

Ocean Wastewater Discharge in the State of California Report and Inventory Prepared by Heal the Ocean

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<http://www.healtheocean.org/>

Additional References, Summaries, and Sources

Pathogens, wastewater, and ocean water quality

California Beach Report Card, Heal the Bay, May 21, 2008

Heal the Bay's site shows comprehensive analysis of coastline water quality in California. Each week, over 350 beaches are graded A to F based on bacteria analysis.

<http://www.healthebay.org/brcv2/>

Colford, et al., Water Quality Indicators and the Risk of Illness at Beaches with Nonpoint Sources of Fecal Contamination, Epidemiology, Vol. 18, 1, Jan 07

BACKGROUND: Indicator bacteria are a good predictor of illness at marine beaches that have point sources of pollution with human fecal content. Few studies have addressed the utility of indicator bacteria where nonpoint sources are the dominant fecal input. Extrapolating current water-quality thresholds to such locations is uncertain. METHODS: In a cohort of 8797 beachgoers at Mission Bay, California, we measured baseline health at the time of exposure and 2 weeks later. Water samples were analyzed for bacterial indicators (enterococcus, fecal coliforms, total coliforms) using both traditional and nontraditional methods, ie, chromogenic substrate or quantitative polymerase chain reaction. A novel bacterial indicator (Bacteroides) and viruses (coliphage, adenovirus, norovirus) also were measured.

<http://www.ncbi.nlm.nih.gov/>

DeLong EF. Microbial seascapes revisited. Current Opinion in Microbiology. 2001;3: 290-295

Abstract: A remarkable array of new discoveries is emerging from studies of naturally occurring marine microbes. These discoveries originate from novel applications of evolving technologies, ranging from molecular phylogenetics to stable isotope analyses, to advanced microscopic techniques, to genomics. As a consequence, new perspectives on the natural history of marine microbes, the inseparable nature of the geological and biological worlds, and a plethora of unexpected new genotypes, phenotypes and physiologies are now being revealed. As our observations of naturally occurring microbes become increasingly more sophisticated, so will theory, technical applications and predictive capabilities in microbial ecology.

<http://www.sciencedirect.com/>

Department of Agriculture, State of Michigan, Biosolids Q &A. State of Michigan website (accessed December 2009).

Frequently Asked Biosolids Questions - Dept. of Agriculture, Michigan State Government information.

http://www.michigan.gov/mda/0,1607,7-125-1567_1599_26799-82107--,00.html

Dorfman, Mark, Swimming in Sewage: The Growing Problem of Sewage Pollution and How the Bush Administration Is Putting Our Health and Environment at Risk, National Resources Defense Council and the Environmental Integrity Project, 2004, website (accessed July 2009).

Sewage overflows cost Americans billions a year in medical treatment, lost productivity and repairs, and Bush administration policies are compounding the problem. This February 2004 report from NRDC and the Environmental Integrity Project describes the emerging environmental and public health crisis resulting from our nation's failure to effectively treat sewage, presents seven case studies from around the country that illustrate how exposure to sewage pollution has killed or seriously injured people and harmed local economies, and recommends solutions to America's sewage problem.

<http://www.nrdc.org/water/pollution/sewage/contents.asp>

Dorfman, M., Rossel, K. , Testing the Waters: A Guide to Water Quality at Vacation Beaches, 18th edition. NRDC, 2008 (Project design David Beckman & Nancy Stoner, NRDC)

In 2007 beach closings and advisories hit their second highest level in the 18 years the Natural Resources Defense Council (NRDC) has been tracking them. The number of closing and advisory days at ocean, bay, and Great Lakes beaches topped 20,000 for the third year in a row, confirming that our nation's beaches continue to suffer from serious water pollution that puts swimmers at risk.

