



Environmental Sensor Development at SSD- SD: Past and Present

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**Federal Remediation Technologies
Roundtable meeting - Dec. 7, 2005**



Sensor Classifications



- **Sensors for Site Characterization**
- **Sensors for Environmental Monitoring**
- **Sensors to Assess Environmental Quality/Health**
- **Modeling**



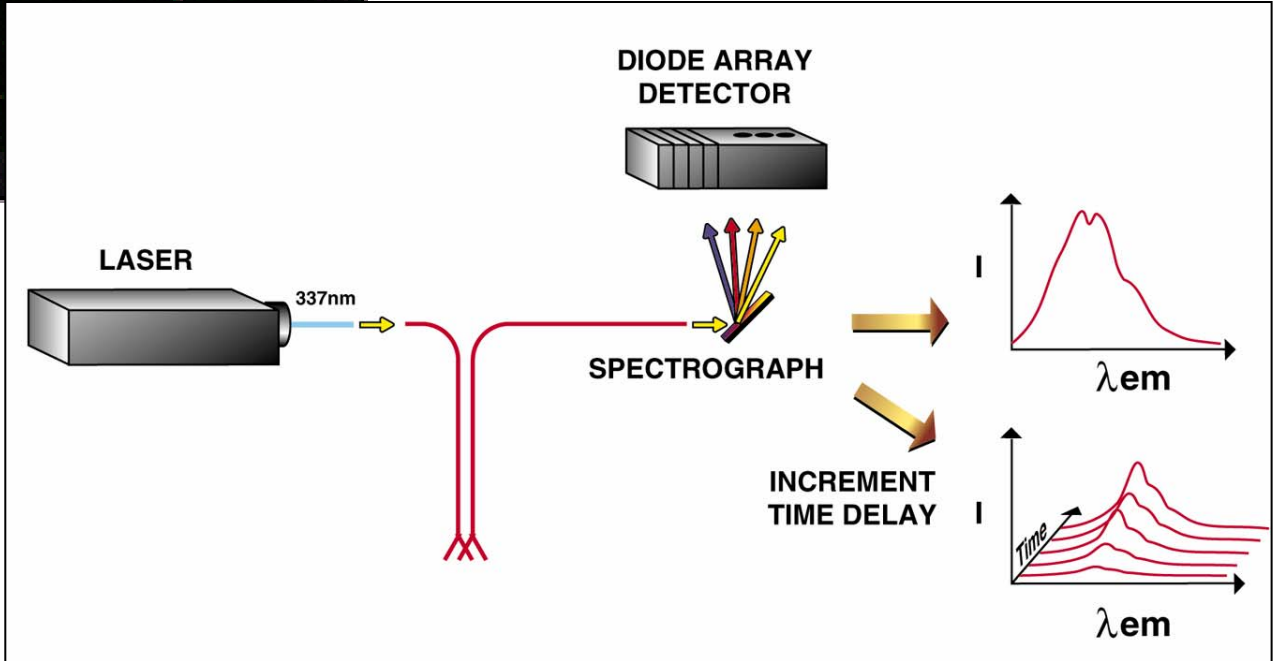
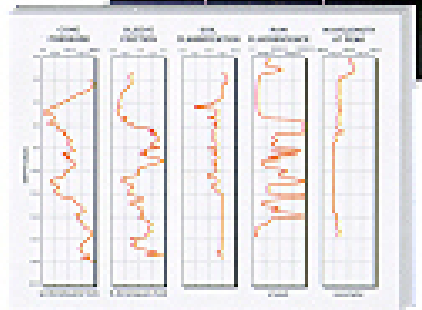
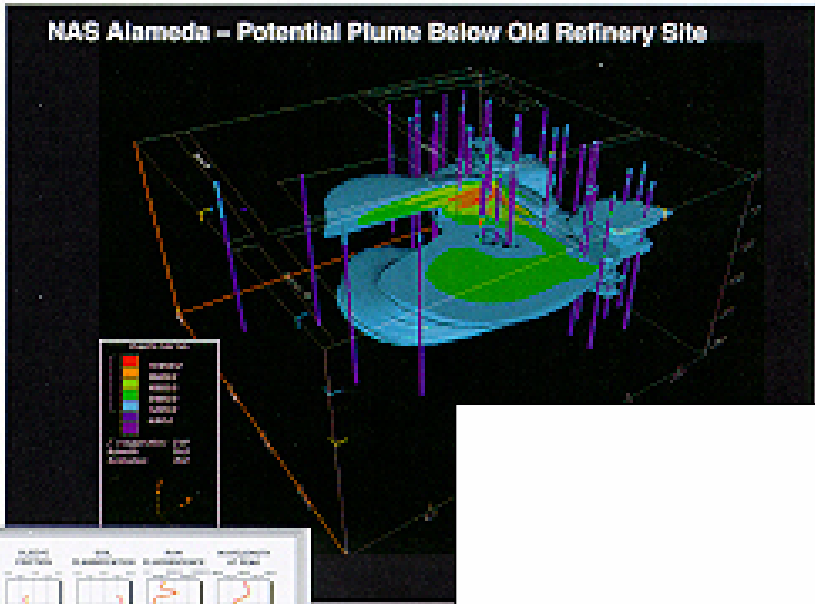
Site Characterization and Analysis Penetrometer System (SCAPS)



- Laser Induced Fluorescence (LIF) – petroleum hydrocarbons
- GeoVis – soil type and porosity, DNAPL, groundwater
- Laser Induced Breakdown Spectroscopy (LIBS) – heavy metals
- VOC Sensor Based on Surface Enhanced Raman Spectroscopy (SERS) – BTEX, chlorinated solvents, MTBE

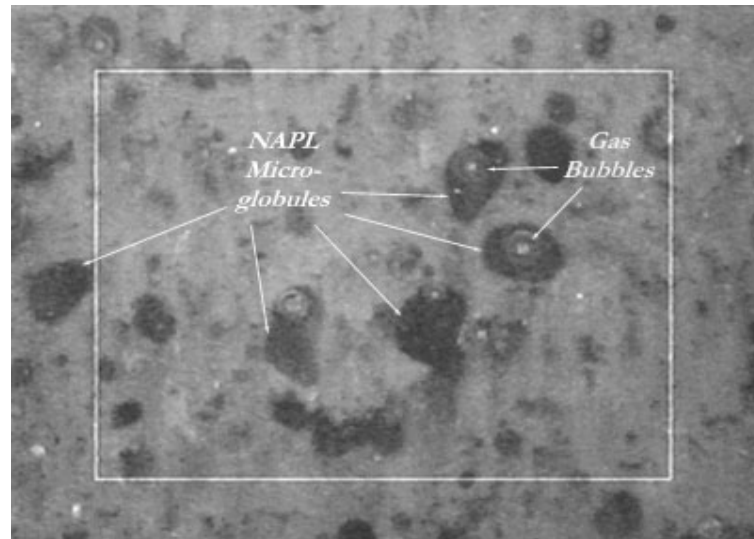
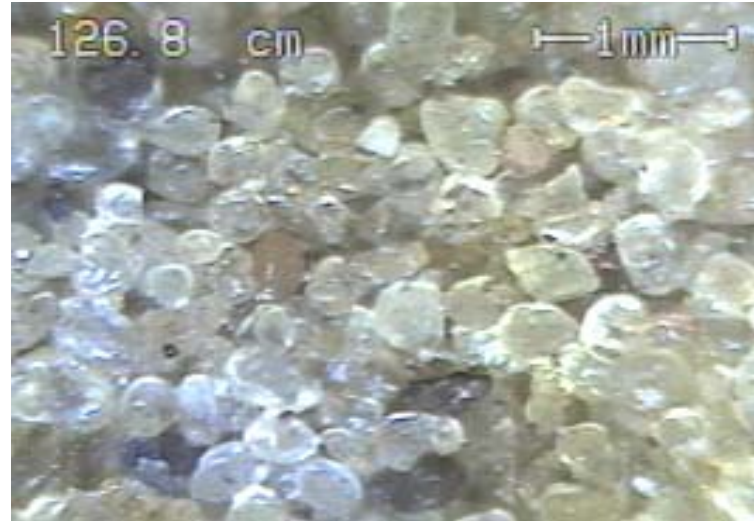
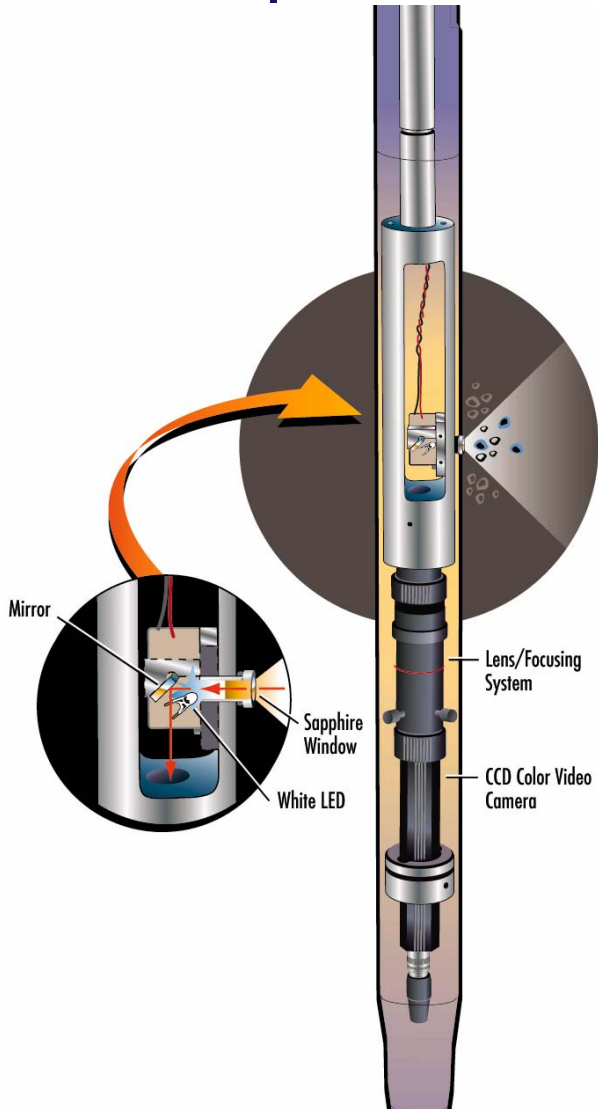
Laser Induced Fluorescence

