

SUMMARY OF EXPERT OPINIONS ON IMPACT OF A CHANGE IN P-CONCENTRATION IN INFLUENT TO A WWTW (OPERATING P-REMOVAL) ON P-CONCENTRATION IN DISCHARGE

by Tim Evans BSc MS PhD CChem CEnv FCIWEM MRSC

1 Executive summary

The direct answer to the question posed by CEEP regarding the opinion of experts of the effect that a 25-30% reduction in the phosphate concentration in sewage would have on the phosphate load to surface waters was that there would be no, or negligible, effect.

Wastewater treatment works (WwTW) that discharge to sensitive waters operate phosphate removal according to the requirements of the Urban Wastewater Treatment Directive (UWwTD). A 25-30% reduction in the influent-P load would affect how the WwTW achieve the required effluent-P, but not the absolute value.

Reducing the concentration in sewage would reduce the load discharged when there is a storm overflow, however such events are only a few occasions each year and even then it is only a proportion of the flow. Storm overflows are dilute and when they are discharged the receiving watercourses have large flows, i.e. there is substantial dilution and dispersion.

In terms of reducing phosphate loads to sensitive areas, the largest effect has been achieved by designating the areas and imposing P-discharge consents as required by the UWwTD. The most significant effect of a 25-30% reduction in influent-P would be on the means of achieving the required effluent standard; the effect on P-load to surface waters would be small.

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2 Brief

CEEP has asked Tim Evans to undertake a survey of opinions regarding the following question:

“For a sewage works operating phosphorus removal, what would be the consequence on P-load to surface waters (and sewage works discharge P-concentration) if there were to be a decrease of 25-30% the P concentration in sewage (i.e. in the sewage works inflow P-concentration)?”

The scenario that CEEP proposed might cause such a decrease in P concentration would be a move from the use of mainly P-based to mainly P-free domestic laundry detergents.

CEEP’s objective was NOT to address the impacts on operating costs, sludge production, or any of the other potential consequences, but only the question of whether or not there would be a decrease in the quantity of P discharged. If there is a decrease in the P concentration in the sewage, by what percentage would the P concentration in the effluent decrease. Since there is also the question of storm overflows of dilute sewage, what would be the effect of the load to the receiving water? This might, or might not, be the same as the change in effluent concentration.

3 Introduction

Phosphate can be the eutrophication limiting element, especially in surface water but also for some marine waters where there is limited exchange; for this reason the Urban Wastewater Treatment Directive (UWwTD) requires Member States (MS) to identify 'sensitive areas' and to apply more stringent treatment to discharges into these sensitive areas (see Appendix A for relevant extracts from the UWwTD). MS are permitted to choose to define this 'more stringent treatment' by the concentration of P in the effluent (2 mgP/l or 1 mgP/l) or/and an 80% reduction in relation to the influent P-load.

A letter requesting information using a formatted questionnaire was sent to an extensive list of contacts (Appendix B). The deadline set by CEEP for the first report was 10:00 on Monday 5th March and has been extended for 'late' replies.

4 Results

Detailed replies were received from Belgium, the Czech Republic, Germany, Hungary, Ireland, The Netherlands, Sweden and the UK in Europe and also a reply from Australia. The consensus was that a 25% reduction in the influent-P to WwTW operating P-removal would have little effect on the effluent-P load, which is already being controlled by the UWwTD, and that the most significant effect would be to reduce the amount of chemical dosing that would be required to achieve the current effluent concentrations.

A change in the influent-P would reduce the load from storm overflows but since these are relatively few per year, the overall effect on the annual load would be modest.

At many WwTW, the carbon to phosphate ratio in the wastewater (sewage) is too low for biological nutrient removal (BNR) to be effective. A 25-30% reduction in

influent-P would improve the C:P ratio and BNR might become viable at more WwTW. This would not affect the effluent-P load, just the means of achieving the permitted discharge consent.

