



Udvaskning fra tagpap

Katepal K-PS 170/5000

Tankudvaskningstest DS/CEN/TS 16637-2:2014



Rapport udarbejdet for

Katepal OY

af

Jiri Hyks og Ole Hjelmar

Danish Waste Solutions ApS

Februar 2020

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Bilag 1: Resultater af tankudvaskningstest

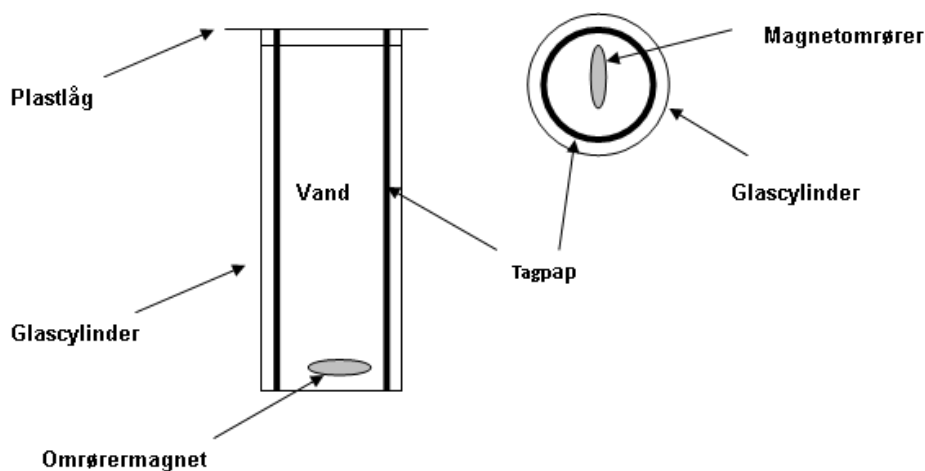
Bilag 2: Akkrediteret analyserapport fra ALS Tjekkiet

1 Baggrund

I Danmark findes der ikke officielle normer/regler eller grænseværdier for stofudvaskningen fra tagdækningsprodukter, herunder bitumenbaserede tagdækningsmembraner. Ikke desto mindre er bygherrer og myndigheder ofte interesserede i at kunne redegøre for den eventuelle miljøbelastning, som bortledning af afløbsvand fra tage dækket med sådanne tagmembraner kan udgøre. MiJAMA A/S har derfor på vegne af Katepal OY anmodet Danish Waste Solutions ApS (DanWS) om at gennemføre en udvaskningstest på produktet K-PS 170/5000 i henhold til tankudvaskningstesten DS/CEN/TS 16637-2:2014 *Byggevarer – Vurdering af afgivelse af farlige stoffer – Del 2: Horisontal dynamisk overfladeudvaskningsprøvning*. K-PS 170/5000, der produceres af finske Katepal OY, er en fleksibel, vandtæt tagdækningsmembran baseret på styren-butadienstyren (SBS)-modificeret asfalt. Denne rapport beskriver de gennemførte aktiviteter og de fundne resultater.

2 Gennemførelse af udvaskningstests

Udvaskning fra fleksible bitumenmembraner/tagpap er et overfladefænomen, hvor stofudvaskningen forventes dels at være proportional med det eksponerede overfladeareal, dels at aftage betydeligt som funktion af tiden. Hvis udvaskningen er styret af diffusion ud gennem overfladen, vil fluxen (stofudvaskningen per overfladeenhed per tidsenhed) være omvendt proportional med kvadratroden på tiden, dvs. i en dobbeltlogaritmisk afbildning vil fluxen aftage lineært som funktion af tiden med en hældning af udvaskningskurven på $-0,5$, indtil der ikke kan udvaskes mere stof. Til at teste tagpap under forhold, som tager hensyn til den forventede udvaskningsmekanisme, har denne rapport forfatter udviklet det på Figur 1 viste udstyr, hvor et tilskåret stykke af tagpappet anbringes på indersiden af en glascylinder med den eksponerede overflade vendt ind mod midten af cylinderen. Denne metode indgår nu i den harmoniserede europæiske testmetode, DS/CEN/TS 16637-2, hvor den er beskrevet i Annex C. Metoden er anvendt til testning af stofudvaskningen fra en rulle af den fleksible membran, K-PS 170/5000, som DanWS modtog fra MiJAMA i september 2019 (registreret hos DanWS som 2019-106-A).



Figur1 Tankudvaskningsudstyr til undersøgelse af stofudvaskningen fra tagpap.

Efter fjernelse af den første meter af membranmaterialet fra den modtagne rulle, blev en repræsentativ delprøve udskåret fra rullen og efter tilpasning anbragt en lodretstående cylinder med diameter = 10 cm og højde = 29,5 cm med bagsiden mod cylindervæggen i hele pladens højde, så siderne sluttede

tæt og derved forhindrede eksponering af kanter og bagside til det vand, som efterfølgende placeredes i cylinderen. I denne sammenhæng blev der ikke anvendt omrøring (har ikke væsentlig betydning ved de aktuelle meget lave stofkoncentrationer). Ved testens start blev der tilsat demineraliseret vand til en højde ca. 1 – 2 cm under membranmaterialets overkant, og cylinderen blev tildækket med et låg.

Det demineraliserede vand blev udskiftet efter følgende (akkumulerede) tider: 6 timer, 1 døgn, 2,25 døgn, 4 døgn, 9 døgn, 16 døgn, 36 døgn og 64 døgn, som beskrevet i DS/CEN/TS 16637-2. De udtagne vandprøver (8 eluater i alt) blev efterfølgende analyseret for pH, ledningsevne og en række uorganiske stoffer (klorid, fluorid, sulfat, Si, Ca, Mg, Na, K, Al, As, Ba, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, P, Pb, Sb, Se, og Zn) samt de 16 polycykliske aromatiske hydrocarboner (PAH'er), som indgår i US EPA-pakken (naphthalen, acenaphtylen, acenaphten, fluoren, phenanthren, anthracen, fluoranthen, pyren, benz(a)anthracen, chrysen/triphenylen, benz(b+k+j)fluoranthen, benz(a)pyren, indeno(1,2,3-cd)pyren, dibenz(a,h)anthracen og benz(g,h)perylen). Testningen er udført af DanWS og alle kemiske analyser er foretaget af det akkrediterede laboratorium ALS i Prag (Tjekkiet) i februar 2020.

Der er udført en bestemmelse af baggrundskoncentrationer (blindtest) i henhold til DS/CEN/TS 16637-2:2014. Der er i samme udstyr, som er anvendt til testen, men uden testmateriale isat, tilsat demineraliseret vand, som efter 1 døgn er blevet opsamlet og erstattet med rent vand. Efter yderligere et døgn er denne fraktion også blevet opsamlet, og begge eluatfraktioner er derefter blevet analyseret efter samme program som de øvrige eluater, dvs. klorid, fluorid, sulfat, Si, Ca, Mg, Na, K, Al, As, Ba, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, P, Pb, Sb, Se, Zn og PAH (US EPA 16). Alle resultaterne – undtagen for Zn – lå under detektionsgrænserne for analyserne for de respektive stoffer.

3 Resultater og diskussion

Resultaterne af testen er vist i Bilag 1, hvor de er opdelt i to sektioner, en for uorganiske stoffer og en for PAH'er. I hver sektion viser den første tabel de fundne koncentrationer (i mg/l) af de undersøgte stoffer i hvert af de 8 eluater. Den anden tabel viser for hvert vandskift de udvaskede stofmængder per overfladearealenhed (i mg/m²) i hvert trin af testen, mens den tredje tabel viser de akkumulerede udvaskede stofmængder per overfladearealenhed (i mg/m²) som funktion af tiden eller antal eluater, mens den fjerde tabel viser den gennemsnitlige stofudvaskningshastighed per overfladearealenhed (fluxen, i g eller µg per m² per dag) for hver eluatfraktion (eller som funktion af tiden). Den sidste tabel i hver sektion viser resultaterne af blindprøverne.

Af resultaterne i Bilag 1 fremgår det, at for klorid, fluorid, sulfat, Si, Ca, Mg, Na, K, P, Ba, Cu, Mn, Ni og Zn ligger koncentrationsniveauet i alle 8 eluatfraktioner over detektionsgrænsen. For Co ligger koncentrationen i 5 af de 8 fraktioner under detektionsgrænsen, mens analyseresultaterne for Al, As, Cd, Mo, Pb, Sb og Se samt for alle PAH'erne ligger under detektionsgrænserne for analysemetoderne for alle 8 eluatfraktioner. Kun de 14 førstnævnte stoffer indgår derfor i den videre databehandling. Det fremgår endvidere af Bilag 1, at alle resultater af blindtestene, undtagen for Zn, ligger under detektionsgrænserne. Dette indikerer, at hverken afsmitning fra det anvendte udstyr eller stofindhold i det anvendte demineraliserede vand har haft målbar indflydelse på de fundne resultater.

