

NEPTUNE BEACH'S NITROGEN REDUCTION OVERVIEW AND RECOMMENDATION

The Department of Environmental Protection (DEP) and the Environmental Protection Agency (EPA) have mandated that all sewer and storm water facilities in Northeast Florida reduce the nitrogen in their sewer effluent that ends up in the St. Johns River. The mandate is a result of a lawsuit by the River Keeper against the EPA and DEP.

Neptune Beach and Atlantic Beach have been conducting a joint study to determine if they can jointly handle the Total Maximum Daily Loads (TMDL) nitrogen reduction requirements mandated by DEP, at a shared cost savings. The plan was for Neptune Beach to build a sewer force main from its plant at Forest Avenue to the Atlantic Beach Plant at Sandpiper Lane.

Earlier this month, at a joint meeting with Atlantic Beach, Neptune Beach learned that the Atlantic Beach plant would only be able to process up to a maximum of 1,000,000 gallons per day. While Neptune Beach's average daily sewer flow is 550,000 gallons per day, during storm events the infiltration has been as high as 2,500,000 gallons per day. Old private residential lines running to the City's line and old city lines cause the infiltration. Neptune Beach has already spent \$3,000,000 to rehab lines and has plans to bring that flow down to the Ten State Standard of 1.76 million gallons per day (considered the industrial norm). This would still be 700,000 gallons more than Atlantic Beach could process during a storm event. For Neptune Beach to get to the 1,000,000 gallons maximum that Atlantic Beach could process would create rate hikes that Neptune Beach ratepayers could not sustain.

Therefore, the Neptune Beach staff and consulting engineers are recommending that the City Council approve the use of a fixed film media process at its sewer plant to reduce nitrogen levels. Neptune Beach's consulting engineers have studied seven different methods to reduce the nitrogen to the required levels. Their recommendation is that the fixed film media process will be the least expensive method to meet the DEP's required level of nitrogen reduction.

NITROGEN REMOVAL OPTIONS EXPLORED

1. Joint Venture with Atlantic Beach:

Not feasible due to limit on sewer accepted (1,000,000 gallons per day), NB at times has up to 2,500,000 gpd during major storm events. Because of the cost to fix the infrastructure and provide holding tanks the cost and timing doesn't work (would require a very large additional rate increase now). The costs to reduce peak flows would exceed the potential savings of joint City wastewater operations.

2. Effluent Reuse:

Not feasible due to lack of areas to apply the effluent. Our engineers worked on using the space we had available, but DEP felt it wasn't permittable due to being too close to our storm water drainage system and water supply wells.

3. ANUE Process:

Not feasible because the company would not guarantee the required removal amount of nitrogen.

4. Advanced Waste Water Sewer Treatment Plant:

Not feasible due to high cost. Would require an additional large rate increase. Unable to reduce nitrogen to the levels required by the FDEP mandated TMDL (Total maximum Daily Load) requirements.

5. Bio Process Demonstration Project:

Fuel cost (additional carbon source) for bugs too high and process demonstration was inconsistent and could not be guaranteed.

6. Fixed Film Media:

Treatment results can be guaranteed by the company and plant modifications would not cost more than already planned with previous rate adjustments. Low cost resulting through use of existing treatment plant structures.

7. In-Pipe Technology:

Partly works Reduces influent nitrogen levels by initiating treatment in the collection system and cleans sewer system at a low cost. Might be best used with number (6) above to lower cost and/or just to clean sewer lines. Orange Park and Lakeland are using this process now with success. Would not require a rate increase.

SEWER PROCESSING SIMPLIFIED

In general, the processing of sewer waste is accomplished by creating or adding microbes (bugs) to the waste stream in tanks at sewer plants. The microbes reduce the impurities in the sewer stream. Once the microbes have treated the waste stream, the plant is left with treated solids and water. In the Jacksonville area, the treated solids are trucked to the landfill and the water is piped to the river.

The different methods of processing sewer have many different titles. However, the processes are all different ways of creating and introducing the microbes to the untreated sewerage so that they can remove impurities in the waste stream for sanitary disposal.

**City of Neptune Beach
Preliminary Cost Estimate for TMDL WWTP Upgrade**

<u>Description</u>	<u>Cost (Thousand \$)</u>	
IFAS Equipment (0.55 mgd)	495	
Tank modifications	120	
Piping Modifications	85	
Valves and Appurtenances	25	
Supplemental Carbon Source (Tank and feed)	40	
Contractor installation and overhead	<u>255</u>	
Subtotal (3/20/09 costs)		\$1,020
IFAS upgrade (0.65 mgd)	80	
SCADA/Electrical Improvements at WWTP	115	
Solids removal in existing tanks	20	
Rehabilitate stairs for existing tanks	25	
New blower	20	
CCT Hydraulic modifications	<u>10</u>	
Subtotal Extra items		<u>\$270</u>
Subtotal Construction		\$1,290
Engineering (incl. design, permitting, Constr. Admin.)	240	
Contingency (20%)	<u>260</u>	
Total Estimated Project Cost		\$1,790
Total Estimated Construction Cost without contingency		\$1,530

