

NUTRIENT RATIOS IN WASTEWATER DURING THE APPLICATION OF STRETCH TARGETS

Suzanna Healey
Wessex Water

COMPANY OVERVIEW

- Water supply and sewerage utility company serving 10,000 square kilometers of South West England
- Treat over 485million litres of sewage a day at 407 sewage treatment sites
- Water industry one of most highly regulated sectors in the UK
- In 2016 overall sewage treatment compliance was 99.3%
- Wessex Water have started several scientific investigations to enable the company to better understand how the business effects the environment

INTRODUCTION

- Phosphorus (P) is a nutrient that increases plant growth, too much P in effluent from a sewage treatment works (STW) can lead to eutrophication
- This investigation is an innovative method of regulating phosphorus discharges from sewage treatment works
- An overall tonnage reduction target is shared amongst STWs within the Bristol Avon catchment
- Each site within the catchment also has an individual P reduction target known as a 'stretch target'
- These stretch targets require an increase in ferric dosing to remove additional P

METHOD

Three sites (Site A, Site B and Site C) were investigated to see if this increased ferric dosing caused reduced treatment due to nutrient imbalance. The following steps were undertaken as part of this investigation:

- Crude nutrient ratios were compared to expected literature ratios (C: N: P ratio of 100: 20: 5) to demonstrate the crude sewage is representative of normal municipal wastewater
- Assessment of primary settlement tank (PST) effluent nutrient ratios were all compared to expected literature values (N: P ratio of 5: 1) before and after the introduction of the stretch targets
- Assessment of final effluent (FE) ammonia to determine if the stretch targets have had an impact on ammonia levels on site
- A t-test analysis was carried out to determine if there was any significant difference in the PST effluent nutrient ratios or FE ammonia results due to the increase in ferric dosing

SITE DETAILS

SITE NAME	P PERMIT LIMIT (mg/L)	STRETCH TARGET (mg/L)	AMMONIA PERMIT LIMIT (mg/L)
Site A (filter STW, population = 23,000)	2.0	1.0	6.0
Site B (filter STW, population = 115,000)	1.0	0.8	10.0
Site C (activated sludge STW, population = 8,000)	2.0	0.5	6.0

RESULTS

	TARGET	SITE A	SITE B	SITE C
CRUDE C: N: P	100: 20: 5	100: 20: 3	100: 17: 4	100: 43: 6
PST EFFLUENT N: P	5: 1	5: 0.3	5: 0.2	5: 0.4
SIGNIFICANT DIFFERENCE IN NUTRIENT RATIOS?	N	N	N	Y
SIGNIFICANT DIFFERENCE IN FINAL EFFLUENT AMMONIA RESULTS?	N	N	N	N

CONCLUSION

- PST effluent for all sites deficient in P, this is to be expected on sites with ferric dosing
- Statistical analysis results show Sites A and B have no difference in nutrient ratios or ammonia during the increased ferric dosing
- Site C PST effluent nutrient ratios appear to have been affected by the increase in ferric dosing however this increase has had no impact on final effluent ammonia results
- There were no N: P ratios that exceeded the ideal ratio of 5: 1
- No results indicate conclusively that an increase in ferric dosing to reach stretch targets has any detrimental impact on ammonia consents or biological processes on site

FURTHER RECOMENDATIONS

- Additional sampling at other STWs with P stretch targets to increase number of sites included and further increase understanding
- Include additional activated sludge plants (ASP) to understand whether the "no change in final effluent ammonia" seen at Site C (in spite of changes in nutrient balance) was a feature of ASPs, or just a feature at Site C
- Include additional sites where the crude ammonia ratio entering site is high (as seen at Site C) to understand whether this has influenced the significant difference seen in nutrient ratios after increases in ferric dosing