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EXECUTIVE SUMMARY

Comparison of the Colilert Method and Standard Fecal Coliform Methods

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BACKGROUND

The new Coliform Rule requires major monitoring changes by the drinking water industry. First, the testing requirements for drinking water are markedly increased. Not only is the number of routine coliform tests increased, particularly for the smaller utilities, but also a new regulation mandates automatic repeat testing from all sites that show a total coliform positive. Within 24 hours of being notified of a total-coliform-positive sample a utility must resample three or four times from each site and its adjacent connections from every test site showing a total coliform positive sample. This resampling must occur even on weekends.

Second, every sample, regardless of whether it is a routine drinking water test or a repeat test, that shows a total coliform positive requires a fecal coliform or *Escherichia coli* analysis. If either fecal coliforms or *E. coli* are present, public notification may be required. Therefore, utilities face the dual burden of increased testing and increased possibility of public notification. The Colilert® test, developed in anticipation of the Coliform Rule, provides both total coliform and *E. coli* results within 24 hours without the need for confirmation. The Colilert test has been approved for total coliforms and *E. coli* by the United States Environmental Protection Agency (USEPA). Utilities will have to decide whether to perform a fecal coliform or *E. coli* analysis of each sample showing total coliform positivity.

APPROACH

The fecal coliform test, which was developed in 1904, takes advantage of the observation that most *E. coli* will tolerate temperatures of 44.5°C, whereas most total coliforms will not. The fecal coliform test is essentially a total coliform confirmation test performed at an elevated temperature. It was originally developed as a screening method for *E. coli*. The thermotolerant coliform group contains not only *E. coli* but other coliforms as well. The literature has reported a lack of both sensitivity and specificity on the part of the fecal coliform test. The fecal coliform test was developed because in the latter part of the nineteenth century it was extremely difficult to identify *E. coli* specifically. However, recent investigation of the β-glucuronidase enzyme system has shown it to be specific and sensitive for the detection of *E. coli*.

The Colilert test assays for the presence of *E. coli* by a unique indicator-nutrient metabolic analysis system that relies on the activity of β-glucuronidase from the target bacterium. It is a primary water test (i.e., a test directly from a water sample) that requires no confirmation. The USEPA has also approved two β-glucuronidase-based enzyme assays, EC-MUG and nutrient-agar-MUG,

which are used for the confirmation of water samples that have already shown total coliform positivity.

In the early 1900s, inefficient water treatment practices often allowed enteropathogens to enter water distribution systems. Therefore, most thermotolerant coliform analyses that were positive were in fact due to *E. coli*. However, water treatment practices have been improved so much that this is no longer the case. Now it is rare to find *E. coli* in a water distribution system in the United States. However, because the total coliform group of bacteria (excluding *E. coli*) contains many free-living species, it is not uncommon to find one of them in drinking water. The Coliform Rule acknowledges this situation by allowing up to 5 percent of drinking water samples to be total coliform positive on a monthly basis before a utility is found to be in violation.

Because approximately 15 percent of *Klebsiella* are thermotolerant, many of the total coliform positive isolates that are also fecal coliform positive are due to the presence of *Klebsiella* or related coliforms and not *E. coli*. Therefore, the ability of the fecal coliform test to signal a true fecal contamination event in water distribution systems is significantly diminished. Thus, the predictive value of a positive fecal coliform analysis from a water distribution sample in the United States would be low. If utilities were to use the fecal coliform test they would likely be in unnecessary violation situations more often than if they utilized an *E. coli* test. Such violations would adversely and unnecessarily affect the confidence of public health officials and consumers. To document the superiority of *E. coli* as the best indicator of microbial water quality, a national evaluation comparing the multiple tube fermentation and membrane filtration fecal coliform tests with an *E. coli* analysis was conducted with a spectrum of water sources (secondary effluent, surface water, and distribution system water).

RESULTS

The national evaluation showed that the *E. coli* analysis was much more specific for the detection of true fecal contamination. There was no loss of sensitivity, however. The data showed that the more likely a sample was to be contaminated, the higher the correspondence between a fecal coliform positive test and *E. coli* analysis. It has been hypothesized that the fecal coliform test is a broader "safety net" than the *E. coli* analysis. This study did not support that hypothesis.

Although the broader safety net hypothesis may have been accurate early in the century, current means to detect *E. coli* are sensitive to the 1 bacterium/100 mL level. It should be noted that between 10 and 15 percent of *E. coli* are not thermotolerant and would be missed under the elevated temperature conditions of the fecal coliform test. Therefore, there is no loss of sensitivity if the utility chooses to use *E. coli* as its public health indicator, and there is a significant gain in specificity. Based on the results of this national comparison and previous studies from the literature, utilities choosing *E. coli* as their preferred specific indicator of fecal contamination would avoid unnecessary public notification requirements and maintain excellent public health protection.