

THE INSTITUTE OF PUBLIC HEALTH BELGRADE

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Authorization for waste testing
021-01-00031/2009-05, 1.12.2009.
Official Gazette RS No. 101/09

ATC 01-036 ACCREDITED LABORATORY FOR TESTING JUS ISO/IEC 17025:2006	REPORT ON WASTE TEST	
TRETMENT / DISPOSAL OF WASTE		No. II – 8:500/4 Date: 19.04.2012.

<i>Data on applicant</i> PUC "Vodovod i Kanalizacija "			
Name of applicant PUC "Vodovod i Kanalizacija " (department for investments and development)			
Address: 24 000 Subotica 9/a Lazara Nešića Square			
Contact person: Mr. Gligor Gelert	Tel: 024/673-380	Fax: 024/ 557-700	e-mail: gellert@vodovodsu.rs
A. General data			
1.	Type of waste: Waste stabilized sludge from waste water treatment process		
2.	Waste producer: PUC „Vododvod i Kanalizacija" 24 000 Subotica 9/a Lazara Nešića Square		
3.	Waste owner: PUC „Vododvod i Kanalizacija" 24 000 Subotica 9/a Lazara Nešića square		

4.	<p>Description of waste generation.</p> <p>In the treatment process of waste waters from the City of Subotica municipal waste water is generated by combining household waste water, rain water and technological waste water from industries connected to the sewerage network in Subotica. At the beginning of the line lattices for mechanical treatment are installed and they are cleaned manually. Soil waste particles from lattice are loaded in the container used for solid waste from the lattice. Waste water from sewerage is taken to the plant with three worm pumps. After the lifting, water is treated on a fine automatic lattice with mechanical cleaning. During filtration water passes through lattice and gravitationally into the sand trap for grease with flat bottom. After sand trap, the waste water is then sedimentated. There are three identical sedimentation tanks. The tanks are radial and equipped with circular sludge collector and here, floating particles are also removed. Waste water then flows into biological pool. Aeration of biological pool is achieved by compressed air. This pool is multipurpose pool and it is used for biological decomposition of carbon organic pollutants, nitrification of ammonium compounds, simultaneous denitrification and chemical dephosphorization. Part of nitrified water is discharged from biological pools and collected in one pool from which the water is gravitationally taken to the pool for denitrification, like a system of internal recirculation. Other components (water, biological and chemical sludge) treated together in phases are separated in later sedimentation tanks which have the shape and functions similar to the previously mentioned tanks.</p> <p>On the sludge treatment line, the primary sludge is pumped through collective pipeline from previous sedimentation tanks for mechanical gravitational thickening. The thickened sludge is pumped into digestors and water over the sludge is discharged into the sewerage. Excess biological sludge mixed with chemical sludge from previous two tanks is pumped out of the gravitational line and sent for mechanical thickening. The thickened sludge is stabilized by anaerobic procedure and two closed digestors. Digested sludge is then taken out of the digestors and directly pumped for mechanical drainage. After dehydration, sludge is loaded into a system of containers.</p> <p>Biogas produced in the process of sludge stabilization in anaerobic digestors is collected below the dome.</p>
5.	Identification number of waste sample: 12-11-0191
6.	Quantity of sampled waste: 12.5t
7.	<p>Physical properties of waste:</p> <p>1. powder</p> <p>2. solids</p> <p>3. visous matter</p> <p>4. paste</p> <p>5. sludge X</p> <p>6. liquids</p> <p>7. gases</p> <p>8. other (precise it)</p>

B. Waste classification	
1.	Waste category based on the List of waste categories (Q list) : Q9
2.	Index number of waste according to Catalogue of Waste: 190805
3.	Type of waste nonhazardous / inert
4.	Y mark for the List of hazardous waste categories based on their nature and activities by which they are generated (Y list)
5.	C mark for the List of components which make waste hazardous (C list)

