

RELIABILITY OF SMALL WASTE WATER TREATMENT PLANT

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Abstract. In the present study are the main technologies that are suitable for small waste water treatment plant (facilities used for local capacity than isolated or individual households), options for beneficiaries in choosing types of plants and their reliability. The case study concerns a total of 360 small waste water treatment plant, located in its vicinity Stuttgart (Germany). It highlighted the share of different treatment technologies and operating and maintenance problems that occurred. Conclusions stemming relate to the proper way of operating such facilities, potential beneficiary of the interventions alone remove some damage or disruption in service, and the number of such damage according to the treatment technology adopted. As potential beneficiaries of small waste water treatment plant, may opt to choose an installation, in addition to the purchase price, and by operating and maintenance work to come. It noted that the beneficiaries of such plants are often placed in a position themselves to address specific interventions to avoid further damage to major damage.

Keywords: small waste water treatment plant, reability

1. INTRODUCTION

The issue of retail customers who do not have a centralized system for collection, transport, treatment and discharge of wastewater is topical in our country, trying to implement solutions fast and efficient but technically and economically. The aim in this, creation and development of rural infrastructure relevant current standards of comfort and hygiene. [1]. The small waste water treatment plant are stations serving a total of 50 people equivalents. Thus they are a good solution for remote communities (family houses, hotels and motels, parks, nursing homes). The choice of location and the achievement stations will consider the environmental effects are minimal (especially smell and noise). The location will be made so as to avoid affecting water resources and

comfort conditions of household (or group homes). If it requires a location in close proximity to housing by the use of noise screening plant and the provision of ventilation forced draft above the roof level. For above-ground facilities, in addition to noise protection and will provide protection against freezing. Wastewater treatment plants are by their nature of construction which requires large areas of land they must be integrated into the landscape more pleasant ambient. For reasons of maintenance will not be placed in areas carriageway sewage plants, [2], [6].

For normal models, (trade), the small waste water treatment plant were imposed following treatment technologies, (small waste water treatment plant can be prefabricated to executed on the spot): technologies based on pools of activation with or without primary settling, the biological filter drip on rotating biological contactors, aerobic submerged body and cleaning technologies to plant (grass beds), [2], [3], [6].

2. CURRENT TRENDS IN CONSTRUCTION AND OPERATION OF SMALL WASTE WATER TREATMENT PLANT

For this survey were evaluated 360 test reports containing findings and records of some of the small waste water treatment plant Stuttgart-Germany. These were grouped into six categories, the number of population equivalents served, and depending on the treatment technology adopted as follows, tab. 2.1, tab. 2.2:

In parentheses is the total number of past small waste water treatment plant analyzed for that size (see table above).

2. OPERATION AND MAINTENANCE PROBLEMS FOUND OF SMALL WASTE WATER TREATMENT PLANT

Small waste water treatment plant for 4 – 6 population equivalent.

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Total small waste water treatment plant 64, faults 9, 7 BA, 2 to FB as in Table 3.1: operating period 1 to 8 years, the number of major

Tab. 2.1 Grouping waste water treatment plant in function to the number of people served

Number of equivalent population deserved	Number of analysis reports
4-6	64
8-10	164
12-24	91
25-60	39
80	1
100	1
Total	360

Tab. 2.2 Grouping small waste water treatment plant in function of size and treatment technology adopted

Sewage technology	Number of small waste water treatment plant			% of total	
	total technology	number of people served by the size			% total technology
Activation basin	274	4-6	43 (64)	15.69	76.111
		8-10	142 (164)	51.82	
		12-24	62 (91)	22.62	
		25-60	26 (39)	9.48	
		80	0 (1)	0	
		100	1 (1)	0.36	
Biological filter, (on drip) FB	73	4-6	19 (64)	26.02	20.277
		8-10	16 (164)	21.91	
		12-24	27 (91)	36.98	
		25-60	11 (39)	15.06	
		80	0 (1)	0	
		100	0 (1)	0	
Rotating biological contactors CBR	9	4-6	1 (64)	11.11	2.500
		8-10	4 (164)	44.44	
		12-24	1 (91)	11.11	
		25-60	2 (39)	22.22	
		80	1 (1)	11.11	
		100	0 (1)	0	
Body submerged aerobic CAS	0	4-6	0 (64)	0	0.000
		8-10	0 (164)	0	
		12-24	0 (91)	0	
		25-60	0 (39)	0	
		80	0 (1)	0	
		100	0 (1)	0	
Treatment plant to plant SEP	4	4-6	1 (64)	25.00	1,111
		8-10	2 (164)	50.00	
		12-24	1 (91)	25.00	
		25-60	0 (39)	0	
		80	0 (1)	0	
		100	0 (1)	0	
Total general	360	X	X	X	100

