

Antibiotic Resistant Bacteria and Genes in Wastewater Treatment Facilities

**Presentation to the SCCWRP Commission
September 9, 2016**

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WHAT IS A SUPERBUG?

Superbugs are drug-resistant microbes that present a severe danger to human health

- Methicillin-resistant *Staphylococcus aureus* (MRSA)



- Vancomycin-resistant *Enterococcus* (VRE)



- Carbapenem-resistant Enterobacteriaceae (CBE/CRE)

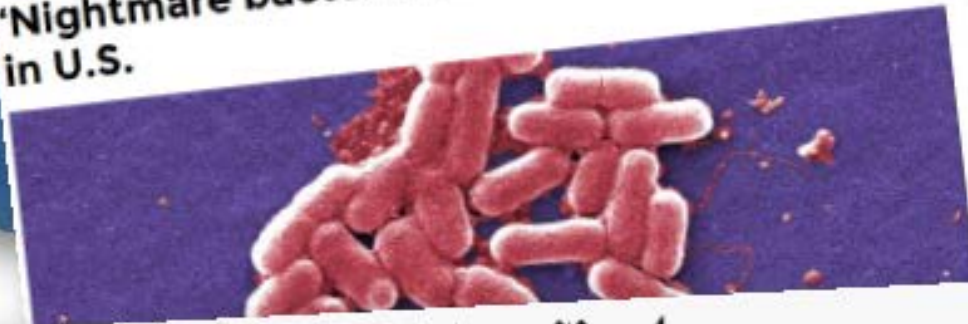


Los Angeles Times

Deadly superbugs from hospitals get stronger in the sewers and could end up in the Pacific Ocean



'Nightmare bacteria' resistant to antibiotic of last resort found in U.S.



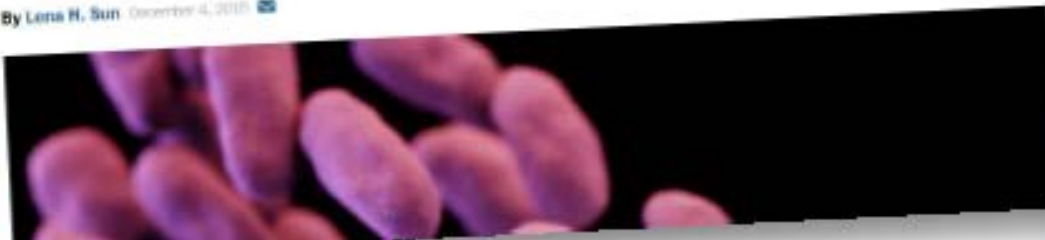
The Washington Times

The Washington Post

To Your Health

Superbug known as 'phantom menace' on the rise in U.S.

By Lena H. Sun December 4, 2010



The Economist

World politics Business & Finance Economics Science & technology Culture

Antibiotic resistance

The grim prospect

The evolution of pathogens is making many medical problems worse. Time to take drug resistance seriously
May 2nd 2010 | From the print edition



COMMISSION REQUEST

- **How prevalent an issue is antibiotic resistance in the ocean environment?**
- **How real is the connection between antibiotic resistance and wastewater treatment plants?**
 - Media has called out wastewater treatment plants as a source of antibiotic resistant bacteria and genes
 - Some evidence that antibiotic resistant bacteria and genes may persist following common treatment processes
- **Based on the answers to the first two questions, is there a need to study the issue locally?**

ARE ANTIBIOTIC RESISTANT BACTERIA PREVALENT IN THE OCEAN?

- **Not well known for Vancomycin-resistant *Enterococcus* and Carbapenem-resistant Enterobacteriaceae**
 - No smoking gun
- **SCCWRP looked for methicillin-resistant *Staphylococcus aureus* in our epidemiology studies**
 - We found MRSA in 1.6% of our water samples
 - We also found it in 2.7% of our sand samples
- **Similar values have been reported in smaller studies of MRSA at other California beaches**

ARE TREATMENT PLANTS CONTRIBUTING ANTIBIOTIC RESISTANT BACTERIA AND GENES TO THE OCEAN?

- **It's likely that they are**
 - A WERF study demonstrated that antibiotic resistant bacteria increase dramatically with time during the activated sludge process
- **Several studies have documented high levels of antibiotic resistant genes in wastewater effluent**
 - Genetic analyses have detected a broad array of antibiotic resistance genes in wastewater effluent
 - There is danger that these genes may be picked up by native bacteria in the ocean environment

DOES SCCWRP RECOMMEND FURTHER STUDY?

- **Yes**
 - Existing data show the potential for this to be a problem
 - My review suggests it's more likely a potential problem than a big one
 - However, you don't have the information to support my view
- **Have already agreed to partner with POTW member agencies to conduct a study**
- **Currently refining study design**

PROPOSED STUDY

- **Track presence and abundance of antibiotic resistant bacteria through wastewater treatment process**
 - Start by looking at primary influent and finished effluent
- **Multiple plants to capture across plant differences in treatment regimens**
- **Four sampling events to capture seasonality**
- **Multiple methods**
 - Live bacteria
 - Genetic methods

TIMELINE

- **September, 2016 – Circulate Draft Study Plan**
- **October, 2016 – Finalize Study Plan**
- **January, 2017 – First sampling event**