Potential Risks to Freshwater Aquatic Organisms Following a Silvicultural Application of Herbicides in Oregon’s Coast Range

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Figure 3. Concentrations of Pesticides Detected in 129 Post-Spray Samples from 26 operations (mdl = 0.04-1.0). Seven out of 25 samples tested at mdl < 1 ppb contained trace concentrations of pesticide.
Needle Branch, Alsea Watershed, Oregon Coast

Upper 91 acres

Helicopter Application

Mix -
Glyphosate - 681 g/ac (a.e.)
Imazapyr 85 g/ac (a.e.)
SMM 64 g/acre (a.i.)
MSM 17 g/ac (a.i.)

BMPs -
Mid to High – 18 m no spray buffer
Above High – half boom – 3m buffer
Table 3. Comparison of Time-Weighted Average Exposures to Roundup® or Vision® Formulations Associated with Multiple Scenarios

<table>
<thead>
<tr>
<th>Scenario/Species</th>
<th>Conc. (ng/L)</th>
<th>Duration (h)</th>
<th>Absolute (ng/L*h)</th>
<th>Experimental Endpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needle Branch:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>application pulse</td>
<td>62</td>
<td>4</td>
<td>248</td>
<td></td>
</tr>
<tr>
<td>storm pulse #1 (8 DAT)</td>
<td>115</td>
<td>10</td>
<td>1,150</td>
<td></td>
</tr>
<tr>
<td>storm pulse #2 (10 DAT)</td>
<td>42</td>
<td>12</td>
<td>504</td>
<td></td>
</tr>
<tr>
<td>baseflow (to 8 DAT)</td>
<td>25</td>
<td>192</td>
<td>4,800</td>
<td></td>
</tr>
<tr>
<td>cumulative exposure</td>
<td></td>
<td></td>
<td>6,702</td>
<td></td>
</tr>
</tbody>
</table>

NOECs and NOAECs for Roundup® or Vision® based on "traditional" endpoints:

- *Selanastrum capricornutum* (algae): 226,300 ng/L · h (72 h), 1.63E+07 growth (biomass)
- *Oncorhynchus mykiss* (fingerling): 260,000 ng/L · h (96 h), 2.50E+07 survival
- *Daphnia magna* (invertebrate): 589,000 ng/L · h (48 h), 2.83E+07 survival, growth
- *Oreochromis niloticus* (tilapia): 310,000 ng/L · h (96 h), 2.98E+07 survival
- *Lepomis macrochirus* (bluegill): 700,000 ng/L · h (96 h), 6.72E+07 survival
- *Myriophyllum sibiricum* (watermilfoil): 242,000 ng/L · h (336 h), 8.13E+07 root length
- *Daphnia magna* (invertebrate): 992,000 ng/L · h (504 h), 5.00E+08 survival, growth, reproduction
- *Gammarus pseudolimnaeus* (invert.): 14,000,000 ng/L · h (48 h), 6.72E+08 survival
- *Lemna minor* (duckweed sp.): 16,910,000 ng/L · h (48 h), 8.12E+08 ?
- *Potamogeton pectinatus* (pondweed): 7,440,000 ng/L · h (336 h), 2.50E+09 growth

NOECs and NOAECs for Roundup® or Vision® based on biochemical or "non-traditional" endpoints:

- *Oncorhynchus mykiss*: 7,400 ng/L · h (0.0333), 246 neurophysiological olfaction
- *Oncorhynchus mykiss*: 7,400 ng/L · h (0.5), 3,700 "behavioral olfaction"
- *Oncorhynchus mykiss*: 742,000 ng/L · h (0.167), 1.24E+05 avoidance
- *Ephemeralla walkeri* (mayfly): 1,000,000 ng/L · h (1), 1.00E+06 avoidance
- *Oncorhynchus mykiss*: 6,750,000 ng/L · h (96), 6.48E+08 "erratic swimming and rapid respiration"
- *Oncorhynchus kisutch* (coho): 2,880,000 ng/L · h (240), 6.91E+08 "several sublethal parameters"
- *Oncorhynchus mykiss*: 2,880,000 ng/L · h (1440), 1.15E+10 "aggressive behavior"
Conclusions

- Glyphosate was detected at HIGH (62 ng/L) but not at LOW during application.

- Glyphosate was present in baseflow at all stations 3 DAT and still detectable at HIGH 8 DAT (only).

- Discrete pulses of Glyphosate at 2 upper sites after first two storms: 8 DAT a 10 h pulse maxed at 115 ng/L at MID. 2nd event 10 DAT a 12 h pulse at 42 ng/L at HIGH.

- Glyphosate < 20 ng/L at all storm events at LOW.

- Needle Branch TWA exposures are orders of magnitude less than known endpoints of aquatic biota based on the literature.

- Magnitude of Needle TWA is within known olfaction endpoints of salmon, however incoming coho arrive OCT/NOV.


Scarborough et al. 2015. Herbicide concentrations in first-order streams after routine application for competition control in establishing pine plantations. Forest Science 61(3).