Respondent	Reply, or summary of reply, to question																		
Belgium																			
Marjoleine Weemaes Research & Development AquaFin BE	<p>Taking into account storm water overflows and the current effluent requirements, it was calculated that a 30% decrease in the phosphorus load at the entry of a WwTW, would result in +/- 6% decrease of the P-discharge to receiving waters (total for 208 WwTWs in Flanders, treating 3.9 million PE (COD based)).</p> <p>Whether or not there would be a change in the WwTW-effluent concentration, depends on the specific circumstances: effluent discharge limits can be based on a concentration limit or on a %reduction, some WwTW's already have a better performance than what is required by legislation etc...</p> <p>Please note that these figures only apply for sewers connected to a WwTW (66% treatment coverage),</p>																		
Czech Republic																			
Olga Krhutkova Water Supply and Sewerage Association of the Czech Republic - SOVAK CR, member of EUREAU	<p>Generally, in the Czech Republic the concentration of P in wastewaters has been decreasing slowly over recent years.</p> <p>Decrease of phosphorus in receiving water bodies one could observe mostly (in my opinion) in case of conventional WwTW (with technology – mechanical pretreatment - aerated activated sludge tank - SST, without chemical precipitation of P).</p> <p>Most of the Czech WwTWs that do not have enhanced biological phosphorus removal (EPBR) use chemical precipitation (mainly Fe salts) to decrease P concentration in effluent. Efficiency of P-removal depends on effluent limits, which are appropriate by water authorities.</p> <p>Regarding the question about the P concentration in the receiving waters - I think that quality of surface water will improve, but slowly.</p>																		
Statistical data for year 2005 from 1159 WwTW																			
	<table border="1"> <thead> <tr> <th>PE</th> <th>Average P-removal efficiency</th> <th>Average effluent (mgP/L)</th> </tr> </thead> <tbody> <tr> <td><500</td> <td>52.0 %</td> <td>2.9</td> </tr> <tr> <td>501-2000</td> <td>55.5 %</td> <td>3.2</td> </tr> <tr> <td>2001-10000</td> <td>67.1 %</td> <td>2.1</td> </tr> <tr> <td>10001-100000</td> <td>81.8 %</td> <td>1.2</td> </tr> <tr> <td>>100000</td> <td>77.8 %</td> <td>1.3</td> </tr> </tbody> </table>	PE	Average P-removal efficiency	Average effluent (mgP/L)	<500	52.0 %	2.9	501-2000	55.5 %	3.2	2001-10000	67.1 %	2.1	10001-100000	81.8 %	1.2	>100000	77.8 %	1.3
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Germany																			
Dr.-Ing. Norbert Jardin Ruhrverband, DE	<p>Because Germany has used P-free detergents now for nearly 20 years, it is nearly impossible to estimate to the consequences of a reduction in influent-P on the effluent load, especially if you take into account the additional emissions from storm water discharges.</p> <p>The following summarises experiences of the effect of the change to P-free detergent:</p> <ul style="list-style-type: none"> – Monitoring in DE is based on effluent concentrations, consequently no remarkable effect of lower influent concentrations on the effluent load was observed. The main driver to minimize the P-discharges from WwTW are the effluent requirements (German Wastewater Ordinance) and the effluent fee, all operators have to pay for the P-load discharged into the receiving water. – The P-discharge from storm water treatment is usually lower than 10 % of the total P-emissions of a particular catchment - assuming that the German regulations regarding storm water treatment are fulfilled in that catchment. 																		
Dr. Joachim Bartl HSE Abwasserreinigung GmbH & Co. KG, DE	<p>Data for two WwTW in questionnaire. There would be no reduction in effluent-P because treatment is already achieving very low effluent-P:</p> <p>240,000 p.e. 0.34 mgP/l effluent from input = 9.9 mg/l [10 days' storm overflow]</p> <p>50,000 p.e. 0.35 mgP/l effluent from input = 12.8 mg/l [15 days' storm overflow]</p>																		

