Water Management Framework for the Industrial Heartland and Capital Region

Effluent Characterization Program

June 15, 2015

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Effluent Characterization Program (Industrial Version)

1 Introduction

The Effluent Characterization Program (ECP) is an important component of implementing cumulative effects management on the North Saskatchewan River (NSR), particularly in the Devon to Pakan reach (Industrial Heartland Reach). The regional need for the Effluent Characterization Program has been recognized by the Water Management Framework Advisory Committee, a multi-stakeholder group whose focus is implementing the Framework, understanding water management issues and developing solutions for the Industrial Heartland and Capital Region. Environment and Parks has developed and refined the program using input from the stakeholder committee as well as an outside consultant. The ongoing development of the program will continue to be a consultative, iterative process.

The Effluent Characterization Program is a program that describes monitoring and reporting requirements for effluent directly entering the North Saskatchewan River. This program will assess substances from municipal, agricultural, and industrial sources. The ultimate objective of the program is to provide economically and scientifically sound data for tools that are used to monitor, evaluate, and inform management decisions in this reach of the river.

Effluent characterization was identified as a knowledge gap during the development of Maximum Allowable Loads for this region. The Effluent Characterization Program has been designed to fill this gap by requiring seasonal sampling of effluent for all point source emitters in this region for a standardized set of parameters using consistent sampling and analytical testing methods. The results from this program will also be used to further develop Maximum Allowable Loads and to support several other water quality management tools used by Environment and Parks to manage water quality in the NSR.

The Effluent Characterization Program is not a policy, regulatory, compliance, or approval document. Rather, it is an operational program that provides the foundation for consistent reporting by dischargers on effluent conditions. It is supported through the *Environmental*

Protection and Enhancement Act (EPEA), in Part 5, Division 1 – Release of Substances Generally – which requires that facilities have knowledge of the substances they are discharging into a water body and the duty to report the release of a substance that might cause, is causing or has caused an adverse effect. This program will be implemented for facilities regulated by Environment and Parks and the Alberta Energy Regulator (AER) within the Industrial Heartland Reach as both are regulated by EPEA.

This version of the program has been modified for industry only.

1.1 Background

1.1.1 Cumulative Effects Management Framework

Cumulative effects management is a current approach being used to manage regional surface water quality issues in the Province. It addresses the combined impact of natural and anthropogenic levels of substances, both point and non-point sources. Cumulative effects management also recognizes that while effluent from each individual emitter might be below guideline limits, the sum across all the emitters and the background level could result in a substance level in the NSR that is above the objective levels.

A cumulative effects management framework approach was initiated in 2007 and is encompassed in the Water Management Framework (WMF) for the Industrial Heartland and Capital Region (IH/CR). The delineation of the NSR for the IH/CR is from the Long-Term River Network (LTRN) station at Devon to the LTRN station at Pakan. This reach supports a large segment of Alberta's resource processing heavy industry, as well as the City of Edmonton (CoE) and surrounding municipalities.

The WMF presents a collaborative, cumulative effects management approach to support the mandate of water quality protection; specifically: "…there will be **no further deterioration of water quality**, and ultimately, that there will be an improvement of current conditions" (ESRD, 2008). Science-based decision-making is foundational to support this goal and to implement the WMF.

Desired outcomes of the WMF include:

- water quality improvement,
- minimal loading discharge, and

- **the development of a process to evaluate water quality to ensure continuous improvement**.

Strategies for the achievement of these outcomes include:

- all types of water users participate in contributing to improve the overall sustainability of the NSR, and
- an adaptive management system is put in place that provides for evaluation, monitoring, and reporting (with adjustments as required).

River flow rates (seasonally) are a large source of variability for measuring water quality. To address this variability, concentrations are converted to mass flow rates (kg/day) using river flow rates. Mass flow rates are divided into ranges on the basis of the associated river flow rate. In this way, high flow rates (including the spring runoff events and large summer storms) which involve a large non-point source component can be grouped together. Very low flow rates (winter), which tend to be dominated by point source phenomena, are grouped together, but separate from high flow rates. This is the basis for the Load Duration Analysis method which is used to generate Maximum Allowable Load (MAL) values (further detailed in the Pilot Water Quality report, ESRD 2013). By addressing this large source of variability through blocking, fewer samples are necessary.

In order to have a better understanding of the relationship between effluent and surface water quality, more information is required about the state and trends of the river, and the effluents over time and along the river. Knowledge of the nature of this relationship between the effluent levels and the amount in the river will assist in managing the parameter. Ultimately, it would be valuable to understand the relationship where it would be possible to make useful predictions through modelling. Also, levels for some parameters in the IH/CR have fluctuated above acceptable levels and need to be decreased. Other parameters are well below limits, but it is still necessary to determine what the current levels are for determining a baseline, and monitor for change in order to ensure that the objective to maintain or improve water quality is met.

1.1.2 Prairie Provinces Water Board

The Master Agreement on Apportionment is a water quality and quantity agreement among Alberta, Saskatchewan, and Manitoba. This agreement includes water quality objectives for the North Saskatchewan River at the Saskatchewan border for parameters including metals, nutrients, anions, physical parameters, phenolic compounds, polychlorinated biphenyls (PCBs),

and pesticides. In the past few years, there have been exceedances noted for aluminum, copper, iron, lead, zinc, fecal coliform and pH at the border.

1.1.3 Status of tool development

The WMF Implementation Advisory Committee for the IH/CR, and additional subcommittees assisted Environment and Parks in the development of decision-making support tools including monitoring studies, evaluations, models and water quality objectives. To support the development and use of these tools, Environment and Parks completed substantial research on the NSR studying pollutant loadings, water quality, sediment quality, biological communities, and engineering evaluations on the feasibility of integrated regional water and wastewater treatment system options. These tools are important for the management of the data gathered from the ECP. The data can be used in various ways and these tools will help make management decisions that will improve water quality in the IH/CR reach of the NSR. The data from the ECP will be used to support these tools.

1.2 Purpose of the ECP

The ECP is a screening tool to assist in the implementation of achieving water quality objectives in the Devon to Pakan reach of the NSR, commonly referred to as the Industrial Heartland Reach.

The program has the following specific purpose:

- To allow for consistent effluent characterization.
- To support the determination of Maximum Allowable Loads.
- To provide insight for management responses following long-term river changes.
- To provide consistency in sampling, analysis and reporting for representative results by creating a consistent:
    - list of parameters being monitored,
    - frequency of monitoring,
    - laboratory methodology, and
    - reporting formats.