Additional Items Considered but not included:

- Demolition of existing unused concrete clarifier
- SCADA Improvements for lift stations and/or wells
- SCADA Improvements for WTP
- SCADA coordination JB/AB effluent
- More than one SCADA control station
- Flow equalization modifications
- IPT coordination/consideration
- Consideration of outside flow from Atlantic Beach or elsewhere

Moving Bed Biofilm Reactor Municipal References List

ANOXKALDNES

	Name of Plant/ Place	Year of completion	Flow (MGD)	Size (P.E.)	Reactor volume (ft ³)	Reactor volume (m ³)	Objectives
Australia							
1	Caboolture	1999		40,000	7,062	200	N-removal, post denitrification
Austria							
1	Grossraming WWTP	2004		4,550	22,669	642	Nitrogen removal
Brazil							
1	Delphi (ETE Jambeiro), Sao Paulo	2002		700	1,518	43	BOD-removal
Canada							
1	Highland Creek, Toronto	2002		20,000	42,019	1,190	Pilot study. Nitrification ahead of existing activated sludge
2	St. Julie	2006		-	44,349	1,256	BOD removal ahead of lagoon
China							
1	TEDA West WWTP (Phase 1)	2006		56 000 ca.	148,302	4,200	HYBAS. Nitrification and denitrification. BioP. K3.
Croatia							
1	Varazdin	2004		60,000	19,774	560	BOD-removal. Roughing AS
Denmark							
1	Kalundborg	2006		-	42,372	1,200	Final treatment, Nitrogen removal
Finland							
1	Velkua Kunta	1998		100	424	12	BOD-removal
2	Vihti	2001		1,600	5,297	150	Replacement of AS. To achieve nitrification
Germany							
1	Penig	1998		50	212	6	Upgrade BOD-removal
Gran Canaria							
1	Tauro	2001		2,000	1,695	48	BOD-removal
Hungary							
1	Dejtar	1995		3,000	7,274	206	N-removal, pre-denitrification
2	Kishartyan	1995		1,500	4,908	139	N-removal, pre-denitrification
Iceland							
1	Hveragerdi	2002		4,500	2,119	60	BOD-removal
Indonesia							
1	Plaza Indonesia R.	1997		1,800	6,003	170	BOD-removal
Italy							
1	BAS, Bergamo	1999 & 2002		220,000	98,868	2,800	Nitrification after AS
2	Caia Gonone, Sardinia	2000		15,000	9,039	256	BOD-removal
3	Trento Mattarello	2000		6,000	9,569	271	BOD-removal
4	Darvico	2001		14,000	18,326	519	Nitrification, pre- and post-denitrification
5	Comune di Goni	2003		5,000	10,593	300	BOD-removal and nitrification
6	Pignone	2003		1,000	4,237	120	BOD removal
7	CID	2004		350	706	20	BOD-removal + nitrification
8	Comune Carrù	2004		3,500	10,593	300	BOD-removal + nitrification
9	Comune Cipressa	2004		11,500	17,655	500	BOD-removal
10	Comune Crova	2004		2,000	7,062	200	BOD-removal
11	Comune Pignone	2004		1,000	3,884	110	BOD-removal
12	Euroeco	2004		4,000	3,531	100	BOD-removal + nitrification
13	ISEA	2004		250	530	15	BOD-removal
14	San Remo	2006		130,000	105,718	2,994	BOD-removal
15	Garda Uno (Limone del Garda)	2007		18,750	19,562	554	Nitrogen removal

Moving Bed Biofilm Reactor Municipal References List

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Japan							
1	Chiba Prefecture	2000		3,500	8,722	247	Waste water treatment

Korea							
1	Namyang Gje (Nungnae)	2004		-		-	-

New Zealand							
1	Western Plant, Wellington	1997		11,000	12,359	350	BOD-removal
2	Moa Point, Wellington	1998		200,000	97,456	2,760	BOD-removal