Respondent	Reply, or summary of reply, to question
Margit Heinz for Prof. Dr. Armin K. Melsa Niersverband DE	<p>Niersverband operates 24 WwTW, serving 715,000 people and with an addition 160,000 population equivalents from industry. In addition it has 34 rain retention basins and 24 sewage pumping stations.</p> <p>Most of the WwTW have a discharge consents based on the P concentration in the effluent of 1-2 mgP/l. Only the small WwTW do not have a restriction on their P discharge. The annual average effluent concentration of the main plants is <1 mgP/l.</p> <p>Biological P removal combined with chemical is used. A reduction in the P-load to the receiving waters of 15-20% was predicted, but this refers to an already very low residual P-load because the P-elimination in the WwTW is very effective, it is >90 % removal.</p>
Prof. Dr.-Ing. Peter Cornel Technische Universitaet Darmstadt DE	<p>As head of the chair for waste water technology at Technische Universitaet Darmstadt, I feel that a P-reduction by 25% in the influent, will in fact reduce the cost for precipitants but will have little effect on the effluent concentration of all WwTW with nutrient removal, which are more than 90 % (counted in PE). Only at small WwTW with a BOD-load < 600 kg/d, where no P-elimination is required, would a reduction in the influent-P cause a reduction in the effluent-P.</p>
Hungary	
György Garai Budapest Sewage Company HU	<p>At the treatment plants of Budapest we apply chemical P removal. Iron(III) solution is dosed upon the on-line measurement of P content of the wastewater. I analysed the data of South Budapest Wastewater Treatment Plant. I came to the conclusion, that there is no significant correlation between the influent and effluent P content. (chemical dose is continuously adjusted to keep the P below the limit) The yearly average influent P is 19.2mg/l the yearly effluent P content is 1.2mg/l.</p> <p>I think, in the case of chemical P removal, the effluent P depends simply on the on-line measurement and of dosage of chemicals. 25-30% decrease of influent P would not cause significant decrease in the effluent P, not more, than 5%, but would cause decrease in chemical dosage.</p> <p>Significant decrease of effluent P would occur at plants without P removal, or with biological P removal. I have no data about this kind of plants</p>
Ireland	
PJ Howell Water Services Dept Fingal County Council, Dublin 15 IRELAND	<p>The works is required to achieve an effluent concentration of 2mgP/l it uses biological combined with chemical P removal. A reduction in incoming P would allow for a reduction in Alum dosing to maintain the limit (2mg/l) in the effluent. There would be no reduction of outgoing Phosphorus but the amount of Alum required would be reduced.</p>
The Netherlands	
Jeffrey den Elzen The Rijnland District Water Control Board NL	<p>The Rijnland District Water Control Board area is 1,100km² and serves 1.3 million people in North Holland and South Holland. Municipal sewage (influent to WwTW) is in the range 6-10 mgP/l. The discharge limit is 1 mgP/l. Some works have bio-P removal, some have chemical precipitation and some have a combination. The WwTW that use chemical precipitation (alone or after bio-P) aim to meet the 1 mgP/l limit. If the influent P is low enough, bio-P can produce effluent below 1 mgP/l. If the sewage concentration were reduced by 30% there would be a reduction in the use of chemicals to precipitate P and more WwTW would be able to meet the effluent standards by bio-P alone.</p> <p>For WwTWs with bio-P and an influent P concentration < 5 mg/l the effluent P-concentration will be lower (0.5 mgP/l) than the P-limit of 1 mgP/l. For these WWTW's a significant reduction (circa 50%) in annual load to the receiving water would result.</p> <p>The annual P-load to receiving waters from storm overflows is only a few percent of the total P-load. Therefore a P-reduction of 30% in the influent will have only a small effect on the reduction of the total annual load to the receiving waters.</p>
Sweden	
Peter Balmér SE	<p>Used questionnaire to report that the effect for Rya WwTW (330,000 p.e.) would be a 20% reduction (including storm overflows) in an already small P-load: the annual average effluent is currently 0.37 mgP/l.</p>

