should be satisfied:**

$$\frac{c_1}{C_1} + \frac{c_2}{C_2} + \ldots \frac{c_i}{C_i} \leq 1$$

where c_1, c_2 and c_i are the observed concentrations, and C_1, C_2 and C_i are the maximum acceptable concentrations for each contributing radionuclide.

***** Radionuclide concentrations that exceed the maximum acceptable concentrations may be tolerated for a short duration, provided that the annual average concentrations remain below this level and meet the restriction for multiple radionuclides.**

Note: For further information on the radionuclide objectives as related to potable water supplies, consult the publication *Ontario Drinking Water Objectives* (Revised, 1994).

Resin Acids (Dehydroabietic Acid and Total Resin Acids)

dehydroabietic acid (DHA) - CAS No. 1740-19-8

Total Resin Acids - includes: abietic acid CAS No. 514-10-3; sandaracopimaric acid CAS No. NA; isopimaric acid CAS No. 5835-26-7; levopimaric acid CAS No. 79-54-9; neoabietic acid CAS No. 471-77-2; palustric acid CAS No. 1945-53-5; pimaric acid CAS No. 127-27-5;

Interim PWQOs[5]:

Interim PWQOs for Dehydroabietic Acid (DHA) and Total Resin Acids are pH dependent as shown below:

	Interim PWQO	
Receiving water pH	DHA (μg/L)	Total Resin Acids (μg/L)
5*	1	1
5.5*	2	3
6*	2	4
6.5	4	9
7	8	25
7.5	12	45
8	13	52
8.5	14	60
9*	14	62

*** - pH is outside the range of the PWQO for pH**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Selenium CAS No. 7782-49-2	**100 μg/L (PWQO)[1]**
Silver CAS No. 7440-22-4	**0.1 μg/L (PWQO)[1]**
Simazine CAS No. 122-34-9	**10 μg/L (PWQO)[1]**
Styrene CAS No. 100-42-5	**4 μg/L (Interim PWQO)[b]**
Swimming & bathing	**See *Escherichia coli***
Temperature CAS No. NA	**PWQO[1]:** **1) General** **The natural thermal regime of any body of water shall not be altered so as to impair the quality of the natural environment. In particular, the diversity, distribution and abundance of plant and animal life shall not be significantly changed.** **2) Waste Heat Discharge** **(a) Ambient Temperature Changes** **The temperature at the edge of a mixing zone shall not exceed the natural ambient water temperature at a representative control location by more than 10C° (18F°). However, in special circumstances, local conditions may require a significantly lower temperature difference than 10C° (18F°). Potential dischargers are to apply to the MOEE for guidance as to the allowable temperature rise for each thermal discharge. This ministry will also specify the nature of the mixing zone and the procedure for the establishment of a representative control location for temperature recording on a case-by-case basis.** **(b) Discharge Temperature Permitted** **The maximum temperature of the receiving body of water, at any point in the thermal plume outside a mixing zone, shall not exceed 30°C (86°F) or the temperature of a representative control location plus 10C° (18F°) or the allowed temperature difference, which ever is the lesser temperature. These maximum temperatures are to be measured on a mean daily basis from continuous records.** **(c) Taking and Discharging of Cooling Water** **Users of cooling water shall meet both the Objectives for temperature outlined above and the "Procedures for the Taking and Discharge of Cooling Water" as outlined in the MOEE publication *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters*** (1994).
Tetrachlorobenzene, 1,2,3,4- CAS No. 634-66-2	**0.1 μg/L (PWQO)[2]**
Tetrachlorobenzene, 1,2,3,5- CAS No. 634-90-2	**0.1 μg/L (PWQO)[2]**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Tetrachlorobenzene, 1,2,4,5- CAS No. 95-94-3	**0.15 μg/L (PWQO)[2]**
Tetrachloroethane, 1,1,1,2- CAS No. 630-20-6	**20 μg/L (Interim PWQO)[a]**
Tetrachloroethane, 1,1,2,2- CAS No. 79-34-5	**70 μg/L (Interim PWQO)[6]**
Tetrachloroethylene CAS No. 127-18-4	**50 μg/L (Interim PWQO)[6]** • synonym - perchloroethylene or perc
Tetrachloroguaiacol CAS No. 2539-17-5	**0.009 μg/L (Interim PWQO)[a]**
Tetrachlorophenols CAS No. 25167-83-3	**1 μg/L (PWQO)[3]** • PWQO can be applied to 3 individual isomers which were assessed: 2,3,4,5-, 2,3,4,6-, and 2,3,5,6-tetrachlorophenol
Tetraethyl lead CAS No. 78-00-2	**0.0007 μg/L (Interim PWQO)[7]**
Tetramethyl lead CAS No. 75-74-1	**0.006 μg/L (Interim PWQO)[7]**
Thallium CAS No. 7440-28-0	**0.3 μg/L (Interim PWQO)[b]**
Toluene CAS No. 108-88-3	**0.8 μg/L (Interim PWQO)[10]**
Tolyltriazole CAS No. 29385-43-1	**3 μg/L (Interim PWQO)[a]**
Toxaphene CAS No. 8001-35-2	**0.008 μg/L (PWQO)[1]**
Tributyl phosphate CAS No. 126-73-8	**0.6 μg/L (Interim PWQO)[a]**
Tributyltin CAS No. various	**0.000005 μg/L (Interim PWQO)[12]**
Trichlorobenzene, 1,2,3- CAS No. 87-61-6	**0.9 μg/L (PWQO)[2]**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Trichlorobenzene, 1,2,4- CAS No. 120-82-1	**0.5 μg/L (PWQO)[2]**
Trichlorobenzene, 1,3,5- CAS No. 108-70-3	**0.65 μg/L (PWQO)[2]**
Trichloroethane, 1,1,1- CAS No. 71-55-6	**10 μg/L (Interim PWQO)[a]**
Trichloroethane, 1,1,2- CAS No. 79-00-5	**800 μg/L (Interim PWQO)[6]**
Trichloroethylene CAS No. 79-01-6	**20 μg/L (Interim PWQO)[6]**
Trichloroguaiacol, 3,4,5- CAS No. 57057-83-7	**0.1 μg/L (Interim PWQO)[a]**
Trichloroguaiacol, 4,5,6- CAS No. 2668-24-8	**0.8 μg/L (Interim PWQO)[a]**
Trichlorophenols CAS No. 25167-82-2	**18 μg/L (PWQO)[3]** • PWQO can be applied to all 6 individual isomers: 2,3,4-,(CAS No. 15950-66-0) 2,3,5- (CAS No. 933-78-8), 2,3,6- (CAS No. 933-75-5) 2,4,5- (CAS No. 95-95-4), 2,4,6- (CAS No. 88-06-2), and 3,4,5-trichlorophenol (CAS No. 609-19-8)
Triethyl lead CAS No. 1067-14-7	**0.4 μg/L (Interim PWQO)[7]**
Triethyltin CAS No. 994-31-0	**0.4 μg/L (Interim PWQO)[12]**
Trimethylbenzenes CAS No. 25551-13-7	**3 μg/L (Interim PWQO)[a]**
Triphenyltin CAS No. 76-87-9	**0.002 μg/L (Interim PWQO)[12]**
Tungsten CAS No. 7440-33-7	**30 μg/L (Interim PWQO)[a]**
Turbidity CAS No. NA	**PWQO[1]:** **Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than 10 percent.**