6.	H mark for the List of waste characteristics that make the waste hazardous (H list)
7.	<p>Note:</p> <p>Waste cannot be disposed to landfill without previous treatment (dehydration, thermal dehydration, etc.)</p> <p>Waste is neither hazardous nor inert according to the Council Decision of 19 December, 2002, establishing the criteria and procedures for the acceptance of waste at landfills, pursuant to Article 16 of and Annex II to Directive 1999/31/EC, 2003/33/EC.</p> <p>Since the waste is not inert, a compliance check should be performed 1 time a year in accordance with Regulation of Waste Disposal to Landfills (Official Gazette RS No. 92/2010). Key parameters for compliance check are: total solid organic carbon, dissolvable organic carbon, loss from calcination, phenol index, residue from evaporation, ammonia and nitrate in EP extract, concentration of sulphate in EP extract.</p> <p>The most suitable treatment of waste in question is by composting.</p>

Data on the sample	
Waste: Waste stabilized pressed sludge from waste water treatment plant	
Location of sampling: Waste Water Treatment Plant – PUC "Vodovod i Kanalizacija", Ltd Subotica GPS coordinates: N46°04'53.5" EO 19°41'43.3"	
Identification number of sample: 12-11-0191	
Sampling performed by: V. Karamata, senior sanitary technician	Date and Time: 14.03.2012. 12:00h
Sampling manner and method: according to standard SRPS CEN TR/15310-2:2009 and instructions UZ 011 Waste sampling	
Date and time of reception of sample for testing: 15.03.2012.	
General data on the sample (if relevant):	
<p>Notes:</p> <p>Integral part of this report is the report by Institute of Nuclear Sciences "Vinča", Laboratory for Chemical Dynamics and Permanent Education (Lab. 060), Report on testing No. S12/136</p> <p>Integral part of this report is the report by Anahem Laboratory from Belgrade, Report on testing No. 22032301, dated April, 2012.</p> <p>Integral part of this report is photo documentation related to the sampling of the waste in question, on CD.</p> <p>The test results refer only to the tested sample.</p>	

A) RESULTS OF PHYSICAL, PHYSICO- CHEMICAL AND CHEMICAL INVESTIGATIONS

DESCRIPTION OF WASTE AND SENSORY PROPERTIES			
Sludge in loose condition. Black in color. Strong odor. Very wet.			
Parameter	Determined value	Referential value	Method mark
Moisture percentage(%)	84.48	-	EN 14346:2006
Percentage of solids (%)	15.52	-	EN 14346:2006
Ash (550°C) (%)	39.21	-	EN 15169:2007
Loss in calcination (550°C) (%)	60.79	10(10 ²)	EN 15169:2007
Content of metal in mg/kg *			EPA 3050B
Lead Pb	89.9	120 ⁽ⁱⁱ⁾ 1200 ⁽ⁱⁱⁱ⁾ 1000 (10000) **	EPA 200.7 Rev 5
Cadmium Cd	3.0	2.5 ⁽ⁱⁱ⁾ 40 ⁽ⁱⁱⁱ⁾ 60(5000)**	EPA 200.7 Rev 5
Zinc Zn	530	1500 ⁽ⁱⁱ⁾ 4000 ⁽ⁱⁱⁱ⁾ 5000- 1 000 000	EPA 200.7 Rev 5
Copper Cu	344	700 ⁽ⁱⁱ⁾ 1750 ⁽ⁱⁱⁱ⁾ 70000	EPA 200.7 Rev 5
Nickel Ni	31.2	60 ⁽ⁱⁱ⁾ 400 ⁽ⁱⁱⁱ⁾ 3000	EPA 200.7 Rev 5
Total Chrome Cr	52.7	100 ⁽ⁱⁱ⁾ 1000 ⁽ⁱⁱⁱ⁾ 2500- 1 000 000	EPA 200.7 Rev 5 +EPA 245.1
Mercury Hg	0.9	1.6 ⁽ⁱⁱ⁾ 25 ⁽ⁱⁱⁱ⁾ 7 (20)**	EPA 200.7 Rev 5
Arsenic As	73	15 ⁽ⁱⁱ⁾ 75 ⁽ⁱⁱⁱ⁾ 50(5000)**	EPA 200.7 Rev 5
Barium Ba	284	100000	EPA 200.7 Rev 5
Antimony Sb	<3.6	700	EPA 200.7 Rev 5
Selenium Se	<6.5	40	EPA 200.7 Rev 5
Molybdenum Mo	<0.3	9000	EPA 200.7 Rev 5
Phosphorus P	35700	-	EPA 200.7 Rev 5
Aluminum Al	4660	-	EPA 200.7 Rev 5
Vanadium V	8.8	2000	EPA 200.7 Rev 5
Calcium Ca	33300	-	EPA 200.7 Rev 5
Cobalt Co	4.8	100000	EPA 200.7 Rev 5
Iron Fe	19300		EPA 200.7 Rev 5
Kalium K	2740		EPA 200.7 Rev 5
Magnesium Mg	16500		EPA 200.7 Rev 5
Natrium Na	789		EPA 200.7 Rev 5
Solder Sn	8.1		EPA 200.7 Rev 5
Beryllium be	0.2	30	EPA 200.7 Rev 5
Total carbohydrates C10-C40 (GC-FID) g/kg*	0.13	(20)** (500mg/kg ³)	EN 14039:2004