NA'S Alameda - Potential Plume Below Old Refinery Site



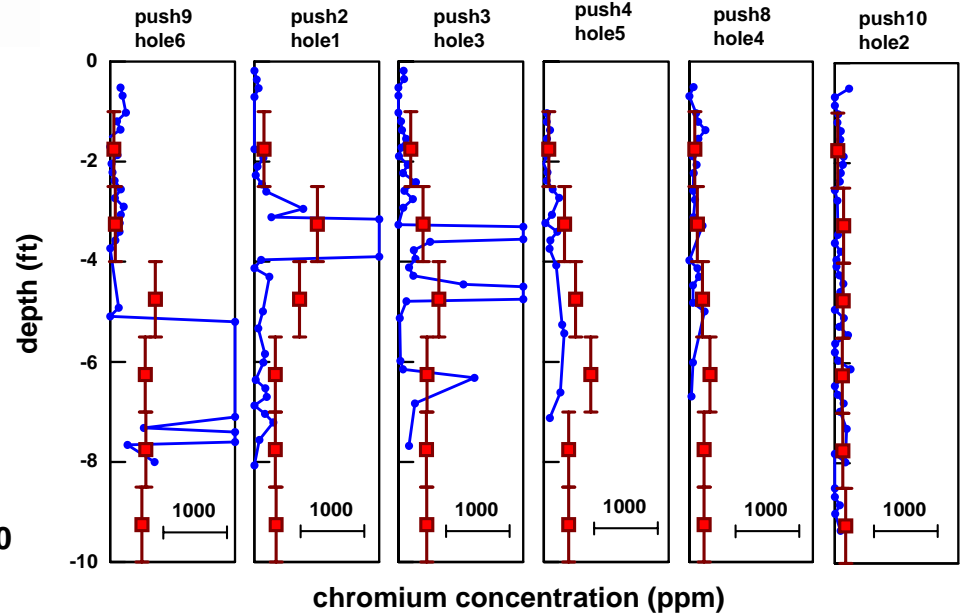
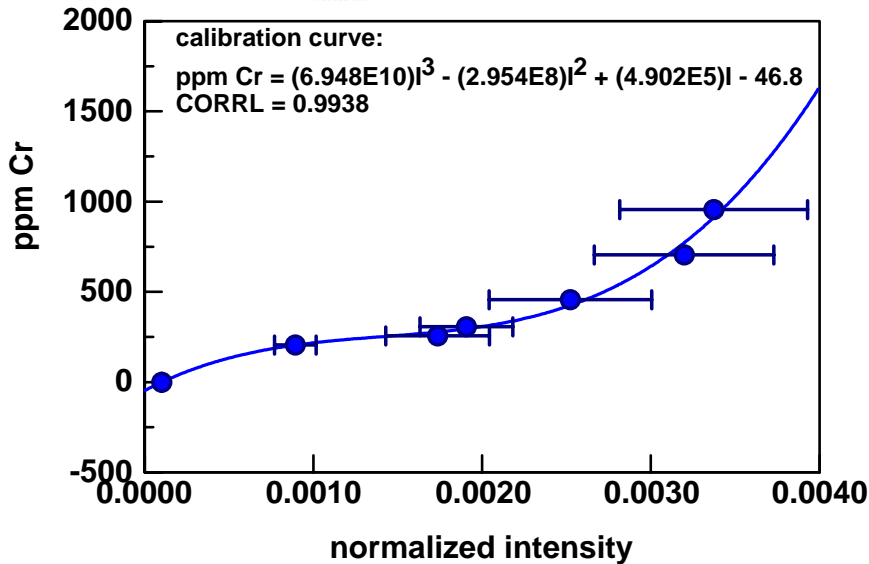
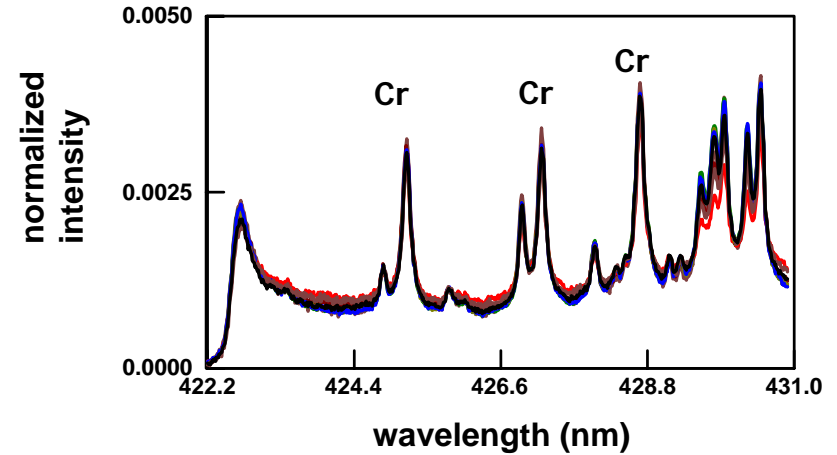
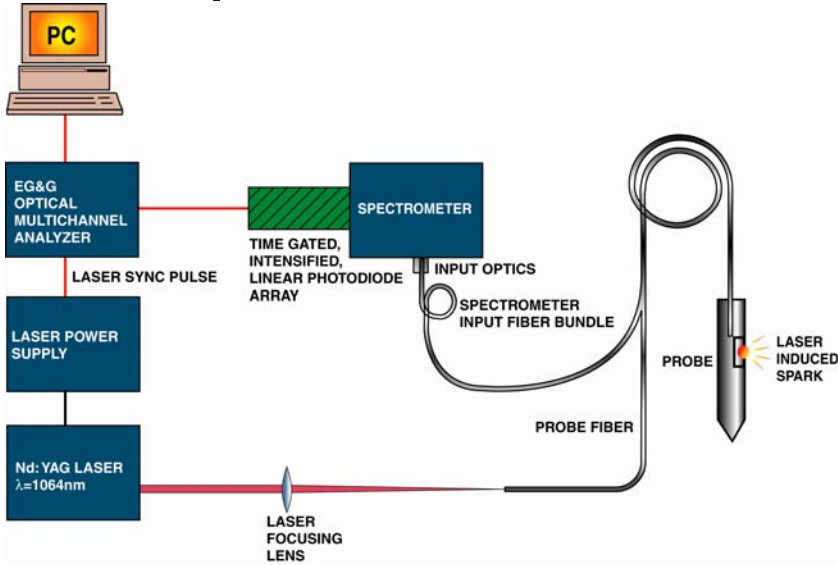


GeoVis (LIF-GeoVis; GeoVis²)