<http://www.nrdc.org/water/oceans/ttw/ttw2008.pdf>

EPA, Report to Congress on Impacts and Control of Combined Sewer Overflows and Sanitary Sewer Overflows. August 26, 2004

This report was delivered to Congress on Thursday, August 26, 2004. The Report presents a comprehensive characterization of CSOs and SSOs, including the extent of environmental and human health impacts caused by CSOs and SSOs, the technologies used by municipalities to address these impacts, and the resources spent by municipalities to control CSO and SSO discharges. The Report finds that the occurrence of CSOs and SSOs is widespread, and that CSOs and SSOs cause or contribute to environmental and human health impacts. Further, the Report finds that there are many existing structural and non-structural technologies that are well-suited for CSO and SSO control (EPA 833-R-04-001).
http://cfpub.epa.gov/npdes/cso/cpolicy_report2004.cfm

Fleming et al., Oceans and human health: Emerging public health risks in the marine environment

Abstract: There has been an increasing recognition of the inter-relationship between human health and the oceans. Traditionally, the focus of research and concern has been on the impact of human activities on the oceans, particularly through anthropogenic pollution and the exploitation of marine resources. More recently, there has been recognition of the potential direct impact of the oceans on human health, both detrimental and beneficial. Areas identified include: global change, harmful algal blooms (HABs), microbial and chemical contamination of marine waters and seafood, and marine models and natural products from the seas. It is hoped that through the recognition of the inter-dependence of the health of both humans and the oceans, efforts will be made to restore and preserve the oceans.
<http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2573863>

Frequently Asked Questions & Answers about Wastewater and Biosolids Worker Health & Safety. National Biosolids Partnership website (accessed December 2009).

Frequently Asked Questions & Answers about Wastewater and Biosolids Worker Health & Safety produced by the National Biosolids Partnership
www.biosolids.org/docs/17880.PDF

Knap A., et al., Indicators of Ocean Health and Human Health: Developing a Research and Monitoring Framework. Environmental Health Perspectives (2002) Sep; 110(9):839-45

Abstract: We need to critically assess the present quality of the marine ecosystem, especially the connection between ecosystem change and threats to human health. In this article we review the current state of indicators to link changes in marine organisms with eventual effects to human health, identify research opportunities in the use of indicators of ocean and human health, and discuss how to establish collaborations between national and international governmental and private sector groups. We present a synthesis of the present state of understanding of the connection between ocean health and human health, a discussion of areas where resources are required, and a discussion of critical research needs and a template for future work in this field. To understand fully the interactions between ocean health and human health, programs should be organized around a "models-based" approach focusing on critical themes and attributes of marine environmental and public health risks. Given the extent and complex nature of ocean and human health issues, a program networking across geographic and disciplinary boundaries is essential. The overall goal of this approach would be the early detection of potential marine-based contaminants, the protection of marine ecosystems, the prevention of associated human illness, and by implication, the development of products to enhance human well-being. The tight connection between research and monitoring is essential to develop such an indicator-based effort.
<http://books.nap.edu/openbook.php?isbn=0309065690>

NRDC, Testing the Waters 2009: A Guide to Water Quality at Vacation Beaches. Online report, 7/29/2009 (accessed July 2009).

NRDC's annual survey of water quality and public notification at U.S. beaches finds that pollution caused the number of beach closings and advisories to hit their fourth-highest level in the 19-year history of the report. The number of 2008 closing and advisory days at ocean, bay and Great Lakes beaches topped 20,000 for the fourth consecutive year, confirming that our nation's beaches continue to suffer from serious water pollution that puts swimmers at risk.
<http://www.nrdc.org/water/oceans/ttw/titinx.asp>

Ocean Studies Board - Index to PDFs: Ocean Science Series. National Academies of Science (NAS).

In one way or another, every landform and creature on Earth reflects the presence of the oceans. Understanding the Earth's oceans is essential to our understanding of human history, the origin of life, weather and climate, medicines, the health of the environment, energy sources, and much more. Reports from the National Academies provide in-depth analysis and useful advice for policymakers and the general public on topics ranging from exploring the ocean's incredible biodiversity and resources to reducing threats to human safety from toxic algal blooms, contaminants, and coastal storms. This series is intended to help readers interpret information about the state of our oceans and better understand the role of ocean science.
http://dels.nas.edu/osb/ocean_science_index.shtml

Pruss A. Review of epidemiological studies on health effects from exposure to recreational water. International Journal of Epidemiology 1998;27(1):1-9.