Polycyclic aromatic carbohydrates	mg/kg*		EN 15527:2007
Naphthalene	0.014	10	EN 15527:2007
Acenaphthylene	<0.010	10	EN 15527:2007
Acenaphthene	<0.010	10	EN 15527:2007
Fluorene	0.030	10	EN 15527:2007
Phenanthrene	0.148	10	EN 15527:2007
Anthracene	0.152	10	EN 15527:2007
Fluoranthene	0.092	10	EN 15527:2007
Pyrene	0.074	10	EN 15527:2007
Benzo(a)anthracene	<0.010	10	EN 15527:2007
Chrysene	<0.010	10	EN 15527:2007
Benzo(b)fluoranthene	<0.010	10	EN 15527:2007
Benzo(k)fluoranthene	<0.010	10	EN 15527:2007
Benzo (a)pyrene	<0.010	10	EN 15527:2007
Indeno(c,d)pyrene	<0.010	10	EN 15527:2007
Dibenzo(a,h)anthracene	<0.010	10	EN 15527:2007
Benzo(g,h,i)perylene	<0.010	10	EN 15527:2007
Total PAH	0.510	(100)** (100 ³)	EN 15527:2007

Volatile organic compounds mg/kg*:			
Benzol	<0.010	(Total BTEX	VDM 0220
Toluene	0.600	500)*	VDM 0220
m,p Xylol	0.100		VDM 0220
o-xylol	0.100		VDM 0220
Ethylbenzol	<0.10		VDM 0220
Total BTEX	0.800		VDM 0220

Organochlorine pesticides mg/kg*			
Lindan	<0.10	50	VDM 0107
Aldrin	<0.10	50	VDM 0107
Dieldrin	<0.10	50	VDM 0107
Endrin	<0.10	50	VDM 0107
Hepatochlor epoxyde	<0.10	50	VDM 0107
Chlordan	<0.10	50	VDM 0107
Hexachlorobenzene	<0.10	50	VDM 0107
Methoxychlor	<0.10	50	VDM 0107
DDT(DDE+DDD)	<0.10	50	VDM 0107

Trihalomethanes mg/kg*			
Chloroform	<0.10		VDM 0068
Trihalomethanes (total)	<0.10		VDM 0068

Other volat. organic compounds mg/kg*			
Trechlorethylene	<0.10		VDM 0068
Terachloethylene	<0.10		VDM 0068
Carbon tetrachloride	<0.10		VDM 0068

PCB 28 (mg/kg)	<0.10		EN 15308:2006
PCB 52 (mg/kg)	<0.10		EN 15308:2006
PCB 101 (mg/kg)	<0.10		EN 15308:2006
PCB 118 (mg/kg)	<0.10		EN 15308:2006
PCB 138 (mg/kg)	<0.10		EN 15308:2006
PCB 153 (mg/kg)	<0.10		EN 15308:2006
PCB 180 (mg/kg)	<0.10		EN 15308:2006
Polychlorinated biphenyl (total) mg/kg*	<0.10	0.1 of congener ⁽ⁱⁱ⁾ 0.2 of congener ⁽ⁱⁱⁱ⁾ 50(100)**	EN 15308:2006