United Kingdom	
<p>Rob Bland Anglian Water, UK</p>	<p>Anglian Water has over 70 WwTWs with P consents, so I am sorry to say I cannot commit time (mine or anyone else's) to complete the form for each one individually! The following provides some generic answers:-</p> <ol style="list-style-type: none"> 1. P removal methods - Chemical dosing (2,416,000 p.e.) is used at all sites, except for one (309,000 p.e.) where BNR is used 2. Consents - Nearly all of AW's are 'UWwTD' consents, which set criteria of either 80% reduction in total P, or a numerical limit ((2 mgP/l if p.e. is <100,000, 1mgP/l if p.e. is >100,000), as annual averages. This could influence whether a change in influent P would have any effect - see below. For our one WwTW using BNR, we have a numeric P consent (i.e. final effluent concentration limit). 3. Impacts of ~30% reduction in influent P <ol style="list-style-type: none"> (a) For WwTW <100,000 p.e., with typical domestic sewage levels averaging ~10 mgP/l in the influent, to achieve the 80% removal criterion we need to get <2 mg/l currently. If the influent level were to be reduced to ~7 mgP/l, we would have to dose more chemical to achieve 80% removal. Rather than incur the extra costs, we would in practice revert to the 2 mgP/l numerical limit, which we could continue to achieve as now. Thus, there would be no impact on P load to rivers. (b) For our BNR site, the numerical limit would still apply, so again no impact on final effluent P load. (c) For the six chemically-dosed WwTW with p.e. >100,000, the maximum reduction in P load discharged would be the same percentage as the reduction in influent concentration, i.e. if the influent drops by 30% the final effluent would have to drop by the same to continue to achieve 80% removal. Say 2 gP/person*d in influent, less 80% assumed current removal => 0.4 gP/person*d in effluent currently, if P-influent reduced by 30% (to 1.4 gP/person*d – effluent at 80% reduction would be 0.28 gP/person*d, a reduction of 0.12 gP/person*d The total p.e. of the 6 sites concerned in AW is 1,186,000; hence P load reduction = 142 kgP/d from WwTWs with P consents. (d) WwTWs without P consents - If we have 2,725,000 p.e. served by WwTW with P limits, discharging at (say) 0.4 gP/person*d in effluent (≈1090 kgP/d discharged), there are a further 4,079,000 p.e. served by WwTW without P limits, discharging at (say) 1.5 gP/person*d in effluent ≈6,118 kgP/d discharged. If their influent is reduced by 30% and the same reduction applied to final effluent, the reduction would be 1836 kgP/d from WwTW without P consents. % impact in Anglian region:- present 1090 + 6118 = 7208 kgP/d; reduction 142 + 1836 = 1978 kgP/d; ≈27% P discharge reduction overall. <p>Note this is a 'best case' figure, as some of the WwTW concerned over-achieve on the 80% removal, and we might decide to use some of their safety margin if compliance became more difficult with a lower influent P level.</p> <ol style="list-style-type: none"> 4. Storm discharges - Regrettably, no information available on these.
<p>Elizabeth Wood Yorkshire Water, UK</p>	<p>Currently all of our P removal works rely on chemical phosphorus removal and are operated to achieve a final effluent consent of 1 or 2 mg/l P. There would be no reduction in the P-load entering surface waters via final effluent discharge even if the influent load decreased - there would just be a consequential decrease in the chemical usage. However, I expect, there would be a decrease in the phosphorus load to surface waters via intermittent discharges. Unfortunately, I cannot quantify this decrease at this time.</p>