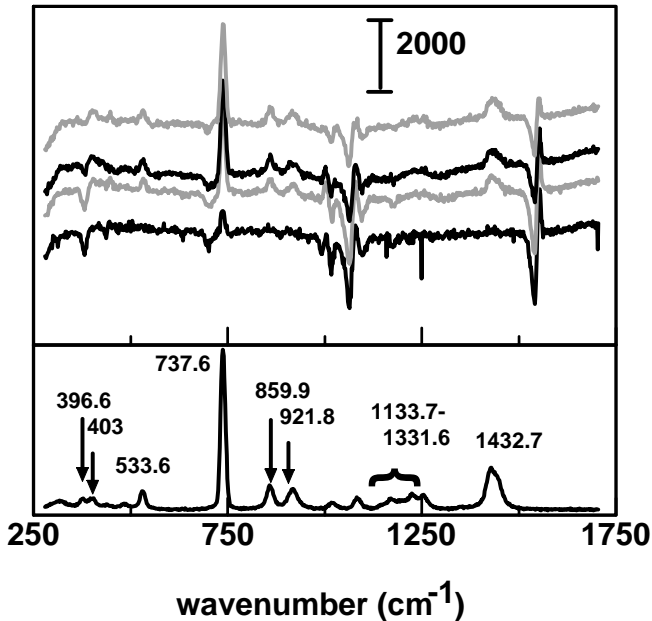
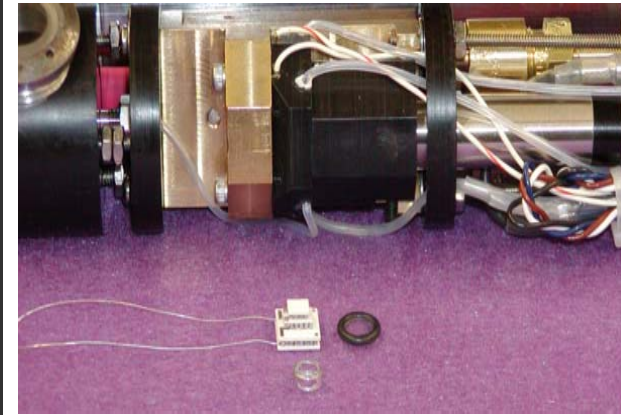
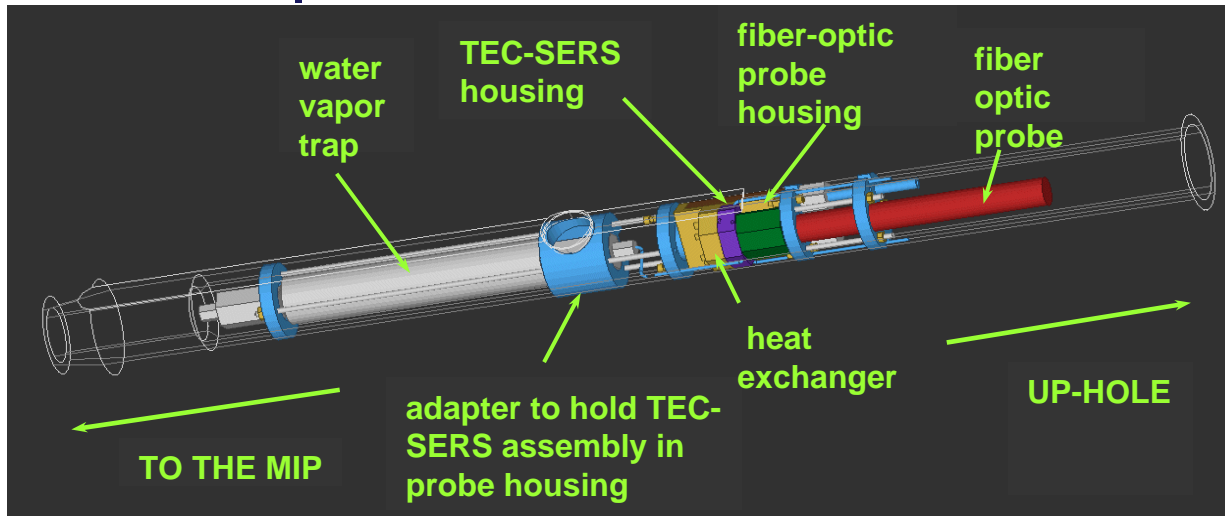




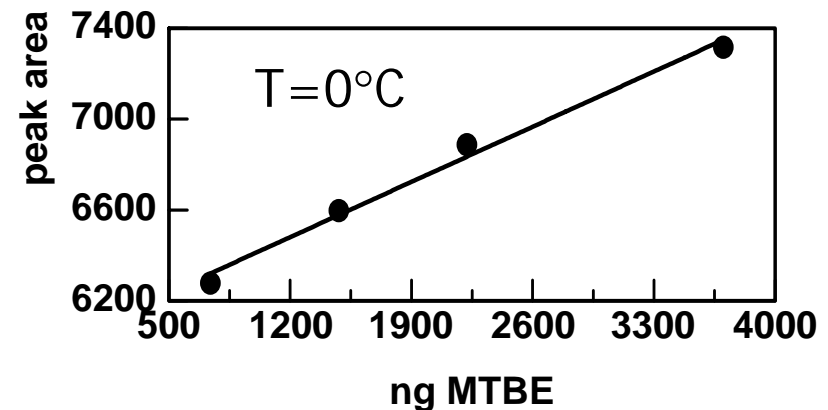
Laser Induced Breakdown Spectroscopy



TEC-SERS Probe

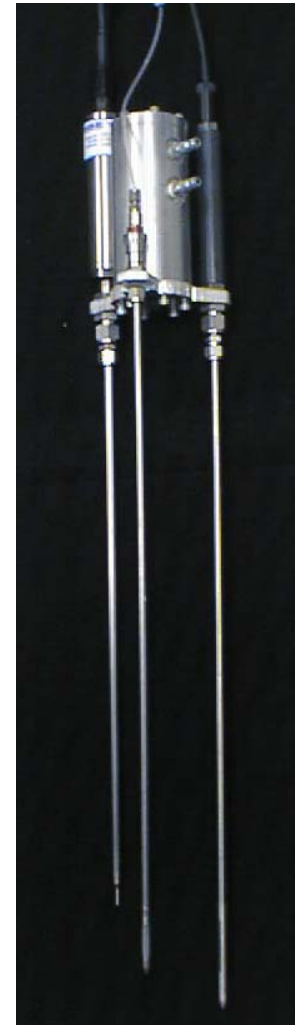
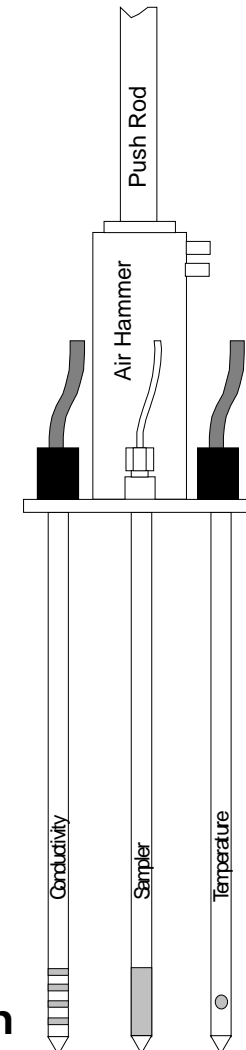
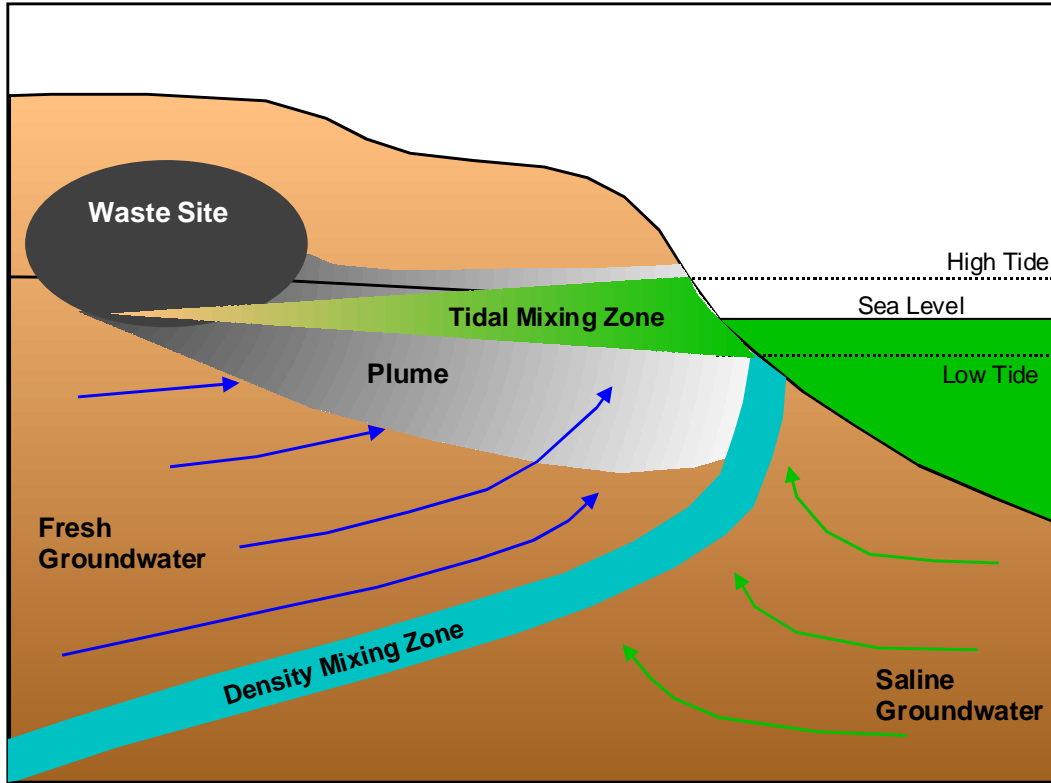