Yderlige oplysninger vedrørende de analytiske grænseværdier, usikkerheden og anvendt analytiske metoder findes i den akkrediteret rapport fra ALS Tjekkiet (vedlagt som Bilag 2).

For at illustrere den potentielle effekt af stofudvaskningen og muliggøre en sammenligning med tidligere udførte undersøgelser af andre tagpaltyper, er der i Tabel 1 foretaget nogle scenarieberegninger med udgangspunkt i resultaterne i Bilag 1 for de 14 ovennævnte uorganiske stoffer. Der er regnet med et horisontalt tagareal på 30 000 m², en årlig nedbør på 600 mm, samt at taget er vådt i ca. 50 % tiden. Under disse forudsætninger vil den årlige mængde vand, der strømmer af fra taget være 18 000 m³ (der er ikke indregnet noget fordampning). På dette grundlag er der foretaget en beregning af det gennemsnitlige koncentrationsniveau af udvalgte stoffer i det afstrømmende vand over det første, andet, tredje og femte år efter pålægningen. Beregningerne er foretaget ved hjælp af ekstrapolationer af dob-

beltlogaritmiske afbildninger af de akkumulerede udvaskede stofmængder som funktion af tiden mellem 16 dage og 64 dage, som udgør en ret linje for alle stoffer.

Det ses af Tabel 1, at de resulterende koncentrationsniveauer for uorganiske stoffer ligesom ved tidligere målinger af udvaskning fra andre typer tagpap generelt er ganske lave og i mange tilfælde af samme størrelsesorden eller lavere end koncentrationsniveaet i forholdsvis rent regnvand, som er vist til sammenligning. Det ses også, at selv om blindprøverne havde et mindre indhold af Zn, ligger de beregnede gennemsnitlige zinkkoncentrationer i afløbsvandet betydeligt lavere end zinkkoncentrationen i den viste prøve af regnvand. Af Bilag 1 fremgår det, at der ikke blev udvasket målelige mængder af PAH ved testen.

Koncentrationsniveaet i det afstrømmende vand vil ikke ændres, hvis tagarealet ændres, men den samlede udvaskede stofmængde per år (fluxen) vil naturligvis forøges, hvis tagarealet forøges i forhold til det i scenarieberegningerne anvendte areal, og formindskes, hvis tagarealet reduceres.

Tabel 1 Scenarieberegninger af de resulterende koncentrationer af udvalgte stoffer i afløbsvand fra tagpappede tagarealer hidrørende fra udvaskning fra tagpappet. Til sammenligning er vist koncentrationsniveaet af de samme stoffer i regnvand opsamlet i Hørsholm i 2009.

Scenarieberegninger baseret på udvaskningstest						
Katepal K-PS 170/5000						
Horisontalt tagareal	30000 m ²					
Årlig nedbør	600 mm/year					
Procent af tiden med regn > 0,1 mm	50 %					
Baseret på udvaskningstest:	DS/CENTS 16637-2					
Beregningsperioder:		År 1	År 2	År 3	År 5	
Årlig mængde afløbsvand fra tag:	m ³ /år	18000	18000	18000	18000	
Koncentration i afløbsvand fra tag	Enhed	År 1	År 2	År 3	År 5	Regnvand
Klorid	mg/l	0,69	0,043	0,027	0,015	0,86
Fluorid	mg/l	0,13	0,018	0,012	0,0071	-
Sulfat	mg/l	8,5	3,8	3,0	2,3	< 1
Si	mg/l	0,10	0,034	0,025	0,018	< 0,04
Ca	mg/l	1,8	0,91	0,73	0,57	0,90
Mg	mg/l	0,075	0,016	0,011	0,0068	< 0,09
Na	mg/l	0,054	0,011	0,0073	0,0047	0,56
K	mg/l	0,33	0,078	0,054	0,036	< 0,5
P	mg/l	0,046	0,0057	0,0037	0,0022	-
Ba	µg/l	1,1	0,46	0,35	0,26	0,96
Cu	µg/l	0,91	0,11	0,074	0,045	1,5
Mn	µg/l	16	5,1	3,7	2,6	5,5
Ni	µg/l	4,2	0,58	0,38	0,23	< 0,5
Zn	µg/l	5,4	0,85	0,56	0,43	16

4 Konklusion

Der er gennemført en tanktest (DS/CEN/TS 16637-2) til undersøgelse af udvaskningen af salte, spor-elementer og PAH'er fra en prøve af tagpap af fabrikatet Katepal K-PS 170/5000. Resultaterne viser, at kun for klorid, fluorid, sulfat, Si, Ca, Mg, Na, K, P, Ba, Cu, Mn, Ni og Zn ligger koncentrationsniveauet i alle 8 eluatfraktioner over detektionsgrænsen, og for Al, As, Cd, Mo, Pb, Sb og Se samt for alle 16 US EPA PAH'er (inklusive de PAH'er, som Miljøstyrelsen normalt fokuserer på: fluoranthen, benz(b+k+j)fluoranthen, benz(a)pyren, indeno(1,2,3-cd)pyren og dibenz(a,h)anthracen) har der ikke i nogen af eluaterne kunnet måles indhold over detektionsgrænsen (for Co gjaldt dette for 5 ud af de 8 eluater). Scenarieregninger viser, at udvaskningen fra Katepal K-PS 170/5000 for de undersøgte stoffer generelt er sammenlignelig med de udvaskningsresultater, der tidligere er fundet for andre tagpaptyper.

Bilag 1: Resultater af tankudvaskningstest



Test report

Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **Material type:** Construction
DanWS ID: 2019-106-A **Sample received:**
Customer ID: Katepal K-PS 170/5000 **Test period:** 02-dec-19 / 04-feb-20

Amount of received laboratory sample (kg): **402,0**
 Cutting/crushing of test sample before testing? **Yes** Note: Details available in the main report

Details on test specimen

Specimen geometry: cylinder
 Exposed Area, A: 682,7 cm²
 Weight, wet: 402 g
 Estimated volume: 291,5 cm³
 Density: 1,38 g/cm³

Details on testing conditions

Leaching vessel material: Glass
 Leaching vessel volume: 1674 cm³
 Volume of leachant (V1): 1658,9 ml
 Temperature during test: 21-25 °C
 Loss of weight (ma1-2): 0,0 g
 Loss of weight (ma3-8): 0,0 g

Eluate pretreatment

Filtration of eluate: no
 Filter type:

Filtration equipment: 0
 Filter pore size (µm):

Analysis of V (ml) Stabilised ml

Analysis of	V (ml)	Stabilised	ml
Anions	60	-	-
Metals	60	HNO ₃	-
NVOC/DOC	-	-	-
-	-	-	-
-	-	-	-

Additional information (if relevant)

not relevant
not relevant
not relevant
not relevant
not relevant

Presentation of results of the leaching test

This test report has 5 pages and contains for each substance:

The measured concentrations per step, contact time and volume of the eluate from each step (page 2)

The released quantities per step (page 3)

The cumulatively released quantities (page 4)

Flux for each substance and eluate fraction (page 5)

NB: an assessment of release mechanisms is **not** part of this report; it is, however, available upon request

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 1/5)

Test carried out: EK-UCHP

Project management: 04/02/2020 JHY

QA/QC: 19/02/2020 JHY

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Test report - Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-A **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0
Interval contact time (days)	0,25	0,75	1,25	1,75	5,0	7,0	20,0	28,0
Accumul. contact time (days)	0,25	1,00	2,25	4,0	9,0	16,0	36,0	64,0
Leaching renewal date	02-dec	03-dec	04-dec	06-dec	11-dec	18-dec	07-jan	04-feb
Leaching renewal time	16:00	10:00	16:00	10:00	10:00	10:00	10:00	10:00
L/A (l/m ²)	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,2

