

BIO-MET v4.0 – a tool for metal bioavailability under the EU Water Framework Directive



Stijn Baken, Christopher A. Cooper, Frank Van Assche, Christian E. Schlekot, M. Jasim Chowdhury, Annalisa Bortoluzzi, Bill Stubblefield, Isabelle Vercaigne and Frederik Verdonck

SUMMARY

Bio-met is a user-friendly tool to assess **Environmental Quality Standard (EQS) compliance** of metals under the EU Water Framework Directive. Based on scientifically validated Biotic Ligand Models (BLMs), bio-met accounts for the bioavailability of copper, nickel, zinc, and lead at the push of a button! The new version 4.0 provides extra functionalities and increased user-friendliness. (<http://bio-met.net/>)

WHAT'S NEW IN VERSION 4.0?

- Increased calculation speed
- **Option to change the EQS_{bioavailable} for specific pollutants**
- **Inclusion of lead (Pb)**
- Updated user guide

BACKGROUND

The same metal concentration can show risk in one water body, but not in others. This is because the effects of metals on living organisms depend on the physico-chemistry of the water – most importantly pH, calcium, and dissolved organic carbon.

Biotic ligand models (BLMs) predict the metal toxicity in different water bodies. **The BLMs are widely accepted for regulatory purposes, including in the EU Water Framework Directive (WFD).** Bio-met has been developed as a user-friendly tool based on these BLMs, with the specific aim of EQS compliance checking of water bodies under the WFD.

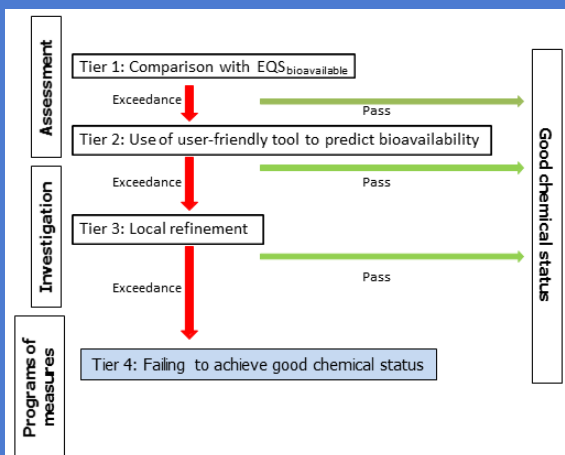
HOW TO USE BIOMET FOR EQS COMPLIANCE CHECKING

Bio-met can be used at tier 2 of the tiered assessment approach shown below (Merrington et al., ET&C 35 257-265):

Tier 1. Compare the dissolved metal concentration to the bioavailable Environmental Quality Standard (EQS_{bioavailable}).

Tier 2. Use bio-met to calculate the bioavailable metal concentration. Compare this to the EQS_{bioavailable}.

Tier 3. Make a locally refined assessment, which may include consideration of natural background concentrations. A non-compliance should only be declared after walking through the entire scheme.



HOW TO PERFORM BIOMET CALCULATIONS

1. Enter name, measured dissolved metal concentrations, and the physico-chemical data (pH, Ca, DOC) for each sample
2. Click the "Calculate" button
3. The results appear in the right hand column. For each metal, the following output is shown:
 - a) The Local HCS, which is calculated from the BLMs using the physico-chemical data.
 - b) The bioavailable fraction (BioF) and the bioavailable metal concentration.
 - c) The Risk Characterization Ratio (RCR). If RCR is below 1, there is no risk; if the RCR is above 1, there may be at risk – a local refinement should follow to confirm.

The screenshot shows the 'Data Input & Results' window. A red arrow labeled '2' points to the 'Calculate' button. A red arrow labeled '1' points to the 'INPUT (BIOLIGAND) DATA' table. A red arrow labeled '3' points to the 'RESULTS (Copper with EC50max = 1 µg/L)' table.

INPUT (BIOLIGAND) DATA											RESULTS (Copper with EC50max = 1 µg/L)					
ID	Sample Name	Sample Number	Date	Measured Copper Conc (µg/L)	Measured Nickel Conc (µg/L)	Measured Zinc Conc (µg/L)	Measured Lead Conc (µg/L)	pH	DOC (µg/L)	Ca (µg/L)	Zinc ABC Conc (µg/L)	Local HCS (dissolved) (µg/L)	BioF	Bioavailable Copper Conc (µg/L)	RCR	Notes

Affiliations and contact details

Stijn Baken, European Copper Institute. Avenue de Tervueren 168 b-10, 1150 Brussels, Belgium. stijn.baken@copperalliance.eu.
Chris Cooper and **Frank Van Assche**, International Zinc Association. Avenue de Tervueren 168 b-4, 1150 Brussels, Belgium. ccooper@zinc.org.
Christian E. Schlekot, NIPERA Inc. (Nickel Producers Environmental Research Association). 2525 Meridian Parkway, Suite 240 Durham, NC 27713 U.S.A. cschlekot@nipera.org.
M. Jasim Chowdhury, International Lead Association. 2530 Meridian Parkway, Suite 115, Durham, NC 27713, U.S.A. Chowdhury@ila-lead.org.
Annalisa Bortoluzzi, Eurometaux. Avenue de Broqueville 12, 1150 Bruxelles, Belgium. bortoluzzi@eurometaux.be.
Bill Stubblefield, Oregon State University, Environmental and Molecular Toxicology, 1007 Agriculture and Life Sciences Building, Corvallis, OR 97331. U.S.A. Bill.Stubblefield@oregonstate.edu.
Frederik Verdonck and **Isabelle Vercaigne**, ARCHE consulting. Liefkensstraat 35d, 9032 Gent-Wondelgem, Belgium. frederik.verdonck@arche-consulting.be.