Coating = thiophenol,
T range: 15, 10, 5, and 0 °C





TRIDENT Probe: a multi-sensor water sampling probe for screening and mapping groundwater plumes at the surface water interface



Conductivity – detects contrast in salinity and/or clay content in unconsolidated sediments

Temperature – detects groundwater by thermal contrast with surface water

Porewater Sampler – allows contaminant characterization and detection of other groundwater-specific tracers

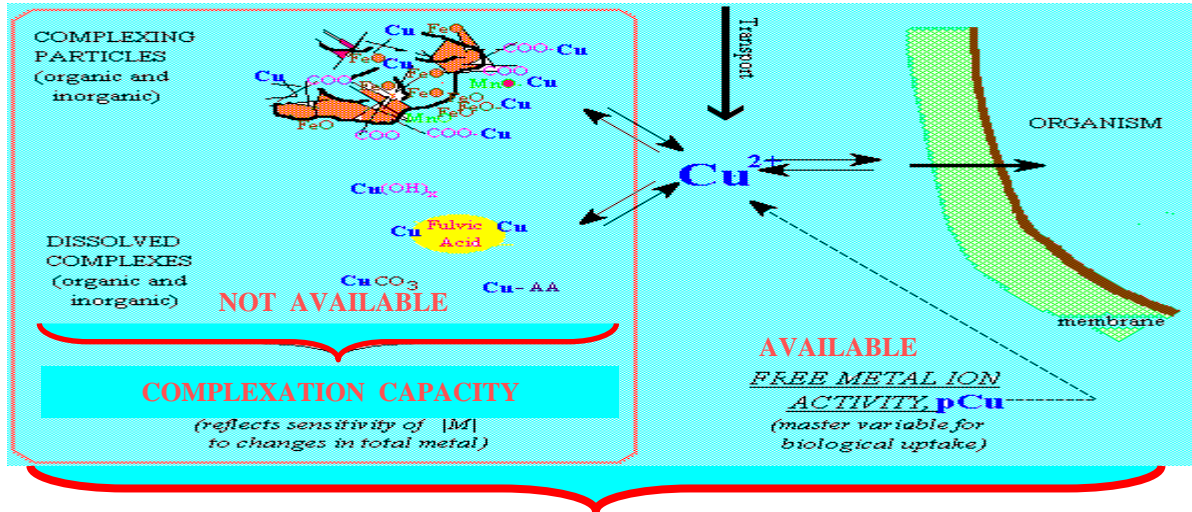


Environmental Monitoring

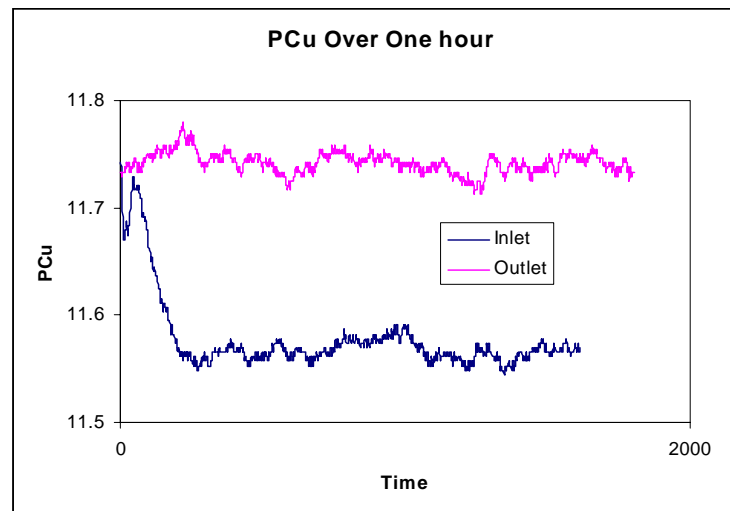
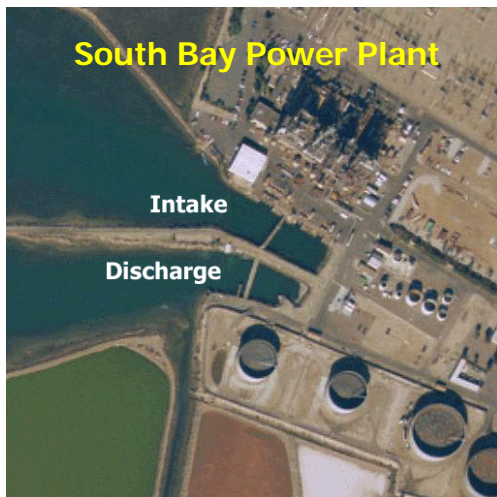


- **Total Copper Analyzer**
- **Spill Sentry: Oil-Spill Monitor**
- **Oil-Content Monitor**
- **BioBuoy**
- **Benthic Flux Chamber**
- **Fluorescence Detection of Bacteria**
- **SERS-Based Anion Detection**

Total Copper Monitor: Inline ultrasonic digester coupled with an ISE

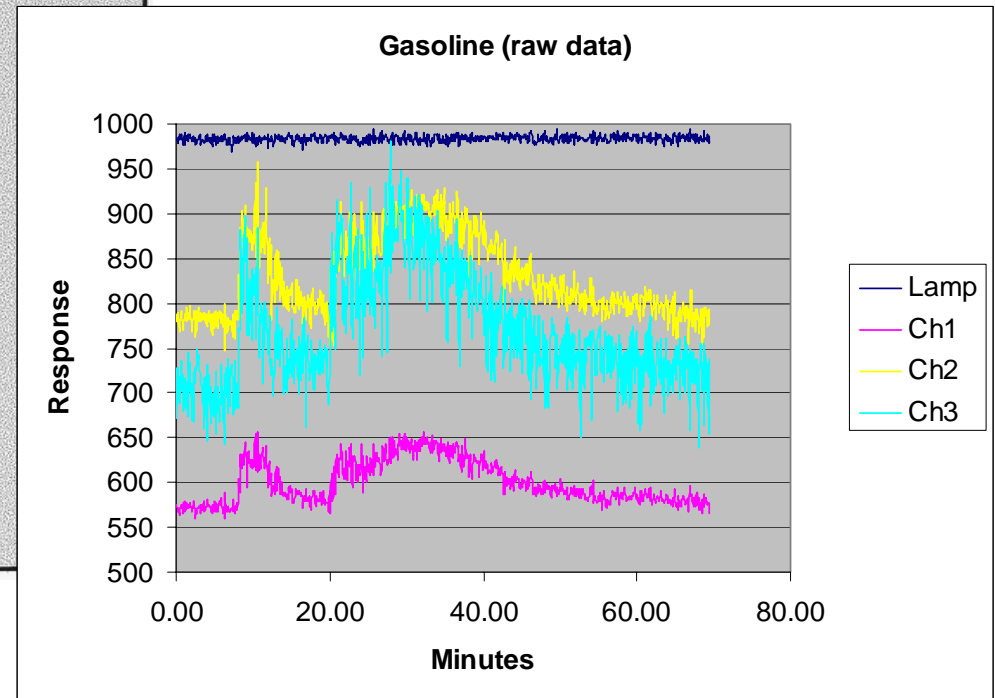
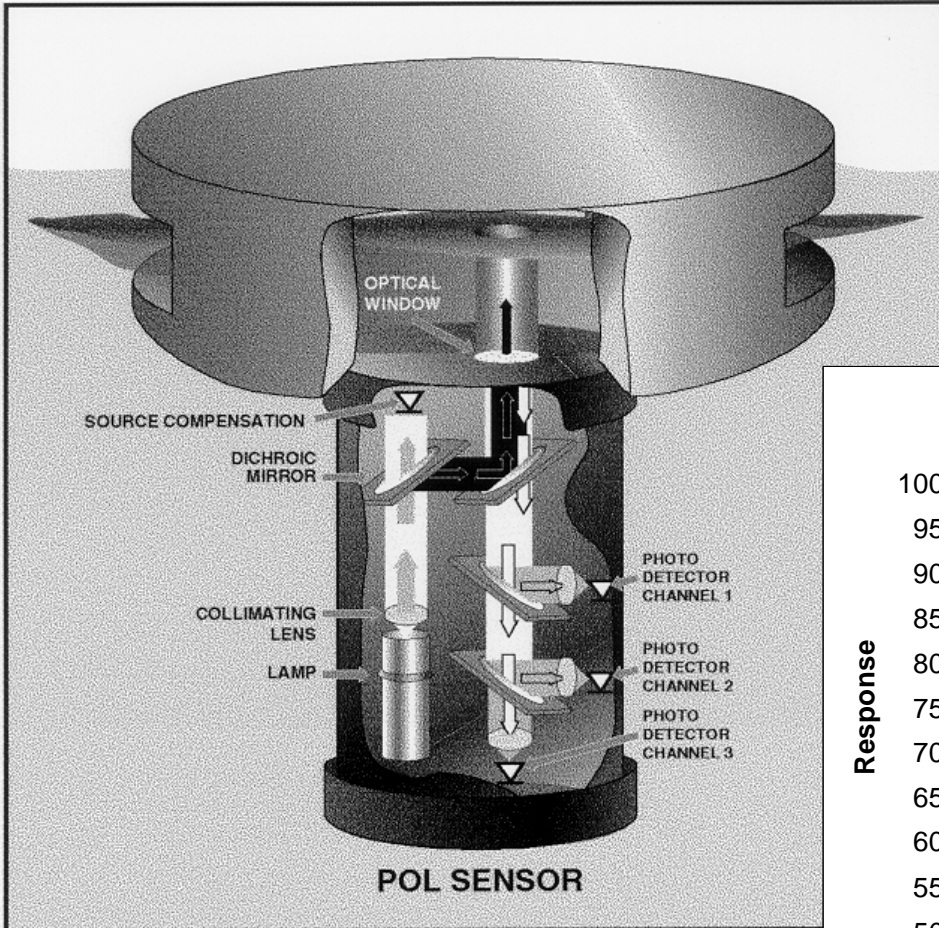


