Assessing 21st century contaminants of concern using integrative passive sampling devices to obtain more meaningful and cost effective data on impacts from stormwater runoff

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• Grab (and composite) stormwater samples may not be representative of stormwater impacts to the receiving environment, as they may miss the pulse of contaminants.

• Total recoverable metal concentrations used in compliance monitoring are not biologically meaningful for ecological effects.

• Composite autosampling has limitations (reliability, cost)

• Integrative passive sampling with Diffusive Gradients in Thin film (DGT) and Polar Organic Chemical Integrative Samplers (POCIS) can provide cost-effective continuous monitoring

• DGTs are being evaluated for end-of-pipe monitoring and value towards assessment of best management practices (BMP) at Naval Base San Diego (NBSD)

• DGTs and POCIS were deployed during ambient monitoring at nearshore locations at Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS&IMF), Naval Base Kitsap (NBK) and reference locations.

• DGT3 samplers provide a time-averaged concentration of labile (biologically available) metal concentrations following diffusion through a gel layer and permanent binding to a resin layer (Chelex-100).

• POCIS3 sample weakly hydrophobic (log Kow ≤ 6) organic chemicals that bind to a polymeric (hydrophilic-lipophilic-balanced; HLB) sorbent sandwiched between polyethersulfone (PES) membranes.

POCIS3 sample slowly lipophilic-balanced; HLB) organic chemicals that bind to a resin layer (Chelex-100).

CONCLUSIONS

• Integrative passive samplers show promise towards biologically relevant exposure/assessment of stormwater discharges and associated contaminants of concern in receiving water monitoring.

• Highly sensitive, reproducible results that support trace level changes in metal availability (DGT) and weakly hydrophobic (POCIS) contaminants in a marine estuary

• End of pipe sampling promising, but requires additional work to address possible issues associated with low ionic strength rainwater and highly dynamic stormwater discharges

• Passive sampling devices provide supplemental data to reduce costly traditional monitoring

• Surveillance monitoring with passive samplers can be used to fingerprint likely sources of contamination

RESULTS: San Diego Bay, CA

Linear loading of copper on to DGT Chelex-100 resin between 1.5-24 h durations in copper solutions. Shows detectable metal loading during short pulses.

RESULTS: Puget Sound, WA

Comparison of first half and second half of ~24 hr storm in comparison with DGT samplers placed for full storm.

REFERENCE