Content in EP extract (neutral test, L/S =10/1) mg/kg*			SRPS EN 12457-4:2008
pH value	7.8	6-13**	ISO 10523:2008
Residue from evaporation at 105°C	28400	100000**(60000 ¹) (100000 ²) (4000 ³)	EN 15216:2007
Chlorides (Cl)	<20.0	(15000 ¹) (25000 ²) (800 ³)	SRPS ISO 9297-1:2007
Cyanide – total (CN)	<0.1	200**	ASTM D2036-82
Sulphates (SO ₄ ²⁻)	6941.4	(20000 ¹) (50000 ²) (1000 ³)	EPA 375.4
Phenol index	86.8	1000**(1 ³)	SRPS ISO 6439:1997
Fluorides (F)	<0.1	500**(150 ¹) (500 ²) (10 ³)	EPA300.1
Dissolved organic carbon (DOC)	8000	(800 ¹) (1000 ²) (500 ³)	SRPS ISO 8245:1994
Ammonia (NH ₄ ⁺)	7000	10000**	ISO 14911:1998
Nitrates(NO ₃)	101	-	EPA 300.1
Nitrites (NO ₂)	<0.06	1000**	EPA 300.1
Sulphides (S ²⁻)	<0.1	200**	ISO 10530:1992(E)
Chrome hexavalent Cr ⁺⁶	<0.5	20**	SMEWW 19 th Method3500- Cr ⁺⁶ D
Chemical oxygen demand COD (DICHROMATE METHOD) (O ₂)	35700	-	SRPS ISO 6060
Biochemical oxygen demand (BOD) (O ₂)	22600	-	SRPS ISO 5815:1994
AOX	0.75	100	SRPS EN ISO

			9562:2008
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Total solid organic carbon (TOC) in %*	21.4	6% ² , 3% ³	SRPS EN 13137:2005
Total nitrogen in % (mg/g) *	16.7 (167.7 mg/g)	-	SRPS ISO 11261:2005

Tests of content of macrocomponents

Parameter ^{b)}	Values in %	Mark of the method
SiO ₂	11	CEN/TR 15018
Al ₂ O ₃	2.9	CEN/TR 15018
Fe ₂ O ₃	3.4	CEN/TR 15018
CaO	0.45	CEN/TR 15018
MgO	1.6	CEN/TR 15018
TiO ₂	0.20	CEN/TR 15018
Mn ₂ O ₃	0.084	CEN/TR 15018

Test of halogen content

Content (%) ^{b)}:			
Chlorine (Cl)	0.29	-	EN 14582/EPA 9056
Fluorine (F)	<0.05	-	EN 14582/EPA 9056
Bromine (Br)	<0.03	-	EN 14582/EPA 9056
Halogens total %	0.29	-	EN 14582/EPA 9056
Sulphur S (%)	1.4	-	EN 14582/EPA 9056

Parameter	Determined value	Referential value	Mark of the method
Salmonella MPN/ 10g SO	negative	0-10 ⁽ⁱⁱ⁾	Modif. VDM 0148

Note:

EN – European standards

EPA – Environmental Protection Agency (US) – method

VDM – validate documented method

VDM 220 – EPA publication SW – 846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods: Method 5021A, Automated Head Space, Method 8015 D nonhalogenated organics using GC/FID

VDM 0107 – Characterization of waste – determination of pesticides in waste by using gas chromatography method / mass spectrometry, EPA Method 8270D Semivolatile organic compounds by gas chromatography /mass spectrometry (GC/MS)
EPA Method 3510C, Separatory liquid-liquid extraction, EPA Method 3540C, Soxhlet extraction, EPA Method 3610C, Alumina clean up, EPA Method 3630C, Silica gel, clean up

VDM 0148 – Karakašević, B et al.: Practicum of standard methods for microbial routine work, Medicinska knjiga, 1967, page 1548-1551
Regulation on Methods of Microbiological Analysis and Super Analysis of Food, "Official Gazette SFRY" No. 25/80

SRPS ISO – Serbian technical standard in compliance with ISO standard
SMEWW – Standard methods for Examination of Water and Wastewater
ASTM – American Society for Testing and Materials
ISO – International Organization for Standardization

* dry mass

**concentration values refer to H15(H13) hazardous characteristic

¹ – concentration values refer to disposal of nonhazardous and hazardous waste to landfills for nonhazardous waste

² - concentration values refer to disposal of waste to landfills for hazardous waste