Norway							
1	Steinsholt	1990		625	1,766	50	N-removal, pre-denitrification
2	Eidsfoss	1992		500	1,836	52	BOD-removal, 1,000 P.E. max
3	Harran	1992		600	177	5	BOD-removal
4	Bekkelaget, Oslo	1992		15,000	21,009	595	Test line 1992-1993 N-removal, post-denitrification
5	Karasjok	1993		4,000	3,072	87	Aerobic reactor, BOD-removal
6	Risby	1993		70	177	5	BOD-removal
7	Tana-Bru	1993		1,750	3,496	99	Aerobic reactor, BOD-removal
8	Lillehammer	1994		70,000	135,590	3,840	N-removal, pre-/post-denitrification
9	Sanderstølen	1994		350	671	19	BOD-removal
10	Mediå, Grong	1995		1,700	3,531	100	BOD-removal
11	Siljan	1995		2,200	3,884	110	BOD-removal
12	Byrkjelo	1996		2,850	1,165	33	BOD-removal
13	Holmestrand	1996		15,000		-	COD and phosphorous removal No MBBR reactors
14	Nordre Follo	1997		40,000	130,647	3,700	N-removal pre-/post-denitrification
15	Rørdal, Odda	1997		700	494	14	BOD and phosphorous removal
16	Røra, Inderøy	1997		7,500	6,320	179	BOD-removal
17	Skare, Odda	1997		500	424	12	BOD and phosphorous removal
18	Spållind	1997		250	282	8	BOD-removal
19	Gardermoen	1998		50,000	204,445	5,790	N-removal pre-/post-denitrification
20	Frya	1999		9,000	6,215	176	BOD-removal. Replace fixed filter
21	Svarstad	1999		2,000	3,178	90	BOD-removal. Replace AS plant
22	Tretten	1999		4,300	3,813	108	BOD-removal. Replace RBC plant
23	Vindfjelltunet	1999		200	247	7	BOD-removal. Tourist plant
24	Skei wwrtp	1999		700	1,342	38	BOD removal
25	Fyresdal (train 1)	2000		2,800	1,624	46	BOD removal. Replace RBC plant
26	Moøya	2000		5,000	2,860	81	BOD removal.
27	Vassenden	2000		1,500	1,836	52	BOD-removal
28	Beito	2001		9,700	4,237	120	BOD-removal
29	Bekkelaget, Oslo	2001		350,000	46,786	1,325	AS with Kaldnes reactors for post-denitrification
30	Byrkjelo	2002		8,000	6,073	172	BOD-removal
31	Hogset	2002		1,320	1,095	31	BOD-removal
32	RA-2	2002		160,000	670,890	19,000	N-removal, pre- and post-denitrification
33	Dovre	2003		2,100	3,178	90	BOD-removal
34	Fyresdal (train 2)	2003		2,400	2,895	82	BOD-removal
35	Skreia	2003		9,300	5,720	162	BOD-removal MBBR + Actiflo
36	Bjørkeløngen	2004		8,000	5,332	151	BOD-removal
37	Brandbu	2004		8,000	14,124	400	BOD-removal
38	Kasper Flyktningmottak	2004		320	424	12	BOD-removal
39	Rambekk	2004		3,700	3,955	112	BOD-removal Reject water
40	Røn RA	2004		1,800	1,730	49	Replacement of RBC. BOD-removal
41	Ustaaset RA	2004		2,250	2,260	64	BOD-removal
42	Øvre Sirdal	2004		5,000	4,837	137	BOD-removal MBBR + Actiflo
43	Fåvang RA	2005		12,000	3,319	94	BOD-removal
44	Mebonden RA	2005		2,500	1,660	47	BOD-removal
45	Mysen RA	2005		9,500	12,147	344	BOD-removal
46	Nordlia RA	2006		1,500	2,119	60	BOD-removal
47	Nordlia RA, Østre Toten	2006		1,000	2,119	60	BOD-removal

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ANOXKALDNES

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48	Seljord RA	2006		3,000	1,907	54	BOD-removal
49	Treim RA	2006		7,300	4,837	137	BOD-removal
	Norway (continued)						
50	Fagemes-Leira RA, Nord-Aurdal	2007		4,000	7,062	200	BOD-removal, upgrading to a new biological treatment
51	Fossbergom RA, Lom	2007		2,400	2,648	75	BOD-removal, upgrading to a new biological treatment
52	Geilo, Hol kommune	2007		20,000	31,779	900	BOD-removal, upgrading to a new biological treatment
53	Golsfjellet RA, Gol	2007		1,800	2,119	60	BOD-removal, new plant
54	Volla RA, Lunner	2007		3,500	4,449	126	BOD-removal
	Oman						
1	OWSC Quriat STP	2006		1,330	4,237	120	BOD-removal. Reuse of greywater

Portugal							
1	Pridesa STP	2004		3,500	4,943	140	BOD-removal

Slovenia							
1	Naprava, Domzale	1998		2,700	17,655	500	Test plant. N-removal

Spain							
1	Tafalla & Olite	2000		34,300	30,014	850	Roughing reactor and upgrade with BOD and partly ammonia removal
2	E.D.A.R. Lekunberri, (Navarra)	2001		8,370	7,062	200	COD-removal. First stage.
3	E.D.A.R. Santesteban, (Navarra)	2002		3,440	2,119	60	COD-removal. First stage.
4	E.D.A.R. Isaba, (Navarra)	2003		800	1,766	50	COD-removal. First stage.
5	E.D.A.R. Irurzun, (Navarra)	2004		4,930	8,474	240	COD, N and P removal.
6	E.D.A.R. Tommeloso, (Ciudad Real)	2005		24,000	44,138	1,250	COD-removal. First stage.
7	Edar el Quiñon-Seseña, Toledo	2006		-	37,076	1,050	COD and N-removal