Tab. 3.1 Problems found at small waste water treatment plant for 4-6 people equivalents

C.I.	Type fault	Number of defects	Obs.
A	Small waste water treatment plant with activation basin		
1	Fault timer, (Automation)	1	Lock operation facility
2	Clogged air filter	1	Failure of aeration, the negative influence of basin operation activation, blocking gaslift
3	Jam electroadmission valve	1	Penetration of foreign bodies hard
4	Clogged sludge recirculation circuit	2	Malfunctioning basin activation
5	Damaged partition compartments	1	Affecting the proper functioning of the entire plant, unwanted interference between water in different compartments
6	Defect soft control proces	1	Full lock of small waste water treatment plant
B	Small waste water treatment plant with biological filter		
1	Clogged siphon pump (transfer pump clogged)	2	Hoses damaged by rodents, affecting the proper functioning of the entire plant

Other general recommendations and technical assistance mentioned in the analysis report:

Facilities with basin activation:

- Ignite faster installation by adding coagulant and / or sewage grafting;
- aeration intensity control
- regulate the concentration of sludge in the activation basin;
- empty compartment settling primary / secondary (too much mud accumulated);
- removal of floating sludge from the entrance

- general cleaning of the plant, reamorsarea it, (too much mud accumulated);
- replace worn components aeration system (filter, distributor, aerator).

Small waste water treatment plant for 8-10 population equivalent

Total small waste water treatment plant analyzed 164, operating from 3 to 6 years, the number of major defects 16, 15 BA, 1 CBR, Table 3.2:

Tab. 3.2 Problems found at small waste water treatment plant for 8 - 10 people equivalents

C.I	Type fault	Number of defects	Obs.
A	Small waste water treatment plant with activation basin		
1	Auto disconnect the fuse panel	2	Disconnection is caused by overloading a consumer usually drive motor pump, and lead to stopping the whole process of treatment
2	Defective ventilation system	9	Defect resulting from clogged air filters, clogged aeration, damaging pipelines connecting or blowers (compressors)
3	Defective valve	1	Defect resulting from rusting valves (recommended quality materials)
4	Defective pump, (or exhaust recirculation sludge)	3	Defect leading to malfunction or stop functioning activation basin, namely clogging of the sludge settling
B	Small waste water treatment plant with rotating biological contactor		
1	Defective drum drive motor	1	The defect leads to interruption of the functioning facility

Other general recommendations and technical assistance mentioned in the analysis report:

Plant with activation basin:

- raising the danger of clogging due to beneficiaries of textiles thrown into the canal;
- specify the recipients who had reviewed their own sewage plant.
- faster priming of the plant by adding coagulant and / or sewage grafting;
- making current repair aeration plant;
- aeration intensity control;
- adjusting the concentration of sludge in the activation basin;
- empty compartment settling primary / secondary (too much mud accumulated):

- removal of floating sludge from the entrance;
- general cleaning of the plant, repriming it, (too much mud accumulated);
- training the beneficiary on the proper use of biodegradable detergents and other cleaning solutions;
- Regular cleaning of gutter water distribution, (ensuring a uniform distribution), remove plaque inlaid on gutters.

Small waste water treatment plant for 12-24 population equivalent

Total small waste water treatment plant analyzed 91, operating from 3 to 8 years, the number of major defects 11, 7 at BA, 4 at FB, Table 3.3:

Tab. 3.3 Problems found at small waste water treatment plant for 12 - 24 people equivalents

C.I	Type fault	Number of defects	Obs.
A	Small waste water treatment plant with activation basin		
1	Fault timer, (Automation)	2	Lock operation facility
2	Defective ventilation system	1	Defect resulting from clogged air filters, clogged aeratoarelor, damaging pipelines connecting or blowers (compressors)
3	Faulty circuit recirculation (pump and pipe clogging sludge)	3	Defect leading to malfunction or stop functioning activation basin, namely clogging of the sludge settling
4	Purified water discharge pump defect	1	Purified water discharge pump defect

B	Small waste water treatment plant with biological filter		
1	Mud pump defect	2	The defect leads to interruption of the functioning facility
2	Clogged pump sludge	1	The defect leads to interruption of the functioning facility
3	Fault timer, (Automation)	1	Lock operation facility