TOTAL COPPER CONCENTRATION

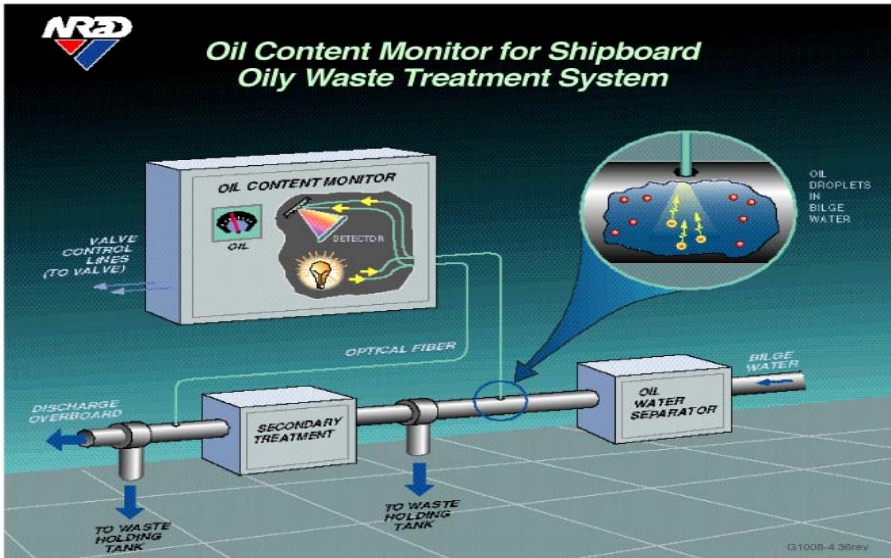




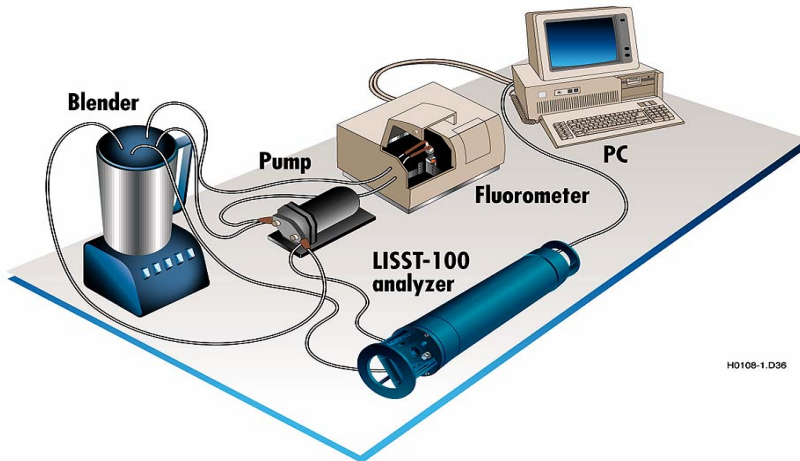
Spill Sentry: Automated Oil Spill Detection System



Oil-Content Monitor

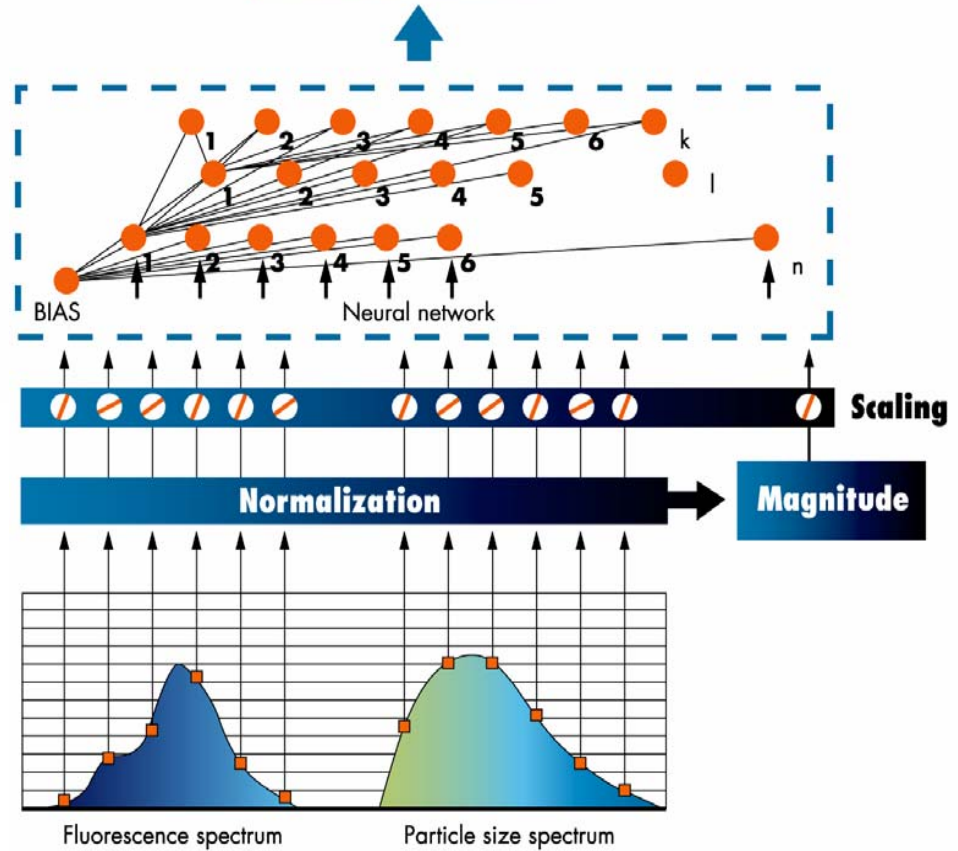


Data Collection



Data Processing

Concentration (PPM)

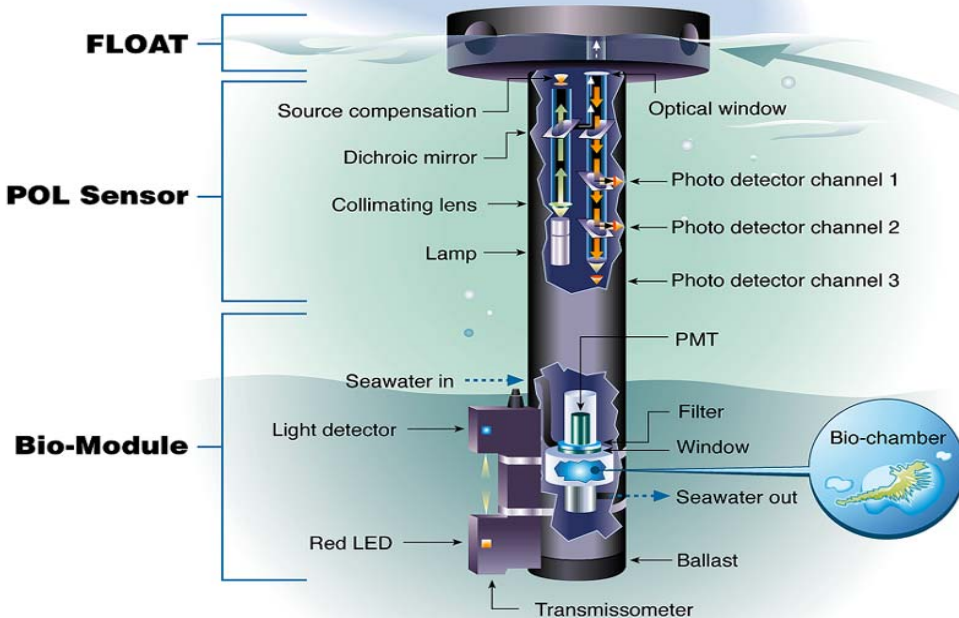
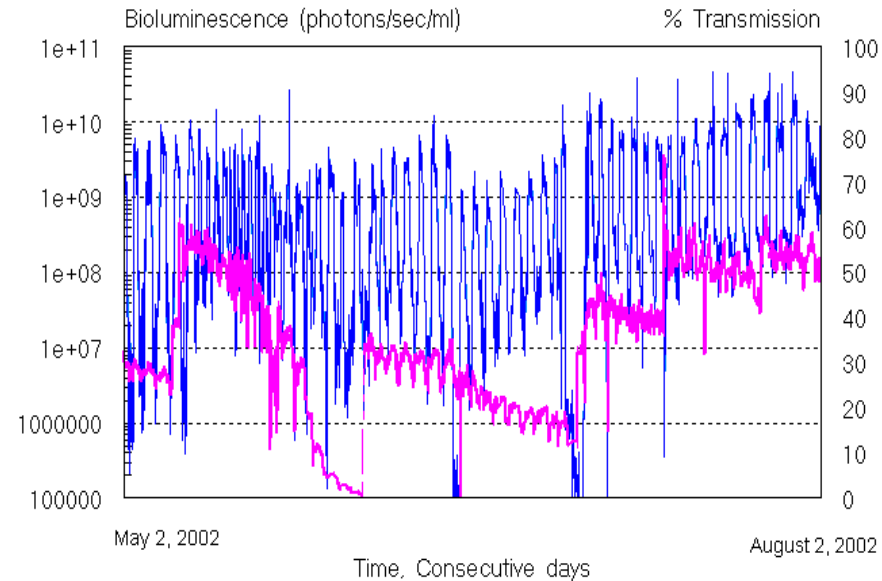