Sweden							
1	Farstorp	1994		200	777	22	Replacement of activated sludge
2	Saleboda	1994		700	777	22	Aerobic reactor, BOD-removal
3	Vrigstad	1994		2,300	4,025	114	Replacement of activated sludge
4	Munkedal	1995		7,000	8,121	230	BOD-removal
5	Spiken	1995		900	1,236	35	BOD-removal
6	Deje	1996		4,200	3,531	100	BOD-removal and DAF
7	Bjuv	1997		16,000	6,038	171	Nitrogen removal post-denitrification
8	Hallabro	1997		300	494	14	BOD-removal
9	Klagshamn	1997		90,000	6,038	171	Post-denitrification
10	Linneryd	1997		600	2,825	80	BOD-removal
11	Skeppshult	1997		800	1,059	30	BOD-removal
12	Öckerö	1997		14,000	15,501	439	N-removal. Post-denitrification.
13	Burgsvik	1998		2,000	1,589	45	BOD-removal
14	Ljusdal	1998		12,500	1,977	56	BOD-removal
15	Nyköping	1998		70,000	129,235	3,660	Nitrogen removal 15 mg/l pre-denitrification
16	Näsrum	1998		500	883	25	BOD-removal
17	Sjöblunda	1998		375,000	219,981	6,230	Post-denitrification
18	Strängsnäs	1998		25,000	35,310	1,000	Nitrification + post-denitrification
19	Margretelund	1999		40,000	90,041	2,550	Nitrification, pre- and post denitrification
20	Knivsta	2000		15,000	19,774	560	Nitrification
21	Marsvikens kursgård	2001		100	212	6	BOD-removal
22	Visby	2001		50,000	19,421	550	Post-denitrification
23	Vänernborg	2001		31,000	8,828	250	Post-denitrification
24	Sollefteå	2003		-	17,655	500	BOD-removal. Replace AS plant
25	Gräbbedad	2004		2,000	1,695	48	BOD-removal

Moving Bed Biofilm Reactor Municipal References List

ANOXKALDNES

	Name of Plant/ Place	Year of completion	Flow (MGD)	Size (P.E.)	Reactor volume (ft ³)	Reactor volume (m ³)	Objectives
26	Klippan WWTP	2004		7,000	7,062	200	Hybas for enhanced nitrification in winter
27	Råneå	2005		2,400	6,356	180	BOD-removal
28	Söderköping WWTP	2005		10	16,949	480	HYBAS for nitrogen removal
	Sweden (continued)						
29	Hagfors	2006		350	706	20	BOD-removal
30	Lessebo	2006		-	-	-	BOD-removal
31	Orsa Grönklitt WWTP	2006		-	1,059	30	BOD-removal
32	Östhammar	2006		3,600	5,579	158	BOD-removal
33	Björnö-Långvik	2007		2,500	3,178	90	BOD-removal
34	Himmerfjärdsverket	2007		-	35	1	Deammonification
35	Hovgården Leachate	2007		-	12,359	350	BOD-removal+Nitrification
36	Hyppeln	2007		500	706	20	BOD-removal
37	Kramfors	2007		ca 30 000	26,483	750	COD-removal
38	Tällberg	2007		3,000	9,534	270	BOD-removal
39	Vansbro	2007		7,500	7,945	225	BOD-removal
3	Visby	2007		60,000	204,798	3300+2500	Nitrogen removal
40	Gryaab	2008		-	373,580	10,580	Post-denitrification

Switzerland							
1	Lisighaus Wildhaus I	1998		500	636	18	Compact Plant. Replace rot. disc filter
2	Fislisbach	1999		12,200	36,616	1,037	Replacement of AS. N-removal with pre-denitrification
3	Sernftal, Engi	1999		3,000	7,133	202	Replacement of RBC. BOD-removal & nitrification
4	Dürrenroth	2002		3,000	7,486	212	Replacement of RBC. BOD-removal and nitrification
5	Nesslau	2002		6,000	11,864	336	Replacement of RBC. BOD-removal and nitrification
6	Schönenwerd, Part 1	2002		33,000	60,804	1,722	Replacement of AS. N-removal with pre-denitrification
7	Scul	2002		14,000	23,163	656	Replacement of AS. BOD-removal
8	Schönenwerd, Part 2	2003		33,000	60,804	1,722	Replacement of AS. N-removal with pre-denitrification
9	Wohlen AG, Part 1	2003		36,500	87,286	2,472	Replacement of AS. N-removal with pre-denitrification
10	Silvaplana	2004		16,000	25,423	720	Replacement of AS. BOD-removal
11	Sägenboden, Wildhaus	2004		1,560	6,250	177	Replacement of AS. N-removal with pre-denitrification
12	Wohlen AG, Part 2	2004		36,500	87,286	2,472	Replacement of AS. N-removal with pre-denitrification
13	Röti	2004		110,000	294,803	8,349	Replacement of AS. N-removal with pre-denitrification. Hybas™
14	Splügen	2005		2,200	7,486	212	Replacement of RBC. BOD-removal

Thailand							
1	ABAC University	2000		-	-	-	BOD-removal. Pre-treatment prior to SBR.