The ECP provides an outline of analytical and reporting requirements for all EPEA-approved facilities directly discharging point source effluents into the NSR and its tributaries and to carry out a consistent effluent characterization (refer to map in Appendix C). It includes EPEA

approval holders under both Environment and Parks and AER. Current focus is on industrial facilities within the Industrial Heartland Reach.

The ECP is necessary for several reasons. Historically, there has been a substantial gap in knowledge of point source discharge pollutant loads relative to ambient river loads. However, the cumulative effects management approach has evolved monitoring to include effluent pollutant loads for a more comprehensive understanding and management of the river. This program is designed to:

- ensure pollutant load sources in the IH/CR are better understood through the monitoring of a consistent and comprehensive set of parameters, done in a consistent manner;
- improve understanding of the cumulative influences on river pollutant loads at a regional scale, enabling comparability of ambient river water quality with effluent data; and
- assist in the development of pollutant load management responses when long-term exceedances of water quality or aquatic health benchmarks occur.

The Program will further assist with assessing risk(s) to meet instream water quality objectives under the IH/CR WMF, Prairie Provinces Water Board or other regional thresholds.

This program may be used in development of ECPs for other areas or regions in Alberta.

Data collected through the ECP may be used for:

- identification of pollutant load sources,
- effluent trend analysis including seasonality,
- current state assessments,
- Contaminant Loading Tools,
- load duration curves and MALs calculations,
- Environmental Fluid Dynamics Code (EFDC) model,
- indicating typical industry specific substance levels,
- informing future river monitoring decisions including synoptic studies, and
- indicating which parameters will need baselines developed

The initial effluent characterization is a screening exercise to inform subsequent development of a long-term effluent monitoring system that will result in a cost-effective and statistically meaningful effluent quality database for each discharger.

The ECP is based on the most recent version of the Canadian Council of Ministers of the Environment (CCME) *Technical Supplement 3: Canada-wide Strategy for the Management of*

Municipal Wastewater Effluent: *Standard Method and contracting Provisions for Environmental Risk Assessment* (June 2008) (referred to in this Program as MWWE) and is also consistent with a number of other existing federal and provincial strategies, policies, guidelines and procedures including:

- Environmental Protection and Enhancement Act, RSA 2000, c E-12. Mar. 29, 2014)
- Provincial Laboratory Data Quality Assurance Policy
- Provincial sampling and reporting procedures
- Water Quality Based Effluent Limits (Procedures Manual)
- Industrial Release Limits Policy

1.3 Specific Objectives of the Effluent Characterization

Below are the specific tasks for each facility to consider when drafting their proposal to Environment and Parks.

1. Determine representative values (or non-detects) for substances under four different flow regimes (seasonality described in section 4.4) for the following groups of parameters as listed in detail in Appendix D.
2. Determine the effluent flow rate for the sampling time.
3. Determine the total volume of effluent being represented by the sample.
4. Calculate an adjusted flow rate to accommodate for discontinuous discharges.

Environment and Parks will match the load to the river flow rate and conduct the compilation of the data.

2 About the Program

It is recognized that each facility has a unique system for managing its effluent. Environment and Park's interest is specifically in the quality and quantity of the effluent at end-of-pipe that discharges into the NSR. Facilities shall propose a representative sampling program to achieve the requirements of the Program. Representative sampling is *that which accurately reflects the composition of the effluent being released through the outfall into the river and is representative of variability due to seasonality or facility activities.*

2.1 Substances of Concern

To better understand pollutant loads for substances of concern, the ECP requires each facility to sample for the comprehensive set of parameters listed in Appendix D. This list may be expanded and/or modified per facility in subsequent effluent characterizations.

2.1.1 Criteria for substances of concern

The list of parameters was established based on:

- the pilot MAL variables, which constitute a list of substances of concern tailored to the NSR,
- those outlined in the Canadian Council for Ministers of the Environment (CCME) MWWE Strategy, which are based on the CCME Canadian Environmental Quality Guidelines,
- substances that have been detected in the NSR or effluents in previous studies, and
- substances that are part of the analytical laboratory's standard testing suite.

2.1.2 Low level substances

The CCME and the EPA provide lists of parameters that should be monitored in surface water although many of these are low level parameters. Low level parameters include many of the polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and pesticides. Guideline limits might not have been set for some of these parameters. Even though some of these substances are at or below laboratory detection limits, the number of detections versus non-detections also provides meaningful and statistical information about increasing levels of these parameters in the river or effluent.

Effluent is more concentrated than river water, so it becomes necessary to do infrequent but regular effluent monitoring for these low level substances. These parameters can also be monitored to provide a baseline, particularly if new industry is anticipated along the river.

Many of these low level parameters are analyzed as part of a suite which makes it possible to monitor for a large number of important parameters at once and also include parameters that might not normally be detected at a given facility.

2.1.3 Toxicity testing

Toxicity testing is presently not in scope as it is generally addressed in approval monitoring. Such testing may be required on a case-by-case basis pending individual effluent characterization results.

3 Characterization Date and Cycle

The initial characterization is to be commenced as directed by Environment and Parks for existing, amended, or new EPEA-approved facilities. Based on the initial results from the program, changes to analytic technology, and changes in effluent along the river, future assessments might include changes to parameters, number of samples, or analytic methods required for the initial or reassessment characterizations for new, renewed, or amended approvals in subsequent versions of this document.

A reassessment characterization shall be done:

1. If there have been major changes to the facility process (to be determined during the application for amendment to the approval permit).
2. After five years from initial assessment or subsequent assessments.
3. When notified by a letter from the Director.

4 Initial Effluent Characterization Proposal

EPEA-approved facilities discharging into the Industrial Heartland reach of the NSR are varied in size, type and the way they process their effluents. Core requirements for carrying out the ECP are outlined in this document. Recognizing the unique circumstances of each discharging facility, each facility is required to submit a proposal outlining how the requirements of the ECP as described herein this document shall be met.

4.1 Timeline Table

The following table outlines the general process and estimated timelines for carrying out the ECP.

