Contaminants of Emerging Concern: How are These Identified?

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Introduction

- The Plan is based on the CCME Municipal Effluent Strategy, that is being implemented through the Wastewater Systems Effluent Regulation under the Fisheries Act.
- The CCME process is conservative and follows an environmental risk management procedure.
CCME Strategy – Key Elements

- National Performance Standards (NPS)
- Effluent Discharge Objectives (EDOs)
- Toxicity
- Initial wastewater characterization
- Reduction of pollutants at source (source control)
- Combined and sanitary sewer overflows (CSO/SSO)
- Compliance monitoring and reporting
- Governance
- Economic plan
National Performance Standards (NPS)

- cBOD5 ≤ 25 mg/L
- TSS ≤ 25 mg/L
- Total residual chlorine ≤ 0.02 mg/L
- Non-acutely toxic effluent (Rainbow trout and Daphnia magna)
Effluent Discharge Objectives (EDOs)

- Considered since NPS may not be sufficiently protective of the environment
- Determined using a risk-based approach
- Ensure that Environmental Quality Objectives (EQOs) are met at edge of the Initial Dilution Zone (IDZ)
- Degradable substances are allowed to mix in a proportion of the receiving water
- Toxic, persistent and bioaccumulative substances are not allowed a mixing zone (EDO = EQO)
- Established on basis of single-discharge or watershed approach
Single-Discharge Versus Watershed Approach

- For a single discharge, EDOs are to be established for substances of potential concern.
- In the watershed approach, substances of concern in the watershed are to be identified and EDOs are to be established for them.
- In our assessment, both approaches were incorporated into one and a single list of EQOs was developed.
Risk Assessment Approach

- Consider contaminant database
- Develop list of potential environmental quality objectives (EQOs)
- Designate water uses – protection of irrigation waters, primary-contact recreational beaches and ecosystem health (fisheries, aquatic life or marine life, and wildlife areas)
A list of substances of concern is developed based on industrial discharges to the sewer and effluent monitoring results.

Industrial operations included when flows from a specified industrial category exceed 5% of the annual dry-weather flow.

Specified industrial categories for consideration:
- resource exploration and development
- manufacturing/fabrication
- processing (including food)
- marine and air transport (including container cleaning)
- landfill leachate
- hospitals and laboratories (but not nursing stations)
Potential EQOs

- Physical/chemical/pathogenic – describing the level of a particular substance of concern that will protect water quality
- Whole Effluent Toxicity (WET) – specifying the proportion of the effluent discharge that may enter the water body without toxicological effect
- Biological criteria or bio-assessment – describing the level of ecological integrity that must be maintained
Step 1: Development of a List of Applicable EQOs

- First considered EQOs for water column in the receiving water body, BC approved and “working” guidelines, and CCME guidelines for fresh and marine waters
- General order of priority: WQO > BC guidelines > CCME guidelines
- Preliminary list included every potential substance with a WQO or guideline
- Subsequently also considered existing objectives for sediments and fish and developed EQOs for bed sediments and fish tissue
Step 2: Assessment of EQOs and Monitoring Data

- Compared EQOs to maximum effluent concentration - routine monitoring & special studies
  Substance eliminated if maximum effluent conc. < EQO
Step 3: Assessment of Remaining Substances

- Determined whether remaining substances had “reasonable potential” to be present in the effluent

  Elimination of substances based on a reasonable potential not to be present in the sewerage area
Step 4: Consideration of Dilution Ratios

- Minimum and average predicted dilution ratios during low river flows and slack water conditions (from dispersion/dilution modeling and dye studies)
- Measured dilution ratios from fecal coliform and ammonia data at IDZ boundary during all three tidal cycles
- Selected the worst case option for maximum environmental protection (conservative approach): the lowest 5\textsuperscript{th} percentile low dilution ratio
Step 5: Comparison of EQOs to Concentrations at Edge of IDZ

- Compared EQOs to maximum actual measured concentrations (over a period of several years) at edge of IDZ
- Considered the lowest dilutions for all three tidal cycles
  Substance eliminated if flow adjusted IDZ conc. < EQO
Step 5: Calculation of EDOs

- For persistent, toxic, bio-accumulative substances
  \[ EDO = EQO \]
- First used minimum dilution available with present diffuser, then calculated potential EDOs based on projected improvement of minimum dilution ratio (Annacis)
- Ignored any potential reduction in effluent concentrations from secondary treatment (Lions Gate)
- Background adjustment was possible only in few instances, since for many substances \( EDO = EQO \), or due to lack of data (most had non-detectable values)
Process Used to Identify Sediment and Fish Tissue Concerns

- Compiled a list of EQOs for sediments and fish tissue, as per water column – considerably fewer number of EQOs
- EQOs compared to data collected in sediment and fish surveys
- Considered nature of substances, sediment particle size variations and difference in measured concentrations in sediments collected at the IDZ and at reference site
- Included precision and accuracy considerations in assessment of difference between the measured substance concentrations in sediments and EQOs
- Findings of fish tissue assessment either could not be related to the existence of the WWTP, or confirmed the need for EDOs identified in water column considerations
Step 6: Toxicity Considerations

- Acute effluent toxicity is not allowed
- For chronically toxic, biodegradable substances, dilution of effluent is acceptable
  EDO based on EQO at the IDZ edge
Chronic Toxicity

- CCME guidance is vague as to end point to use
- One reference states that the NOEL should be used; however, this depends on the dilutions used for testing
- Another CCME reference indicates that IC, EC, NOEL or LOEL can be used. LOEL and NOEL are hypothesis-based values
- Selected use of IC25 because it is a regression-based value with confidence limits
Comparison of EDOs with the Most Recent Monitoring Data

- Very few parameters exceeded EDOs
Effluent, influent and IDZ data need to be collected for a number of pesticides (and PBDEs at IDZ) to allow an assessment of their true potential to be in the discharge – could be considered as part of an “initial characterization program”

The CCME Strategy document indicates that ongoing monitoring for the EDOs is required only for those substances where the mean effluent values exceed 80% of the EDO value

Evaluation of wastewater system required every ten years to confirm whether a significant change has occurred to effluent quality, and if so initial monitoring frequency must be undertaken
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Questions?