Measured solution concentrations per step

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-	6,1	6,5	6,6	7,2	7,4	6,8	6,8	7,5
x Ledningsevne	mS/cm	0,013	0,007	0,010	0,011	0,023	0,027	0,044	0,046
klorid	mg/l	10	7,0	4,4	4,6	9,9	13	45	85
fluorid	mg/l	0,40	0,40	0,40	0,20	0,40	0,20	0,20	0,40
sulfat	mg/l	17	6,1	4,0	3,9	11	15	30	34
Si	mg/l	0,081	0,098	0,11	0,11	0,25	0,31	0,39	0,35
Ca	mg/l	0,69	0,61	1,1	1,3	3,2	4,2	6,8	6,9
Mg	mg/l	0,24	0,13	0,15	0,12	0,18	0,16	0,22	0,22
Na	mg/l	0,22	0,15	0,066	0,060	0,11	0,095	0,13	0,18
K	mg/l	0,83	0,40	0,40	0,50	0,85	0,90	1,1	1,0
Al	mg/l	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010	0,015	0,010
As	mg/l	< 0,0050	< 0,0050	< 0,0050	< 0,0050	< 0,0050	< 0,0050	< 0,0050	< 0,0050
Ba	mg/l	0,0012	0,0010	0,00060	0,00057	0,0016	0,0021	0,0037	0,0043
Cd	mg/l	< 0,00040	< 0,00040	< 0,00040	< 0,00040	< 0,00040	< 0,00040	< 0,00040	< 0,00040
Co	mg/l	0,0065	0,0022	< 0,0020	< 0,0020	< 0,0020	< 0,0020	< 0,0020	0,0031
Cr	mg/l	< 0,0010	< 0,0010	< 0,0010	< 0,0010	< 0,0010	< 0,0010	< 0,0010	< 0,0010
Cu	mg/l	0,0020	0,0050	0,0020	0,0020	0,0020	0,0020	0,0020	0,0020
Fe	mg/l	0,047	0,015	0,0040	0,0040	0,0040	0,0040	0,0062	0,0048
Mn	mg/l	0,034	0,021	0,023	0,015	0,026	0,027	0,051	0,059
Mo	mg/l	< 0,0020	0,0050	< 0,0020	< 0,0020	< 0,0020	< 0,0020	< 0,0020	< 0,0020
Ni	mg/l	0,027	0,012	0,0091	0,0051	0,0062	0,0056	0,0086	0,011
P	mg/l	0,10	0,25	0,10	0,10	0,10	0,10	0,10	0,10
Pb	mg/l	< 0,0050	< 0,0050	< 0,0050	< 0,0050	< 0,0050	< 0,0050	< 0,0050	< 0,0050
Sb	mg/l	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010
Se	mg/l	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010	< 0,010
Zn	mg/l	0,012	0,015	0,0050	0,012	0,018	0,018	0,0071	0,020

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 2/5)

Test carried out: EK-UCHP

Project management: 04/02/2020 / JHY

QA/QC: 19/02/2020 / JHY



Test report - Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-A **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0
Interval contact time (days)	0,25	0,75	1,25	1,75	5,0	7,0	20,0	28,0
Accumul. contact time (days)	0,25	1,00	2,25	4,0	9,0	16,0	36,0	64,0
Leaching renewal date	02-dec	03-dec	04-dec	06-dec	11-dec	18-dec	07-jan	04-feb
Leaching renewal time	16:00	10:00	16:00	10:00	10:00	10:00	10:00	10:00
L/A (l/m ²)	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,2

Released quantities per step

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-	6,1	6,5	6,6	7,2	7,4	6,8	6,8	7,5
x Ledningsevne	mS/cm	0,013	0,007	0,010	0,011	0,023	0,027	0,044	0,046
klorid	mg/m ²	240	170	110	110	240	310	1100	2100
fluorid	mg/m ²	9,7	9,7	9,7	4,8	9,7	4,8	4,8	9,7
sulfat	mg/m ²	420	150	95	93	260	360	720	810
Si	mg/m ²	2,0	2,4	2,6	2,7	6,0	7,5	9,3	8,5
Ca	mg/m ²	17	15	26	32	76	100	160	170
Mg	mg/m ²	5,7	3,2	3,6	2,9	4,3	3,8	5,3	5,4
Na	mg/m ²	5,4	3,6	1,6	1,5	2,6	2,3	3,2	4,4
K	mg/m ²	20	9,6	9,7	12	21	22	25	24
Al	mg/m ²	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24	0,37	0,25
As	mg/m ²	< 0,12	< 0,12	< 0,12	< 0,12	< 0,12	< 0,12	< 0,12	< 0,12
Ba	mg/m ²	0,028	0,024	0,015	0,014	0,039	0,051	0,090	0,10
Cd	mg/m ²	< 0,0097	< 0,0097	< 0,0097	< 0,0097	< 0,0097	< 0,0097	< 0,0097	< 0,0097
Co	mg/m ²	0,16	0,053	< 0,048	< 0,048	< 0,048	< 0,048	< 0,048	0,075
Cr	mg/m ²	< 0,024	< 0,024	< 0,024	< 0,024	< 0,024	< 0,024	< 0,024	< 0,024
Cu	mg/m ²	0,048	0,12	0,048	0,048	0,048	0,048	0,048	0,048
Fe	mg/m ²	1,1	0,37	0,097	0,097	0,097	0,097	0,15	0,12
Mn	mg/m ²	0,83	0,50	0,55	0,37	0,62	0,64	1,2	1,4
Mo	mg/m ²	< 0,048	0,12	< 0,048	< 0,048	< 0,048	< 0,048	< 0,048	< 0,048
Ni	mg/m ²	0,66	0,30	0,22	0,12	0,15	0,14	0,21	0,27
P	mg/m ²	2,4	6,0	2,4	2,4	2,4	2,4	2,4	2,4
Pb	mg/m ²	< 0,12	< 0,12	< 0,12	< 0,12	< 0,12	< 0,12	< 0,12	< 0,12
Sb	mg/m ²	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24
Se	mg/m ²	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24	< 0,24
Zn	mg/m ²	0,30	0,36	0,12	0,28	0,44	0,44	0,17	0,49

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 3/5)

Test carried out: EK-UCHP

Project management: 04/02/2020 / JHY

QA/QC: 19/02/2020 / JHY



Test report - Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-A **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0
Interval contact time (days)	0,25	0,75	1,25	1,75	5,0	7,0	20,0	28,0
Accumul. contact time (days)	0,25	1,00	2,25	4,0	9,0	16,0	36,0	64,0
Leaching renewal date	02-dec	03-dec	04-dec	06-dec	11-dec	18-dec	07-jan	04-feb
Leaching renewal time	16:00	10:00	16:00	10:00	10:00	10:00	10:00	10:00
L/A (l/m2)	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,2

Cumulatively released quantities per step

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-	6,1	6,5	6,6	7,2	7,4	6,8	6,8	7,5
x Ledningsevne	mS/cm	0,013	0,007	0,010	0,011	0,023	0,027	0,044	0,046
klorid	mg/m2	240	410	520	630	870	1200	2300	4300
fluorid	mg/m2	9,7	19	29	34	44	48	53	63
sulfat	mg/m2	420	570	660	750	1000	1400	2100	2900
Si	mg/m2	2,0	4,3	6,9	9,6	16	23	32	41
Ca	mg/m2	17	31	57	88	160	270	430	600
Mg	mg/m2	5,7	8,9	12	15	20	24	29	34
Na	mg/m2	5,4	9,0	11	12	15	17	20	25
K	mg/m2	20	30	39	51	72	93	120	140
Al	mg/m2	< 0,24	< 0,48	< 0,73	< 0,97	< 1,2	< 1,5	< 1,8	< 2,1
As	mg/m2	< 0,12	< 0,24	< 0,36	< 0,48	< 0,60	< 0,73	< 0,85	< 0,97
Ba	mg/m2	0,028	0,052	0,067	0,081	0,12	0,17	0,26	0,36
Cd	mg/m2	< 0,0097	< 0,019	< 0,029	< 0,039	< 0,048	< 0,058	< 0,068	< 0,077
Co	mg/m2	0,16	0,21	< 0,26	< 0,31	< 0,36	< 0,40	< 0,45	< 0,53
Cr	mg/m2	< 0,024	< 0,048	< 0,073	< 0,097	< 0,12	< 0,15	< 0,17	< 0,19
Cu	mg/m2	0,048	0,17	0,22	0,27	0,31	0,36	0,41	0,46
Fe	mg/m2	1,1	1,5	1,6	1,7	1,8	1,9	2,0	2,2
Mn	mg/m2	0,83	1,3	1,9	2,3	2,9	3,5	4,7	6,2
Mo	mg/m2	< 0,048	0,17	< 0,22	< 0,27	< 0,31	< 0,36	< 0,41	< 0,46
Ni	mg/m2	0,66	0,96	1,2	1,3	1,5	1,6	1,8	2,1
P	mg/m2	2,4	8,5	11	13	16	18	21	23
Pb	mg/m2	< 0,12	< 0,24	< 0,36	< 0,48	< 0,60	< 0,73	< 0,85	< 0,97
Sb	mg/m2	< 0,24	< 0,48	< 0,73	< 0,97	< 1,2	< 1,5	< 1,7	< 1,9
Se	mg/m2	< 0,24	< 0,48	< 0,73	< 0,97	< 1,2	< 1,5	< 1,7	< 1,9
Zn	mg/m2	0,30	0,66	0,78	1,1	1,5	1,9	2,1	2,6

