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FEMMtool — FEMM (Framework for Ecotoxicological Marine mCDR), a standardized ecotoxicological risk screening workflow for Marine Carbon Dioxide Removal (mCDR) projects.

FEMMtool Project Report

Project Bay of Fundy Screening Pilot
Location Bay of Fundy, Canada
Jurisdiction Canada
Regulatory context (salinity) Marine
Generated July 28, 2026 at 6:58 PM UTC

Executive Summary

This report summarizes selected exposure scenarios for **Bay of Fundy Screening Pilot**.

Scenario(s)

Each row lists **User inputs** and platform-calculated **Calculated outputs** for one selected run.

User inputs				Calculated outputs					
Compartment	**Stressor**	**Exposure (PEC)**	**SSD pool**	**HC5**	**PNEC**	**RQ**	**Risk**	**Confidence**	**AF**
Water Column	Nickel	0.2 µg/L	Standard	20.5 µg/L	2.05 µg/L	**0.1**	Low	Moderate	10

Overall risk: All 1 selected scenario(s) classify as Low risk.

Notes. HC5 — Hazardous Concentration for 5% of species (fitted SSD). **PNEC** — Predicted No-Effect Concentration (HC5 ÷ Assessment Factor). **RQ** — Risk Quotient (PEC ÷ PNEC). **Risk** — classification from the Risk Quotient. **Confidence** — confidence level when risk is Low. **AF** — Assessment Factor applied to HC5 to derive PNEC.

SSD pool — species sensitivity dataset used to fit the distribution: **Standard** = full species pool; **Temperate** or **Tropical** = temperature-zone sensitivity analysis paired with Standard for the same exposure.

Methodology & Data Consistency

This assessment uses FEMMtool's chronic SSD screening method. A summary of how this method relates to published guidance for Canada is in Appendix 2.

Jurisdiction. Canada. Acute versus chronic classification uses the FEMMtool default chronic-duration criteria table. Jurisdiction is taken from the project location (US, Canada, EU, or Australia/New Zealand).

Default process (hybrid). FEMMtool combines cross-habitat data pooling (when permitted), row-level Uncertainty Factors, species-level SSD fitting, and marine taxonomic Assessment Factor tiers. It is documented step-by-step here rather than tied to a single published regulatory citation.

Data sources. Species sensitivity values are drawn from the selected SSD species pool (bundled demonstration datasets or ECOTOX, depending on the stressor). One value per species is retained for fitting.

Uncertainty Factors on data points. Where acute, endpoint, or cross-habitat adjustments are required, an *Uncertainty Factor* is applied to individual SSD input values before fitting. This is distinct from the Assessment Factor (AF) applied to HC5 to derive PNEC.

Inclusion criteria. Project regulatory salinity: Marine. Data habitat scope: Freshwater and marine. Extrapolated data: Include extrapolated data per framework rules.

SSD statistical distribution. log-normal.

Uncertainty factor types (row-level). The following Uncertainty Factors may be applied to individual SSD input values before fitting. Each addresses a specific source of uncertainty in the donor data:

Endpoint-based. Adjusts percent-effect endpoints (for example, EC50 versus EC10) to a common severity scale so species sensitivity values are comparable within the SSD.

Acute-to-chronic. Converts acute test endpoints to chronic-equivalent concentrations when chronic data are sparse. The default Uncertainty Factor is 10, reflecting typical acute-to-chronic ratios in ecotoxicology literature.

Freshwater-to-Saltwater / Saltwater-to-Freshwater. Applied when freshwater and marine data are pooled for a single regulatory context. This Uncertainty Factor accounts for cross-habitat uncertainty in the extrapolated donor values themselves — it is not the Assessment Factor applied to HC5 after fitting.

Assessment Factor (AF) on HC5. After fitting, an AF is applied to HC5 to derive PNEC based on taxonomic coverage of the fitted species pool. When freshwater taxa fill saltwater taxonomic gaps, AF may remain 1 even though row-level Uncertainty Factors were applied earlier.

Appendix 1: Water Column Nickel

Scenario Details

Location Bay of Fundy, Canada
Compartment Water Column
Stressor Nickel
SSD pool Standard
PEC 0.2 µg/L

Assessment Summary

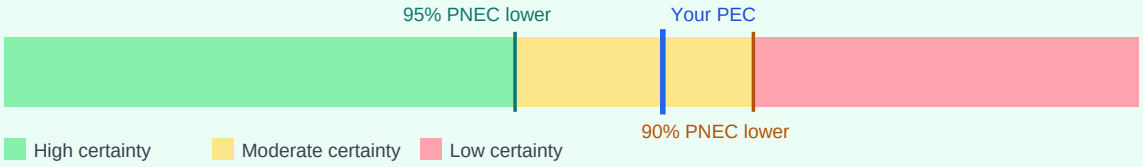
This section summarizes the key risk outputs from the FEMMtool workflow.
PNEC 2.05 µg/L (95% CI: 0.8 – 4.5 µg/L); 90% CI: 1 – 4 µg/L
Risk quotient (PEC/PNEC) 0.1 (95% CI: 0.05 – 0.18)

Risk level

Low

Confidence level: Moderate

Moderate certainty of low-risk classification: PEC is between the 95% and 90% lower confidence bounds on PNEC.