Pete Pearce, Thames Water, UK	A reduction in influent-P would have no effect on the effluent-P, which is in all cases controlled by an absolute concentration consent (1 or 2 mgP/l). At a minority of WwTW the C:P ratio is sufficient to operate BNR (biological nutrient removal) but at most WwTW it is too low and therefore chemical dosing is required. If the influent-P decreased, BNR might become possible at more WwTW but it would not change effluent-P. A reduction in influent-P would reduce P inputs in storm overflows, but since that is relatively few occasions per year, and since the load for the rest of the year is small and very well controlled, the overall change in load would be very small.
Prof. Simon Parsons Cranfield University UK	Even a 20% reduction in phosphorus levels would mean an influent concentration of on average 6 mgP/l; typically WwTW meet the UK discharge consents currently set at 1 or 2 mgP/l. To achieve this target you would still need chemical or biological treatment and as the costs for both chemical and biological P removal processes are typically stoichiometric I would be surprised to see any reduction in the phosphorus discharged into the environment as there is no driver to do this. The only impact would be in reducing chemical usage and sludge.
Australia	
Allen Gale Goulburn Valley Water Australia	For a BNR plant, if the effluent is at the consented limit then a reduction in influent-P reduction would have marginal effect on effluent-P. The most significant impact would be in the size of the plant and the operating costs. For a chemical P removal plant it is unlikely that there would be a noticeable difference if the process is operating efficiently – the effect would be more one of a reduction in chemical requirements.

5 Conclusions

In the time available there was a rather limited response to the request for information, however the opinion of experts was consistent. A reduction of 25-30% in the P-concentration in sewage would have little effect on the P-load to surface waters from wastewater treatment works that operate P-removal.

6 Acknowledgements

This study was commissioned by CEEP, Comité Européen d'Etudes des Polyphosphates, <http://www.ceep-phosphates.org/>, the phosphate industry's research association and a sector group of Cefic (the European Chemical Industry Council). It was managed by Chris Thornton, TECC SARL, Bourgoin Jallieu, France

Appendix A Extracts from the UWwTD¹

Article 5

1. For the purposes of paragraph 2, Member States shall by 31 December 1993 identify sensitive areas according to the criteria laid down in Annex II.
2. Member States shall ensure that urban waste water entering collecting systems shall before discharge into sensitive areas be subject to more stringent treatment than that described in Article 4, by 31 December 1998 at the latest for all discharges from agglomerations of more than 10 000 p.e.
3. Discharges from urban waste water treatment plants described in paragraph 2 shall satisfy the relevant requirements of Annex I B. These requirements may be amended in accordance with the procedure laid down in Article 18.
4. Alternatively, requirements for individual plants set out in paragraphs 2 and 3 above need not apply in sensitive areas where it can be shown that the minimum percentage of reduction of the overall load entering all urban waste water treatment plants in that area is at least 75 % for total phosphorus and at least 75 % for total nitrogen.
5. Discharges from urban waste water treatment plants which are situated in the relevant catchment areas of sensitive areas and which contribute to the pollution of these areas shall be subject to paragraphs 2, 3 and 4.

Annex I REQUIREMENTS FOR URBAN WASTE WATER

D. Reference methods for monitoring and evaluation of results

1. *Member States shall ensure that a monitoring method is applied which corresponds at least with the level of requirements described below. Alternative methods to those mentioned in paragraphs 2, 3 and 4 may be used provided that it can be demonstrated that equivalent results are obtained.*
Member States shall provide the Commission with all relevant information concerning the applied method. If the Commission considers that the conditions set out in paragraphs 2, 3 and 4 are not met, it will submit an appropriate proposal to the Council.
2. *Flow-proportional or time-based 24-hour samples shall be collected at the same well-defined point in the outlet and if necessary in the inlet of the treatment plant in order to monitor compliance with the requirements for discharged waste water laid down in this Directive.*
Good international laboratory practices aiming at minimizing the degradation of samples between collection and analysis shall be applied.
3. *The minimum annual number of samples shall be determined according to the size of the treatment plant and be collected at regular intervals during the year:*
 - *2,000 to 9,999 p. e.: 12 samples during the first year.*
four samples in subsequent years, if it can be shown that the water during the first year complies with the provisions of the Directive; if one sample of the four fails, 12 samples must be taken in the year that follows.
 - *10,000 to 49,999 p. e.: 12 samples.*
 - *50,000 p. e. or over: 24 samples.*