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

Uranium CAS No. 7440-61-1	**5 μg/L (Interim PWQO)[a]**	
Vanadium CAS No. 7440-62-2	**6 μg/L (Interim PWQO)[20]**	
Vinyl chloride CAS No. 75-01-4	**600 μg/L (Interim PWQO)[a]** • common synonym - chloroethylene	
Water clarity CAS No. NA	**PWQO[1]:**	**The water in swimming areas should be sufficiently clear to estimate depth or to see submerged swimmers who may require assistance. To achieve this degree of safety, water clarity should be such that, if the bottom of the bathing area is not visible, the water should have a Secchi disc transparency of at least 1.2 m.**
Xylene, *m*- CAS No. 108-38-3	**2 μg/L (Interim PWQO)[b]**	
Xylene, *o*- CAS No. 95-47-6	**40 μg/L (Interim PWQO)[b]**	
Xylene, *p*- CAS No. 106-42-3	**30 μg/L (Interim PWQO)[b]**	
Zinc CAS No. 7440-66-6	**30 μg/L (PWQO)[1]**	
Zinc (revised) *CAS No. 7440-66-6*	***20 μg/L (Interim PWQO)[b]***	*(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)*
Zirconium CAS No. 7440-67-7	**4 μg/L (Interim PWQO)[a]**	

Notes for Table 2:

- All PWQOs are for the for the protection of aquatic life, unless otherwise noted.
- The PWQOs are based on the total concentration of an unfiltered sample, unless otherwise noted.
- The "CAS No." is the number assigned by the American Chemical Society's Chemical Abstracts Services.

REFERENCES FOR TABLE 2

1. MOE. 1979. Rationale for the Establishment of Ontario's Water Quality Objectives. 236 pp.

2. MOE. 1984. Scientific Criteria Document for Standard Development - Chlorinated Benzenes in the Aquatic Environment. 197 pp.

3. MOE. 1984. Scientific Criteria Document for Standard Development - Chlorinated Phenols in the Aquatic Environment. 180 pp.

a See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

b See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-21 References for criteria development documents - see last page of Table 2.

4. MOE. 1988. Scientific Criteria Document for the Development of Provincial Water Quality Objectives and Guidelines - Aluminum. 81 pp.

5. MOE. 1988. Scientific Criteria Document for the Development of Provincial Water Quality Objectives and Guidelines - Resin Acids. 60 pp.

6. MOEE. 1993. Scientific Criteria Document for the Development of Provincial Water Quality Guidelines for Chlorinated Ethanes & Chlorinated Ethylenes. PIBS 2603, 111 pp.