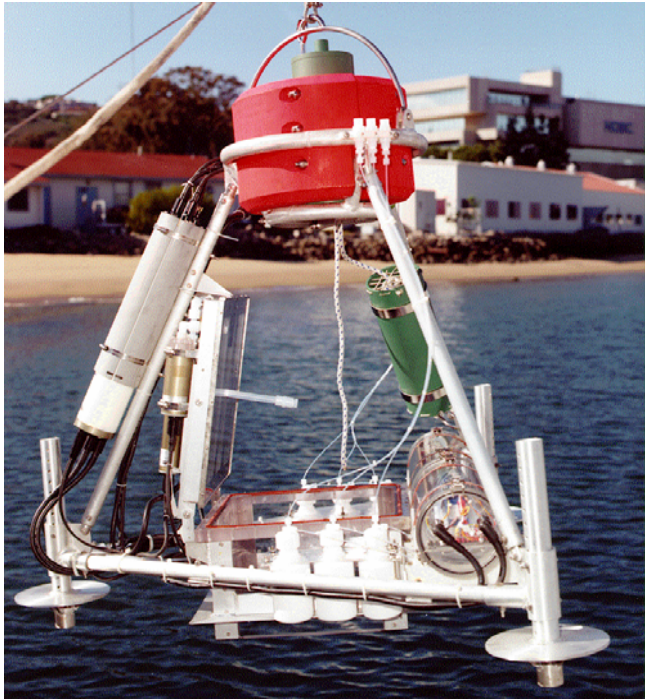
Bioluminescent dinoflagellates are sensitive to metals, organics, and oceanographic processes and could serve as indicators of potential toxicity and developing red tides

Bioluminescence in San Diego Bay Continuous BioBuoy Measurements

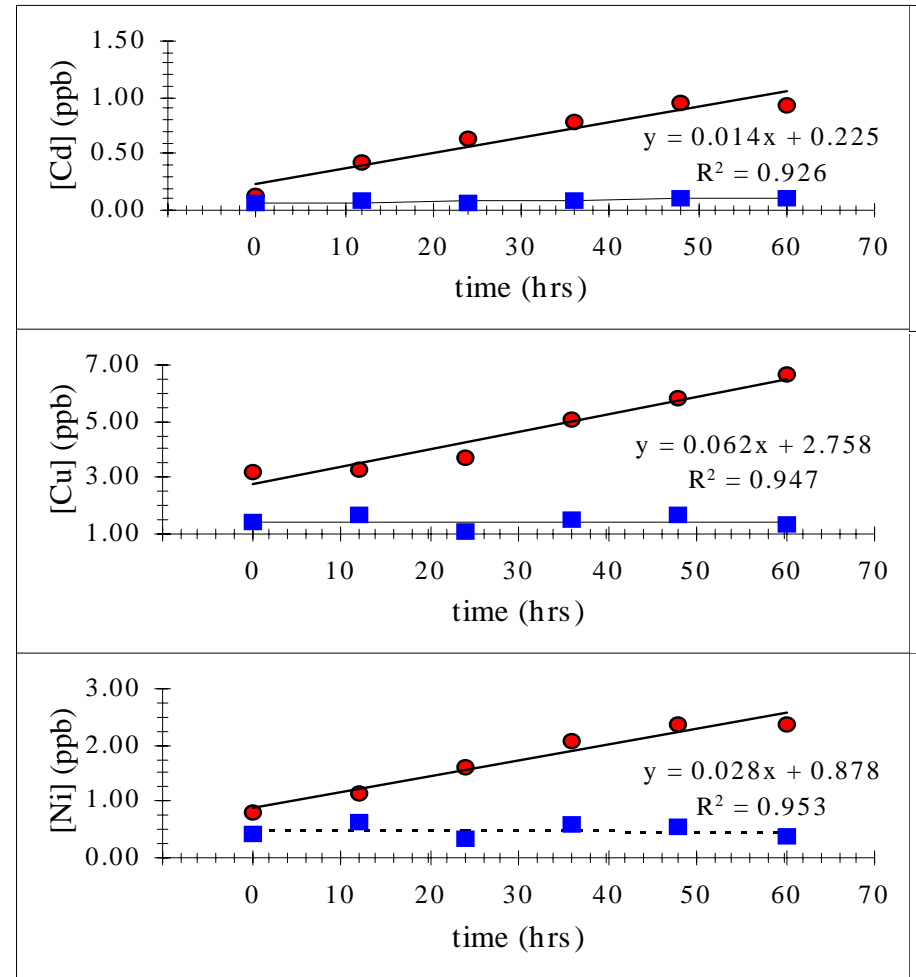
— Bioluminescence — % Transmission



Benthic Flux Chamber

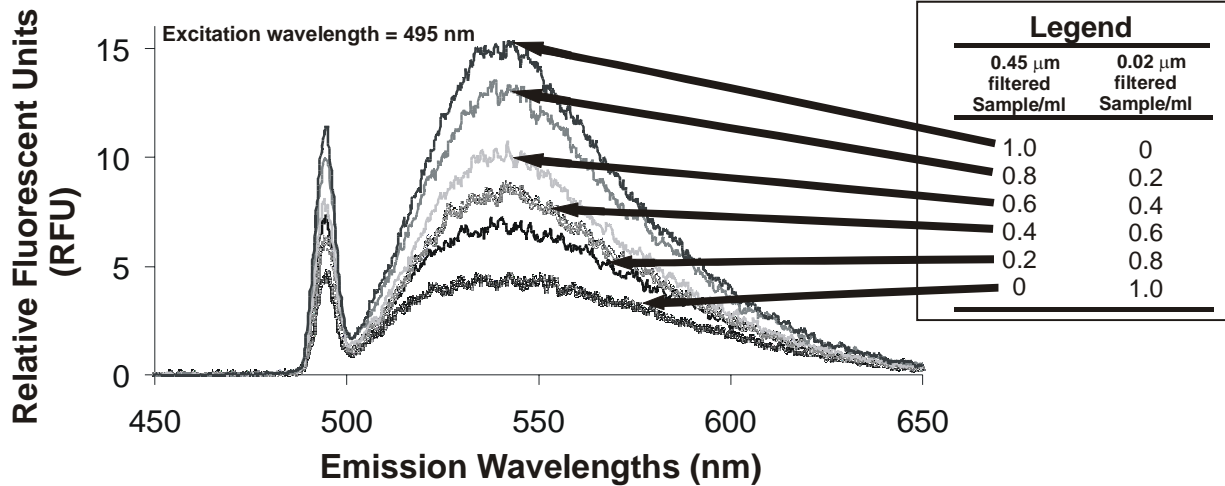


Effective non-intrusive monitoring and compliance tool for *direct quantification* of sediments as contaminant sources.

