Impact of Tropical Storm Debby in North Florida: An Observational Study Concerning Levels of Total Coliform Bacteria and E coli in Water Supply Systems

Abstract

Background: Tropical Storm (TS) Debby slammed the coast of northwest Florida on June 26, 2012; with effects being felt by June 24th. The storm brought torrential rainfall and many areas in north Florida received at least 15 inches of rain, resulting in flash flooding. Columbia County alone had damages of at least $20 million. The flooding affected water supply systems and led to potential contamination. An observational study was conducted in the Columbia County Health Department Laboratory under the Drinking Water Program. Methods: The project involved the compilation of archived and ongoing data involving qualitative sample water analysis concerning drinking water supply systems in Columbia, Hamilton, Suwannee, Union, Baker, Alachua, Taylor, Bradford, and Gilchrist. Three time-periods concerning the presence/absence of Total Coliform and E coli were studied: the year 2012 (January 9, 2012- November 1, 2012, including all supply types), 8 week period surrounding TS Debby (June 25, 2012 – August 16, 2012, only Private Wells), and 8 week period surrounding TS Debby (first-time submissions of Private Wells). Lab procedures were consistent with National Environmental Lab Accreditation Conference (NELAC) standards. Total coliform and E coli were evaluated using the Enzyme Substrate Coliform Test (Standard Method #9223 B). Spatial data was tabulated to account for rainfall dispersion from TS Debby (inches), Aquifer Recharge Potential (low, medium, high), and Flood Zones (100 yr, 500yr, minimal). Results: For 2012, 4,714 samples were analyzed (removing Quality Control samples). Private Wells accounted for 28% of samples (highest) and also had the highest failure rate (positive for Total Coliform) at 45%. On the other hand, Community Water Systems (CWS) accounted for 18% of all samples and had the lowest failure rate with 2.9%. For E coli, Private Wells had a 7% failure rate whereas CWS had 0%. For the 8 week period including TS Debby, 1,338 samples were analyzed. Once again, Private Wells accounted for the majority of the samples (52%) and also had the highest failure rate at 56%. On the other hand, CWS accounted for 12% of the samples, with a failure rate of 1.7%. For E coli, Private Wells had a failure rate of 10% whereas CWS had 0%. For first-time Private Well submissions during the period involving TS Debby, 527 samples were analyzed. 55% were positive for Total Coliforms and 12% for E coli. The period surrounding TS Debby exhibited a significant rise in rates of Total Coliform bacteria and E coli for the year 2012 (January 9-November 1) for all water supply types. Private Wells had the highest frequency of contamination (positive tests) as compared to other supply types. Moreover, higher rainfall and high recharge potential accounted for higher frequency of contamination. Overall, areas with higher frequency of submissions accounted for higher rates of contamination. Discussion: The study being observational in nature highlights the fact that the majority of the samples contaminated were in areas with the highest frequency of sample submissions. This can be due to high population centers around the clusters of sample submissions (and sample contaminations). In conclusion, the observational study highlights the vulnerability of Private Wells to a tropical system and the need to conduct more studies to test for association and further emphasize the importance of protecting both our public and private water supply systems against natural disasters.