	Actions	Deadline*
1.	Letter to EPEA-approved facility from Environment and Parks requesting Effluent Characterization to be carried out	June 15, 2015
2.	Facility provides contact info for the facility representative	July 15, 2015
3.	Facility prepares and submits proposal to Environment and Parks	December 1, 2015
4.	Environment and Parks reviews and accepts or rejects proposal	March 1, 2016
5.	Facility resubmits if necessary	May 1, 2016
6.	Environment and Parks reviews and accepts or rejects resubmitted proposal	June 1, 2016
7.	Facility begins Effluent Characterization program	July 1, 2016
8.	Facility submits first sample results	September 1, 2016
9.	Facility submits second sample results	December 1, 2016
10.	Facility submits third sample results	March 1, 2017
11.	Facility completes effluent characterization program	April 3, 2017
12.	Program data is submitted to Environment and Parks	May 1, 2017

4.2 Contact Person for Facility

The facility shall assign a contact person within the first month of the process and provide the contact info to Environment and Parks.

4.3 Changes to Program

Any notification from Environment and Parks with regards to removal of parameters from the study, changes in method detection limits, deadline extensions, or other changes will be sent by email to the contact person for the facility as provided by the facility.

4.4 Proposal Submission Process

The approval holder shall submit the proposal by the date prescribed in the above timeline table by email to both:

- Joy Wesley, Framework Implementation Coordinator
  Mary.Wesley@gov.ab.ca
- Mohammad Habib, Approvals Manager
  Mohammad.Habib@gov.ab.ca

4.5 Design of Representative Sampling

The ECP requires facilities discharging into the Industrial Heartland Reach of the NSR and its tributaries to conduct a **representative** one-year (twelve-month period) initial characterization of direct discharge to the NSR (or its tributaries).

The frequency of sampling shall be such that there are at least four samples (at least one for each season) accurately showing the variability in effluent within a four season period as indicated in the table below.

Flow Exceedance Range	Season	Approximate River Flow Range (m^3/sec)	Typical months associated with flow rate
Low Flow	Winter	65-140	Dec - Jan
Dry weather	Spring	100-140	Feb – Mar
Wet weather	Summer	145-600	April - July
Mid-range flow	Fall	100-175	Aug - Nov

(The flow exceedance chart includes for five categories of flow rate, the fifth being the greater than 90% flow exceedance range which has been included with summer wet weather for the purpose of industrial ECP. Separating out this high flow rate is more relevant for an effluent characterization for combined storm sewer system and wastewater treatment plants and is specifically addressed for municipal and storm effluent. The lowest flow exceedance which typically occurs in December or January is more meaningful for effluent characterization for point sources such as industry.)

There are challenges created by trying to plan the project while predicting anticipated river flow rates. Therefore, sampling dates can be selected within the months shown for the “seasons” given even though there is the possibility that any given date might actually have a flow rate more typical of a different season. It would be optimal but not mandatory, if an approval holder has the flexibility to adjust their sampling schedule to increase the likelihood of catching the correct flow rate. For example, if there is a dry period causing lower than average seasonal flow in the river during the week for which the approval holder had scheduled a sample, it would be preferred if the approval holder could postpone sampling until the river flow increases. Any deviations from the proposal shall be reported to Environment and Parks as soon as possible.

Ice cover can occur during dry weather or low flow range although not all dry weather flow range is under ice. At least one sample shall be done when there is an ice cover on the river. This should not create a challenge since the low flow months of December and January typically involve the river being under ice.

The focus of this program is to collect a representative sample which represents the mean or typical levels for the parameters for that season. It is not intended to fully characterize the distribution of all possible levels within each season. Nor is it intended to capture maximum effluent levels within a season.

Discontinuous or batch dischargers that do not discharge during one of the above flow regimes can omit that sample, but shall sample the first discharge event in the next season in addition to the sample required for the next season.

4.5.1 Additional samples

The approval holder is not limited to four samples. If additional samples are needed to meet the intent of the program with respect to meeting the requirement of a representative sample then this shall be outlined in the proposal.

4.5.2 Grab or composite

The facility can choose either a grab or composite sample depending on which would be representative of the effluent conditions for that season. The proposal shall indicate if the sample is a grab or composite sample and if the latter, the method by which the composite sample shall be created.

4.5.3 Large process variation

Facilities having large variation in their process system shall address the variation within the proposal. The proposal shall indicate what the major sources of process variation are and how these are addressed by the sampling.

4.5.4 Maintenance turn-around

Facilities doing annual maintenance turn-arounds shall also consider this in their proposal for a representative sample. The proposal shall indicate when the turn-around is likely to occur and how this source of variability shall be addressed.

4.5.5 Multiple ponds on one pipe

Recognizing that composition of effluent water and flow rate would be different for different ponds, the impact of variability from multiple ponds shall be addressed by the sampling. The facility can propose composite sampling or another strategy for dealing with this variation as long as the result is a representative sample. The proposal shall indicate the number and working volumes of the effluent ponds on site, how they relate to each other, and how this source of variability shall be addressed.

4.5.6 Upstream emitters on same pipe

It is recognized that composition of effluent water and flow rate would likely be different for an approval holder accepting effluent from an upstream emitter and this variation shall be addressed in the proposal. It is understood that this upstream effluent is the responsibility of the

owner of the end-of-pipe. The downstream facility shall adjust sampling to accommodate for variation introduced by the upstream facility. The proposal shall list the sources of effluent that originate off site and the associated volumes. The proposal shall indicate how this source of variability was addressed.

4.5.7 Location of sampling

While it would be optimal to have samples taken at the end of pipe, it is recognized that a facility has existing sampling infrastructure in place. Samples may be taken at a location that provides a representative sample even if this is not at the end of the pipe. The location of sampling and reason for its selection shall be indicated in the proposal.

4.5.8 Other sources of variation

Any other sources of substantial variability shall be reported and accounted for in the proposal.

4.6 Flow Volumes

The facility shall provide the daily flow volumes for each day of each three month season.

The goal is to be able to calculate an average daily mass loading rate (kg/day) for each season from the information.

4.7 Sample Collection Protocols

Facilities shall propose their sample collection protocols consistent with Section 4 in the CCME MWWE Strategy: Technical Supplement 3. If CCME MWWE Strategy protocols conflict with methodologies prescribed under an EPEA Approval, then methodologies outlined by Environment and Parks in the facility Approval, or by written communication shall take precedence. Any deviations from the CCME protocols shall be included in the proposal.

The date and time that the sample was taken as well as details regarding the location of the sampling shall be provided with the results for each season.

4.8 Intake Sampling

Approval holders interested in having influent sampled and analyzed for comparison with the effluent shall include this in the proposal. Influent sampling date, time and location shall be provided in the proposal.