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 4/5)

Test carried out: EK-UCHP

Project management: 04/02/2020 / JHY

QA/QC: 19/02/2020 / JHY



Test report - Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-A **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0
Interval contact time (days)	0,25	0,75	1,25	1,75	5,0	7,0	20,0	28,0
Accumul. contact time (days)	0,25	1,00	2,25	4,0	9,0	16,0	36,0	64,0
Leaching renewal date	02-dec	03-dec	04-dec	06-dec	11-dec	18-dec	07-jan	04-feb
Leaching renewal time	16:00	10:00	16:00	10:00	10:00	10:00	10:00	10:00
L/A (l/m2)	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,2

Flux for each substance and eluate fraction

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-	6,1	6,5	6,6	7,2	7,4	6,8	6,8	7,5
x Ledningsevne	mS/cm	0,013	0,007	0,010	0,011	0,023	0,027	0,044	0,046
klorid	mg/(m2-day)	960	230	85	63	48	44	55	73
fluorid	mg/(m2-day)	39	13	7,7	2,8	1,9	0,69	0,24	0,35
sulfat	mg/(m2-day)	1700	200	76	53	52	52	36	29
Si	mg/(m2-day)	7,8	3,2	2,1	1,5	1,2	1,1	0,47	0,30
Ca	mg/(m2-day)	66	20	20	18	15	14	8,2	6,0
Mg	mg/(m2-day)	23	4,3	2,9	1,7	0,86	0,55	0,26	0,19
Na	mg/(m2-day)	21	4,8	1,3	0,83	0,53	0,33	0,16	0,16
K	mg/(m2-day)	80	13	7,7	6,9	4,1	3,1	1,3	0,87
Al	mg/(m2-day)	< 0,97	< 0,32	< 0,19	< 0,14	< 0,048	< 0,035	0,018	0,0088
As	mg/(m2-day)	< 0,48	< 0,16	< 0,097	< 0,069	< 0,024	< 0,017	< 0,0060	< 0,0043
Ba	mg/(m2-day)	0,11	0,032	0,012	0,0079	0,0079	0,0072	0,0045	0,0037
Cd	mg/(m2-day)	< 0,039	< 0,013	< 0,0077	< 0,0055	< 0,0019	< 0,0014	< 0,00048	< 0,00035
Co	mg/(m2-day)	0,63	0,071	< 0,039	< 0,028	< 0,0097	< 0,0069	< 0,0024	0,0027
Cr	mg/(m2-day)	< 0,097	< 0,032	< 0,019	< 0,014	< 0,0048	< 0,0035	< 0,0012	< 0,00086
Cu	mg/(m2-day)	0,19	0,16	0,039	0,028	0,0097	0,0069	0,0024	0,0017
Fe	mg/(m2-day)	4,6	0,49	0,077	0,055	0,019	0,014	0,0075	0,0041
Mn	mg/(m2-day)	3,3	0,66	0,44	0,21	0,12	0,092	0,061	0,051
Mo	mg/(m2-day)	< 0,19	0,16	< 0,039	< 0,028	< 0,0097	< 0,0069	< 0,0024	< 0,0017
Ni	mg/(m2-day)	2,6	0,40	0,18	0,070	0,030	0,019	0,010	0,0095
P	mg/(m2-day)	9,7	8,1	1,9	1,4	0,48	0,35	0,12	0,086
Pb	mg/(m2-day)	< 0,48	< 0,16	< 0,097	< 0,069	< 0,024	< 0,017	< 0,0060	< 0,0043
Sb	mg/(m2-day)	< 0,97	< 0,32	< 0,19	< 0,14	< 0,048	< 0,035	< 0,012	< 0,0086
Se	mg/(m2-day)	< 0,97	< 0,32	< 0,19	< 0,14	< 0,048	< 0,035	< 0,012	< 0,0086
Zn	mg/(m2-day)	1,2	0,49	0,097	0,16	0,087	0,062	0,0086	0,018

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 5/5)

Test carried out: EK-UCHP

Project management: 04/02/2020 / JHY

QA/QC: 19/02/2020 / JHY



Test report - Horizontal dynamic surface leaching test (BLANK TEST) Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-BL **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0						
Interval contact time (days)	1,00	1,00						
Accumul. contact time (days)								
Leaching renewal date	06-feb	07-feb						
Leaching renewal time	10:00	10:00						
L/A (l/m2)								

Measured solution concentrations per step

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-								
x Conductivity	mS/cm								
klorid	mg/l	< 0,60	< 0,60						
fluorid	mg/l	< 0,20	< 0,20						
sulfat	mg/l	< 0,60	< 0,60						
Si	mg/l	< 0,020	< 0,020						
Ca	mg/l	< 0,10	< 0,10						
Mg	mg/l	< 0,0060	< 0,0060						
Na	mg/l	< 0,060	< 0,060						
K	mg/l	< 0,10	< 0,10						
Al	mg/l	< 0,010	< 0,010						
As	mg/l	< 0,0050	< 0,0050						
Ba	mg/l	< 0,00050	< 0,00050						
Cd	mg/l	< 0,00040	< 0,00040						
Co	mg/l	< 0,0020	< 0,0020						
Cr	mg/l	< 0,0010	< 0,0010						
Cu	mg/l	< 0,0020	< 0,0020						
Fe	mg/l	< 0,0040	< 0,0040						
Mn	mg/l	< 0,00050	< 0,00050						
Mo	mg/l	< 0,0020	< 0,0020						
Ni	mg/l	< 0,0020	< 0,0020						
P	mg/l	< 0,10	< 0,10						
Pb	mg/l	< 0,0050	< 0,0050						
Sb	mg/l	< 0,010	< 0,010						
Se	mg/l	< 0,010	< 0,010						
Zn	mg/l	0,0056	0,0099						

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 1/1)

Test carried out: EK-UHP

Project management: 19/02/2020 / JHY

QA/QC: 19/02/2020 / OH



Test report

Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **Material type:** Construction
DanWS ID: 2019-106-A **Sample received:**
Customer ID: Katepal K-PS 170/5000 **Test period:** 02-dec-19 / 04-feb-20

Amount of received laboratory sample (kg): **402,0**
 Cutting/crushing of test sample before testing? **Yes** *Note: Details available in the main report*

Details on test specimen

Specimen geometry: cylinder
 Exposed Area, A: 682,7 cm²
 Weight, wet: 402 g
 Estimated volume: 291,5 cm³
 Density: 1,38 g/cm³

Details on testing conditions

Leaching vessel material: Glass
 Leaching vessel volume: 1674 cm³
 Volume of leachant (V1): 1658,9 ml
 Temperature during test: 21-25 °C
 Loss of weight (ma1-2): 0,0 g
 Loss of weight (ma3-8): 0,0 g

Eluate pretreatment

Filtration of eluate: no
 Filter type:

Filtration equipment: 0
 Filter pore size (µm):

Analysis of V (ml) Stabilised ml

Analysis of	V (ml)	Stabilised	ml
Anions	-	-	-
Metals	-	-	-
NVOC/DOC	-	-	-
PAH	250	-	-
-	-	-	-

Additional information (if relevant)

not relevant
not relevant
not relevant
not relevant
not relevant

Presentation of results of the leaching test

This test report has 5 pages and contains for each substance:

The measured concentrations per step, contact time and volume of the eluate from each step (page 2)

The released quantities per step (page 3)

The cumulatively released quantities (page 4)

Flux for each substance and eluate fraction (page 5)

NB: an assessment of release mechanisms is **not** part of this report; it is, however, available upon request

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2970 Hørsholm

Denmark

Test report: 2019-106 (side 1/5)