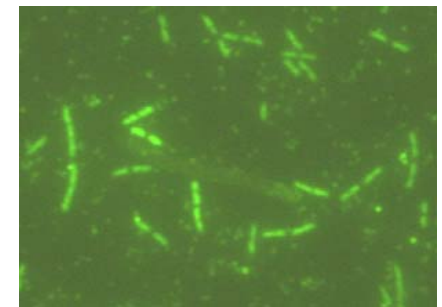
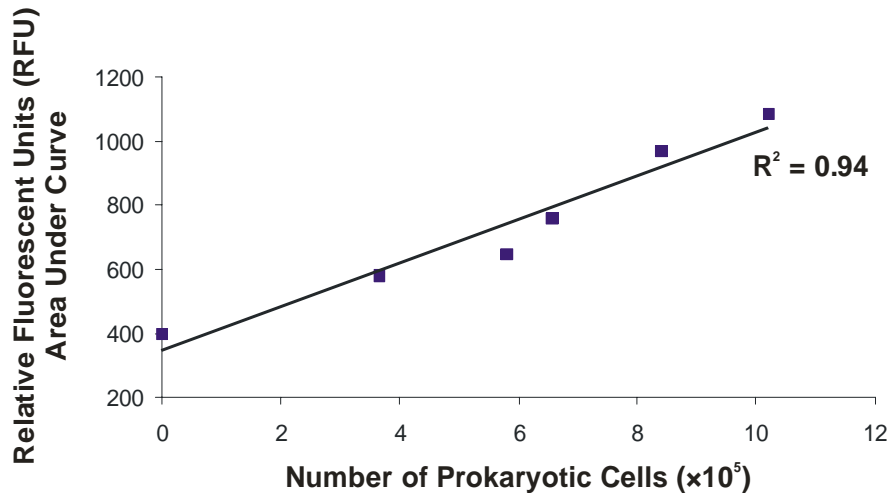


Fluorescence Detection of Bacteria

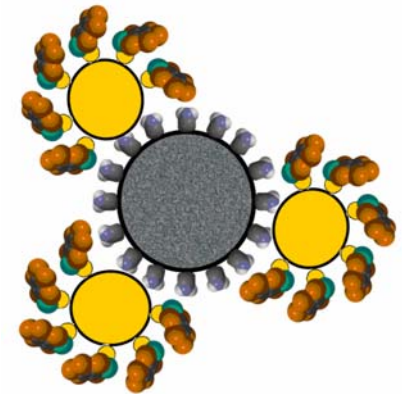
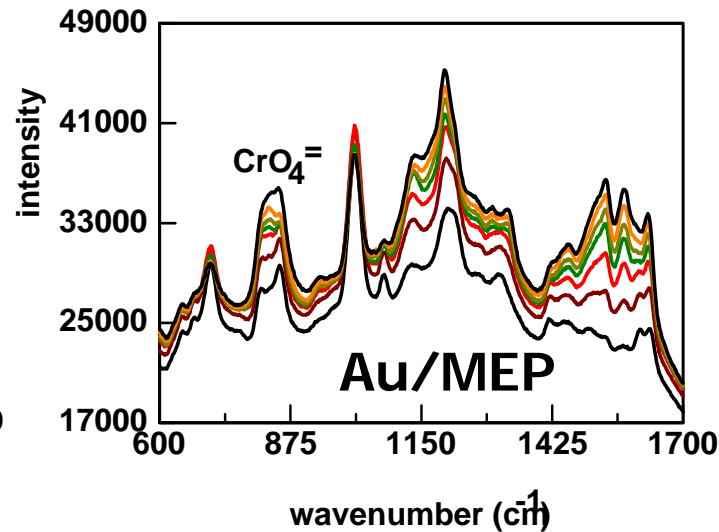
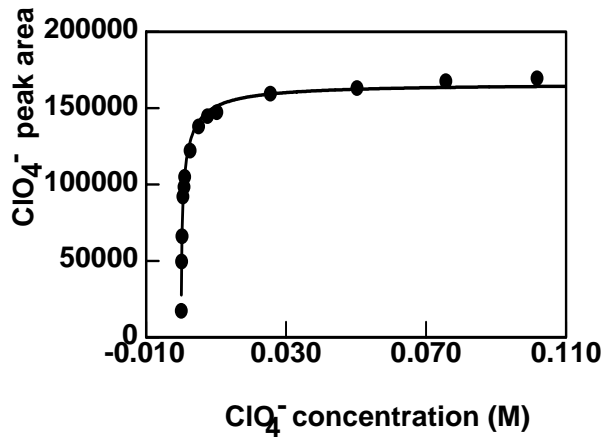
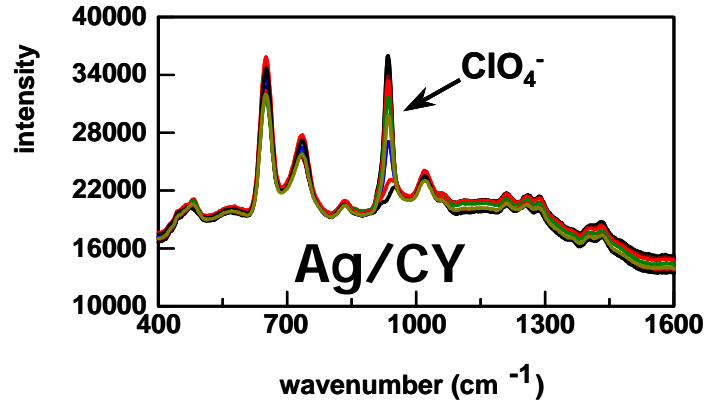
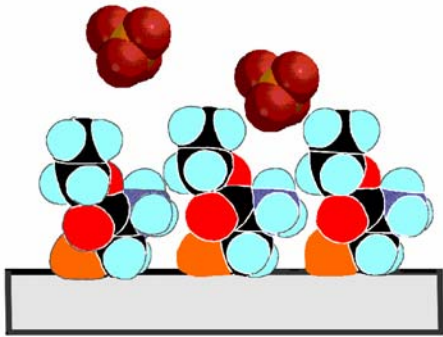
TOTAL BACTERIA