United Kingdom							
1	Bury St. Edmunds	1995		17,000	17,655	500	Tertiary nitrification
2	Doddington	1995		3,600	10,593	300	BOD-removal
3	Anwick STW	1995		N/A	63,558	1,800	Replacement of fixed media process
4	Dunwick	1996		250	706	20	BOD and nitrification
5	Derby Pride	1997		N/A	19,244	545	BOD-removal
6	Nettleham	1997		4,800	11,158	316	BOD-removal
7	Tuddenham	1997		1,000	1,306	37	Tertiary nitrification
8	Braintree STW	1998		28,000	83,332	2,360	Upgrade with K2. N-removal
9	Bury St. Edmunds II	1998		17,000	35,310	1,000	Tertiary nitrification
10	Corby STW	1998		240,000	141,240	4,000	Increased capacity for BOD-removal
11	Great Dunmow STW	1998		8,000	22,952	650	Upgrade with BOD and ammonia removal
12	Pyewipe	1998		314,000	139,828	3,960	BOD-removal
13	Colchester	1999		110,000	48,657	1,378	Roughing reactor to aid nitrification in AS

**Moving Bed Biofilm Reactor
Municipal References List**

ANOXKALDNE5

	Name of Plant/ Place	Year of completion	Flow (MGD)	Size (P.E.)	Reactor volume (ft ³)	Reactor volume (m ³)	Objectives
14	Shoreham	1999		625	4,061	115	Treatment of reject water
15	Oxford WWTP	2005		28,800	30,720	870	Hybas™

USA							
1	Broomfield, Colorado	2002	8.00	73,500	165,851	4,697	HYBAS for nitrification
2	Merimac WWTP, Wisconsin	2003	0.08	460	13,347	378	Pre-denitrification
3	South Adams County, CO	2003	5.50	25,000	163,803	4,639	Nitrogen removal
4	Johnstown WWTP, Colorado	2004	1.50	4,000	43,184	1,223	Post-nitrification. After existing Lagoons
5	Poipu WWTP, Poipu, Hawaii	2004	1.00	1,100	13,206	374	Replacement of AS. BOD-removal
6	Cheyenne - Crow Creek, Wyoming	2005	6.50	25,000	197,100	5,582	BOD removal & nitrification
7	Cheyenne - Dry Creek, Wyoming	2005	9.50	30,000	196,994	5,579	HYBAS for nitrification
8	Taos, NM WWTP	2005	0.20		9,004	255	HYBAS for nitrification
9	City of Manawa	2006	0.20		6,109	173	BOD removal ahead of AS
10	Yucaipa WWTP	2007	8.00		142,546	4,037	HYBAS for Nitrification and TIN of < 6 mg/L
11	James River WWTP, VA	2007	2.20		66,383	1,880	HYBAS for Nitrification and TIN < 10 mg/L
12	Greensboro WWTP, NC	2008	3.50		222,453	6,300	HYBAS for Nitrification
13	Flagstaff WWTP, AZ	2008	6.00		208,329	5,900	HYBAS for Nitrification and TIN of < 8 mg/L
14	Waikaloa WWTP, HI	2008	0.80		18,361	520	BOD removal & nitrification
15	Northport WWTP, MI	2008	0.13		11,970	339	Nitrogen removal
16	Fields Point WWTP, RI	2010	77.00		1,207,602	34,200	HYBAS for Nitrification and TIN of < 3 mg/L
17	Lubbock WWTP, TX	2010	18.00		745,747	21,120	HYBAS for nitrification and TIN of < 8 mg/L
18	Fairplay WWTP, CO	2008	0.30		14,040	398	HYBAS for nitrification and TIN of < 10 mg/L
19	Wisconsin Rapids, WI	2008	5.50		68,672	1,945	BAS for BOD removal ahead of activated sludge
20	Broomfield Phase 2, Colorado	2008	4.00		81,515	2,309	HYBAS for nitrification and TIN of < 8 mg/L

Vietnam							
1	Nam Du WTP	2004		-	63,028	1,785	Other

Moving Bed Biofilm Carrier Process

Reference	Location	Size (MGD)	Year	Objective	Consultant	Application/Technology
City of Moorhead	Moorhead, MN	6.00	2003	Nitrification	CDM	Upgrade of a 6 MGD Municipal WWTP utilizing ActiveCell biofilm carriers in a single-basin for nitrification.
Mirant Corporation	Montego Bay, Jamaica	1.80	2002	Nitrification, BOD reduction	AMEC	Treatment of 1.8 MGD secondary effluent from a sewage plant through a three stage ActiveCell process for ammonia mitigation.
Royal Caribbean Cruise Lines Ltd.	-Enchantment of the Seas -Vision of the Seas -Radiance of the Seas -Summit of the Seas -Jewel of the Seas -Brilliance of the Seas	0.3	2002	BOD reduction		Turn-key refit of an existing ship incorporating multistage ActiveCell and ActiveFloat™ DAF technology combined with disc filters, and UV sterilization.
Ultra Viendes	Montreal, QC	0.26		BOD reduction	-	Dual stage ActiveCell process combined with an SBR designed for the treatment of slaughterhouse wastewater.
Ocean Cuisine	Danvers, MA	0.12		BOD reduction	-	Turnkey installed ActiveCell/Infilco process followed by a DAF for the treatment of food processing wastewater. The ActiveCell/Infilco biological treatment facility upgrade replaced a trickling filter to increase capacity and eliminate odors.
EarthSource	Raynham, MA	0.11		BOD reduction	-	Treatment of septage wastewater utilizing ActiveCell process.



