7. UV DISINFECTION UPDATE

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The purpose of this report is to update the Committee on the UV Disinfection trials that have been carried out so far on the oxidation pond effluent and to recommend some further limited testing to better quantify UV dose to pathogen kill rate to allow UV equipment suppliers to provide more accurate costs for the systems to be offered.

BACKGROUND

At the City Services Meeting of March 2000, the Committee approved the trial of three disinfection technologies to assess the capability of disinfection technology to further reduce pathogens in the wastewater from the oxidation ponds prior to discharge and to asses the claims of reduced operating costs for one of these technologies against standard UV technology already available. The third technology tested involved a high voltage process under development locally.

TESTING PROGRAM

Following calibration of the systems and initial testing with an indicator bacteria a range of tests were carried out involving the addition of various organisms to samples of pond water. These organisms were giardia, cryptosporidium, poliovirus and a relatively hardy bacterium known as FRNA phage. The numbers of faecal coliforms were also measured in the testing. Power consumption was measured and in each run the log reduction (power ten) of each of the tested organisms was derived. The impact of the new technology UV process was also evaluated. Testing was carried out over a range of flow rates.

RESULTS

The most encouraging result from the trials was that conventional UV disinfection technology is capable of achieving significant kills of all the major pathogen types. A 2-log reduction (100 times) of faecal coliforms and viruses could easily be achieved. The testing also showed a reduction in giardia.

It was disappointing that the new technology “low power” UV system did not provide any advantage over the standard UV technology. The performance of this technology was in almost all cases below the performance of standard UV disinfection for very little difference in total power input although the power input to the UV part of the process was considerably less. Since no advantage could be shown in the “low power” UV disinfection technology there was little point in continuing with the originally proposed full testing program of five replicate runs.

The high voltage disinfection trials were disappointing in that they only achieved a one-log reduction. At present this technology operates by passing the effluent through a very small gap and is adversely affected by the presence of both solids and soluble salts in the effluent. At the present time this technology cannot offer a viable disinfection solution.

FURTHER TESTING

Whilst the above trials have been invaluable in confirming the effectiveness of conventional UV, they have not been able to assess the effectiveness of UV disinfection at a full range of operating conditions, nor have they been able to specify the dose that would be required to achieve a specific log reduction for a particular pathogen. To achieve this outcome further testing at a laboratory scale is required. These tests will relate the kill rate to the intensity and exposure time to the UV light with the main variables of UVT (transmissivity of the liquid) and suspended solids in the liquid (mainly algae). The transmissivity of the wastewater varies greatly (ranges from 13% to 35%) while the suspended solids vary from 10 to 150 gm/m^3.

SUMMARY

In the applications for renewal of discharge consents currently before Environment Canterbury, disinfection has been incorporated in the Council’s plans to achieve the desired bacteriological standards for the discharge. The trials have confirmed that conventional UV disinfection can achieve the desired reduction in pathogens. Further testing as outlined above will enable UV disinfection equipment suppliers to provide accurate cost estimates for their own systems. The suppliers have data that demonstrates how effective their equipment is in killing specific pathogens. This can be

compared with the test results specific to the Christchurch conditions. There is sufficient money remaining in the current budget to cover this testing program which is expected to cost $30,000.

Recommendation: That further testing to quantify UV dose with pathogen reduction for the specific Christchurch conditions proceed.

Chairman's Recommendation: That the above recommendation be adopted.