4.9 Exemptions for Parameters

Most of the testing done by laboratories is done in suites or sets of parameters. Therefore, it is required that the full suite associated with the required parameters be done unless the facility is exempt from an entire set or suite of parameters. Since not all labs use the same suites, a description of the components of the exempted suite shall be provided in the proposal.

In the Environmental Quality Guidelines for Alberta Surface Waters – July 14, 2014, guidelines for water quality for the following parameters have been withdrawn: Aldrin, Chlordane, DDT, Dieldrin, Endosulfan I and II, Endrin, Toxaphene, PCBs, and Heptachlor. These parameters will not be included in the ECP at this time.

An exemption from testing for a pesticides suite will be granted for an approval holder if none of the pesticides within the suite were manufactured or stored at the facility site in the past 20 years. Similarly, an exemption from testing for glyphosate and/or sulfolane will be granted for an approval holder if the chemical was neither manufactured nor stored at the facility site in the past 20 years. In order to qualify for the exemption, the approval holder shall sign a statement to that effect as part of the initial proposal.

Any other requests involving justifications for exclusion of parameters shall receive approval from Environment and Parks in writing before the submission of the proposal.

4.10 Lab Methodology and Detection Limits

Analytical methodology shall meet the detection limits provided in the List of Parameters of Concern (Appendix D) unless authorized by Environment and Parks in writing in advance of the proposal submission. Details on specific methodologies, consistent with required method detection limits, shall be provided in facility proposals, and in consultation with Environment and Parks. A component of the proposal shall consist of the laboratory proposal which shall include details on analytic method and method detection limits.

Mercury analyses shall be done by ultra-trace cold vapor atomic fluorescence spectrometry (CVAFS) or a method having similar or better detection limits. All other trace metals shall be done using ICP-MS or a method having similar or better detection limits.

4.11 Quality Assurance/Quality Control

All testing shall be done by ISO certified laboratories using ISO certified methods unless authorized by ESRD in writing in advance of the proposal submission. A copy of the Canadian Association for Laboratory Accreditation Inc. (CALA) scope of accreditation document for each laboratory used as part of this study shall be provided to Environment and Parks with the proposal. Quality assurance/quality control (QA/QC) shall be consistent with quality management procedures as outlined in CCME MWWE Strategy (2008), Section 4.5.

5 Implement Initial ECP

Once the approval holder has received notification of an acceptable proposal, the approval holder shall conduct the ECP as described in the proposal. The approval holder shall notify Environment and Parks as soon as possible regarding any deviations from the accepted proposal that occur during implementation.

6 Reporting

6.1 Draft Data Summary

A draft summary of results (data in Excel format) from each sampling event shall be sent by email to the Approvals Manager within one month of the end of the season for which the sample set was taken. This summary shall include the effluent flow rates for the season.

6.2 Final Report

A final report will be sent to the Director within two months of the last sample taken for program. The report will contain the following:

6.2.1 Field notes

Description related to sampling, preservation, and storage shall be provided consistent with the format given in Appendix A of the CCME Document Technical Supplement 3, and shall include any changes in sampling techniques.

6.2.2 Lab methodology

Description of methodology shall include considerations such as:

- instrument calibration,
- precision/accuracy – **within-run (repeatability) and between run (reproducibility)**,
- QA/QC, and
- field and lab protocols.

A copy of the original lab test reports shall be provided as an Appendix to the report.

6.2.3 Contextual notes

Additional notes are to include descriptions of factors that might affect sample variability or representativeness, for example:

- batch or composite (detailed notes on composition of composite)
- issues related to release type at time of sampling
- variation or issues with sample representativeness (operation or plant events)

6.2.4 Deviations

Any deviations from the accepted proposal shall be reported to Environment and Parks as soon as possible.

6.2.5 Sampling data

The data shall be submitted in an Excel spreadsheet format, consistent with the example template attached. Copies of lab reporting results and QA/QC are to be included with the final report. The data shall also include the effluent flow rates for each of the days of the four sampled seasons.

6.2.6 Additional sampling

If the approval holder monitors for any substances or parameters as part of the sampling for this program, in addition to the ones indicated in the approval holder's proposal, then the approval holder shall provide the results of such monitoring as part of the effluent characterization program. This includes any sampling of the river, intake water, or recycle water as well as information about the location, time, and method of sampling or analysis. Any additional sampling shall be put on a separate tab labeled "additional sampling" within the excel workbook and a copy of the lab test reports shall be included in an Appendix.

6.3 Data Accessible Publicly

Facility effluent characterization data submitted to Environment and Parks is evaluated by Environment and Parks and will be publicly accessible. Environment and Parks will collaborate with the approval holder and the advisory committee for the WMF to develop a report summarizing results with appropriate context.

7 References

Alberta Environment (AENV), 2004. *Alberta Environment Laboratory Data Quality Assurance Policy Procedures and Guidelines* July 30, 2004 ISBN No. 0-7785-3734-X Tech. No. T/761 http://aep.alberta.ca/water/inspections-and-compliance/documents/LaboratoryDataAssurancePolicyGuidelines.pdf

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Wastewater Effluent: Environmental Risk Management: Framework and Guidance (June 2008)

Canadian Council of Ministers of the Environment (CCME), 2008. *Technical Supplement 3: Canada-wide Strategy for the Management of Municipal Wastewater Effluent: Standard Method and Contracting Provisions for Environmental Risk Assessment* (June 2008)

North Saskatchewan Watershed Alliance (NSWA), 2010. *Proposed Site-Specific Water Quality Objectives*

Province of Alberta. *Environmental Protection and Enhancement Act*, RSA 2000, c E-12. Current as of Mar. 29, 2014.

8 APPENDIX A – Acronyms

AER	Alberta Energy Regulator
AEW	Alberta Environment and Water (prior to May 2012, see ESRD)
CCME	Canadian Council of Ministers of the Environment
ECP	Effluent Characterization Program
EFDC	Environmental Fluid Dynamic Code
EPA	United States Environmental Protection Agency
EPEA	*Environmental Protection and Enhancement Act*
ESRD	Environment and Sustainable Resource Development
IH/CR	Industrial Heartland – Capital Region
LTRN	Long Term River Network
MAL	Maximum Allowable Load
MDL	Minimum Detection Limit
MWWE	Municipal Wastewater Effluent
NSR	North Saskatchewan River
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
QA/QC	Quality Assurance / Quality Control
VOCs	Volatile Organic Compounds
WMF	Water Management Framework

9 APPENDIX B – Definitions

Cumulative Effects

Changes in the environment caused by all past, present and reasonably foreseeable future human activities. [1]

Cumulative Effects Management

An approach that establishes outcomes for an area by balancing environmental, economic and social considerations and implementing appropriate plans and tools to ensure those outcomes are met. [2]

- Outcomes-based: clearly defining, desired end-state
- Place-based: meeting the differing needs of regions within the province
- Performance management-based: using adaptive approaches to ensure results are measured and achieved
- Collaborative: building on a culture of shared stewardship, using a shared knowledge base
- Comprehensively implemented: using both regulatory and non-regulatory approaches

Direct Discharger

A facility that has an outfall to the river or a tributary of the river.