ACTIVECELL® Systems Reference List



Degremont Technologies

Infilco

Suez

Reference	Location	Size (MGD)	Year	Objective	Consultant	Application/Technology
Hilton Sharmis waterfall	Sharm Waterfall, Egypt	0.1		BOD reduction	-	Upgrade of a 100,000 gallon per day resort WWTP utilizing ActiveCell biofilm carriers.
Keystone Landfill	Dunhill, PA	0.1		Nitrification	Gannett Fleming	Three-stage ActiveCell process designed to nitrify high strength landfill leachate after anaerobic treatment.
CTBM	Montréal, QC	0.071		BOD reduction	SNC-Lavalin	ActiveCell process that is incorporated into a centralized sludge treatment facility that receives DAF sludge from local slaughterhouses via tank trucks. The treated sludge then is used to make compost.
Purepac Pharmaceuticals	Elizabeth, NJ Piscataway, NJ	0.0288 - 0.0432	2001	BOD reduction	Levine Fricke	Two (2) modular biological treatment systems for multi-contaminant wastewater treatment employing ActiveCell three-stage biological treatment stream.
SPL Wastewater Recovery Center	Langford, BC	0.04	2000	BOD reduction	-	Treatment of septage wastewater utilizing ActiveCell process and ActiveFloat DAF.
TRC	Antioch, CA	0.043	2003	BOD reduction	TRC	ActiveCell process designed for the treatment of groundwater for the removal of TOC, Phenol and Acetone.
S&G Cannery	St. Sophie, QC	0.03		BOD reduction	-	Dual stage ActiveCell process for BOD reduction from a cannery.
Jacques Forget	Terre Bon, QC	0.03		BOD reduction, Nitrification	-	Retrofit of an existing SBR for enhanced capacity for BOD reduction and nitrification of ammonia.
F. Menard	Granby, QC	0.03		BOD reduction	-	Slaughterhouse wastewater treatment using dual stage ActiveCell process combined with an SBR.
Littleton Nursing Home	Littleton, MA	0.018		Nitrification	-	ActiveCell process for nitrification.
Chem Group	Evansville, IN	0.015		BOD reduction	Goodman & Associates	ActiveCell process designed for the treatment of plant effluent with high levels of BOD.

Reference	Location	Size (MGD)	Year	Objective	Consultant	Application/Technology
Chem Group	Evansville, IN	0.015		BOD reduction	Goodman & Associates	ActiveCell process designed for the treatment of plant effluent with high levels of BOD.
Nimmo Bay Resort	Port McNeil, BC	0.015	1999	BOD reduction	-	ActiveCell process to treat resort wastewater with direct discharge to environmentally sensitive ocean region.
Aquaeter	Beaumont, TX	0.003		BOD reduction	Aquaeter	ActiveCell process for the treatment of creosote bearing groundwater.
Columbia Icefields	Columbia Icefields, AB	0.07	1997	BOD reduction, Nitrification		High performance sewage treatment system utilizing <i>ActiveCell</i> TM , PFM and ozone polishing to provide effluent quality for surface discharge within a National Park.
PTT PolyCanada (Division of Shell Chemicals)	Montreal, QC	0.03		BOD reduction		Three <i>ActiveCell</i> TM Bioreactors in series treat variable and complex wastewater from PTT (polytrimethylene terephthalate) production facility
Lewis County Dairy - Ahava Foods (under construction)	Lowville, NY			BOD reduction		Turnkey installed multi-stage <i>ActiveCell</i> TM Bioreactor process combined with pre and post DAF systems for designed to treat dairy wastewater for direct discharge to the Black River.
Avalon County	Avalon, TX	0.03	1999	BOD reduction		Modular biological system for combined treatment of municipal sewage and landfill leachate utilizing <i>ActiveCell</i> TM and PFM.
Marmot Basin Ski Resort	Jasper, AB	0.07		BOD reduction, Nitrification		Domestic effluent from a resort
Harrisburg Authority AWTF (Pilot Plant)	Harrisburg, PA	1.2 - 15 GPM	11/ 2005 - 06/2006	Nitrification	Malcolm & Pirnie	Two-stage Meteor <i>ActiveCell</i> process to establish full-scale design to provide complete nitrification at a 45 MGD municipal WWTP.
Blue Plains AWTF (Pilot Plant)	Washington, DC	5 -30 GPM	11/ 2007 - 09/2008	Denitrification	Metcalf & Eddy	Meteor <i>ActiveCell</i> process to establish full-scale design to provide complete denitrification at a 475 MGD municipal WWTP.