³ - concentration values refer to disposal of waste to landfills for inert waste

ii and iii Table 7. Limit Emission Values for Residue from treatment of municipal waste waters, according to the Regulation on emission limit values in waters and deadlines for the achievement thereof ("Official Gazette RS" No. 67/11)

Referential values and classification of waste are given based on:

- Commission Decision of 16. January 2001. amending Decision 2000/532/EC as regards the list of wastes;
- Risk-Based Waste Classification in California, National Academies Press, Washington, D.C., 1999.
- Interim guidelines on hazard characteristic H13 of Annex III to the Basel Convention, UNEP/CHW.7/11Add.3,22.07.2004.
- Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to classification, packaging and labeling of dangerous substances and its amendments including DIRECTIVE 2006/121/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 amending Council Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to classification, packaging and labeling of dangerous substances in order to adapt it to Regulation (EC) No 1907/2006 concerning Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) and establishing a European Chemicals Agency;
- The European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) 2007;
- Council Regulation (EC) No 1195/2006 of 18 July 2006 amending Annex IV to regulation (EC) No 850/2004 of the European Parliament and of the Council on persistent organic pollutants.
- Environment Agency HWR08 How to find out if waste oil and wastes that contain oil are hazardous, Version 3.1 – June 2007, Environment Agency, Rio House, Waterside Drive, Aztec West;

<p align="center">INSTITUTE FOR NUCLEAR SCIENCES "VINČA" Laboratory for Chemical Dynamics and Permanent Education WU Chemical Dynamics (060)</p>			
Address: Mike Petrovića – Alasa 12-14, 11351 Vinča PO box no. 522 11001 Belgrade Tel/fax 011-2455-654 E-mail: lab060@vinca.rs		Register number:07035250 Code of activity:7219 TIN: 101877940 T.m. 205-113594-67	ZP.3.060.03 Page 1/1
Institute for Public Health Laboratory for human ecology and ecotoxicology 54a Despota Stefana Blvd. 11 000 Belgrade tel/fax : 3225080			ATC 01-063 ACREDITTED LABORATORY FOR TESTING SRPS ISO/ IEC 17025:2006

Subject: REPORT ON TESTING no. S12/136

Upon your request No. 11/71 dated 16.03.2012. analysis on the content of radionuclide in the submitted sample was conducted. The testing results are given in the Table 1.

Table 1.

Internal mark of sample	Mark of the sample	Description of sample	⁴⁰ K (Bq/kg)	²³² Th (Bq/kg)	²²⁶ Ra (Bq/kg)	¹³⁷ Cs (Bq/kg)
S12/136	12-11-0191	Waste stabilized pressed sludge from waste water treatment process	< 14	<3.7	<20	<2.8

The testing was performed by employing the technique of gamma spectrometry on semiconductor HPGe detector after the method IAEA TR-295.

The results of analysis showed that the content of radionuclide in the tested sample was below the radioactive contamination limits set for waste material (Rulebook on limits of radioactive contamination of people, work and living environment and decontamination methods, Art. 12, "Official Gazette RS" No. 38/2011) and therefore, regarding the radioactive contamination, the tested sample meets the requirements for disposal to the environment.

Test leader:

PhD Mirjana Marković

Acting Director:

Velibor Andrić, dipl. ing. phys.chem.

- Law on confirmation of Basel Convention on the Control of transboundary movement of hazardous waste and their disposal ("Official Gazette SRY – International agreements, no. 2/99);
- COUNCIL DECISION OF 19 December 2002 establishing the criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC (2003/33/EC)
- Guidance for waste destined for disposal in landfills, Version 2, June 2006, Interpretation of the Waste Acceptance Requirements of the Landfill, (England and Wales) Regulations 2002 (as amended)
- Regulation on categories, testing and waste classification ("Official Gazette RS" No. 56/2010)
- Regulation on waste disposal to landfills ("Official Gazette RS" no. 92/2010).

Place and date of conducted tests: Belgrade, 19.04.2012.

CHIEF OF LABORATORY:

Tests certified by:

PhD Marina Mandić – Miladinović, hygiene specialist

Place and date of report : Belgrade, 19.04.2012.

Report made by:

MSc Dragan Crnković, technology

Unit Chief:

PhD Slaviša Mladenović, hygiene specialist

DIRECTOR'S ASSISTANT

Prim. PhD Snežana Matić – Besarabić, hygiene spec.