

Restoring Coastal Water Quality by Limiting Groundwater Pollutant Discharges

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Challenges with Submarine Discharge of Pollutants

- Magnitude and location highly variable
- Modeling has proven to be inconsistent
- Tracers (radon, exotics) can be unreliable
- Seepage flux meters, thermometers, and collector vessels difficult to maintain
- Well points on shoreline often destroyed

Subtropical Bay



Bay Water Quality Issues

- High bacterial counts associated with wet weather and major runoff events
- Periodic, but persistent, algal blooms during dry weather conditions
- Reports of failing septic tanks and cesspools associated with waterfront houses
- Lack of detailed water quality parameters

Possible Restoration Options

- Construct new sewer system (too costly)
- Replace septic systems (valid long-term)
- Install of physical and/or chemical barrier (limited by lithology and hydrology)
- Separation of graywater from blackwater (affordable short-term partial solution)

A photograph of a beach with ripples in the sand and a shallow pool of water. The sand is dark and has a wavy, rippled texture. The water is shallow and reflects the light. The background is a bright, hazy sky.

Shallow well points on beach indicated two groups of homes had consistently higher levels of indicators and nutrients

Nutrients (N, P, Fe) and indicators (fecal sterols, caffeine, LABS, microbes, etc.)

Long-term solution was replacement of septic systems, as well as installation of graywater systems at some homes

Preliminary Results from Well Points and Bay Samples

- Installation of graywater systems reduced some indicators, but not nutrients.
- New septic systems reduced nutrients, but no additional chemical indicators.
- Thus far no change in bacterial counts, but less frequent algal blooms in bay.
- Still monitoring both bay and well points.

Temperate Coastal Lagoon



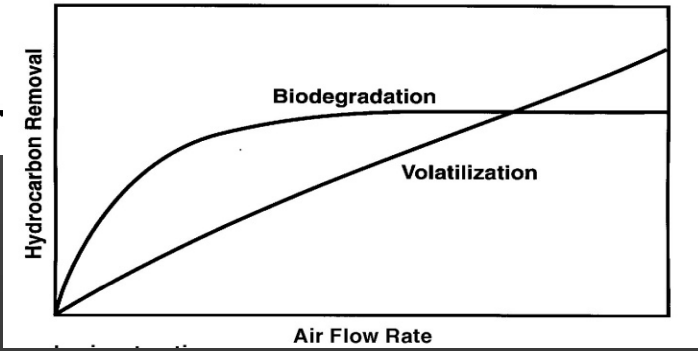
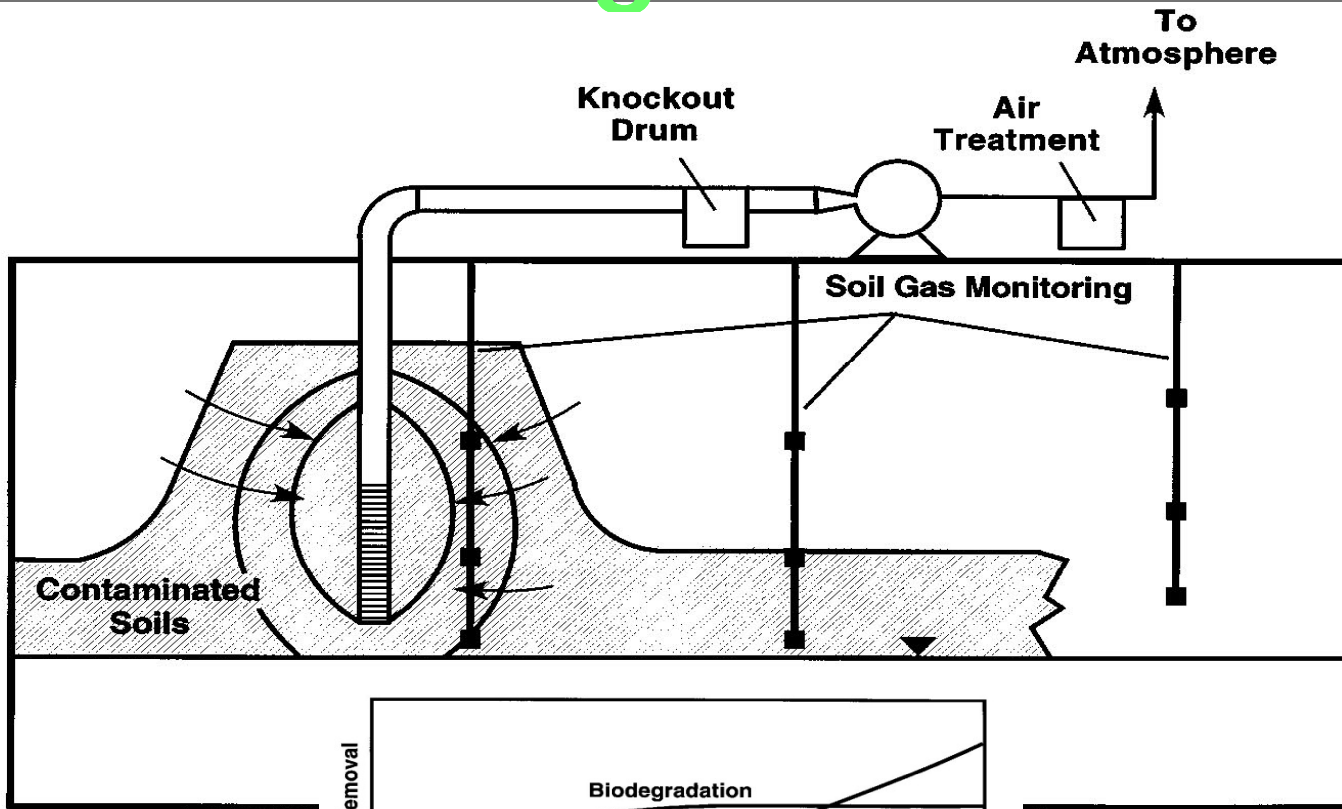
Lagoon Water Quality Issues

- Presence of gasoline and diesel in soil at the site of a former mobile fueling facility.
- Petroleum odor in the lagoon water reported during low tides.
- Low concentrations of semi-volatile fuel hydrocarbons in ground and lagoon waters.
- Modified stormwater drainage at the site to accommodate the former facility.

Possible Restoration Options

- Total removal of contaminated soil (costly)
- In-situ chemical oxidation (uncertain)
- Vapor extraction of most “mobile” fraction and enhanced biodegradation of HCs (rapid)
- Reduce water infiltration through sands and restore natural surface drainage (feasible)

Bioventing Schematic





*Site re-vegetated to reduced infiltration,
and natural stormwater channel restored.*

*Bioventing (combination of SVE and enhanced
biodegradation) used to reduce volatile and
semi-volatile hydrocarbons in soil/sand.*

Preliminary Results from Groundwater and Lagoon

- SVE removed lightest HCs, but g.w. levels were unchanged (HC composition altered)
- SVE raised redox potentials, which should increase kinetics of HC biodegradation
- Surface drainage changes reduced total HC loading to lagoon (despite g.w. levels)
- Thus far, fewer reports of petroleum odors

Summary

- Restoration of two coastal environments was enhanced by minimizing the contribution of groundwater-transported pollutants.
- Submarine discharge of pollutants to shallow surface waters may be important in some coastal environments.
- When total removal of pollutants from the source is impractical, measures to reduce their transport can be implemented.