IFAS Biofilm Carrier Process

Reference	Location	Size (MGD)	Year	Objective	Consultant	Application/Technology
Town of Groton	Groton, CT	7.50	2006	Total Nitrogen reduction	Fuss & O'Neill	Enhanced MLE process using the ActiveCell Hybrid process. This facility upgrade project is to meet the Long Island Sound Initiative for total nitrogen removal. (Under final design for Construction)
City of Raisio	Raisio, Finland	4.89	2003	Total Nitrogen reduction	Elomatic	Municipal upgrade of an 18,500 M3/day wastewater treatment facility to four stage dual anoxic ActiveCell Hybrid process for total nitrogen removal.
Regional Municipality of Peel - Lakeview Facility	Brampton, ON	3.70	2003	Nitrification	KMK	Municipal retrofit and upgrade of a 3.7 MGD activated sludge aeration train to an ActiveCell Hybrid process for nitrification of ammonia. This is a full scale demonstration project, operated over 2 years. Lakeview facility is Ontario's second largest treatment facility with a total flow of 103 MGD.
Waterdown Full-scale Demonstration	Waterdown, ON	0.40	1998	Nitrification	-	Full-scale demonstration of the ActiveCell Hybrid process to retrofit existing conventional activated sludge process for ammonia reduction.
Fields Point WWTF (Pilot Plant)	Providence, RI	1 - 8 GPM	2004	Total Nitrogen reduction	-	Four-stage dual anoxic ActiveCell Hybrid process to demonstrate the applicability at low temperatures and establish full-scale design to meet stringent total nitrogen requirements at a 65 MGD municipal WWTP.
Springettsbury WWTP (Pilot Plant)	Springettsbury, PA	2 - 5 GPM	2007	Total Nitrogen reduction	Buchart Horn	Two-stage Meteor ActiveCell process in MLE configuration to demonstrate the applicability at low temperatures and establish full-scale design to meet total nitrogen requirements at a 15 MGD municipal WWTP.

This is a list of Meteor[®] systems supplied by Degremont.

Reference	Size (MGD)	Year	Type of Treatment	Water Quality
Municipal Wastewater References				
Bellozanne, UK	6.1	2001	Upgrade C to N/DN	BOD ₅ : In 197 mg/l, Out 20 mg/l SS: In 239 mg/l, Out 30 mg/l TKN: In 49 mg/l, Out 10 mg/l
Galashiels, UK Pegazur Package Plant	0.16	2001	New plant for nitrification of drying condensates and centrates	NH ₃ -N: In 200 mg/l More than 90% removal
Colburn, UK Pegazur Package Plant	0.051	2001	New plant for nitrification of belt filter Juice	NH ₃ -N: In 425 mg/l More than 90% removal
Industrial Wastewater References				
Buchmann, Germany	1.9	2000	Dual stage upgrade	BOD ₅ : In 780 mg/l, More than 80% removal COD: In 1,940 mg/l, More than 80% removal
Holmen, Spain	1.59	2001	Dual stage new plant	BOD ₅ : In 1,750 mg/l, More than 80% removal COD: In 3,500 mg/l, More than 80% removal
Aticarta, Italy	2.64	2002	Dual stage new plant	BOD ₅ : In 210 mg/l, More than 80% removal COD: In 500 mg/l, More than 80% removal