End-of-pipe

The point of discharge into the receiving environment.

or

A point between the end of the treatment process and the receiving environment. [3]

Environment	Components of the earth and include i) air, land and water, ii) all layers of the atmosphere, iii) all organic matter and living organisms, and the interacting natural systems that include components referred to in i) to iii). [4]
Receiving Environment	The water body into which effluent is discharged. [3]
Release	Includes: to spill, discharge, dispose of, spray, inject, inoculate, abandon, deposit, leak, seep, pour, emit, empty, throw, dump, place and exhaust. [4]
Representative sampling	Samples accurately showing the variability in effluent within a twelve-month period. It is the intent that the data be representative of seasonality (e.g., ice covered vs. open water; high ambient flows vs. lower flows), regardless of temporal frequency (e.g., three months apart) and if appropriate, shall be representative of facility activity (e.g. system flushing, change in production).
Substance	Chemical substance or any other parameter associated with wastewater, including carbonaceous biochemical oxygen demand (CBOD), total suspended solids (TSS), temperature, pH, pathogens, etc. [3] or Any matter that is capable of becoming dispersed in the environment, or is capable of becoming transformed in the

	environment into matter that is capable of becoming dispersed in the environment. [4]
Substance releases	Includes Discharge(s), Effluent(s), Wastewater into a receiving body of water, in this case, the North Saskatchewan River.

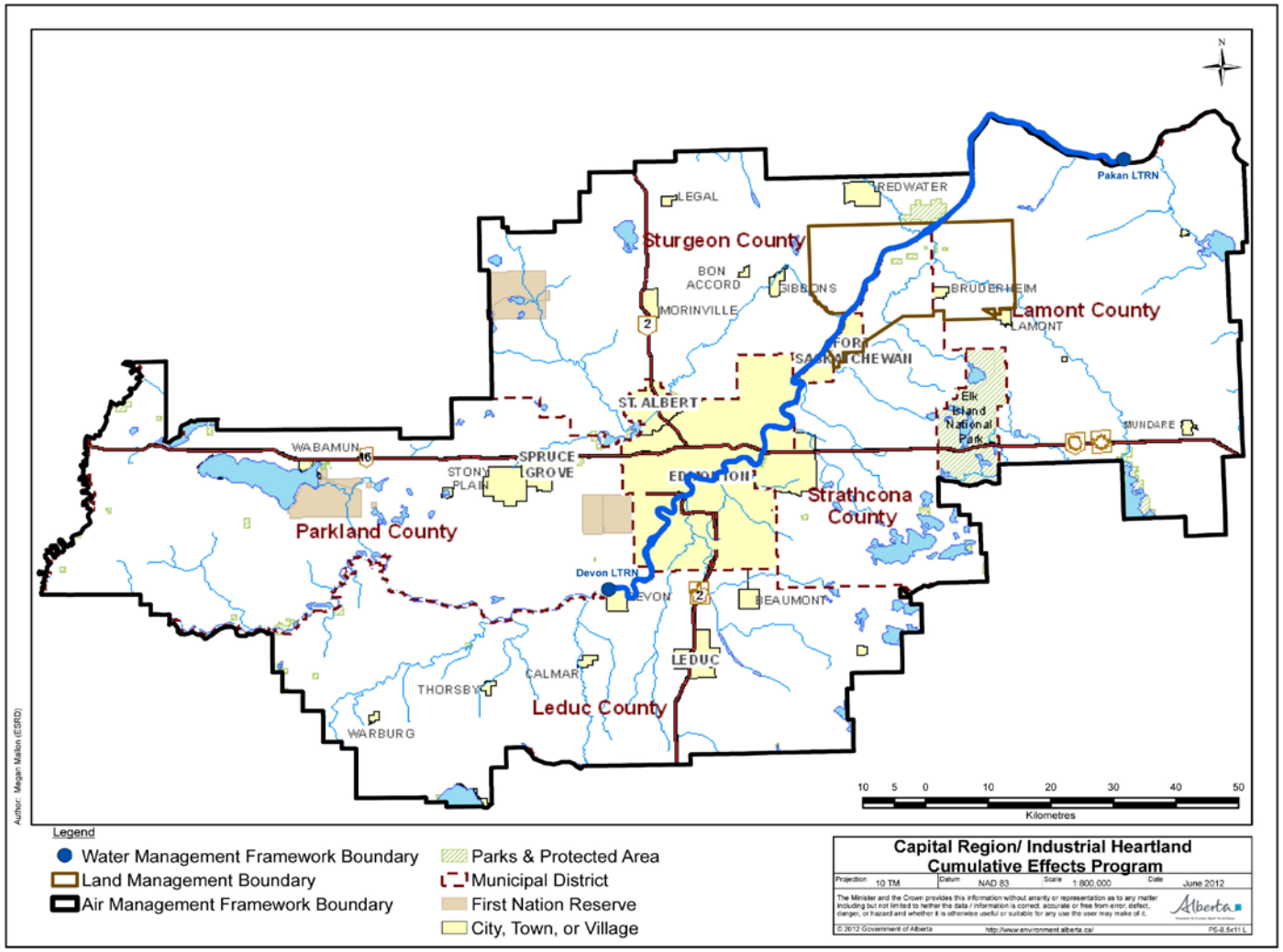
[1] Alberta Environment and Sustainable Resource Development (ESRD), 2008. *The Water Management Framework for the Industrial Heartland and Capital Region.*

[2] Cumulative Effects

[3] Canadian Council of Ministers of the Environment (CCME), 2008. *Technical Supplement 2: Canada-wide Strategy for the Management of Municipal Wastewater Effluent: Environmental Risk Management: Framework and Guidance* (June 2008)

[4] *Environmental Protection and Enhancement Act*, RSA 2000, c E-12.