Test carried out: EK-UCHP

Project management: 04/02/2020 JHY

QA/QC: 19/02/2020 JHY

JHY



Test report - Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-A **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0
Interval contact time (days)	0,25	0,75	1,25	1,75	5,0	7,0	20,0	28,0
Accumul. contact time (days)	0,25	1,00	2,25	4,0	9,0	16,0	36,0	64,0
Leaching renewal date	02-dec	03-dec	04-dec	06-dec	11-dec	18-dec	07-jan	04-feb
Leaching renewal time	16:00	10:00	16:00	10:00	10:00	10:00	10:00	10:00
L/A (l/m2)	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,2

Measured solution concentrations per step

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-	6,1	6,5	6,6	7,2	7,4	6,8	6,8	7,5
x Ledningsevne	mS/cm	0,013	0,007	0,010	0,011	0,023	0,027	0,044	0,046
Naphthalene	mg/l	< 0,00010	< 0,00010	< 0,00010	< 0,00010	< 0,00010	< 0,00010	< 0,00010	< 0,00010
Acenaphthylene	mg/l	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010
Acenaphthene	mg/l	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010
Fluorene	mg/l	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020
Phenanthrene	mg/l	< 0,000030	< 0,000030	< 0,000030	< 0,000030	< 0,000030	< 0,000030	< 0,000030	< 0,000030
Anthracene	mg/l	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020
Fluoranthene	mg/l	< 0,000030	< 0,000030	< 0,000030	< 0,000030	< 0,000030	< 0,000030	< 0,000030	< 0,000030
Pyrene	mg/l	< 0,000060	< 0,000060	< 0,000060	< 0,000060	< 0,000060	< 0,000060	< 0,000060	< 0,000060
Benz(a)anthracene	mg/l	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010
Chrysene	mg/l	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010
Benzo(b)fluoranthene	mg/l	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010
Benzo(k)fluoranthene	mg/l	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010
Benzo(a)pyrene	mg/l	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020	< 0,000020
Indeno(1,2,3-cd)pyrene	mg/l	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010
Benzo(g,h,i)perylene	mg/l	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010
Dibenz(a,h)anthracene	mg/l	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010	< 0,000010

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 2/5)

Test carried out: EK-UHP

Project management: 04/02/2020 / JHY

QA/QC: 19/02/2020 / JHY



Test report - Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-A **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0
Interval contact time (days)	0,25	0,75	1,25	1,75	5,0	7,0	20,0	28,0
Accumul. contact time (days)	0,25	1,00	2,25	4,0	9,0	16,0	36,0	64,0
Leaching renewal date	02-dec	03-dec	04-dec	06-dec	11-dec	18-dec	07-jan	04-feb
Leaching renewal time	16:00	10:00	16:00	10:00	10:00	10:00	10:00	10:00
L/A (l/m2)	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,2

Released quantities per step

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-	6,1	6,5	6,6	7,2	7,4	6,8	6,8	7,5
x Ledningsevne	mS/cm	0,013	0,007	0,010	0,011	0,023	0,027	0,044	0,046
Naphthalene	mg/m2	< 0,0024	< 0,0024	< 0,0024	< 0,0024	< 0,0024	< 0,0024	< 0,0024	< 0,0024
Acenaphthylene	mg/m2	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024
Acenaphthene	mg/m2	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024
Fluorene	mg/m2	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048
Phenanthrene	mg/m2	< 0,00073	< 0,00073	< 0,00073	< 0,00073	< 0,00073	< 0,00073	< 0,00073	< 0,00073
Anthracene	mg/m2	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048
Fluoranthene	mg/m2	< 0,00073	< 0,00073	< 0,00073	< 0,00073	< 0,00073	< 0,00073	< 0,00073	< 0,00073
Pyrene	mg/m2	< 0,0015	< 0,0015	< 0,0015	< 0,0015	< 0,0015	< 0,0015	< 0,0015	< 0,0015
Benz(a)anthracene	mg/m2	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024
Chrysene	mg/m2	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024
Benzo(b)fluoranthene	mg/m2	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024
Benzo(k)fluoranthene	mg/m2	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024
Benzo(a)pyrene	mg/m2	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048	< 0,00048
Indeno(1,2,3-cd)pyrene	mg/m2	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024
Benzo(g,h,i)perylene	mg/m2	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024
Dibenz(a,h)anthracene	mg/m2	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024	< 0,00024

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 3/5)

Test carried out: EK-UCHP

Project management: 04/02/2020 / JHY

QA/QC: 19/02/2020 / JHY



Test report - Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-A **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0
Interval contact time (days)	0,25	0,75	1,25	1,75	5,0	7,0	20,0	28,0
Accumul. contact time (days)	0,25	1,00	2,25	4,0	9,0	16,0	36,0	64,0
Leaching renewal date	02-dec	03-dec	04-dec	06-dec	11-dec	18-dec	07-jan	04-feb
Leaching renewal time	16:00	10:00	16:00	10:00	10:00	10:00	10:00	10:00
L/A (l/m2)	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,2

Cumulatively released quantities per step

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-	6,1	6,5	6,6	7,2	7,4	6,8	6,8	7,5
x Ledningsevne	mS/cm	0,013	0,007	0,010	0,011	0,023	0,027	0,044	0,046
Naphthalene	mg/m2	< 0,0024	< 0,0048	< 0,0073	< 0,0097	< 0,012	< 0,015	< 0,017	< 0,019
Acenaphthylene	mg/m2	< 0,00024	< 0,00048	< 0,00073	< 0,00097	< 0,0012	< 0,0015	< 0,0017	< 0,0019
Acenaphthene	mg/m2	< 0,00024	< 0,00048	< 0,00073	< 0,00097	< 0,0012	< 0,0015	< 0,0017	< 0,0019
Fluorene	mg/m2	< 0,00048	< 0,00097	< 0,0015	< 0,0019	< 0,0024	< 0,0029	< 0,0034	< 0,0039
Phenanthrene	mg/m2	< 0,00073	< 0,0015	< 0,0022	< 0,0029	< 0,0036	< 0,0044	< 0,0051	< 0,0058
Anthracene	mg/m2	< 0,00048	< 0,00097	< 0,0015	< 0,0019	< 0,0024	< 0,0029	< 0,0034	< 0,0039
Fluoranthene	mg/m2	< 0,00073	< 0,0015	< 0,0022	< 0,0029	< 0,0036	< 0,0044	< 0,0051	< 0,0058
Pyrene	mg/m2	< 0,0015	< 0,0029	< 0,0044	< 0,0058	< 0,0073	< 0,0087	< 0,010	< 0,012
Benz(a)anthracene	mg/m2	< 0,00024	< 0,00048	< 0,00073	< 0,00097	< 0,0012	< 0,0015	< 0,0017	< 0,0019
Chrysene	mg/m2	< 0,00024	< 0,00048	< 0,00073	< 0,00097	< 0,0012	< 0,0015	< 0,0017	< 0,0019
Benzo(b)fluoranthene	mg/m2	< 0,00024	< 0,00048	< 0,00073	< 0,00097	< 0,0012	< 0,0015	< 0,0017	< 0,0019
Benzo(k)fluoranthene	mg/m2	< 0,00024	< 0,00048	< 0,00073	< 0,00097	< 0,0012	< 0,0015	< 0,0017	< 0,0019
Benzo(a)pyrene	mg/m2	< 0,00048	< 0,00097	< 0,0015	< 0,0019	< 0,0024	< 0,0029	< 0,0034	< 0,0039
Indeno(1,2,3-cd)pyrene	mg/m2	< 0,00024	< 0,00048	< 0,00073	< 0,00097	< 0,0012	< 0,0015	< 0,0017	< 0,0019
Benzo(g,h,i)perylene	mg/m2	< 0,00024	< 0,00048	< 0,00073	< 0,00097	< 0,0012	< 0,0015	< 0,0017	< 0,0019
Dibenz(a,h)anthracene	mg/m2	< 0,00024	< 0,00048	< 0,00073	< 0,00097	< 0,0012	< 0,0015	< 0,0017	< 0,0019

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 4/5)

Test carried out: EK-UHP

Project management: 04/02/2020 / JHY

QA/QC: 19/02/2020 / JHY



Test report - Horizontal dynamic surface leaching test

Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-A **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0	1650,0
Interval contact time (days)	0,25	0,75	1,25	1,75	5,0	7,0	20,0	28,0
Accumul. contact time (days)	0,25	1,00	2,25	4,0	9,0	16,0	36,0	64,0
Leaching renewal date	02-dec	03-dec	04-dec	06-dec	11-dec	18-dec	07-jan	04-feb
Leaching renewal time	16:00	10:00	16:00	10:00	10:00	10:00	10:00	10:00
L/A (l/m2)	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,2