7. MOEE. 1994. Scientific Criteria Document for the Development of Provincial Water Quality Guidelines for Alkylleads. PIBS 3160, 50 pp.

8. MOEE. 1994. Ontario Drinking Water Objectives (Revised 1994). 68 pp.

9. MOEE. 1994. Scientific Criteria Document for the Development of a Provincial Water Quality Guideline for Ethylbenzene. PIBS 3231e, 32 pp.

10. MOEE. 1994. Scientific Criteria Document for the Development of a Provincial Water Quality Guideline for Toluene. PIBS 3232e, 43 pp.

11. Emerson, K., R.C. Russo, R.E. Lund and R.V. Thurston. 1975. Aqueous ammonia equilibrium calculations: Effect of pH and temperature. J. Fish. Res. Board Can. 32: 2379-2383.

12 MOEE. 1995. Scientific Criteria Document for the Development of Provincial Water Quality Guidelines for Organotins. PIBS 3252e, 93 pp.

13. MOEE. 1995. Scientific Criteria Document for the Development of an Interim Provincial Water Quality Objective for Thallium. PIBS 3373e, 29 pp.

14. MOEE. 1996. Scientific Criteria Document for the Development of an Interim Provincial Water Quality Objective for Antimony. PIBS 3348e02, 32 pp.

15. MOEE. 1996. Scientific Criteria Document for the Development of an Interim Provincial Water Quality Objective for Aniline. PIBS 3347e01, 29 pp.

16. MOEE. 1996. Scientific Criteria Document for the Development of a Provincial Water Quality Objective for Cobalt (Stable Isotope). PIBS 3361e, 44 pp.

17. MOEE. 1997. Scientific Criteria Document for the Development of Interim Provincial Water Quality Objectives for 2,4-Dinitrotoluene and 2,6-Dinitrotoluene. PIBS 3559e, 35 pp.

18. Canadian Council of Ministers of the Environment. 1998. Canadian Environmental Quality Guidelines, Chapter 4: Canadian water quality guidelines for the protection of aquatic life. CCME, Winnipeg, MB. *note: Provincial Water Quality Objectives with this reference were adopted from CCME.*

19. MOE. 1999. Scientific Criteria Document for the Development of a Provincial Water Quality Objective for Molybdenum. in press, 26 pp.

20. MOE. 1999. Scientific Criteria Document for the Development of a Provincial Water Quality Objective for Vanadium . in press, 30 pp.

21. MOE. 1999. Scientific Criteria Document for the Development of a Provincial Water Quality Objective for N, Nitrosodimethylamine. in press, 28 pp.

List of corrections

February 99 printing

- October 98 corrections incorporated (see “What’s New))
- radionuclides - tritium value changed to agree with Ontario Drinking Water Objective
- vinyl chloride PWQO corrected
- references 12 to 21 added
- minor changes
  - number of dichlorophenols isomers,
  - synonyms added for several chemicals
  - corrections/additions to CAS numbers

TABLE 3 - Table of Fish Tissue Residue Criteria

The following are fish tissue residue criteria for the protection of fish-consuming birds and also, in the case of mercury, aquatic life. All the criteria are in μg of contaminant per gram of whole-fish (wet weight). Fish tissue residue criteria for the protection of human consumers of sport fish can be found in the publication *Guide to Eating Ontario Sport Fish*.

DDT and Metabolites	The sum of the concentrations of DDT and its metabolites in whole-fish should not exceed 1 μg/g (wet weight basis) for the protection of fish-consuming birds.
Mercury	Concentrations of mercury in whole-fish should not exceed 0.5 μg/g (wet weight basis) for the protection of aquatic life and fish-consuming birds.

REFERENCES FOR TABLE 3

MOE. 1979. Rationale for the Establishment of Ontario's Water Quality Objectives. 236 pp.

MOEE. 1993. Guide to Eating Ontario Sport Fish. 1993-94 edition. Ontario Ministry of Environment and Energy. 171 pp.

APPENDIX B

BANNED HAZARDOUS SUBSTANCES

Aldrin[1] (CAS No. 309-00-2)

Chlordane[1] (CAS No. 57-74-9)

Chlordecone (Photo-mirex, Kepone)[1] (CAS No. 143-50-0)

DDT[1] (CAS No. 50-29-3)

Dieldrin[1] (CAS No. 60-57-1)

Endrin[1] (CAS No. 72-20-8)

Mirex (Declorane)[2] (CAS No. 2385-85-5)

Polybrominated Biphenyls[2]

Polychlorinated Biphenyls[3]

Polychlorinated Terphenyls[2]

Toxaphene[4] (CAS No. 8001-35-2)

July, 1994

Notes:

[1] - Prohibited pesticides under Regulation 914 of the Pesticides Act.
[2] - Prohibited commercial, manufacturing or processing uses under Federal Legislation.
[3] - Prohibited commercial, manufacturing or processing uses under Federal Legislation; limited uses permitted in existing electrical transformers.
[4] - Not registered for use in Canada.