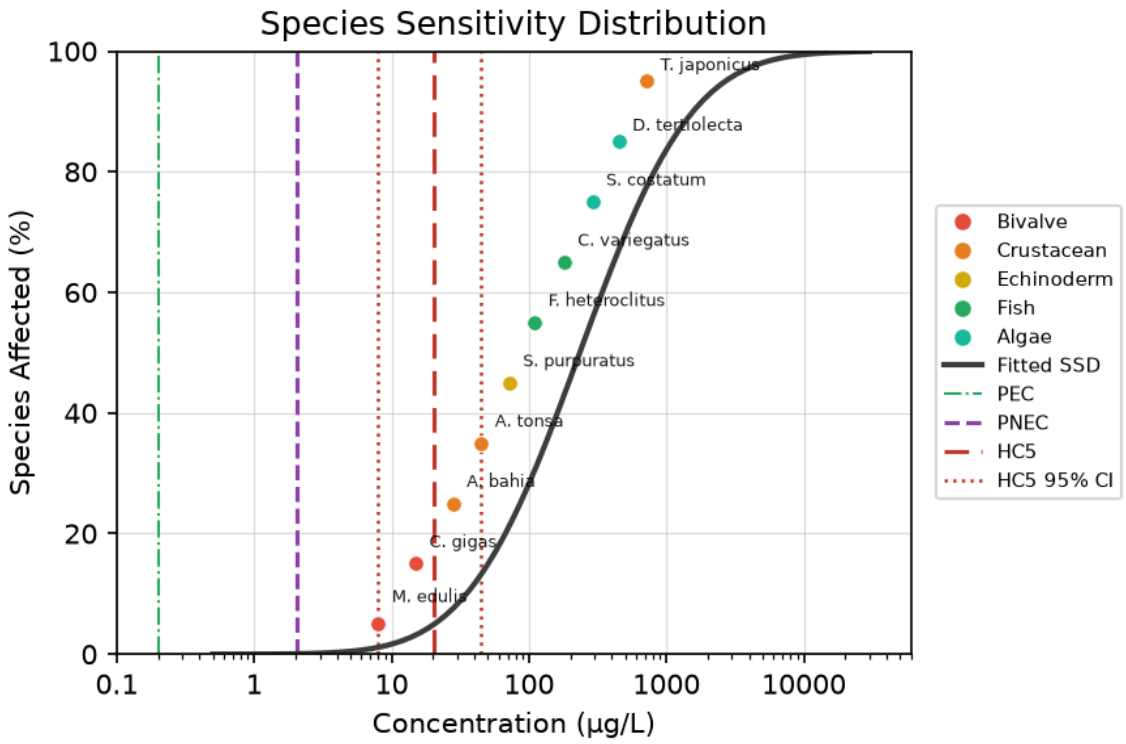
SSD

The SSD characterizes species sensitivity and provides HC5 and confidence intervals.
HC5 and CIs 20.5 µg/L (95% CI: 8 – 45 µg/L)
Species count 10
Statistical fit distribution = log_normal

Species pool habitats. This SSD draws on freshwater and marine test data for a Marine regulatory context.

Cross-habitat extrapolation. Freshwater and marine data were pooled for this assessment. 4 freshwater-derived row(s) received a cross-habitat Uncertainty Factor of 10 before SSD fitting. This addresses uncertainty in the extrapolated values themselves; the Assessment Factor on HC5 reflects taxonomic coverage of the fitted pool.

Acute-to-chronic extrapolation. Acute test endpoints were converted to chronic-equivalent values using an Uncertainty Factor of 10 where required.



Assessment Factor

The Assessment Factor (AF) is applied to HC5 to derive PNEC. It is distinct from row-level Uncertainty Factors applied to individual SSD data points before fitting.
Assessment factor 10
PNEC 2.05 µg/L (95% CI: 0.8 – 4.5 µg/L); 90% CI: 1 – 4 µg/L

Assessment factor criteria

• Freshwater regulatory context is selected for this project.
• Marine taxonomic MAF tiers are not applied in MVP for freshwater.
• Assessment factor 10 is the platform default for this context.