Flux for each substance and eluate fraction

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-	6,1	6,5	6,6	7,2	7,4	6,8	6,8	7,5
x Ledningsevne	mS/cm	0,013	0,007	0,010	0,011	0,023	0,027	0,044	0,046
Naphthalene	mg/(m2·day)	< 0,0097	< 0,0032	< 0,0019	< 0,0014	< 0,00048	< 0,00035	< 0,00012	< 0,000086
Acenaphthylene	mg/(m2·day)	< 0,00097	< 0,00032	< 0,00019	< 0,00014	< 0,000048	< 0,000035	< 0,000012	< 0,0000086
Acenaphthene	mg/(m2·day)	< 0,00097	< 0,00032	< 0,00019	< 0,00014	< 0,000048	< 0,000035	< 0,000012	< 0,0000086
Fluorene	mg/(m2·day)	< 0,0019	< 0,00064	< 0,00039	< 0,00028	< 0,000097	< 0,000069	< 0,000024	< 0,000017
Phenanthrene	mg/(m2·day)	< 0,0029	< 0,00097	< 0,00058	< 0,00041	< 0,00015	< 0,00010	< 0,000036	< 0,000026
Anthracene	mg/(m2·day)	< 0,0019	< 0,00064	< 0,00039	< 0,00028	< 0,000097	< 0,000069	< 0,000024	< 0,000017
Fluoranthene	mg/(m2·day)	< 0,0029	< 0,00097	< 0,00058	< 0,00041	< 0,00015	< 0,00010	< 0,000036	< 0,000026
Pyrene	mg/(m2·day)	< 0,0058	< 0,0019	< 0,0012	< 0,00083	< 0,00029	< 0,00021	< 0,000073	< 0,000052
Benz(a)anthracene	mg/(m2·day)	< 0,00097	< 0,00032	< 0,00019	< 0,00014	< 0,000048	< 0,000035	< 0,000012	< 0,0000086
Chrysene	mg/(m2·day)	< 0,00097	< 0,00032	< 0,00019	< 0,00014	< 0,000048	< 0,000035	< 0,000012	< 0,0000086
Benzo(b)fluoranthene	mg/(m2·day)	< 0,00097	< 0,00032	< 0,00019	< 0,00014	< 0,000048	< 0,000035	< 0,000012	< 0,0000086
Benzo(k)fluoranthene	mg/(m2·day)	< 0,00097	< 0,00032	< 0,00019	< 0,00014	< 0,000048	< 0,000035	< 0,000012	< 0,0000086
Benzo(a)pyrene	mg/(m2·day)	< 0,0019	< 0,00064	< 0,00039	< 0,00028	< 0,000097	< 0,000069	< 0,000024	< 0,000017
Indeno(1,2,3-cd)pyrene	mg/(m2·day)	< 0,00097	< 0,00032	< 0,00019	< 0,00014	< 0,000048	< 0,000035	< 0,000012	< 0,0000086
Benzo(g,h,i)perylene	mg/(m2·day)	< 0,00097	< 0,00032	< 0,00019	< 0,00014	< 0,000048	< 0,000035	< 0,000012	< 0,0000086
Dibenz(a,h)anthracene	mg/(m2·day)	< 0,00097	< 0,00032	< 0,00019	< 0,00014	< 0,000048	< 0,000035	< 0,000012	< 0,0000086

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 5/5)

Test carried out: EK-UCHP

Project management: 04/02/2020 / JHY

QA/QC: 19/02/2020 / JHY



Test report - Horizontal dynamic surface leaching test (BLANK TEST) Method: DS/CEN/TS 16637-2

Project: 2019-106 **DanWS ID:** 2019-106-BL **Cust. ID:** Katepal K-PS 170/5000

Test specific information	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
Volume of eluate, V1 (ml)	1650,0	1650,0						
Interval contact time (days)	1,00	1,00						
Accumul. contact time (days)								
Leaching renewal date	06-feb	07-feb						
Leaching renewal time	10:00	10:00						
L/A (l/m ²)								

Measured solution concentrations per step

Parameter	Unit	Eluate 1	Eluate 2	Eluate 3	Eluate 4	Eluate 5	Eluate 6	Eluate 7	Eluate 8
x pH	-								
x Conductivity	mS/cm								
Naphthalene	mg/l	< 0,00010	< 0,00010						
Acenaphthylene	mg/l	< 0,000010	< 0,000010						
Acenaphthene	mg/l	< 0,000010	< 0,000010						
Fluorene	mg/l	< 0,000020	< 0,000020						
Phenanthrene	mg/l	< 0,000030	< 0,000030						
Anthracene	mg/l	< 0,000020	< 0,000020						
Fluoranthene	mg/l	< 0,000030	< 0,000030						
Pyrene	mg/l	< 0,000060	< 0,000060						
Benz(a)anthracene	mg/l	< 0,000010	< 0,000010						
Chrysene	mg/l	< 0,000010	< 0,000010						
Benzo(b)fluoranthene	mg/l	< 0,000010	< 0,000010						
Benzo(k)fluoranthene	mg/l	< 0,000010	< 0,000010						
Benzo(a)pyrene	mg/l	< 0,000020	< 0,000020						
Indeno(1,2,3-cd)pyrene	mg/l	< 0,000010	< 0,000010						
Benzo(g,h,i)perylene	mg/l	< 0,000010	< 0,000010						
Dibenz(a,h)anthracene	mg/l	< 0,000010	< 0,000010						

x = not accredited

All values shown as two significant digits

Danish Waste Solutions

Agern Allé 3

2970 Hørsholm

Denmark

Test report: 2019-106 (side 1/1)

Test carried out: EK-UCHP

Project management: 19/02/2020 / JHY

QA/QC: 19/02/2020 / OH

Bilag 2: Akkrediteret analyserapport fra ALS Tjekket



CERTIFICATE OF ANALYSIS

Work Order	: PR2013097	Issue Date	: 19-Feb-2020
Customer	: Danish Waste Solutions	Laboratory	: ALS Czech Republic, s.r.o.
Contact	: Jiří Hyks	Contact	: Client Service
Address	: Agern Alle 3 2970 Hørsholm Danmark	Address	: Na Harfe 336/9 Prague 9 - Vysocany 190 00 Czech Republic
E-mail	: jhy@danws.dk	E-mail	: customer.support@alsglobal.com
Telephone	: +45 26687051	Telephone	: +420 226 226 228
Project	: 2019-106	Page	: 1 of 7
Order number	: -	Date Samples	: 11-Feb-2020
		Received	
		Quote number	: PR2018DANWA-DK0001 (CZ-250-18-0344)
Site	: -	Date of test	: 11-Feb-2020 - 19-Feb-2020
Sampled by	: client	QC Level	: ALS CR Standard Quality Control Schedule

General Comments

This report shall not be reproduced except in full, without prior written approval from the laboratory.

The laboratory declares that the test results relate only to the listed samples. If the section "Sampled by" of the Certificate of analysis states: "Sampled by Customer" then the results relate to the sample as received.

Sample(s) PR2013097/001-010, method W-ANI-ENV - required dilution due to high nitrate content, LOR has been adjusted accordingly.

Sample(s) PR2013097/001-010, method W-METMSFX - LOR for particular sample(s) raised due to matrix interference.