Abstract: Numerous epidemics and cases related to swimming in recreational waters have long been reported. The World Health Organization (WHO), as the international public health authority, has been requested repeatedly to issue authoritative guidelines on the quality of recreational waters for national health authorities as well as the general public, which would affect tourism and the management of beach resorts worldwide. This review has, therefore, been carried out in the framework of the WHO project for setting guidelines for the quality of recreational water and bathing beaches. It is designed to provide a scientific basis for the derivation of guideline values for the microbiological quality of uncontrolled waters (natural water bodies such as lakes, rivers or the sea).

<http://ije.oxfordjournals.org/cgi/reprint/27/1/1>

Sahlstrom, Leena, et al. Vancomycin resistant enterococci (VRE) in Swedish sewage sludge, Acta Veterinaria Scandinavica. 51: 24, 29 May 2009.

A study that demonstrated widespread occurrence of VRE in sewage sludge in the studied WWTP. This implies a risk of antimicrobial resistance being spread to new farms and to the society via the environment if the sewage sludge is used on arable land.

<http://www.actavetscand.com/content/pdf/1751-0147-51-24.pdf>

Shuval, H., Estimating the global burden of thalassogenic diseases: human infectious diseases caused by wastewater pollution of the marine environment.

This paper presents a preliminary attempt at obtaining an order-of-magnitude estimate of the global burden of disease (GBD) of human infectious diseases associated with swimming/bathing in coastal waters polluted by wastewater, and eating raw or lightly steamed filter-feeding shellfish harvested from such waters. Such diseases will be termed *thalassogenic*—caused by the sea. Until recently these human health effects have been viewed primarily as local phenomena, not generally included in the world agenda of marine scientists dealing with global marine pollution problems.

<http://www.iwaponline.com/jwh/001/0053/0010053.pdf>

Wade, T. J., et al., Rapidly measured Indicators of Recreational Water Quality Are Predictive of Swimming Associated Gastrointestinal Illness, Environmental Health Perspectives, vol. 114, No. 1, Jan 2006.

Standard methods to measure recreational water quality require at least 24 hr to obtain results, making it impossible to assess the quality of water within a single day. Methods to measure recreational water quality in ≤ 2 hr have been developed. Application of rapid methods could give considerably more accurate and timely assessments of recreational water quality. We conducted a prospective study of beachgoers at two Great Lakes beaches to examine the association between recreational water quality, obtained using rapid methods, and gastrointestinal (GI) illness after swimming. Beachgoers were asked about swimming and other beach activities and 10–12 days later were asked about the occurrence of GI symptoms. We tested water samples for *Enterococcus* and *Bacteroides* species using the quantitative polymerase chain reaction (PCR) method. We observed significant trends between increased GI illness and *Enterococcus* at the Lake Michigan beach and a positive trend for *Enterococcus* at the Lake Erie beach. The association remained significant for *Enterococcus* when the two beaches were combined. We observed a positive trend for *Bacteroides* at the Lake Erie beach, but no trend was observed at the Lake Michigan beach. *Enterococcus* samples collected at 0800 hr were predictive of GI illness that day. The association between *Enterococcus* and illness strengthened as time spent swimming in the water increased. This is the first study to show that water quality measured by rapid methods can predict swimming-associated health effects.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1332651/pdf/ehp0114-000024.pdf>

Yamashita, H., et al, Management of the health risks posed by cryptosporidium in sewage. Ministry of Land, Infrastructure, & Transport, Japan, 2002

Abstract: We conducted a nationwide monitoring study of *Cryptosporidium* levels in treated sewage for the quantitative risk evaluation. The risk of infection per capita on an annual basis is in the range 10^{-5} to 10^{-2} . In order to formulate standards for risk management, we drew up potential risk scenarios and considered the standards required for the target risk. The maximum theoretical concentration of *Cryptosporidium* in raw sewage is 10^6 /l. We developed two different countermeasure procedures in order to address both of the annual infection risk and the risk of a mass outbreak. When deviation from the probability distribution of *Cryptosporidium* concentrations in the observed data is used as the standard for developing countermeasures for a mass infection incident, the resulting annual infection risk may be below the target risk 10^{-2} , although the degree of risk reduction depends on the level and type of contact.

<http://www.nilim.go.jp/lab/bcg/siryoutnn/tnn0123pdf/ks0123021.pdf>