

Risk of Gastrointestinal Disease Associated with Exposure to Pathogens in the Water of the Lower Passaic River[∇]

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Received 15 March 2007/Accepted 27 November 2007

During precipitation events, untreated human sewage is often intentionally discharged to surface water bodies via combined sewer overflow (CSO) systems in order to avoid overloading wastewater treatment plants. The purpose of this analysis was to evaluate the risk of pathogen-related disease associated with CSO discharges into the Lower Passaic River. Concentrations of fecal coliform, total coliform, fecal *Streptococcus*, and fecal *Enterococcus* bacteria were measured at six river locations on six different days in 2003 ($n = 36$). In addition, water samples ($n = 2$) were collected directly from and in the immediate vicinity of a discharging CSO in Newark, NJ. These samples were analyzed for fecal coliforms, total coliforms, fecal *Streptococcus*, fecal *Enterococcus*, *Giardia lamblia*, *Cryptosporidium parvum*, and several viruses. Risk estimates for gastrointestinal illness and *Giardia* infection resulting from indirect and direct ingestion of contaminated water were calculated for three potential exposure scenarios: visitor, recreator, and homeless person. Single-event risk was first evaluated for the three individual exposure scenarios; overall risk was then determined over a 1-year period. Monte Carlo techniques were used to characterize uncertainty. Nearly all of the pathogen concentrations measured in the Passaic River exceeded health-based water quality criteria and in some cases were similar to levels reported for raw sewage. The probability of contracting gastrointestinal illness due to fecal *Streptococcus* and *Enterococcus* from incidental ingestion of water over the course of a year ranged from 0.14 to nearly 0.70 for the visitor and recreator scenarios, respectively. For the homeless person exposure scenario, the risk for gastrointestinal illness reached 0.88 for fecal *Streptococcus* and *Enterococcus*, while the probability of *Giardia* infection was 1.0. This risk analysis suggests that, due to the levels of pathogens present in the Lower Passaic River, contact with the water poses, and will continue to pose, significant human health risks until CSO discharges are adequately controlled or abated.