Dataset

Source species-level values used in this report output.

Species	Endpoint	Duration	Acute/Chronic	Uncertainty Factor	Uncertainty Factor Type	Raw value (mg/L)	Adjusted value (mg/L)	Status	Reasons	Study reference
Mytilus edulis	EC10	96 h	Acute	10	Acute-to-chronic	0.08	0.008	Included		Smith et al. 2018
Crassostrea gigas	NOEC	21 d	Chronic			0.015	0.015	Included		Jones et al. 2019
Americamysis bahia	EC10	7 d	Chronic			0.028	0.028	Included		Lee et al. 2020
Acartia tonsa	LC50	48 h	Acute	5 × 10	Non-lethal endpoint + acute-to-chronic	2.25	0.045	Included		Nguyen et al. 2017
Strongylocentrotus purpuratus	EC10	72 h	Chronic	10	Freshwater-to-Salt water	0.72	0.072	Included		Park et al. 2021
Fundulus heteroclitus	NOEC	28 d	Chronic			0.11	0.11	Included		Garcia et al. 2016
Cyprinodon variegatus	EC10	7 d	Chronic			0.18	0.18	Included		Brown et al. 2022
Skeletonema costatum	EC10	72 h	Chronic			0.29	0.29	Included		Chen et al. 2015
Dunaliella tertiolecta	EC50	72 h	Chronic	5	Non-lethal endpoint	2.25	0.45	Included		Ali et al. 2014
Tigriopus japonicus	NOEC	14 d	Chronic			0.72	0.72	Included		Kim et al. 2019

Uncertainty Factor Methodology

Uncertainty factor types (row-level). The following Uncertainty Factors may be applied to individual SSD input values before fitting. Each addresses a specific source of uncertainty in the donor data:

Endpoint-based. Adjusts percent-effect endpoints (for example, EC50 versus EC10) to a common severity scale so species sensitivity values are comparable within the SSD.

Acute-to-chronic. Converts acute test endpoints to chronic-equivalent concentrations when chronic data are sparse. The default Uncertainty Factor is 10, reflecting typical acute-to-chronic ratios in ecotoxicology literature.

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Assessment Factor (AF) on HC5. After fitting, an AF is applied to HC5 to derive PNEC based on taxonomic coverage of the fitted species pool. When freshwater taxa fill saltwater taxonomic gaps, AF may remain 1 even though row-level Uncertainty Factors were applied earlier.

Appendix 2: Relation to published Canada guidance

This appendix summarizes how FEMMtool's chronic SSD screening method relates to CCME water quality guideline derivation (Type A / Type B) for a project in Canada. FEMMtool uses one hybrid derivation workflow for all supported jurisdictions; it is not a jurisdiction-specific guideline calculator.

Aligned or closely related elements.

Where the approaches are closest. Both methods can use a chronic SSD and an HC5-style percentile when data allow. FEMMtool's default chronic-duration cutoffs are broadly similar to common long-term test durations for fish and algae, though they follow FEMMtool's Default table rather than CCME's duration rules.

Material differences for this jurisdiction.

Type A guideline value. Under CCME Type A, the guideline is the SSD HC5 with no additional safety factor. FEMMtool always applies an Assessment Factor to HC5 (typically 10 for freshwater).

Type A taxonomic minima. CCME Type A requires prescribed taxa (for example freshwater: ≥3 fish including salmonid and non-salmonid, ≥3 invertebrates including a planktonic crustacean, and ≥1 plant/alga). FEMMtool does not enforce that checklist.

Type B path. When SSD data are insufficient, CCME uses deterministic Type B1/B2 critical toxicity values with safety factors of 10, 20, or 100. FEMMtool does not offer that deterministic fallback.

Acute-to-chronic conversion. CCME does not use acute-to-chronic ratios; short-term endpoints feed short-term guidelines. FEMMtool may bring acute values into the chronic SSD via Uncertainty Factors.

Higher-effect chronic endpoints. CCME prefers EC10 and may include EC15–20 without conversion, but excludes EC50/LOEC/MATC from the chronic SSD. FEMMtool may convert and pool those higher-effect endpoints.

Notes for this report's assessments.

This report's SSD pool(s) used 10 species (FEMMtool fits at ≥3; trusted-screening warning below 10).

Assessment Factor(s) applied to HC5 for PNEC: 10.

Cross-habitat pooling was used with a concentration Uncertainty Factor of 10 on donor-habitat rows.

Acute and/or higher-effect endpoints may have been adjusted with Uncertainty Factors (including default acute-to-chronic ÷10) before SSD fitting.

This screening output supports project decision-making; it is not a substitute for a formal water-quality guideline derivation under the cited Canada methods.