Illicit Discharge Detection and Elimination: Chemical Outfall Monitoring



The ORI Cannot:

- Find all discharges (can sometimes lead to a "false positive" as well)
- Detect intermittent flows that leave no trace
- Quantify impacts definitively (no direct measure of relative problem)
 Define sources (except for some obvious indicators)

Indicator Monitoring

More detailed sampling to:
 ID problem outfalls not apparent from physical indicators alone

- Test suspect or problem outfalls to confirm if illicit discharge
- Determine flow type
- Analyze intermittent discharges



Outfall (vs. Stream) Monitoring:

- Flows are more concentrated
- Can identify source more easily.
- Not as good a measure of the resource quality.
- Takes more samples to characterize a watershed

Techniques to Interpret Indicator Data

- Single Parameter Screening
- Flow Chart Method
- Industrial Flow Benchmarks
- Chemical Mass Balance Model



Single Parameter Screening (not necessarily recommended)

Detergents Best single parameter to detect illicit discharges Analysis conducted in controlled lab setting Ammonia Concentrations >1mg/L is positive indicator of sewage Analysis in field using portable spectrophotometer



Chemical Fingerprint Library

- Shallow Groundwater
- Spring Water
- Tap water
- Irrigation
- Sewage
- Septic Tank Discharge
- Common Industrial Discharges
- Commercial Car Wash
- Commercial Laundry

Preliminary Tuscaloosa, AL, "Library" File Data

Mean/(COV)	Fluoride	Detergents	Ammonia	Potassium
	(mg/L)	(mg/L MBAS)	(mg/L, as N)	(mg/L)
Tap water	0.95	0	0	1
	(0.03)	(0)	(0)	(0)
Spring water	0.024	0	0.034	3.4
	(1.3)	(0)	(0.82)	(0.79)
Car wash water	0.02	80	0.55	6
	(1.4)	(1.2)	(0.27)	(0.94)
House laundry	1.1	960	1.0	2
water	(0.18)	(0.06)	(0.15)	(0)
Sewage	0.68	11	22	12
	(0.07)	(0.12)	(0.71)	(0.19)
Industrial	0.21	6.0	5.3	49
wastewater	(1.7)	(0.68)	(0.73)	(0.52)

Benchmark Concentrations to Identify Industrial Discharges

Benchmark	Concentration	Notes	
Ammonia (mg/L)	<u>></u> 50	 Existing "Flow Chart" Parameter Concentrations higher than the benchmark can identify a few industrial discharges 	
Potassium (mg/L)	<u>≥</u> 20	 Existing "Flow Chart" Parameter Excellent indicator of a broad range of industrial discharges 	
Color (Units)	<u>></u> 500	 Supplemental parameter that identifies a few specific industrial discharges 	
Conductivity (µS/cm)	<u>≥</u> 2,000	 Identifies a few industrial discharges May be useful to distinguish between industrial sources 	
Hardness (mg/L as CaCO ₃)	<u>≤</u> 10 <u>≥</u> 2,000	 Identifies a few industrial discharges May be useful to distinguish between industrial sources 	
pH (Units)	<u><</u> 5	 Only captures a few industrial discharges High pH values may also indicate an industrial discharge but residential wash waters can have a high pH as well 	
Turbidity (NTU)	<u>≥</u> 1,000	 Supplemental parameter that identifies a few specific industrial discharges 	

Take Home Points

- For single parameter screening, use detergents or ammonia
 - Detergents, fluoride, ammonia, and potassium recommended as most useful for identifying contamination of storm drainage systems, as well as tests for *E. coli* or Enterococci

Indicators to Identify Sources of Contamination

Ideal indicator to identify major flow sources has the following characteristics:

- Significant difference in concentrations between possible pollutant sources;
- Small variations in concentrations within each likely pollutant source category;
- Conservative behavior (i.e., no significant concentration change due to physical, chemical or biological processes);
 - Ease of measurement with adequate detection limits, good sensitivity and repeatability.

Key Lab Considerations

HORIBA

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Equipment cost
Staff training
Number of samples
Safety
Disposal



Center for Watershed Protection

Photo Source: Robert Pitt

Simple and Inexpensive Analytical Methods (can be used in the field, but usually much easier, safer, and more efficient in lab)

- Comparative colorimetric methods (apparent color, detergents after extraction)
- Simple probes (pH, conductivity, ion selective potassium)
- Spectrophotometric (fluoride, ammonia, boron)





















Bacteria Monitoring







Quantitray Under UV Light



3M Petrifilm Plates



Discussion: What types of monitoring are you considering adding?