10 APPENDIX C – Map: Industrial Heartland – Capital Region



11 APPENDIX D – List of Parameters – Effluent Characterization Program

This list was developed using scans from the Alberta Innovates Technology Futures (AITF) laboratories.

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
Physical Nutrients & Major Ions	Alkalinity	PAL	20 mg/L	0.50 mg/L $CaCO_3$
	Ammonia Nitrogen (total)	PAL	equation	0.050 mg/L
	$CBOD_5$ – Carbonaceous			2.0 mg/L
	$NBOD_5$ – Nitrogenous			2.0 mg/L
	Chloride (dissolved)		120 mg/L (640 mg/L)	1.0 mg/L
	Conductivity			1.0 uS/cm
	Dissolved Oxygen			0.1 mg/L
	E. coli	ASWQG REC	200 /100 mL	10 CFU/100 mL
	Fecal Coliforms	ASWQG REC	200 /100 mL	10 CFU/100 mL
	Fluoride (dissolved)	PAL	120 ug/L	0.050 mg/L
	Hardness			0.5 mg/L $CaCO_3$
	Nitrite Nitrogen	PAL	Varies with chloride	0.0030 mg/L
	Nitrite+Nitrate Nitrogen	CEQG Ag	100 mg/L	0.003 mg/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	Nitrogen (total)	PAL	narrative	0.050 mg/L
	Total Kjedahl Nitrogen (TKN)			0.050 mg/L
	Organic Carbon (dissolved)			0.50 mg/L
	Organic Carbon (total)			0.50 mg/L
	pH	PAL	6.5 – 9 and not more than 0.5 from background	n/a
	Phosphorus (dissolved)	PAL	narrative	0.003 mg/L
	Phosphorus (total)	PAL	narrative	0.003 mg/L
	Potassium (dissolved)			0.30 mg/L
	Sodium (dissolved)			1.0 mg/L
	Sulphate (dissolved)	PAL	varies	1.0 mg/L
	Temperature	PAL	narrative	n/a
	Total Dissolved Solids (TDS)			10 mg/L
	Total Suspended Solids (TSS)			1.0 mg/L
	Turbidity	PAL	narrative	0.10 NTU
	Nitrate	PAL	3 mg/L (124 mg/L)	0.0030 mg/L
	Total Residual Chlorine (TRC)			0.05 mg/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
Physical Nutrients & Major Ions	Chemical Oxygen Demand (COD)			2.0 mg/L
	Cyanide (total)	PAL	5.2 ug/L (22 ug/L)	0.0020 mg/L
	True Colour			2.0 PtCo
	Orthophosphate			0.0030 mg/L
	Ion Balance			0.01
	Sum of cations, anions			n/a
	Silica (Reactive)			0.050 mg/L
Metals – Total and Dissolved	Aluminum (Al) total			3 ug/L
	Aluminum (Al) dissolved	PAL	50 ug/L (100 ug/L)	3 ug/L
	Antimony (Sb) total			0.05 ug/L
	Antimony (Sb) dissolved			0.05 ug/L
	Arsenic (As) total	PAL	5 ug/L	0.1 ug/L
	Arsenic (As) dissolved			0.1 ug/L
	Beryllium (Be) total			0.1 ug/L
	Beryllium (Be) dissolved			0.1 ug/L
	Boron (B) total	PAL	1.5 ug/L (29 ug/L)	0.8 ug/L
	Boron (B) dissolved			0.8 ug/L
	Cadmium (Cd) total	PAL	equation	0.01 ug/L
	Cadmium (Cd)			0.01 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	dissolved			
	Chromium (Cr) total (unfiltered)	presumed	8.9 ug/L	0.3 ug/L
	Chromium trivalent (CrIII)	PAL/Ag Irrigation	8.9 ug/L 4.9 ug/L	0.3 ug/L
	Chromium Hexavalent (Cr VI)	PAL	1 ug/L	1.0 ug/L
	Cobalt (Co) total	PAL	2.5 ug/L	0.1 ug/L
	Cobalt (Co) dissolved			0.1 ug/L
	Copper (Cu) total	PAL	7 ug/L (equation)	0.1 ug/L
	Copper (Cu) dissolved			0.1 ug/L
	Iron (Fe) total	PAL	300 ug/L	4 ug/L
	Iron (Fe) dissolved			4 ug/L
	Lead (Pb) total	PAL	equation	0.1 ug/L
	Lead (Pb) dissolved			0.1 ug/L
	Lithium (Li) total			0.2 ug/L
	Lithium (Li) dissolved			0.2 ug/L
	Manganese (Mn) total			0.1 ug/L
	Manganese (Mn) dissolved	PAg	200 ug/L	0.1 ug/L
	Mercury (Hg) total	PAL	0.005 ug/L (0.013 ug/L)	0.08 ng/L
	Molybdenum (Mo) total	PAL	73 ug/L	0.1 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	Molybdenum (Mo) dissolved			0.1 ug/L
	Nickel (Ni) total	PAL	Equation (equation)	0.1 ug/L
	Nickel (Ni) dissolved			0.1 ug/L
	Selenium (Se) total			0.2 ug/L
	Selenium (Se) dissolved			0.2 ug/L
	Silver (Ag) total	PAL	0.1 ug/L	0.01 ug/L
	Silver (Ag) dissolved			0.01 ug/L
	Sulfolane (Bondelane)	PAL	50 mg/L	0.2 mg/L
	Sulphide	PAL	1.9 ug/L	1.9 ug/L
	Thallium (Tl) total	PAL	0.8 ug/L	0.1 ug/L
	Thallium (Tl) dissolved			0.1 ug/L
	Tin (Sn) total			0.1 ug/L
	Tin (Sn) dissolved			0.1 ug/L
	Vanadium (V) total			0.1 ug/L
	Vanadium (V) dissolved			0.1 ug/L
	Zinc (Zn) total	PAL	30 ug/L	0.2 ug/L
	Zinc (Zn) dissolved			0.2 ug/L
	Barium (Ba) total			0.1 ug/L
	Barium (Ba) dissolved			0.1 ug/L
