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Tracing heavy metals in the collection system at Hörby

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TRACING OF HEAVY METALS IN THE COLLECTION SYSTEM AT HÖRBY

Background

The three municipalities Höganäs, Hörby and Östra Göinge are all participating in the South Baltic Project Euroslam. One purpose of this project is to promote a better use of sewage sludge from waste water treatment. If a beneficial use of sludge is agriculture should be possible it is imperative that the content of heavy metals in the sludge is low. Hörby municipality at its waste water treatment plant Lyby, has since long been working with a Revaq certification. In this field, a better knowledge about heavy metal flows in the collection system is important.

One indicator for sludge quality is the ratio between cadmium and phosphorus measure as mg Cadmium per kg of phosphorus, Cd/P-ratio. This figure should be as low as possible since one kg of phosphorus should contain as little cadmium as possible. The three municipalities have different readings of this figure with low numbers in Östra Göinge, medium numbers in Höganäs and higher numbers in Hörby. In the middle part of the region Skåne, Cd/P ratios are high. One important question is to see if this has a geographical answer or other measure.

This makes the set up ideal for research. Why are the numbers low in Ostra Göinge and what circumstances provide the contribution of extra heavy metals in Hörby? The Swedish National certification system, Revaq, which have about 30 WWTP in their list, is also a base for comparision. Höganäs is one of these treatment plants which serves as a base for broader characterization of environmental effects.

Hörby´s figures should be compared to the low numbers, especially at Broby WWTP in Östra Göinge. This will make conclusions more clear about the different situation at these plants.

Goal

The purpose of these investigations are to find sources of heavy metals in the collection system. By eliminating these sources, the content of heavy metals in the sludge should be lower. The Cd/P-ration should decrease which is an improvement.

Another purpose of this work is to establish a working method for finding heavy metals sources in the collection system. This method, the Euroslam-method, could thereafter be used by other small and medium sized municipalities that wnts to improve their environmental control of the sewage sludge. Especially interesting could this be for small and medium sized municipalities in Lithuania and Poland, where a clear cross border effect of the findings from the three municipalities in Sweden may contribute with.

Hörby should decrease the cadmium content in the sludge to have an even better use of the sludge in agriculture. A lower content will mean higher sludge applications and an easier handling.

Method

The method used was first presented at the Euroslam meeting in Poland, in Kurzercyna in Maj 2012. The Power Point presentation used at this meeting is enclosed in this report. The method is using a five step procedure to produce a better sewage sludge. The five steps are.

1. Balance of phosphorus over the treatment plant.
2. Check the flows in the collection system
3. Identify what parameters that needs to be improved

4. Start sampling and analyze in the collection system
5. Start a dialogue to remove unwanted sources of pollutants to the treatment plant

This tracing program started in October 2012 by collecting existing data from the following treatment plants.

- Höganäs WWTP
- Lyby WWTP in Hörby
- Broby WWTP in Östra Göinge
- Knislinge WWTP in Östra Göinge

This means that two smaller treatment plants are representing Östra Göinge making the possibility for cross border effects even greater. Höganäs are the largest treatment plant with many corresponding plants in Lithuania of the same size. Hörby is a typical municipal town, without any dominating industry. The high Cd/P values should therefore be possible to trace.

Base data for Hörby

This is the basic information for Lyby Waste Water Treatment Plant in Hörby.

The figures below is an example of a daily composite sample of influent water taken May 20, 2013.

		Lyby WWTP, Hörby
Daily flow	M3/day	2969
Connected persons	No of people	8739
Alkalinity	Mg hco3/l	210
Alkalinity	Mg HCO3/l filt	230
BOD	BOD 7 (ATU)	240
BOD dissolved	Filtered sample	28
COD	Cr MG/L	840
COD dissolved	Filtered sample	89

The values above will be used to compare influent characteristics and to calculate the portion of organics that are easily dissolved and dissolved. Hörby have a very high portion as particulate material since only about 15% of the BOD and COD can be analysed in filtered samples.

Flöde m3/dygn
2969

l/p,d
93845

Datum **2013-05-20** **Hörby Kommun**

Ämne	Mängd/liter	Lyby RV Ink		Lyby RV Utg	gram/dygn ink	gram/d utg	Avskilt till slam g/d	Avskilt till slam g/år	Inkommande g/p	Inkommande mg metall/kg P
Ag	µg/l	1,98	<	0,5	5,88	1,48	4,39	1603,85	*0,0007*	180
As	µg/l	3,62		0,811	10,75	2,41	8,34	3044	*0,0012*	329
Cd	µg/l	0,676	<	0,05	2,01	0,15	1,86	678	*0,000229665*	61
Co	µg/l	2,56	<	0,2	7,60	0,59	7,01	2557	*0,0009*	233
Cr	µg/l	29,9	<	0,9	88,77	2,67	86,10	31427	*0,0102*	2718
Cu	µg/l	213		3,54	632	10,51	622	226989	*0,0724*	19364
Hg	µg/l	0,411	<	0,02	1,22	0,06	1,16	423,72	*0,000139634*	37
Mo	µg/l	9,25		2,34	27,46	6,95	20,52	7488	*0,0031*	841
Ni	µg/l	12,9		1,57	38,30	4,66	33,64	12278	*0,0044*	1173
P	µg/l	11000		542	32659	1609	31050	11333178	*3,7372*	1000000
Pb	µg/l	15,9	<	0,5	47,21	1,48	45,72	16689	*0,0054*	1445
Sn	µg/l	2,67	<	0,5	7,93	1,48	6,44	2352	*0,0009*	243
V	µg/l	7,47		0,232	22,18	0,69	21,49	7844	*0,0025*	679
Zn	µg/l	524		18,5	1556	55	1501	547803	*0,1780*	47636
Cd "Low"	µg/l	0,676	<	0,02	2,01	0,06	1,95	711	*0,000229665*	61

