Epidemiology and Rapid Indicator Studies To Improve Our Beach Water Quality Monitoring Program

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Beach Monitoring is on the Verge of Big Changes

- Beaches have been monitored the same way for decades
  - Limited to growth in cultures

- Existing methods are slow

- Existing methods are nonspecific

- New technology provides opportunities for improvement
  - Genetic based measurements
Studies Necessary To Support Changes In Beach Monitoring

• Method performance evaluation studies
  - Repeatable, sensitive, accurate

• Transferable to local agencies

• Swimming related epidemiology
  - Relationship between health effects and concentrations
California Epidemiology Studies

- Three beaches with different types of fecal sources
  - all nonpoint sources

- Over thirty different indicators of fecal pollution
  - Two dozen of the best researchers in the nation

- More than 30,000 swimmers
  - nearly 20 different symptoms
Enterococcus Concentrations At Avalon Beach, Summer 2007

Colony Forming Units Per 100mL

North of Pier  South of Pier  South Beach

Threshold
TRADITIONAL
Enterococcus Idexx (2)
Enterococcus MF
Fecal Coliform MF
Total Coliform MF

RAPID
Enterococcus QPCR (2)
Enterococcus TMA
E. coli QPCR

MICROBIAL SOURCE TRACKING
Enterococcus esp gene (2)
E. Coli raptor gene
Bacteroides sp.
Bacteroides human marker (2)
B. thetaiotamicron (2)
Legionella
Methanogens
Methanobrevibacter smithii (2)

VIRUS
F+ and Somatic Coliphage
F+ and Somatic Coliphage ELISA
Adenovirus
Enterovirus
Norovirus (2)
Hepatitis A virus
Polyoma virus

COMMUNITY PROFILING
Enterococcus
Bacteroides thetaiotamicron
Heliobacter pylori
Campylobacter jejuni
Clostridium perfringens
Salmonella enteritica
Shigella dysenteriae
Shigella flexneri
Shigella boydii
**GASTROINTESTINAL**
- Nausea
- Vomiting
- Diarrhea
- Cramps
- Highly Credible Gastrointestinal Illness 1 (HCGI-1)
- HCGI-2

**DERMATOLOGICAL**
- Skin rash
- Scrapes

**RESPIRATORY**
- Cough
- Cough with phlegm
- Nasal congestion
- Sore throat
- Significant respiratory disease (SRD)

**NON-SPECIFIC**
- Fever
- Chills
- Earache
- Ear discharge
- Eye irritation
California Is Way Ahead on Rapid Methods

- Started exploring rapid methods in 2001
  - Adopted from other applications

- Close to equivalency with existing methods
  - Conducted two evaluation studies

- Techniques can be conducted by routine laboratories
New vs. Traditional Technology for Enterococcus (per 100 mL)
Outreach and Involvement

- Diverse study team
- Federal, State, and local partners
- Internationally renowned scientific review team
- Managers through the Beach Water Quality Work Group
  - County Health, NPDES, RWQCB