Status of Aquatic and Terrestrial Plant Methods in Canada

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Why do we need standardized biological test methods?

• scientifically defensible
• minimize variation
• comparable data (e.g., national consistency, spatial and temporal trend analysis)
• legally enforceable data
• decision-oriented
• international acceptability
Test Methods Available

• Published 23 standardized biological test method documents for conducting toxicological testing on toxic substances and complex mixtures in water, sediment and soil
• Published 7 national guidance documents to provide specific direction and recommendations on the interpretation and application of aquatic and terrestrial toxicology data
• All methods are used in Federal/Provincial regulations & guidelines
Use in Canada

• Chemical testing
  – Chemical Management Plan

• Environmental samples
  – Assessments of contaminated land
  – Remediation
  – Environmental Effects Monitoring
Test methods are designed to support specific programs & industrial sectors

WATER

• Direct regulatory application
  – Metal Mining Effluent Regulations under the federal Fisheries Act
  – Pulp & Paper Effluent Regulations under the federal Fisheries Act
  – Derivation of water quality guidelines
  – Environmental assessments for chemicals
Test methods are designed to support specific programs & industrial sectors

SOIL

• Direct regulatory application
  – Derivation of soil quality guidelines
  – Canada-wide Standards (e.g. Petroleum Hydrocarbons in Soils)
  – Site-specific clean-up of contaminated lands (e.g. Alberta Tier 2 Eco-contact Derivation Protocol)
Agronomic Plants (EPS 1/RM/45)

• Published in 2005
• Test for measuring emergence and growth of terrestrial plants exposed to contaminants in soil
  – 12 species
    ▪ **Alfalfa** (*Medicago sativa* L.)
    ▪ **Barley** (*Hordeum vulgare* L.)
    ▪ **Blue grama grass** (*Bouteloua gracilis* (HBK) Lag. ex Steud.)
    ▪ **Cucumber** (*Cucumis sativus* L.)
    ▪ **Durum wheat** (*Triticum durum* (Desf.)
    ▪ **Lettuce** (*Lactuca sativa* L.)
    ▪ **Northern wheatgrass** (*Elymus lanceolatus* (Scribn. & J.G. Sm.) Gould)
    ▪ **Radish** (*Raphanus sativus* L.)
    ▪ **Red clover** (*Trifolium pratense* L.)
    ▪ **Red fescue** (*Festuca rubra* L.)
    ▪ **Tomato** (*Lycopersicon esculentum* Mill.)
NEW Boreal Plant (EPS 1/RM/56)

• Completed and available Aug 2013

- Trembling aspen (*Populus tremuloides* Michx.)
- Bluejoint reedgrass [*Calamagrostis canadensis* (Michx.) P. Beauv.]
- Canada Goldenrod (*Solidago canadensis* L.)
- Paper birch (*Betula papyrifera* Marsh.)
- Jack pine (*Pinus banksiana* Lamb.)
- White Spruce [*Picea glauca* (Moench) Voss]
- Black spruce [*Picea mariana* (Mill.) Britton, Sterns & Poggenb.]
NEW Boreal Plant (EPS 1/RM/56)
**NEW Boreal Plant (EPS 1/RM/56)**

- Provisions for soil collected from forested regions to account for horizon development and differentiation
  - Further guidance in **EPS 1/RM/53** (sampling guidance document)
**NEW Wetland Plant Method**

- **Future** test method using wetland species for measuring the effect of contaminants in Canadian boreal and northern wetland regions
  - Research supported by Environment Canada, Natural Resources Canada, and conducted by Saskatchewan Research Council (Mary Moody)
  - Soil/substrate and water collected from reference and contaminated sites across northern and central Alberta and Saskatchewan
    - Bog, fen and marsh

![Map showing 60% wetland coverage](image)
NEW Wetland Plant Method

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Species</th>
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<tbody>
<tr>
<td>Marsh</td>
<td><em>Calamagrostis canadensis</em> <em>(bluejoint reedgrass)</em></td>
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<td><em>Typha latifolia</em> <em>(cattail)</em></td>
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<td></td>
<td><em>Salix bebbiana</em> <em>(Bebb's willow)</em></td>
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<td></td>
<td><em>Carex aquatilis</em> <em>(aquatic sedge)</em></td>
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<td></td>
<td><em>Picea mariana</em> <em>(black spruce)</em></td>
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<tr>
<td>Fen</td>
<td><em>Carex aquatilis</em> <em>(aquatic sedge)</em></td>
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<tr>
<td></td>
<td><em>Larix laricina</em> <em>(tamarack)</em></td>
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<td></td>
<td><em>Myrica gale</em> <em>(sweet gale)</em></td>
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<tr>
<td></td>
<td><em>Calamagrostis canadensis</em> <em>(bluejoint reedgrass)</em></td>
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<tr>
<td>Bog</td>
<td><em>Picea mariana</em> <em>(black spruce)</em></td>
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<tr>
<td></td>
<td><em>Vaccinium vitis-idaea</em> <em>(bog cranberry)</em></td>
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NEW Wetland Plant Method

• Test methods have been validated on reference and contaminated site samples from marsh, fen and bog sites
  – Test designs have successfully included using fresh and dried soils
  – Differences in tolerance to contaminants (e.g., salts, PHCs, metals) among species
  – Test species are ecologically relevant to Canadian boreal regions

• Current research includes
  – Determining tolerance of test species to varying moisture levels
  – Continued assessment of sensitivity to contaminated samples (e.g., fen affected by crude oil spill)
  – Testing of new artificial mixtures, suitable to each habitat (e.g., varying the level of peat from 6 to 95% and pH from neutral to acidic)
NEW Wetland Plant Method

- Future method research will include:
  - Tests of additional reference and contaminated sites including north of 60 and oil sands sites
  - Assessing differences among seed lots
  - Assessing the sensitivity to a standard reference toxicant (e.g., boric acid)
  - Determining the pH tolerance range of the test species
Need more information?

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