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Your ref:
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15 February 2010

INFORMATION LETTER 2/2010

Dear Peter

Disinfection Index – Revised Calculation

Information Letter 3/2006 set out a new water quality measurement, the Disinfection Index, designed to define the stability of the chlorine residual achieved in water leaving a water treatment works, and to compare that stability with a predefined standard.

Experience with the Disinfection Index over the last three years has shown that it is difficult to achieve a low Disinfection Index score at water treatment works where the mean chlorine residual in the water leaving the works is low. Conversely, it is relatively easy to achieve a low score at treatment works where the mean residual is high. To address this situation, and in response to a recent increase in the number of consumers contacting Scottish Water and DWQR about chlorine taste and odour, I have introduced two new calculations; one to ease the difficulties of achieving a satisfactory Disinfection Index at low chlorine residuals and the other to tighten the control at high residuals.

At water treatment works where the mean total chlorine residual is **low** (≤ 0.5 mg/l total chlorine), the new requirements are:

- A. 50% of results should fall within + or - 30% of the mean and,
- B. 90% of results should fall within + or - 55% of the mean and,
- C. 95% of results should fall within + or - 65% of the mean.

Where the mean total chlorine residual is **intermediate** (>0.5 mg/l and <0.9 mg/l total chlorine), the requirements remain as before:

- A. 50% of results should fall within + or - 10% of the mean and,
- B. 90% of results should fall within + or - 25% of the mean and,
- C. 95% of results should fall within + or - 50% of the mean.

At works where the mean total chlorine residual is **high** (≥ 0.9 mg/l total chlorine), the new requirements are:

- A. 50% of results should fall within + or - 5% of the mean and,
- B. 90% of results should fall within + or - 20% of the mean and,
- C. 95% of results should fall within + or - 40% of the mean.

The fundamental conditions for calculating the Disinfection Index remain the same, namely:

1. The chlorine residual data from the Regulatory sampling programme will be used to calculate the Disinfection Index on an annual basis (January to December) for all water treatment works, except those using UV or Chlorine Dioxide for disinfection. As this is existing data, it should not result in any increase in the sampling workload.
2. The Disinfection Index for any new or upgraded WTW will only be determined after 12 calendar months of data is available.
3. Only total chlorine residual data will be used for the calculation. By adopting this approach it alleviates the need to change the methodology for water treatment works where chloramination used.
4. Data from a minimum of 52 samples per annum will be required to calculate the Disinfection Index. Where that number cannot be met through the Regulatory sampling programme, data from operational samples taken at regular intervals throughout the year should be included until a total of 52 data points is reached.
5. Where operational data is included, it must be from manual tests carried out on samples taken at the works using a quality controlled chlorine test kit. Calibration and all other AQC checks on test kit used must be documented and made available to DWQR on request. Data from on-line instrumentation is not valid for calculating the Disinfection Index.
6. The Disinfection Index is a measurement of the variation of individual data points round their mean. The usual method for making such a measurement is to calculate the standard deviation of the data. However, the Disinfection Index is calculated on a percentage basis, as set out in Annex A, which is more consistent with the existing terminology and approach to Regulatory water quality monitoring.

Any enquiries about this letter should be addressed to regulator@dwqr.org.uk

Yours sincerely



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Drinking Water Quality Regulator for Scotland

DISINFECTION INDEX CALCULATION

The Disinfection Index is a single number that describes the relationship between the distribution of total chlorine residual results for a particular water treatment works, and a specific set of conditions that are determined by the mean chlorine residual. A positive Disinfection Index indicates that the works is showing a greater degree of variation than the target values, while a negative Index is the result of lower variation than described by the target ranges. A works absolutely matching the target conditions would have a Disinfection Index of zero.

The Disinfection Index for any given water treatment works is calculated by adding together the percentage difference between the results and the target ranges for the works.

The various steps in the calculation of the Disinfection Index are as follows;

1. Sum (S) all the chlorine residual (X) results recorded at a site over a calendar year,
 - $S = \text{Sum } X \text{ for } N \text{ results}$
2. Determine the mean chlorine residual (M) for the year by dividing (S) by the number of results (N)
 - $\text{Mean Residual } (M) = S / N$
3. Establish whether the Mean Residual (M) is Low, Intermediate or High and identify the specific set of conditions for the works being evaluated.
4. Establish the variation (V) of each result from the mean.
 - $V = M - X$
5. Determine the percentage variation (P) of each result from the mean.
 - $P = V * 100 / M$
6. Count the number of results (n) whose percentage variation (P) is within the first target range (A) for the specific set of conditions for the works being evaluated (e.g. for a low residual works, target range (A) is within + or - 30% of the mean).
7. Repeat for target ranges (B) and (C).
8. Calculate percentage of the total results within the first target range (a%) = $n * 100 / N$
9. Repeat for target ranges (B) and (C) to determine (b%) and (c%)
10. For each works;
 - $x = 50 - a$
 - $y = 90 - b$
 - $z = 95 - c$
11. Disinfection Index score for the works = $x + y + z$