Other general recommendations and technical assistance mentioned in the analysis report:

Plant with activation basin:

- adjusting the concentration of sludge in the activation basin:
- empty compartment settling primary / secondary (too much mud accumulated):
- removal of floating sludge from the entrance:
- general cleaning of the plant, repriming it, (too much mud accumulated) ;
- Training the beneficiary on the proper use of biodegradable detergents and other cleaning solutions;
- attracting attention from the danger of clogging due to beneficiaries of textiles thrown into the canal;
- attracting attention to the beneficiaries of the damage caused by fat entering the treatment plant;

- removing sludge secondary settling carved on the wall;
- mention specify the recipients and maintain their own sewage plant (facilities maintained by the association of owners).

Biological filter plant:

- regular cleaning of gutter water distribution, (ensuring a uniform distribution), remove plaque inlaid on gutters.

Small waste water treatment plant for 25-60 population equivalent

Total small waste water treatment plant analyzed 39, operating from 3 to 6 years, the number of major defects 3, 1at BA, 4 at FB, Table 3.4:

Tab. 3.4 Problems found at small waste water treatment plant for 24 - 60 people equivalents

Nr. crt.	Type fault	Number of defects	Obs.
A	Small waste water treatment plant with activation basin		
1	Electromagnetic contactor is defective	1	Lock operation facility
B	Small waste water treatment plant with biological filter		
1	Mud pump failure	2	The defect leads to interruption of the functioning facility

Other general recommendations and technical assistance mentioned in the analysis report:

Plant with activation basin:

- empty compartment settling primary / secondary (too much mud accumulated);
- removal of floating sludge from the entrance;
- general cleaning of the plant, repriming it, (too much mud accumulated);
- carved on the wall of sludge removal secondary settling;
- specify the beneficiaries who maintain their own sewage plant (facilities maintained by the association of owners).

Biological filter plant:

- regular cleaning of gutter water distribution, (ensuring a uniform distribution), remove plaque inlaid on gutters.

Other general recommendations and technical assistance mentioned in the analysis report:

For small waste water treatment plant of 80 people equivalents served to set the replacement compressor, emptying primary settling and discharging accumulated fats in fat separator.

For the 100 inhabitants equivalent small waste water treatment plant served to increase the recommended time or decreasing the concentration of sludge aeration basin activation.

Tab. 3.5 Type and number of fault:

Type and number of fault		
Nr. crt.	Type fault	Number of fault
1	Defects related to ventilation system	11
2	Defects pump	10
3	Defects related to the electric and electronic actuators; Automatic decoupling of the plant following damage;	7
		2
4	Choke circuit (recirculation sludge, raw water supply, water discharge, clarified)	6

5	Deterioration of plant construction	1
6	Defects related to engine operation	1
7	Defect soft control proces	1
Total of defects		39

The total number of defects in size and technology, the ratio of total number of defects in size and

number of installations on size, in table 3.6

Tab. 3.6 Number of defects in size and technology

Size (total plant)	Total number of defects	Total number of defects on the technology					Nb. def. Nb. pl.
		BA	FB	CBR	CAS	SEP	
4-6 (64)	9	7	2	-	-	-	9/64 (0.140)
8-10 (164)	16	15	-	1	-	-	16/164 (0.097)
12-24 (91)	11	7	4	-	-	-	11/91 (0.120)
25-60 (39)	3	1	2	-	-	-	3/39 (0.076)
80 (1)	0	0	0	-	-	-	-
100 (1)	0	0	0	-	-	-	-
(360)	39	30	8	1	-	-	39/360 (0.108)

The ratio of number of defects on technology and total station technology, Table 3.7:

Tab. 3.7 The ratio of number of defects on technology and total station technology

Number of defects on technology / total station technology					
Technology	BA	FB	CBR	CAS	SEP
Nr. def. Nb. defects	30	8	1	-	0
Nb. inst.	274	73	9	0	4
Ratio	30/274 (0.109)	8/73 (0.109)	1/9 (0.111)	-	0

Assessment of defects and disturbances arising

Aeration system defects are defects that lead to unsatisfactory operation of a pool of activation. If that transfer water-mud mixture is made through a gaslift, and this transfer will be affected, further affecting the efficiency of the activation basin.

