

Selecting Sewage Indicators for Nearshore Coastal Waters: Strategies and Perceptions

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How widespread is the problem?

About 26,000 closings in 2006, when high-risk beaches in the U.S. were contaminated 25% of the time.

What are the major causes?

Stormwater runoff events and sewer system leaks; however, synergistic effects of chemicals possible.

Is the water testing adequate?

Few pathogens/pollutants are analyzed and turnaround times are often too long to provide warnings.

[According to NRDC data]



People recognize gross differences in the appearance of seawater; however, subtle differences usually go unnoticed.

Biological pathogens and toxic chemicals are transported primarily on particulates—not dissolved in seawater.



Sensory Indicators of Possible Polluted Coastal Waters


- Proximity to river or stream mouths and discharge pipes for stormwater or industrial facility
- Unusual odors or “feeling” of the seawater
- Clarity of water (both sediment and plankton)
- Interfaces between waters of different clarity, temperature, or floating debris (scum lines)
- Relative abundance of fish and marine mammals
- Dissipation of foam from breaking waves
- Appearance of sand just above tidal line

Hanalei Bay, Kauai, Hawaii



Bay Water Quality Issues

- High *Enterococcus* and *Coliform* counts associated with wet weather and major runoff events
- Sewage-like or hydrogen sulfide odors occasionally detected near surf break
- Periodic, but persistent, nearshore algal blooms during dry weather conditions
- Reports of failing septic tanks and cesspools in Hanalei town (<200 m from shore)



Recharge

Wetland (shallow
water table)

Shallow Submarine
Groundwater Discharge

Holding Tanks on Boats

Surface Water
Discharge

Chemical/Physical Indicators

- Temperature and Salinity
- Fecal Sterols (coprostanol)
- Steroidal Estrogens (pharmaceuticals)
- Household Surfactants (LAS)
- Caffeine (natural vs. anthropogenic)
- Highly-Soluble Nutrients (N, P, F)
- Coliphages (bacteria-borne viruses)
- Chelating Agents (EDTA)
- Heavy Metals (Pb, Hg, Cd)

Selection Criteria for a Groundwater Discharge Source

- Indicative of household waste streams
- Relatively high aqueous solubility
- Resistant to photo- and bio-degradation
- Resistant to filtration or sorption by sands
- Present at reasonable concentrations relative to seawater background
- Easily and/or economically detected

Considerations for Submarine Groundwater Discharge

- Magnitude and location are variable
- Modeling has not proven reliable
- Various tracers (Rn-222, exotics)
- Seepage flux meters, thermometers, and collector vessels on floor of Bay
- Well points on beach and upgradient land

Preliminary Results of a Recent Groundwater Study

[K. Knee et al., Stanford University]

- Nearshore submarine discharge is detectable via salinity differences
- Groundwater could be a localized contributor of nutrients (e.g., nitrate) to nearshore waters
- Bacterial indicators of fecal contamination were present in some groundwater samples

Is there relevant legislation?

Raw Sewage Overflow Community Right to Know Act (HR 2452)

Beaches Environmental Assessment and Coastal Health Act of 2000
(BEACH Act)

How do most people perceive the issue?

The appropriate governing agencies both protect water quality and advise people of health hazards.

Is this collective perception accurate?

Not really—the task of protecting water quality is shared, and people most often manage their own health risks.