Bacterial Indicators of Bathing Water Quality

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Regard for the public health is acknowledged 8$ a principal reason for the adoption of the E.E.C. Directive concerning the quality of bathing water and is the over-riding criterion in considering derogations. The directive required that member states set values for the parameters listed in the Annex, which were not to be less stringent than those listed in Column 1. Member states were required to endeavour to use the values in Column G as guidelines. Provision was made for the setting of values for each individual bathing area or for bathing areas in general.

Sanitary Authorities were requested by letter from the Department of Local Government of 2Bth July 1976 to report on bathing areas within their jurisdiction. The public health implications of the directive the significant and environmental health officers have a vital contribution

To make in ensuring that full consideration is given to the public health need in the manner in which the directive is applied. While the directive provides for micro biological and physico-chemical standards of environmental health significance. This article is restricted to some bacterial aspects in monitoring bathing water quality. In the setting of bacterial standards consideration should, without doubt, be given to the presence and possibility of spread of water-borne communicable disease in a community, and to the nature and quantity of sewage discharged to the bathing waters in question. A sanitary survey, coupled with local knowledge is a must in this regard. When bacterial parametric values have been set, the work of the environmental health officer is by no means ended. The interpretation of results is often a complex matter and always requires professional judgement where the coliform group is used as an indicator in relation to the possible presence of disease causing bacteria in surface waters.

Clarence Veil notes that "difficulty stems from the fact that in addition to Escherichia coli originating from the intestinal tracts of humans and warm blooded animals various types classified in the coliform group are derived from non-faecal vegetable and soil sources that have not been contaminated by sewage. The inclusiveness of the coliform group, drawing microbes from various sources, has led to differences of opinion .mong public health experts about the validity of this test for water quality. Nevertheless the standard test for detecting sewage pollution still remains the presence of the coliform group as a whole. Although it is generally recognized that its inclusive nature may be too severe and that it cannot be considered fully satisfactory as a critical index of faecal contamination: (Page 236).

Scarpino observes that 'coliforms are present not only in the faeces of man and other warm-blooded animals but also in the guts of cold blooded animals, in soils, and on many plants. It is therefore imperative to determine the environmental source of the coliforms.

For example, it has been emphasized that the presence of any member of the coliform group in a treated portable water supply is not acceptable. Therefore, the absence of the coliform group indicates safe water. However, untreated surface waters another problem entirely.

Here, the distinction that exists among the members of the coliform group as to native habitat would have profound influence upon subsequent belief that the water presented a hazard to public health: (Page 664).

Geldreich et al., claim that where the ratio of faecal coliforms to faecal streptococci (calculated from geometric means), exceeds 4.0 the source of bacterial contamination is likely to be human in origin. A ratio of less than 0.7 indicates an animal or Storm water source of bacterial contamination.

And, very significantly, with regard to the Faecal Streptococcal Density Scarpino notes that 'this group comprises a standard test that is a useful supplement to the total coliform and faecal coliform lists when a more precise assessment of the origin of faecal pollution is required. Although this group should not be used as a primary criterion. Their presence is indicative of faecal pollution whereas there absence suggest little or no warm-blooded animal pollution .' (Page 647).

Bacterial indicators of Water Quality Coliforms were chosen as indicators of water quality, primarily based on the work of Escherich, who in 1885 identified Bacillus coli (from which the name 'Coliform' is derived) as being characteristic: of faeces of warm-blooded animals. The presence of these organisms in water was assumed to indicate, potential health hazard because of their association in the intestine with a variety of pathogenic microorganisms: Salmonella, Shigella, Vibrio, Mycobacterium, Pasteurella, Leptospira and enteric viruses. The concept of coli forms as indicator organisms was used for over 50 years with varying degrees of success.

In recent years an ever increasing number of investigators have vigorously attacked the use of the total coliform count as an indicator of faeces-oriented water pollution. Their rejection of coliforms as indicator organisms is based on criteria of a true indicator system. To conform to these criteria, indicator organisms should:

1. Be present and occur in much greater numbers than the pathogens concerned;
2. Not be able 10 proliferate to any greater extent than enteric pathogens in the aqueous environment:
3. be more resistant to disinfectants and to the aqueous environment than the pathogens:
4. Yield characteristic and simple reactions enabling as far as possible an unambiguous identification of the' group.

In recently reported epidemics, pathogens have been isolated from waters which, based on coliform standards should have been safe.

The World Health Organisation has stressed the public health importance of streptococcal and

staphylococcal infections acquired through swimming pool and beach contacts and the need for more effective preventive measures. This emphasis on streptococci and staphylococcal is especially important when One realises that staphylococci and faecal streptococci are more resistant to iodine and chlorine treatment of swimming pool water than coliform organisms, the present indicators of Swimming water quality.

Pseudomonas aeruginosa, a pathogen of particular concern to man because of its ubiquitous nature and resistance to antibacterial agents, is being associated more and more with water pollution. The fact that waters containing Ps. Aeruginosa are unsatisfactory for swimming and human consumption is already recognised in Germany and Hungary. This pathogen has been found to be more resistant to chlorination than coliforms.

The coliform concept is not realistic in its present membrane filtration definition because it does not represent any homogenous group but consists of at least two essentially different main groups.

It is generally accepted that bacteriological measurements of recreational water supply must be based on the detection of faecal contamination by all warm-blooded animals. However, there is an increasing awareness that the majority of infections acquired through water contact sports are upper respiratory tract and skin oriented rather than gastro· intestinal. As there is no known organism which is so man-specific that it could be used to indicate all potential health risks, one obvious solution is to use two or more indicator organism systems. There is an increasing amount of evidence that faecal coliform bacteria are one of the most important indicators of potential public hazard due to faecal pollution. Many studies have shown that faecal streptococci, which rarely if ever multiply in natural waters, should also be used as indicators of faecal pollution. Thus by using faecal coliforms and faecal streptococci as indicators, it is possible to establish the potential health hazards of a specific water body and sources of the pollutant.

The role of Pseudomonas aeruginosa as an indicator of water quality is slowly gaining favour, especially as an indicator of potential upper respiratory tract infections. This indicator organism may provide an estimate of fresh direct pollution and the potential of acquiring, eye, ear, nose and throat infections, which represent more than 60 per cent of the infections related to water contact sports.

References

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