Defects in the pumps are probably the most common treatment technique defects encountered. The pumps can be destroyed due to mechanical wear heavy water channel loaded with hard materials such as sand, glass shards, metal shavings, or due to blocked pump impeller due to penetration of hard bodies and the rotor winding textile fibers.

Pump shaft lock trigger the blocking rotor electric motor. In case that the systems of protection (maximum current relays), not the engine disengaged from the power supply and it is possible to destroy. Decommissioning of a pump may lead to flooding even small plant.

Defects related to the electric and electronic actuators can call them defects actually "brain" small plant. The sequence leading shareholders in the process of purification can be conducted by a clock or even a process computer. The control of a sewage plant is more complex and the performance will be higher. For small installation but not always justify a very

sophisticated automation because they involve a more demanding maintenance, installation greatly increases the price performance of treatment facilities are not always superior simple and high reliability is hard to maintain.

In simple installations throughout the operation and control is contained in a keyboard mounted in close proximity to small plant. In certain situations can justify and drive and remote control.

Clogged channels can occur both in the sludge, (eg activated sludge recirculation circuit), but the aeration facilities, transport of crude or purified water. Ducts usually mud choke because incrustation sludge or closures due to formation caused by coarse materials, which were retained by the sieve of protection. If air ducts to air filter clogging occurs, by loading it in the pipeline, due to ice plugs or plates or membranes for aeration by clogging them with mud.

Clogged pipes can lead to impaired treatment process or even complete blocking of the station. If circuits are supplied by pumping, clogging is observed by signaling overload and decoupling the pump protection relays.

Deterioration of plant construction is an increasingly rare defect. It leads to unwanted mixing of the water in different compartments, etc. hydraulic circuit disruption Deterioration may be

due to construction uneven subsidence of the soil foundation, overloads caused by passing heavy machinery, freezing, errors handling, storage and installation, damage in the material of which is run station, shots

Defective drive motor, generally due to blocked pump or compressor gripării, (whether they are reciprocating compressors driven electric motors). Most pumps are fitted microstațiile sewage submersible pumps, firmly attached to the actuator. Penetration of foreign bodies or the formation of flax on the pump rotor, and thus lead to its destruction lock actuator. A corresponding adjustment of maximum current relays can prevent this damage by decoupling the engine from overload occurrence. Another cause of failure of electric motors for operating the submersible pump is semeringului destruction and sealing of the pump motor. In this situation it is unlikely that the engine can be decoupled in time from the Dashboard.

Of the 360 records of observations is analyzed once noticed the stalled process computer, and that the failure to reinstall software necessary. Control of small plant treatment or even a small sewage plants by computer is something less than normal, because it would significantly increase the cost of initial investment and reduce overall system reliability. For safe operation it is necessary to consider a doubling of computer automation of a classic.

4. CONCLUSIONS AND RECOMANDATION

Treatment facilities with swimming power activation are still first choice among the beneficiaries of the operators concerned. This is due to the following aspects:

- extensive experience in field of design and operation of large stations;
- the installation can be dimension any size for any number of users. The large over 30 population equivalents served, facilities may consist of several small-capacity modules, thus allowing Stages of investment;
- buildings are underground, and integrates well into the decor;
- plants have a simple geometry, usually running the engine version, which shows a volume that occupied a minimal space;
- the most of manufacturers offer prefabricated facilities, made of materials light;
- emanations of smell are rare and usually originate from primary sludge fermentation;
- are simple.

Biological filters, the second option, compared with treatment facilities with activation basin:

- is increasingly based on wide experience gained with large capacity filters;
- space is greater than the first and the buildings are above ground;
- in a small number of people served may arise stability problems;

Treatment plants with rotating biological contactors:

- is a less common technology, experience in this area being less than the first two technologies;
 - buildings are developed horizontally, usually have large facilities suitable for a large number of population served ;
 - to be executed in hard cover, possible fallout of smell;
 - has disadvantages due to the rotor, where the setting is very difficult film biology.
- Treatment facilities with plants:
- are more difficult to run due to large area occupied, compared to other technologies;
 - can be manufactured from local materials;
 - fits well into the decor;
 - are simple;
 - verry little experience yet.

The most common defects refer to the failure of pumps or aeration system. In both the cases were aggregated with moving parts.

A cause of failure would be heavy work conditions. You should use the submersible pumps made of superior materials (stainless steel), and if possible, replace the pump with a pumping system by gaslift.

If capacities are low, may waive the classic compressor, piston compressor for a membrane. It is quieter and more economical.

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