Automated Biological Monitors: Has Their Time Arrived?

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Blacksburg, VA
Environmental Services: Since 1980

- Aquatic Toxicity Testing
- Treatability Studies
- Stream Bioassessments
- Environmental Impact Assessments
- Mitigation Plans
- Total Maximum Daily Loads
- Site Specific Standards Modifications
- TSCA Product Registration
The BioSensor®

- The Canary in the Mine Concept
- Fish Serve As Sensors
- Provide Broad Based Detection
- Continuous Sensors Provide Timely Warning
- Complement Other Security Measures to Provide Safety at a Reasonable Cost
RATIONAL

• Fear of contamination
• Minimize risk
• Enhance public’s trust
• Need for broad scope early warning
• Easy to set up, operate and maintain
• Cost effective
Desired Characteristics of Automated Biomonitor

- Automated
- Real time
- On-line
- Sensitive
- Rapid response
- Easily interpretable alarms
- Reliable alarms
- Minimal false alarms
- Reliable technology
- Commercially available
- Inexpensive
- Minimal installation
- Minimal training
- Minimal maintenance
VENTILATORY RESPONSES

Normal Baseline

Increased Frequency, Amplitude, and Variability

Decreased Amplitude, Increased Gill Purges
BioSensor®

Model 7008  Version 7.02y6

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Blacksburg, VA 24060 USA
(540) 953-2821

Press space bar to continue...
Compiled on 17 January 2007
<table>
<thead>
<tr>
<th>Today's date:</th>
<th>01/16/2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of day:</td>
<td>13:06</td>
</tr>
<tr>
<td>Monitor Period Name:</td>
<td>OP011607</td>
</tr>
<tr>
<td>Bio-Sensor Setup</td>
<td></td>
</tr>
<tr>
<td>Start Fish Monitoring</td>
<td></td>
</tr>
<tr>
<td>End Program</td>
<td></td>
</tr>
</tbody>
</table>

Free disk space:
- 113 years.
- 9 months.
- 11 days.
- 17 hours.
- 19 minutes.
<table>
<thead>
<tr>
<th>Setup Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Alarm Sensitivity</td>
</tr>
<tr>
<td>Physicochemical Sensors</td>
</tr>
<tr>
<td>Waveform Processing Parameters</td>
</tr>
<tr>
<td>Channel Assignments</td>
</tr>
<tr>
<td>Miscellaneous Options</td>
</tr>
<tr>
<td>Done</td>
</tr>
</tbody>
</table>

Bio-Sensor

Choose desired option with the mouse or the arrow keys.
<table>
<thead>
<tr>
<th>Fish No.</th>
<th>Active</th>
<th>Reference</th>
<th>Inactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Active</td>
<td>Reference</td>
<td>Inactive</td>
</tr>
<tr>
<td>1</td>
<td>Active</td>
<td>Reference</td>
<td>Inactive</td>
</tr>
<tr>
<td>2</td>
<td>Active</td>
<td>Reference</td>
<td>Inactive</td>
</tr>
<tr>
<td>3</td>
<td>Active</td>
<td>Reference</td>
<td>Inactive</td>
</tr>
<tr>
<td>4</td>
<td>Active</td>
<td>Reference</td>
<td>Inactive</td>
</tr>
<tr>
<td>5</td>
<td>Active</td>
<td>Reference</td>
<td>Inactive</td>
</tr>
<tr>
<td>6</td>
<td>Active</td>
<td>Reference</td>
<td>Inactive</td>
</tr>
<tr>
<td>7</td>
<td>Active</td>
<td>Reference</td>
<td>Inactive</td>
</tr>
</tbody>
</table>

- **Temperature**
- **Dissolved O2**
- **pH**
- **Conductivity**
- **Turbidity**

Choose desired option with the mouse or the arrow keys.
LOG INFORMATION

Today's date: 01/16/2007
Time of day: 13:06
Monitor Period Name: OP011607
Bio-Sensor Setup
Start Fish Monitoring
End Program

Free disk space:
113 years.
9 months.
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17 hours.
19 minutes
Fish No. 4
Amplitude = 0.76 V
Frequency = 1.28 Hz
Std. dev. = ------ Hz
BI OSENSOR® DATA SUMMARY

- Over 50 Chemicals Tested
- Approximately 10 Different Waste Waters
- Over 40 Different Species
  - Majority = 7 Different Species
  - Species Selection: c.f. Sensitivity Vs Availability
- Acute Toxicants - Response Time < 10 Minutes
- Chronic Toxicant - Response Time = Dose Dependent
  - LOEC = 1 - 4+ h
WHAT THESE FISH KNOW MAY HURT YOU!

Can a Fish Make a Phone Call?
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