	Strontium (Sr) total			0.1 ug/L
	Strontium (Sr)			0.1 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	dissolved			
	Titanium (Ti) total			0.1 ug/L
	Titanium (Ti) dissolved			0.1 ug/L
	Uranium (U) total	PAL	15 ug/L (33 ug/L)	0.1 ug/L
	Uranium (U) dissolved			0.1 ug/L
	Calcium (Ca) total			0.1 mg/L
	Calcium (Ca) dissolved			0.1 mg/L
	Thorium (Th) total			0.1 ug/L
	Thorium (Th) dissolved			0.1 ug/L
	Bismuth (Bi) total			0.1 ug/L
	Bismuth (Bi) dissolved			0.1 ug/L
Pesticides	Alpha-BHC (Lindane byproduct)			0.005 ug/L
Pesticides	Mirex	PAL	0.001	
	Lindane (gamma-BHC)			0.005 ug/L
	Methoxychlor	PAL	0.03 ug/L	0.03 ug/L
	2,4-Dichlorophenoxy-acetic acid (2,4-D)	PAL	4 ug/L	0.005 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	Atrazine	PAL	1.8 ug/L	0.005 ug/L
	Bromoxynil	PAL	5 ug/L	0.005 ug/L
	Dicamba	PAL	10 ug/L	0.005 ug/L
	Diuron			0.2 ug/L
	Glyphosate	PAL	Formulation 65 ug/L Pure 800 ug/L	
	MCPA	PAL	2.6 ug/L	0.005 ug/L
	MCPP (Mecoprop)	PAL	13 ug/L	0.005 ug/L
	Picloram	PAL	29 ug/L	0.005 ug/L
	Simazine	PAL	10 ug/L	0.01 ug/L
	Triclopyr			0.01 ug/L
	2,4-DP			0.005 ug/L
	4-Chloro-2-methylphenol			0.01 ug/L
	Bromacil	PAL	5 ug/L	0.03 ug/L
	Carbathiin (Carboxin)			0.1 ug/L
	Chlorpyrifos (Dursban)	PAL	0.002 ug/L (0.2 ug/L)	0.005 ug/L
	Clodinafop-propargyl			0.04 ug/L
	Cyanazine	PAL	2 ug/L	0.05 ug/L
	Desisopropyl atrazine			0.05 ug/L
	Disulfoton (Di-Syston)			0.2 ug/L
	Ethalfluralin (Edge)			0.005 ug/L
	Ethofumesate			0.005 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	Fluazifop			0.01 ug/L
	Guthion	PAL	3 ug/L	0.2 ug/L
	Imazamethabenz-methyl (Assert)			0.05 ug/L
	Imazethapyr			0.02 ug/L
	Linuron	PAL	7 ug/L	0.02 ug/L
	MCPB			0.02 ug/L
	Malathion	PAL	0.1 ug/L	0.05 ug/L
	Methomyl			0.1 ug/L
	Metribuzin	PAL	1 ug/L	0.01 ug/L
	Oxycarboxin			0.05 ug/L
	Phorate (Thimet)			0.005 ug/L
	2,4-DB			0.005 ug/L
	2,4-Dichlorophenol	PAL	0.2 ug/L for total dichlorophenol	0.01 ug/L
	Aldicarb	PAL	1 ug/L	0.1 ug/L
Pesticides	Aminopyralid			0.01 ug/L
	Bentazon			0.005 ug/L
	Chlorothalonil	PAL	0.18 ug/L	0.005 ug/L
	Clodinafop acid metabolite			0.02 ug/L
	Clopyralid (Lontrel)			0.02 ug/L
	Desethyl atrazine			0.05 ug/L
	Diazinon	PAL	0.17 ug/L (0.17 ug/L)	0.005 ug/L
	Diclofop-methyl (Hoe Grass)	PAL	6.1 ug/L	0.02 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	Dimethoate (Cygon)	PAL	6.2 ug/L	0.05 ug/L
	Ethion			0.1 ug/L
	Fenoxaprop-P-ethyl			0.04 ug/L
	Fluroxypyr			0.01 ug/L
	Hexaconazole			0.05 ug/L
	Imazamox			0.02 ug/L
	Iprodione			0.02 ug/L
	Metalaxyl-M			0.01 ug/L
	Metolachlor	PAL	7.8 ug/L	0.005 ug/L
	Napropamide			0.02 ug/L
	Parathion	PAL	0.013 ug/L (0.065 ug/L)	0.01 ug/L
	Propiconazole			0.05 ug/L
	Quinclorac			0.005 ug/L
	Thiamethoxam			0.05 ug/L
	Vinclozolin			0.01 ug/L
	Pyridaben			0.02 ug/L
	Quizalofop			0.03 ug/L
	Terbufos			0.03 ug/L
	Triallate (Avadex BW)	PAL	0.24 ug/L	0.005 ug/L
	Trifluralin (Treflan)	PAL	0.2 ug/L	0.005 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	PAL	5.8 ug/L	0.1 ug/L
	Acenaphthylene			0.1 ug/L
	Anthracene	PAL	0.012 ug/L	0.1 ug/L
	Benzo(a)anthracene	PAL	0.018 ug/L	0.1 ug/L
	Benzo(a)pyrene	PAL	0.015 ug/L	0.1 ug/L
	Benzo(c)phenanthrene			0.1 ug/L
	Benzo(b)fluoranthene			0.1 ug/L
	Benzo(e)pyrene			0.1 ug/L
	Benzo(g,h,i)perylene			0.2 ug/L
	Benzo(b,j,k)-fluoranthene			0.1 ug/L
	Chrysene			0.1 ug/L
	Dibenzo(a,h)pyrene			0.5 ug/L
	Dibenzo(a,i)pyrene			0.5 ug/L
	Dibenzo(a,l)pyrene			0.5 ug/L
	Dibenz(a,h)anthracene			0.5 ug/L
	Fluoranthene	PAL	0.04 ug/L	0.1 ug/L
	Fluorene	PAL	3 ug/L	0.1 ug/L
	Indeno(1,2,3-cd)pyrene			0.1 ug/L
	Methylnaphthalene			0.1 ug/L
	Naphthalene	PAL	1 ug/L	0.1 ug/L
	Perylene			0.1 ug/L
	Phenanthrene	PAL	0.4 ug/L	0.1 ug/L
	Pyrene	PAL	0.025 ug/L	0.1 ug/L
	Retene			0.1 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
Volatile Organic Compounds (VOCs)	Acridine	PAL	4.4 ug/L	0.01 ug/L
	Benzene	PAL	40 ug/L	0.1 ug/L
	Bromodichloro-methane			0.1 ug/L
	Bromoform			0.5 ug/L