¹ Council Directive of 21 May 1991 concerning urban waste water treatment (91/271/EEC). Official Journal of the European Communities, No L135/40-52. <http://ec.europa.eu/environment/water/water-urbanwaste/directiv.html> (consulted 2 March 2007)

4. *The treated waste water shall be assumed to conform to the relevant parameters if, for each relevant parameter considered individually, samples of the water show that it complies with the relevant parametric value in the following way:*
- (a) for the parameters specified in Table 1 and Article 2 (7), a maximum number of samples which are allowed to fail the requirements, expressed in concentrations and/or percentage reductions in Table 1 and Article 2 (7), is specified in Table 3;*
 - (b) for the parameters of Table 1 expressed in concentrations, the failing samples taken under normal operating conditions must not deviate from the parametric values by more than 100 %. For the parametric values in concentration relating to total suspended solids deviations of up to 150 % may be accepted;*
 - (c) for those parameters specified in Table 2 the annual mean of the samples for each parameter shall conform to the relevant parametric values.*
5. *Extreme values for the water quality in question shall not be taken into consideration when they are the result of unusual situations such as those due to heavy rain.*
- (1) Given that it is not possible in practice to construct collecting systems and treatment plants in a way such that all waste water can be treated during situations such as unusually heavy rainfall, Member States shall decide on measures to limit pollution from storm water overflows. Such measures could be based on dilution rates or capacity in relation to dry weather flow, or could specify a certain acceptable number of overflows per year.*

Table 2: Requirements for discharges from urban waste water treatment plants to sensitive areas which are subject to eutrophication as identified in Annex II.A (a). One or both parameters may be applied depending on the local situation. The values for concentration or for the percentage of reduction shall apply.

<i>Parameters</i>	<i>Concentration</i>	<i>Minimum percentage of reduction (1)</i>	<i>Reference method of measurement</i>
<i>Total phosphorus</i>	<i>2 mgP/l (10,000 – 100,000 p.e.) 1 mgP/l (more than 100,000 p.e.)</i>	<i>80</i>	<i>Molecular absorption spectrophotometry</i>

(1) Reduction in relation to the load of the influent.

Appendix B First letter and questionnaire requesting information

18th February 2007

Dear wastewater colleague,

CEEP² has asked me to undertake a survey of opinions regarding the following question:

For a sewage works operating phosphorus removal, what would be the consequence on P-load to surface waters (and sewage works discharge P-concentration) if there were to be a decrease of 25-30% the P concentration in sewage (i.e. in the sewage works inflow P-concentration)?

The scenario that CEEP proposes might cause such a decrease in P concentration would be a move from the use of mainly P-based to mainly P-free domestic laundry detergents.

CEEP's objective is NOT to address the impacts on operating costs, sludge production, or any of the other potential consequences, but only the question of whether or not there would be a decrease in the quantity of P discharged. If there is a decrease in the P-concentration in the sewage, by what percentage would the P-concentration in the effluent decrease? Since there is also the question of storm overflows of dilute sewage, what would be the effect of the load to the receiving water? This might, or might not, be the same as the change in effluent concentration.

CEEP might submit the resulting document to the EU Commission DG Enterprise in the context of current discussions regarding implementation of the EU Detergents Directive (question of phosphates in detergents).

I appreciate that in some countries some of the phosphate in detergents (more so in laundry than dishwasher) has been replaced by Zeolite A, polycarboxylic acids (PCAs), citrates and/or NTA (sodium nitrilotriacetate) but the question is if there were a decrease of 25-30% in the influent P, how would it affect your effluent P.

CEEP wants my report by Monday 5th March so please can you send me your response (using the attached question form³) by Wednesday 28th February. Your information will help to inform the drafting of European environmental protection legislation. Sorry for the short timescale.

