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Tracing heavy metals in Östra Göinge

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TRACING OF HEAVY METALS IN THE COLLECTION SYSTEM

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.

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.

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.

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 the ir 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.

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 used 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 paramethers that needs to be improved
4. Start sampling and analyse 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

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- 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.

Base data for Östra Göinge

This is the basic information for Broby and Knislinge Waste Water Treatment Plants.

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

		Broby	Knislinge
Daily flow	M3/day	1429	885
Connected persons	No of people	4287	4644
Alkalinity	Mg hco3/l	220	320
Alkalinity	Mg/HCO3/l	240	300
BOD	BOD 7 (ATU)	150	150
BOD dissolved	Filtered sample	14	24
COD	Cr MG/L	500	440
COD dissolved	Filtered sample	51	77

The values above will be used to compare influent characteristics and to calculate the portion of organics that are easily dissolved and dissolved.

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 below.

Datum	**2013-05-20**	Broby		Knislinge	
Ämne	Mängd/liter	BArv Ink	Inkommande mg metall/kg P	KArv In	Inkommande mg metall/kg P
Ag	µg/l	0,5	80	0,5	92
As	µg/l	0,579	93	0,5	92
Cd	µg/l	0,05	8	0,11	20
Co	µg/l	0,895	143	0,996	184
Cr	µg/l	3,2	512	2,69	497
Cu	µg/l	90,1	14416	83,8	15490
Hg	µg/l	0,0868	14	0,0334	6
Mo	µg/l	2,12	339	2,44	451
Ni	µg/l	3,72	595	3,3	610
P	µg/l	6250	1000000	5410	1000000
Pb	µg/l	4,26	682	5,18	957
Sn	µg/l	2,27	363	1,51	279
V	µg/l	2,59	414	2,07	383
Zn	µg/l	182	29120	119	21996

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Cd "Low"	µg/l	0,02	3	0,11	20

These analyses can be made to calculate a number of correlating figures such as.

- Influent phosphorus content according to flow and people connected
- Phosphorus balance over the treatment plant
- Removal efficiency of a number of paramethers
- 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 Östra Göinge, Broby, including the above sampling date is the following.

	Weekly avarage	Flöde m3/dygn				l/p,d			
	Broby	1637							382
	Influent ug/l		Effluent ug/l	gram/24 h in	Gram/24 h out	Separated	To sludge	Influent g/person	In mg/kg phosphorus
Ag	0,50		0,50	0,82	0,82	0,00	0,00	0,0002	104
As	0,60		0,95	0,99	1,58	-0,59	-215	0,0002	119
Cd	0,05		0,05	0,08	0,08	0,00	0,00	1,909E-05	10
Co	0,82		0,23	1,36	0,38	0,98	358	0,0003	154
Cr	3,81		0,90	6,28	1,47	4,81	1755	0,0015	665
Cu	82		1,49	133	2,44	131	47827	*0,0311*	15375
Hg	0,07		0,02	0,12	0,03	0,08	30,74	2,728E-05	14
Mo	2,06		1,25	3,38	2,04	1,34	488	0,0008	402
Ni	4,40		1,37	7,26	2,24	5,02	1834	0,0017	788
P	5107		174	8328	283	8045	2936268	1,94	1000000
Pb	2,69		0,50	4,43	0,82	3,61	1319	0,0010	495
Sn	1,75		0,50	2,87	0,82	2,05	748	0,0007	347
V	2,32		0,43	3,82	0,70	3,11	1137	0,0009	415
Zn	139		8,49	229	14	215	78625	0,05	26496
Cd "Low"	0,02		0,02	0,03	0,03	0,00	0	7,635E-06	4

The reading for Östra Göinge, Knislinge will be this table.

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		Flöde m3/dygn					l/p,d
	Knislinge	969					209

	Influent ug/l	Effluent ug/l	gram/24 h in	Gram/24 h out	Separated	To sludge	Influent g/person	In mg/kg phosphorus
Ag	0,57	0,50	0,55	0,48	0,07	25	0,0001	107
As	0,50	0,60	0,48	0,58	-0,10	-35	0,0001	95
Cd	0,12	0,05	0,12	0,05	0,07	24	0,0000	22
Co	1,17	1,25	1,13	1,21	-0,08	-28	0,0002	218
Cr	2,58	0,90	2,52	0,87	1,65	601	0,0005	447
Cu	86	3,23	84	3,15	81	29426	0,0180	15548
Hg	0,04	0,02	0,04	0,02	0,02	5,88	0,00001	6,50
Mo	2,56	1,89	2,48	1,83	0,65	237	0,0005	471
Ni	3,08	2,60	3,00	2,51	0,49	179	0,0006	557
P	5553	310	5386	303	5083	1855436	1,1599	1000000
Pb	3,26	0,50	3,21	0,48	2,72	993	0,0007	586
Sn	1,43	0,50	1,39	0,48	0,90	329	0,0003	262
V	2,72	0,50	2,65	0,49	2,16	789	0,0006	428
Zn	102	11	100	11	89	32522	0,0215	18357
Cd "Low"	0,12	0,03	0,12	0,03	0,09	33	0,00003	22

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 colle ction system.

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