	Carbon Tetrachloride	PAL	13.3 ug/L	0.1 ug/L
	Chlorobenzene	PAL	1.3 ug/L	0.1 ug/L
	Chlorodibromo-methane			0.1 ug/L
	Chloroform	PAL	1.8 ug/L	0.1 ug/L
	1,2-Dichlorobenzene	PAL	0.7 ug/L	0.1 ug/L
	1,4-Dichlorobenzene	PAL	26 ug/L	0.1 ug/L
	1,2-Dichloroethane	PAL	100 ug/L	0.1 ug/L
	1,1-Dichloroethene			0.1 ug/L
	Dichloromethane	PAL	98.1 ug/L	0.1 ug/L
	Ethylbenzene	PAL	90 ug/L	0.1 ug/L
	1,1,1,2-Tetrachloro-ethane			0.1 ug/L
	1,1,2,2-Tetrachloro-ethane			0.1 ug/L
	Tetrachloroethene	PAL	110 ug/L	0.3 ug/L
	Toluene	PAL	0.5 ug/L	0.1 ug/L
	Trichloroethene	PAL	21 ug/L	0.1 ug/L
	Vinyl Chloride			0.5 ug/L
	M/P-Xylene	PAL	30 ug/L for total xylenes	0.1 ug/L
	O-Xylene		30 ug/L for total xylenes	0.1 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	1,2,4- Trimethyl-benzene			0.1 ug/L
	Methylene chloride (dichloromethane)	PAL	98.1 ug/L	2.0 ug/L
	Trichlorofluoro-methane			0.1 ug/L
	Trihalomethanes			0.1 ug/L
	DBP: Di-n-butyl phthalate	PAL	19 ug/L	0.1 ug/L
	DEHP: Di (or bis) (2-ethylhexyl) phthalate	PAL	16 ug/L	0.1 ug/L
	Diethyl phthalate			0.1 ug/L
Volatile Organic Compounds (VOCs)	BBzP: Butylbenzyl phthalate			0.1 ug/L
	1,1,1-Trichloroethane			0.1 ug/L
	1,1,2-Trichloroethane			0.1 ug/L
	1,1-Dichloroethane			0.1 ug/L
	1,2,3-Trichloro-benzene	PAL	8 ug/L	0.1 ug/L
	1-1-Dichloropropylene			0.1 ug/L
	1,2,3-Trichloro-propane			0.1 ug/L
	1,2,4-Trichloro-benzene	PAL	24 ug/L	0.1 ug/L
	1,2-Dibromo-3-chloropropane			0.3 ug/L
	1,2-Dibromoethane			0.1 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	1,2-Dichloropropane			0.1 ug/L
	1,3,5-Trimethyl-benzene			0.1 ug/L
	1,3-Dichlorobenzene	PAL	150 ug/L	0.1 ug/L
	1,3-Dichloropropane			0.1 ug/L
	2,2-Dichloropropane			0.1 ug/L
	2-Chloro-ethoxyethylene			0.4 ug/L
	2-Chlorotoluene			0.1 ug/L
	4-Chlorotoluene			0.1 ug/L
Volatile Organic Compounds (VOCs)	Bromobenzene			0.1 ug/L
	Bromomethane			0.1 ug/L
	Chloroethane			0.1 ug/L
	Chloromethane			0.5 ug/L
	Dibromomethane			0.1 ug/L
	Hexachlorobutadiene	PAL	1.3 ug/L	0.3 ug/L
	Isopropylbenzene			0.1 ug/L
	MTBE	PAL	10 ug/L	0.1 ug/L
	Naphthalene	PAL	1 ug/L	0.1 ug/L
	Styrene	PAL	72 ug/L	0.1 ug/L
	M/P-Xylene	PAL	30 ug/L	0.1 ug/L
	O-Xylene	PAL	30 ug/L	0.1 ug/L
	Cis-1,2-Dichloroethylene			0.1 ug/L
	Cis-1,3-Dichloropropylene			0.3 ug/L
	n-Butylbenzene			0.1 ug/L
	n-Propylbenzene			0.1 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	p-Isopropyltoluene			0.1 ug/L
	Sec-Butylbenzene			0.1 ug/L
	Tert-Butylbenzene			0.1 ug/L
	Trans-1,2-Dichloroethylene			0.1 ug/L
	Trans-1,3-Dichloropropylene			0.3 ug/L
	1,2,4-Trichlorobenzene	PAL	24 ug/L	0.1 ug/L
	1,2-Diphenylhydrazine			0.1 ug/L
	2,4-Dinitrophenol			0.1 ug/L
	2,4-Dinitrotoluene			0.1 ug/L
	2,6-Dinitrotoluene			0.1 ug/L
	2-Chloronaphthalene			0.1 ug/L
	4-Bromophenyl phenyl ether			0.1 ug/L
	4-Chlorophenyl phenyl ether			0.1 ug/L
	Benzidine			0.2 ug/L
	Bis(2chloroethoxy) methane			0.1 ug/L
	Bis(2-chloroethyl) ether			0.1 ug/L
	Bis(2-chloroisopropyl) ether			0.1 ug/L
	Di-n-octyl phthalate			0.1 ug/L
	Dimethyl phthalate			0.1 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	Hexachlorobenzene			0.1 ug/L
	Hexachlorobutadiene	PAL	1.3 ug/L	0.5 ug/L
	Hexachlorocyclo-pentadiene			0.1 ug/L
	Hexachloroethane			0.5 ug/L
	Isophorone			0.1 ug/L
	N-Nitroso-di-n-propylamine			0.2 ug/L
	N-Nitroso-diphenylamine			0.1 ug/L
	Nitrobenzene			0.1 ug/L
Phenolic Compounds	2,3,4,6-Tetrachlorophenol	PAL	1 ug/L sum of tetrachloro-phenols	0.1 ug/L
	2,4,6-Trichlorophenol	PAL	18 ug/l sum of trichlorophenols	0.1 ug/L
	2,4-Dichlorophenol	PAL	0.2 ug/L sum of dichlorophenols	0.1 ug/L
	Pentachlorophenol	PAL	0.5 ug/L	0.1 ug/L
	Phenols (mono- & dihydric)	PAL	4 ug/L	0.1 ug/L
	2,4-Dimethylphenol			0.2 ug/L
	2-Chlorophenol	PAL	7 ug/L sum of monochloro-phenols	0.2 ug/L
	2-Methyl-4,6-			0.1 ug/L

Parameter Group	Parameter	Type of Guideline Limit	Chronic (Acute)	MDL
	dinitrophenol			
	2-Nitrophenol			0.1 ug/L
	4-Chloro-3-methylphenol			0.1 ug/L