Thank you



(Tim Evans)

² Comité Européen d'Etudes des Polyphosphates <http://www.ceep-phosphates.org/>, the phosphate industry's research association and a sector group of Cefic (the European Chemical Industry Council).

³ <Questionnaire form about P in WwTW effluent if there is change to P-free detergent>

Appendix C Letter to EUREAU members requesting information

5th March 2007

Dear wastewater colleague,

CEEP⁴ has asked me to undertake a survey of opinions regarding the following question:

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I appreciate that in some countries some of the phosphate in detergents (more so in laundry than dishwasher) has been replaced by Zeolite A, polycarboxylic acids (PCAs), citrates and/or NTA (sodium nitrilotriacetate) but the question is if there were a decrease of 25-30% in the influent P, how would it affect your effluent P.

Please can you send me your response (using the attached question form⁵) **as soon as possible**. CEEP's initial deadline was 5th March and it has now extended this "by a few weeks". The interim report, which I understand CEEP will submit to the EU Scientific Committee on Health and Environmental Risks (SCHER), included information from operators in Germany [2], Sweden [1] and the UK [3] and Australia; so a big thank you to them. It would be wonderful to have information from some of the other countries in Europe to make the report more representative, though of course I would welcome more replies from countries where I have had replies already. Your information will help to inform the drafting of European environmental protection legislation.

Thank you



(Tim Evans)

⁴ Comité Européen d'Etudes des Polyphosphates <http://www.ceep-phosphates.org/>, the phosphate industry's research association and a sector group of Cefic (the European Chemical Industry Council).

⁵ <Questionnaire form about P in WwTW effluent if there is change to P-free detergent>

Reply from:

Wastewater treatment works	Country [two letter code please]	Works Size	Discharge consent type [please insert "x" in the appropriate box]	P removal method [please insert "x" in the appropriate box]			Storm overflows	Effect of 25-30% reduction in sewage-P	Additional information			
				Both	Biological	Chemical			Approx. volume per year '000 m ³	Days per year	% reduction in annual load to receiving water	% reduction in effluent-P
		Pop. Equiv.										
		DWF m ³ /day										

Additional information
Please add any information you think might be relevant such as the effluent discharge consents the WwTW is required to meet and the P-removal process – thank you

Appendix D Contact lists

List 1

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Consolidated questionnaires replying to the question about the effect that a 25% reduction in influent-P would have on effluent-P from WwTW operating P-removal

29 March 2007



Wastewater treatment works	Country [two letter code please]	Works Size		Discharge consent type [please insert "X" in the appropriate box]	P removal method [please insert "X" in the appropriate box]			Storm overflows	Effect of 25-30% reduction in sewage-P	Additional information		
		Pop. Equiv.	DWF m ³ /day		Effluent concentration	Chemical	Biological				Both	Days per year
Czech Republic												
Central Prague	CZ	327760	1292211 based on BOD; 1705165 based on COD	X	X			52	353*	??	??	Data of year 2006 Discharge Consent = 1.8 mgP/L; average effluent concentration =0.6 mg/L % reduction achieved 90.3% *353,445 m ³ via WwTW; there are CSOs on the sewerage network and their volumes would be additional
Breznice	CZ	1058	4866	X	X			Not known	229	0-15	0-15	Data of year 2006 Discharge Consent = 3 mgP/L; % reduction achieved 68.6%
Germany												
Niersverband 24 WwTW	DE	190,000	875,000	X			X			25-30	15-20	P-elimination in our sewage-treatment plants is very effective. The elimination ratio is >90 %. Our assumption of a decrease by 25-30 % refers to the low residual P-load; i.e. it is 25-30% of 'not a lot'. The consent limit for most of our plants is 1-2 mgP/l. Only the small ones are not restricted by law concerning P.