The influent heavy metal analyses are done together with a special cadmium analyses called “Cd Low”. The analytical package was specially designed for this Euroslam investigation. A typical analyses of the influent sample is shown in the table above. Sample taken the same day as the caracteristics above.

It is interesting that Hörby get the same value for Cd/P both with the Cd analyses as well as the Cd Low analyses. Cd Low is appropriate to use even with Cd/P values of this reading.

The following calculations can be made to estimate these quality figure.

- Influent phosphorus content according to flow and people connected
- Phosphorus balance over the treatment plant
- Removal efficiency of a number of parameters
- Difference between normal Cd and “Cd Low”
- Samples of influent and effluent values can be compared.

These parameters will indicate the efficiency and sampling procedures at the treatment plants.

The daily composites samples will now be used to create a table showing a weekly figure. The sampling procedures were done during the same period at all treatment plants. This means that high flows due to rainy weather should occur at the same time for all plants.

The weekly table for Hörby, including the above sampling date is the following.

				Flöde m3/dygn					l/p,d
		Hörby		2331					266,73532
Ämne	Mängd/liter	Halt Inkommande	Halt Utgående	**gram/dygn ink**	gram/dygn utg	Avskilt till slam g/d	Avskilt till slam g/år	Inkommande g/p	Inkommande mg metall/kg P
Ag	µg/l	1,64714286	0,5	**3,87199429**	1,1655	2,7064943	987,87041	0,000443	169,6691
As	µg/l	2,15285714	0,69814286	5,17556857	1,64130957	**3,534259**	1290,0045	**0,000592**	213,34787
Cd	µg/l	0,31685714	0,05	0,77831286	0,11655	**0,661762 86**	241,54344	**8,91E-05**	31,095423
Co	µg/l	1,04671429	0,20157143	2,60479086	0,469775	**2,135015 86**	779,28079	**0,000298**	102,08684
Cr	µg/l	12,3528571	0,9	30,8473043	2,0979	**28,749404 3**	10493,533	**0,00353**	1148,2173
Cu	µg/l	167,285714	7,68428571	395,419714	17,3616886	**378,0580 26**	13799 1,18	**0,045248**	16904,943
Hg	µg/l	0,09758571	0,02	0,2610365	0,04662	**0,214416 5**	78,262023	**2,99E-05**	9,4467046
Mo	µg/l	5,00714286	2,00714286	12,1269286	4,71578	**7,411148 57**	2705,0692	**0,001388**	493,22499
Ni	µg/l	6,89428571	1,88285714	16,7737543	4,35192286	**12,42183 14**	4533,9685	**0,001919**	670,80516
P	µg/l	9984,28571	368	23407,04	875,769571	**22531,27 04**	82239 13,7	**2,678457**	10000 00
Pb	µg/l	5,36428571	0,77285714	13,67636	1,76824143	**11,90811 86**	4346,4633	**0,001565**	519,06807
Sn	µg/l	2,66428571	0,52457143	6,24636286	1,21977829	**5,026584 57**	1834,7034	**0,000715**	266,6537
V	µg/l	2,45585714	0,20585714	6,28076829	0,48256514	**5,798203 14**	2116,3441	**0,000719**	234,26783
Zn	µg/l	253	27,6	620,017429	63,2009714	**556,8164 57**	20323 8,01	**0,070948**	24903,686
Cd "Low"	µg/l	0,31685714	0,02	0,77831286	0,04662	**0,731692 86**	267,06789	**8,91E-05**	31,095423
W	µg/l								
								977,637	

The average load of phosphorus to a treatment plant within Revaq is 700 g per person and year. The number above, 977 g of phosphorus per person and year, is a rather high number but indicates an appropriate sampling and samplings handling.

This means that the figure Cd/P of 61 must be reduced according to the plan. The accuracy in sampling and handling will be very useful.

The average level of cadmium in influent water is 0,32 ug/l both with Cd and Cd low. This value, together with the Cd/P ratio, will make it possible to track stream of water in the collection system with additional loads of cadmium.

Conclusions

The sampling methods indicate the basic knowledge about influent water characteritics. This can be used to determine different aspects in how the metals will be removed from the water and either leave the plant with effluent water or be added to the sludge.

By comparing sludge data there now exist an information what the influent water will look like creating a typical sludge analyses.

This information may now be used to further develop sampling procedure in the collection system.

Hörby 2013-11-26

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