Responsible for accuracy

Testing Laboratory No. 1163
Accredited by CAI according to
CSN EN ISO/IEC 17025:2018

Signatories

Zdeněk Jiráček

Position

Environmental Business Unit
Manager





Analytical Results

Sub-Matrix: INDUSTRIAL LIQUID

Client sample ID
Laboratory sample ID
Client sampling date / time

02.12.19-16:00-E1A	03.12.19-10:00-E2A	04.12.19-16:00-E3A
PR2013097-001	PR2013097-002	PR2013097-003
02-Dec-2019 16:00	03-Dec-2019 10:00	04-Dec-2019 16:00

Parameter	Method	LOR	Unit	Result	MU	Result	MU	Result	MU
Physical Parameters									
Electrical Conductivity @ 25°C	W-CON-PCT	0.10	mS/m	697	± 10.0%	774	± 10.0%	656	± 10.0%
pH Value	W-PH-PCT	1.00	-	1.75	± 4.6%	1.69	± 4.7%	1.76	± 4.5%
Nonmetallic Inorganic Parameters									
Bromide	W-ANI-ENV	0.050	mg/L	<1.00	---	<1.00	---	<1.00	---
Chloride	W-ANI-ENV	0.500	mg/L	9.04	± 15.0%	<1.20	---	<1.20	---
Fluoride	W-ANI-ENV	0.020	mg/L	<0.400	---	<0.400	---	<0.400	---
Nitrates	W-ANI-ENV	0.040	mg/L	1100	± 15.0%	1240	± 15.0%	1050	± 15.0%
Nitrites	W-ANI-ENV	0.040	mg/L	<0.600	---	<0.600	---	<0.600	---
Sulphate as SO4 2-	W-ANI-ENV	0.500	mg/L	17.3	± 15.0%	6.11	± 15.0%	3.95	± 15.0%
Nitrate as N	W-ANI-ENV	0.010	mg/L	248	± 15.0%	280	± 15.0%	238	± 15.0%
Nitrite as N	W-ANI-ENV	0.010	mg/L	<0.150	---	<0.150	---	<0.150	---
Total Metals / Major Cations									
Lithium	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0050	---	<0.0020	---
Sodium	W-METMSFX6	0.0300	mg/L	0.222	± 10.0%	<0.150	---	0.0663	± 10.0%
Selenium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---
Phosphorus	W-METMSFX6	0.0500	mg/L	<0.100	---	<0.250	---	<0.100	---
Molybdenum	W-METMSFX6	0.0020	mg/L	<0.0020	---	<0.0050	---	<0.0020	---
Magnesium	W-METMSFX6	0.0030	mg/L	0.235	± 10.0%	0.132	± 10.0%	0.149	± 10.0%
Lead	W-METMSFX6	0.0050	mg/L	<0.0050	---	<0.0050	---	<0.0050	---
Copper	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0050	---	<0.0020	---
Chromium	W-METMSFX6	0.0010	mg/L	<0.0010	---	<0.0010	---	<0.0010	---
Cobalt	W-METMSFX6	0.0020	mg/L	0.0065	± 10.0%	0.0022	± 10.0%	<0.0020	---
Boron	W-METMSFX6	0.0100	mg/L	<0.0200	---	<0.0500	---	<0.0200	---
Barium	W-METMSFX6	0.00050	mg/L	0.00117	± 10.0%	<0.00100	---	0.00060	± 10.0%
Silver	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0050	---	<0.0020	---
Iron	W-METMSFX6	0.0020	mg/L	0.0472	± 10.0%	0.0153	± 10.0%	<0.0040	---
Cadmium	W-METMSFX6	0.00040	mg/L	<0.00040	---	<0.00040	---	<0.00040	---
Calcium	W-METMSFX6	0.0500	mg/L	0.685	± 10.0%	0.606	± 10.0%	1.06	± 10.0%
Beryllium	W-METMSFX6	0.00020	mg/L	<0.00040	---	<0.00100	---	<0.00040	---
Arsenic	W-METMSFX6	0.0050	mg/L	<0.0050	---	<0.0050	---	<0.0050	---
Aluminium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---
Zinc	W-METMSFX6	0.0020	mg/L	0.0123	± 10.0%	0.0151	± 10.0%	0.0050	± 10.0%
Vanadium	W-METMSFX6	0.0010	mg/L	<0.0010	---	<0.0010	---	<0.0010	---
Potassium	W-METMSFX6	0.0500	mg/L	0.825	± 10.0%	0.397	± 10.0%	0.400	± 10.0%
Nickel	W-METMSFX6	0.0020	mg/L	0.0274	± 10.0%	0.0123	± 10.0%	0.0091	± 10.0%
Manganese	W-METMSFX6	0.00050	mg/L	0.0344	± 10.0%	0.0205	± 10.0%	0.0229	± 10.0%
Antimony	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---
Thallium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---
Strontium	W-METMSFX6	0.0010	mg/L	0.0023	± 10.0%	<0.0025	---	0.0017	± 10.0%
Bismuth	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---
Silicon	W-METMSFX6	0.0100	mg/L	0.0807	± 10.0%	0.0979	± 10.0%	0.108	± 10.0%
Titanium	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0050	---	<0.0020	---
Sulphur	W-METMSFX6	0.500	mg/L	1.11	± 10.0%	<2.50	---	<1.00	---
Tin	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---
Tellurium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---
Polycyclic Aromatics Hydrocarbons (PAHs)									
Naphthalene	W-PAHGMS01	0.100	µg/L	<0.100	---	<0.100	---	<0.100	---
Acenaphthylene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---
Acenaphthene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---
Fluorene	W-PAHGMS01	0.020	µg/L	<0.020	---	<0.020	---	<0.020	---
Phenanthrene	W-PAHGMS01	0.030	µg/L	<0.030	---	<0.030	---	<0.030	---
Anthracene	W-PAHGMS01	0.020	µg/L	<0.020	---	<0.020	---	<0.020	---
Fluoranthene	W-PAHGMS01	0.030	µg/L	<0.030	---	<0.030	---	<0.030	---
Pyrene	W-PAHGMS01	0.060	µg/L	<0.060	---	<0.060	---	<0.060	---
Benz(a)anthracene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---
Chrysene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---



Sub-Matrix: INDUSTRIAL LIQUID				Client sample ID		02.12.19-16:00-E1A		03.12.19-10:00-E2A		04.12.19-16:00-E3A	
				Laboratory sample ID		PR2013097-001		PR2013097-002		PR2013097-003	
				Client sampling date / time		02-Dec-2019 16:00		03-Dec-2019 10:00		04-Dec-2019 16:00	
Parameter	Method	LOR	Unit	Result	MU	Result	MU	Result	MU		
Polycyclic Aromatics Hydrocarbons (PAHs) - Continued											
Benzo(b)fluoranthene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Benzo(k)fluoranthene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Benzo(a)pyrene	W-PAHGMS01	0.020	µg/L	<0.020	---	<0.020	---	<0.020	---		
Indeno(1.2.3.cd)pyrene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Benzo(g,h,i)perylene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Dibenz(a,h)anthracene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Sum of 16 PAH	W-PAHGMS01	0.370	µg/L	<0.370	---	<0.370	---	<0.370	---		
Sum of PAH (MoE)	W-PAHGMS01	0.19	µg/L	<0.19	---	<0.19	---	<0.19	---		
Sum of 6 PAH (WHO)	W-PAHGMS01	0.090	µg/L	<0.090	---	<0.090	---	<0.090	---		
Sum of 4 PAH	W-PAHGMS01	0.040	µg/L	<0.040	---	<0.040	---	<0.040	---		