Phage recognition for specific bacteria



SERS-Based Anion Detection



**SERS-active
Capture matrices**

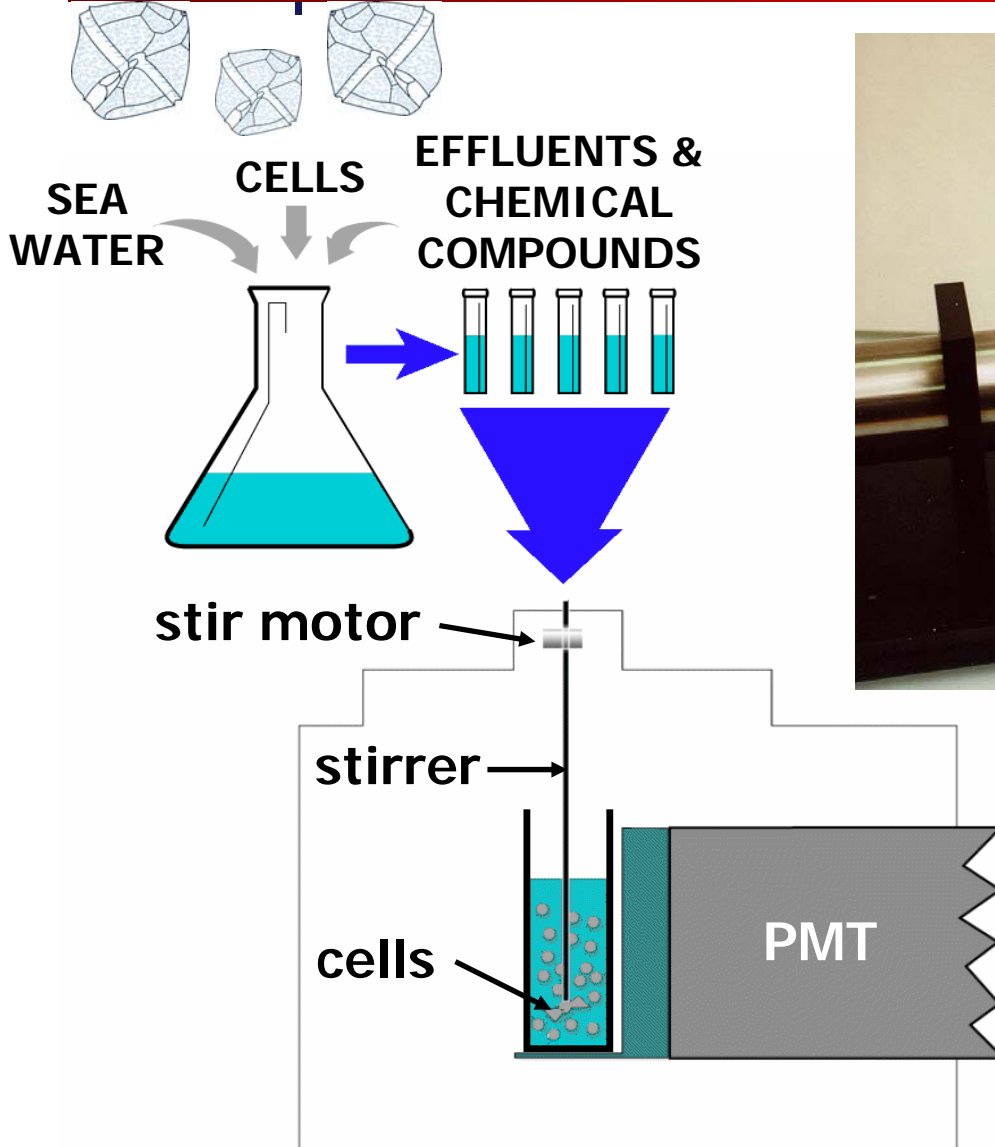


Monitoring Environmental Quality/Health



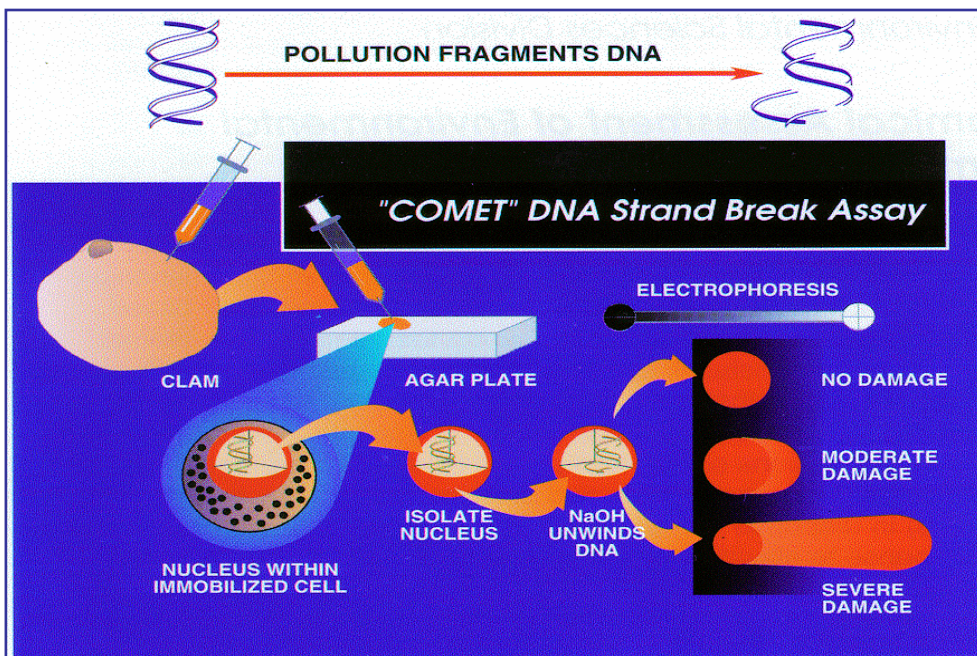
- **Qwiklite and QwikSed**
- **Biochemical Toxicity Indicator-
the "Comet" Assay**

QwikLite and QwikSed

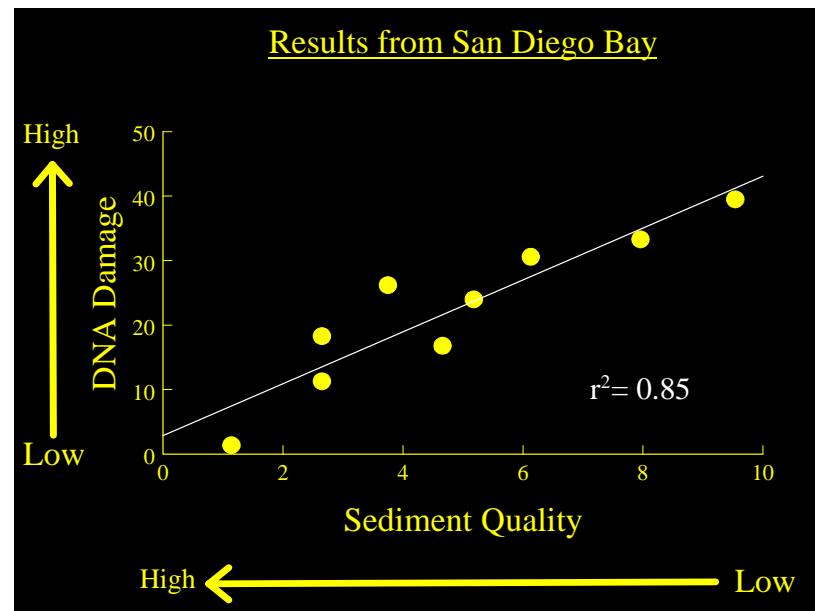
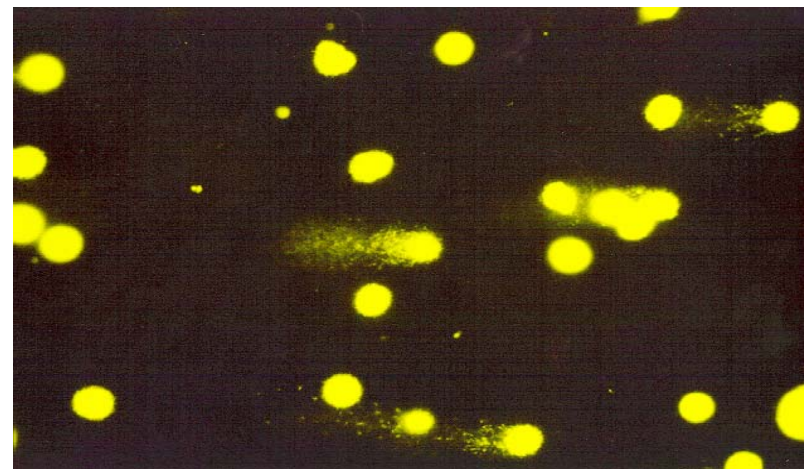


Rapid, inexpensive bioluminescent field screening tool to detect the presence of toxic metals and organics in sediments and pore water samples

Comet Assay



The Comet Assay:
A method for the detection of the genotoxic and cytotoxic effects of pollutants.

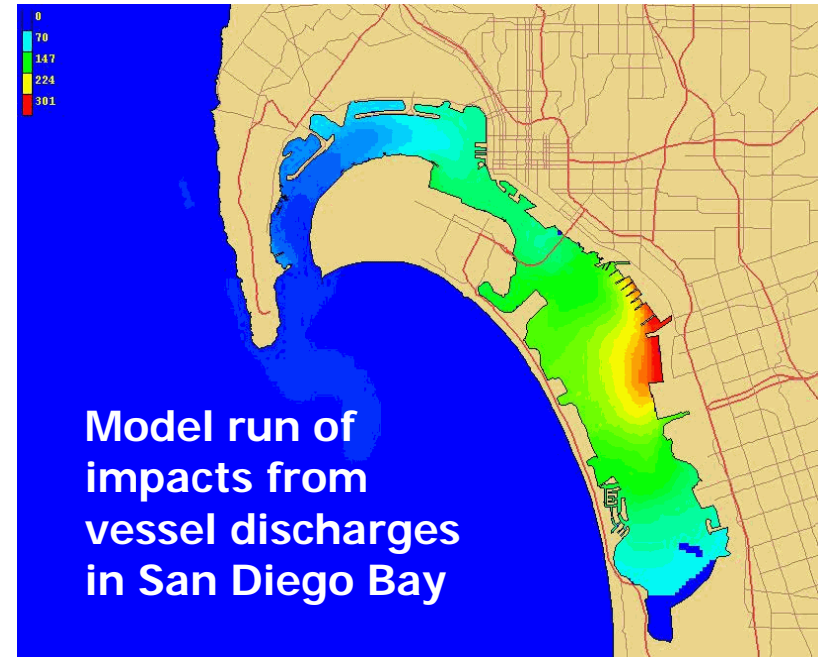
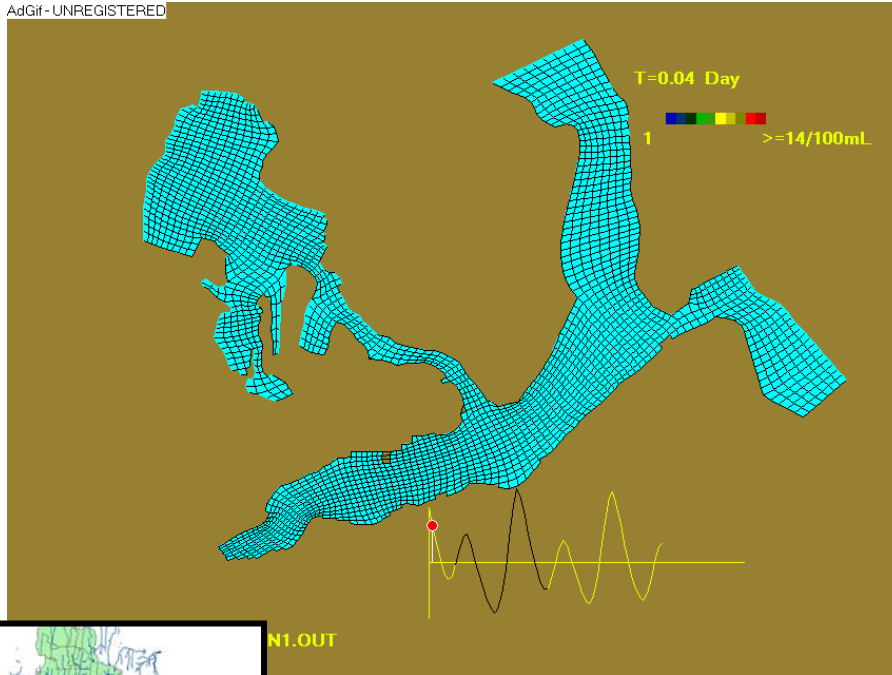




Environmental Modeling



AdGif - UNREGISTERED



Simulation of a storm event