AGAR® Installation List Updated: 06/22/09

Project Name	Location	Status	Application	Remarks	Design Capacity (m ³ /d)	Process Configuration	Performance requirements (mg/l)	Date of Commissioning	HRT (h)	COD load (kg/d)	BOD load (kg/d)	NH4-N load (kg/d)
1 Granador Juice	Switzerland	Operating	Industrial	Polishing of anaerobic effluent for discharge to sewer	500	RF (MBBR)	27% COD removal		1.3	315		
2 Kfar-Ruppin	Israel	Operating	Fish farming	Nitrification and filtration, to allow farming intensification from <20 to >60 kg/m ³	3,000	RF (MBBR)	Non toxic conditions throughout growth cycle		17min			
3 Carmel-Tzur	Israel	Operating	Municipal	Small community, New plant	400	IFAS BNR	Tertiary BOD/SS/NH3-N: 10/10/3		15			
4 Hadera	Israel	Operating	Municipal	Demo plant	1,000	IFAS BNR	Tertiary BOD/SS/NH3-N: 10/10/5		7.2			
5 Yans	Israel	Operating	Municipal	New plant: Design, Build, Own, Operate. Option: future retrofit to BNR	6,500	FFAST	Tertiary: BOD/TSS: 10/10-filtration		2.4			
6 Europaper	Italy	Operating	Paper Mill	Retrofit - pretreatment before RBC	2,000	RF (MBBR)	60% BOD removal		4.3	1440		
7 Mendocino	Mexico	Operating	Municipal	Retrofit: capacity increase by a factor of 1.5 with potential for future expansion	59,300	IFAS BNR	Tertiary BOD/SS/NH3-N: 10/10/5	Aug-06	5.5			
8 Valdivia	Chile	Operating	Paper Mill	Retrofit: addition of bioreactor to physico-chemical treatment	8,500	RF (MBBR)	BOD/TSS: 300/300	Sep-06	2.8			
9 Basco Merengo	Italy	Operating	Paper Mill	New plant	3,000	FFAST	BOD/COD: 40/160	Sep-07	4.8			
10 Torre Mondovi	Italy	Operating	Paper Mill	New plant	480	FFAST	BOD/COD: 40/160	Oct-05	4.6			
11 Trona Minus	Israel	Operating	Municipal	Package plant	50	IFAS	BOD/TSS: 20/30		24			
12 Willow Springs	USA - W. Virginia	Operating	Municipal	Retrofit of 1 line of 4	100	IFAS	BOD/TSS: 20/30	Sep-06	22			
13 Fremont	USA - Ohio	Operating	Municipal	Retrofit of 1 line	5,000	IFAS	BOD/TSS: 10/10	Sep-06	4.5			
14 Neue Iian	Israel	Operating	Municipal	Tourist resort / hotel: Retrofit	50	IFAS	BOD/TSS: 20/30		12			
15 Taurus Ganadera	Spain	Operating	Industrial	new plant	360	IFAS	BOD/TN/TSS: 40/40/80	Oct-06	26	540	90	
16 Thonias	Israel	Operating	Municipal	Retrofit - effluent quality improvement	6,500	Trickling Filter	BOD <60					
17 Demoli	Italy	Plant 04-09/06: Full scale: 2007	Paper Mill	Retrofit - pretreatment before RBC	2,400	RF (MBBR)	BOD rem > 60%		5	1,200		
18 Pea Food Plant	Mexico	Operating	Industrial	New plant	40	RF (MBBR)	BOD/TSS: 30/30	Jun-07	22	2,500 mg/l		
19 West Central Co-op, Des Moines	USA - Iowa	Operating	Industrial	New plant	60	FFAST	BOD/TSS: 400/400	Jun-08	3	1,350		
20 Concentrados Villavieja	Spain	Operating	Industrial	New plant	600	RF (MBBR)	BOD/TSS: 40/80	Oct-06	26	540	90	
21 Marneus	Spain	Operating	Municipal	Retrofit - effluent quality improvement	380	IFAS MLE	BOD/TSS/NTN: 20/25/15	May-07	17	266	167	11
22 Wal-mart Stores, Inc.	USA - Pennsylvania	Operating	Industrial	New plant	57	MBBR	BOD/TSS/NH3: 250/250/25	Apr-08	24		38	7.4
23 Rivolta	Italy	Operating	Paper Mill	New plant	1,000	RF (MBBR)	60% sol COD removal	Oct-07	4.9			
24 Sevilla la Nueva	Spain	Operating	Municipal	Retrofit - effluent quality improvement	1,000	IFAS/ Carousel type	COD/BOD/TSS/NTN: 125/25/35/15			480	240	40
25 Givat Brenner	Israel	Under construction	Municipal	New plant	9,500	IFAS	BOD/TSS/NTN: 10/10/10					
26 Dils Hata	Israel	Under construction	Industrial	New plant	75	RF (MBBR)	specific hydraulic: <2		5.5			

James Jarboe

From: Hersey, Michael [MHersey@appliedtm.com]
Sent: Friday, June 26, 2009 9:48 AM
To: James Jarboe
Cc: Leon Smith; Mark Greenwood; Swann, Steve
Subject: WWTP Tank Evaluation

Jim,

We reviewed the exterior condition of the existing six concrete tanks this morning with Mark Greenwood. The five tanks for the 0.9 mgd treatment train are all cast-in-place concrete tanks. The 0.6 mgd package plant is a prestressed concrete tank, constructed by the Crom corporation. It should be noted that all tanks contained liquid, precluding a detailed internal inspection. Outward signs indicated no significant cracking, spalling or signs of deterioration other than for coatings. The tanks also appeared to be in good to very good condition internally above the water line.

I would estimate the minimum remaining useful life for the tanks as follows:

<u>Tank</u>	<u>Remaining Life</u>	<u>Comments</u>
Stabilization Tank	25 years +	Cast-in-place tank. Stairs could use some work.
Digester	20 years	Cast-in-place tank, a bit rough looking with exposed aggregate on the inside but no exposed steel. Tank bottom has been repoured. Stairs could use some work.
Contact Tank	25 years +	Cast-in-place tank.
Clarifier 1	25 years +	Cast-in-place tank.
Clarifier 2	25 years +	Cast-in-place tank.
Package Plant	25 years+	Prestressed concrete tank.

In general it appears that the tanks would meet or exceed the 20 year life of the IFAS treatment system upgrade. We would recommend providing a more detailed structural evaluation for the access stairs, landings, handrails and ladders as part of the preliminary design. Recommendations would then be made for repairs as necessary to provide reasonable assurance for continued safety over the projected life of the facility.

Regards,

Michael Hersey, P.E.
Vice President

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6/26/2009