												The annual average effluent concentration of our dominant plants is below 1 mg/l P (total).
Zentralkläwerk Darmstadt	DE	40.000	240.000	0,34 ^{*1)}	97		X	10	?	0		I think, there will be nearly NO reduction concerning the effluent, but if so, only a very very small one.
Kläwerk Süd - Eberstadt	DE	3.900	50.000	0,35 ^{*2)}	98,6		X	15	?	0		Please compare "our" input / output!
				1) input = 9.9 mg/l								
				2) input = 12.8 mg/l								
Hungary												
South Pest WwTW	HU	80000	300000	1.6	1.8	X		15		0-5	0-5	
Ireland												
Swords WWTP	IE	17,060	65,000	x			x	<5	<1	0	0	Effluent concentration requirement– 2mg/l. A reduction in incoming Phosphorous would allow for a reduction in Alum dosing to maintain the limit (2mg/l) in the effluent. There would be no reduction of outgoing Phosphorous but the amount of Alum required would be reduced.
Sweden												
Rya WwTW	SE	330000	775000	X			X	23	2800	19	20	Reply based on 2005 data. Average effluent concentration 0.37 mg/l Load 41 tons/year. Overflow average conc. 1.4 g/l total load 4 tons per year. Calculated effect is based on the assumption that all P except 0.1 mg/l is precipitated (soluble effluent P is 0.05-0.1 mg/l) 25 % less P is assumed to lead to 25 % less P in suspended solids. It is also assumed that the concentration of suspended solids is unchanged. In the near future, the effluent will be microsieved and the expected effluent concentration will be about 0.25 mg/l. The future effect of a 25 % P reduction will then be about 15 %.
United Kingdom												
Stamford Bridge	UK	1317	5,700	x			x			0	0	2 mgP/l and 4 mgFe/l currently; 1 mgP/l under AMP4

Malton	UK	5000	27,500	x		x					0	0	2 mgP/l and 6 mgFe/l currently; 1 mgP/l under AMP4
Haxby Walbutts	UK	3900	19,600	x		x					0	0	2 mgP/l and 3 mg/l Al (or 4 mg/l Fe)
Driffield	UK	11539	14,500	x		x					0	0	2 mgP/l and 1.2 mgFe/l currently
Pocklington	UK	2797	11,300	x		x					0	0	1 mgP/l and 4 mgFe/l currently
Kilham	UK	429	1,000	x		x					0	0	2 mgP/l and 4.4 mgFe/l currently
Northallerton/ Romanby	UK	7086	24,500	x		x					0	0	2 mgP/l and 4 mgFe/l currently
Seamer	UK	7300	37,500								0	0	No current P consent; 1 mgP/l under AMP4
Melbourne	UK	563	2,300								0	0	No current P consent; 1 mgP/l under AMP4
Pickering	UK	2150	10,000								0	0	No current P consent; 1 mgP/l under AMP4
Balby	UK	6200	17,500								0	0	No current P consent; 1 mgP/l under AMP4

AMP refers to the 'Asset management Plan' process by which investment, performance and prices are regulated in the UK.

TW (1)	UK	27,000	120,000	1.0			X	16	165	~0.1	15%	P removal mainly BNR, reduced load would trigger reduction in polishing chemical dose to achieve same performance
TW(2)	UK	8,000	38,000	2.0		X		3	50	0-0.1	0-10%	Chemical dosed site, reduced P load would trigger reduced chemical dose to achieve same performance.
TW(3)	UK	1800	15,000	2.0		X		0	0	0-0.1	0-5%	Chemical dosed site, reduced P load would trigger reduced chemical dose to achieve same performance
TW (4)	UK	56,000	290,000	1.0			X	33	184	0-0.1	0-25%	BNR site with large excess of soluble carbon, presently attains average of < 0.3mgP/l, reduction in inlet would only make small difference

TW(5)	UK	2,000	12,000	2.0	X	2	3.5	~0.1	10%	Chemical dosed trickling filter site, reduced P load would trigger reduced chemical dose to achieve same performance.
TW(6)	UK	10400	40,000	2.0	X	20	53	~0.1	10%	Chemical dosed site, reduced P load would trigger reduced chemical dose to achieve same performance