Sub-Matrix: INDUSTRIAL LIQUID				Client sample ID		06.12.19-10:00-E4A		11.12.19-10:00-E5A		18.12.19-10:00-E6A	
				Laboratory sample ID		PR2013097-004		PR2013097-005		PR2013097-006	
				Client sampling date / time		06-Dec-2019 10:00		11-Dec-2019 10:00		18-Dec-2019 10:00	
Parameter	Method	LOR	Unit	Result	MU	Result	MU	Result	MU		
Physical Parameters											
Electrical Conductivity @ 25°C	W-CON-PCT	0.10	mS/m	702	± 10.0%	724	± 10.0%	528	± 10.0%		
pH Value	W-PH-PCT	1.00	-	1.73	± 4.6%	1.72	± 4.6%	1.86	± 4.3%		
Nonmetallic Inorganic Parameters											
Bromide	W-ANI-ENV	0.050	mg/L	<0.500	---	<1.00	---	<0.500	---		
Chloride	W-ANI-ENV	0.500	mg/L	<0.600	---	<1.20	---	<0.600	---		
Fluoride	W-ANI-ENV	0.020	mg/L	<0.200	---	<0.400	---	<0.200	---		
Nitrates	W-ANI-ENV	0.040	mg/L	1120	± 15.0%	1170	± 15.0%	849	± 15.0%		
Nitrites	W-ANI-ENV	0.040	mg/L	<0.300	---	<0.600	---	<0.300	---		
Sulphate as SO4 2-	W-ANI-ENV	0.500	mg/L	3.86	± 15.0%	10.8	± 15.0%	15.0	± 15.0%		
Nitrate as N	W-ANI-ENV	0.010	mg/L	253	± 15.0%	264	± 15.0%	192	± 15.0%		
Nitrite as N	W-ANI-ENV	0.010	mg/L	<0.075	---	<0.150	---	<0.075	---		
Total Metals / Major Cations											
Lithium	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0020	---	<0.0020	---		
Sodium	W-METMSFX6	0.0300	mg/L	<0.0600	---	0.109	± 10.0%	0.0952	± 10.0%		
Selenium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---		
Phosphorus	W-METMSFX6	0.0500	mg/L	<0.100	---	<0.100	---	<0.100	---		
Molybdenum	W-METMSFX6	0.0020	mg/L	<0.0020	---	<0.0020	---	<0.0020	---		
Magnesium	W-METMSFX6	0.0030	mg/L	0.121	± 10.0%	0.178	± 10.0%	0.159	± 10.0%		
Lead	W-METMSFX6	0.0050	mg/L	<0.0050	---	<0.0050	---	<0.0050	---		
Copper	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0020	---	<0.0020	---		
Chromium	W-METMSFX6	0.0010	mg/L	<0.0010	---	<0.0010	---	<0.0010	---		
Cobalt	W-METMSFX6	0.0020	mg/L	<0.0020	---	<0.0020	---	<0.0020	---		
Boron	W-METMSFX6	0.0100	mg/L	<0.0200	---	<0.0200	---	<0.0200	---		
Barium	W-METMSFX6	0.00050	mg/L	0.00057	± 10.0%	0.00163	± 10.0%	0.00209	± 10.0%		
Silver	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0020	---	<0.0020	---		
Iron	W-METMSFX6	0.0020	mg/L	<0.0040	---	<0.0040	---	<0.0040	---		
Cadmium	W-METMSFX6	0.00040	mg/L	<0.00040	---	<0.00040	---	<0.00040	---		
Calcium	W-METMSFX6	0.0500	mg/L	1.31	± 10.0%	3.16	± 10.0%	4.16	± 10.0%		
Beryllium	W-METMSFX6	0.00020	mg/L	<0.00040	---	<0.00040	---	<0.00040	---		
Arsenic	W-METMSFX6	0.0050	mg/L	<0.0050	---	<0.0050	---	<0.0050	---		
Aluminium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---		
Zinc	W-METMSFX6	0.0020	mg/L	0.0116	± 10.0%	0.0180	± 10.0%	0.0181	± 10.0%		
Vanadium	W-METMSFX6	0.0010	mg/L	<0.0010	---	<0.0010	---	<0.0010	---		
Potassium	W-METMSFX6	0.0500	mg/L	0.496	± 10.0%	0.849	± 10.0%	0.901	± 10.0%		
Nickel	W-METMSFX6	0.0020	mg/L	0.0051	± 10.0%	0.0062	± 10.0%	0.0056	± 10.0%		
Manganese	W-METMSFX6	0.00050	mg/L	0.0154	± 10.0%	0.0257	± 10.0%	0.0265	± 10.0%		
Antimony	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---		
Thallium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---		
Strontium	W-METMSFX6	0.0010	mg/L	0.0016	± 10.0%	0.0032	± 10.0%	0.0033	± 10.0%		
Bismuth	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---		



Sub-Matrix: INDUSTRIAL LIQUID				Client sample ID		06.12.19-10:00-E4A		11.12.19-10:00-E5A		18.12.19-10:00-E6A	
				Laboratory sample ID		PR2013097-004		PR2013097-005		PR2013097-006	
				Client sampling date / time		06-Dec-2019 10:00		11-Dec-2019 10:00		18-Dec-2019 10:00	
Parameter	Method	LOR	Unit	Result	MU	Result	MU	Result	MU		
Total Metals / Major Cations - Continued											
Silicon	W-METMSFX6	0.0100	mg/L	0.112	± 10.0%	0.248	± 10.0%	0.309	± 10.0%		
Titanium	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0020	---	<0.0020	---		
Sulphur	W-METMSFX6	0.500	mg/L	<1.00	---	<1.00	---	1.12	± 10.0%		
Tin	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---		
Tellurium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---		
Polycyclic Aromatics Hydrocarbons (PAHs)											
Naphthalene	W-PAHGMS01	0.100	µg/L	<0.100	---	<0.100	---	<0.100	---		
Acenaphthylene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Acenaphthene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Fluorene	W-PAHGMS01	0.020	µg/L	<0.020	---	<0.020	---	<0.020	---		
Phenanthrene	W-PAHGMS01	0.030	µg/L	<0.030	---	<0.030	---	<0.030	---		
Anthracene	W-PAHGMS01	0.020	µg/L	<0.020	---	<0.020	---	<0.020	---		
Fluoranthene	W-PAHGMS01	0.030	µg/L	<0.030	---	<0.030	---	<0.030	---		
Pyrene	W-PAHGMS01	0.060	µg/L	<0.060	---	<0.060	---	<0.060	---		
Benz(a)anthracene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Chrysene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Benzo(b)fluoranthene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Benzo(k)fluoranthene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Benzo(a)pyrene	W-PAHGMS01	0.020	µg/L	<0.020	---	<0.020	---	<0.020	---		
Indeno(1.2.3.cd)pyrene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Benzo(g,h,i)perylene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Dibenz(a,h)anthracene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---		
Sum of 16 PAH	W-PAHGMS01	0.370	µg/L	<0.370	---	<0.370	---	<0.370	---		
Sum of PAH (MoE)	W-PAHGMS01	0.19	µg/L	<0.19	---	<0.19	---	<0.19	---		
Sum of 6 PAH (WHO)	W-PAHGMS01	0.090	µg/L	<0.090	---	<0.090	---	<0.090	---		
Sum of 4 PAH	W-PAHGMS01	0.040	µg/L	<0.040	---	<0.040	---	<0.040	---		

Sub-Matrix: INDUSTRIAL LIQUID				Client sample ID		07.01.20-10:00-E7A		04.02.20-10:00-E8A		05.02.20-16:00-BL1	
				Laboratory sample ID		PR2013097-007		PR2013097-008		PR2013097-009	
				Client sampling date / time		07-Jan-2020 10:00		04-Feb-2020 10:00		05-Feb-2020 16:00	
Parameter	Method	LOR	Unit	Result	MU	Result	MU	Result	MU		
Physical Parameters											
Electrical Conductivity @ 25°C	W-CON-PCT	0.10	mS/m	431	± 10.0%	761	± 10.0%	566	± 10.0%		
pH Value	W-PH-PCT	1.00	-	1.96	± 4.1%	1.70	± 4.7%	1.84	± 4.4%		
Nonmetallic Inorganic Parameters											
Bromide	W-ANI-ENV	0.050	mg/L	<0.500	---	<1.00	---	<0.500	---		
Chloride	W-ANI-ENV	0.500	mg/L	<0.600	---	<1.20	---	<0.600	---		
Fluoride	W-ANI-ENV	0.020	mg/L	<0.200	---	<0.400	---	<0.200	---		
Nitrates	W-ANI-ENV	0.040	mg/L	689	± 15.0%	1230	± 15.0%	915	± 15.0%		
Nitrites	W-ANI-ENV	0.040	mg/L	<0.300	---	<0.600	---	<0.300	---		
Sulphate as SO4 2-	W-ANI-ENV	0.500	mg/L	29.7	± 15.0%	33.6	± 15.0%	<0.600	---		
Nitrate as N	W-ANI-ENV	0.010	mg/L	156	± 15.0%	278	± 15.0%	207	± 15.0%		
Nitrite as N	W-ANI-ENV	0.010	mg/L	<0.075	---	<0.150	---	<0.075	---		
Total Metals / Major Cations											
Lithium	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0020	---	<0.0020	---		
Sodium	W-METMSFX6	0.0300	mg/L	0.132	± 10.0%	0.180	± 10.0%	<0.0600	---		
Selenium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---		
Phosphorus	W-METMSFX6	0.0500	mg/L	<0.100	---	<0.100	---	<0.100	---		
Molybdenum	W-METMSFX6	0.0020	mg/L	<0.0020	---	<0.0020	---	<0.0020	---		
Magnesium	W-METMSFX6	0.0030	mg/L	0.219	± 10.0%	0.224	± 10.0%	<0.0060	---		
Lead	W-METMSFX6	0.0050	mg/L	<0.0050	---	<0.0050	---	<0.0050	---		
Copper	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0020	---	<0.0020	---		
Chromium	W-METMSFX6	0.0010	mg/L	<0.0010	---	<0.0010	---	<0.0010	---		
Cobalt	W-METMSFX6	0.0020	mg/L	<0.0020	---	0.0031	± 10.0%	<0.0020	---		
Boron	W-METMSFX6	0.0100	mg/L	<0.0200	---	<0.0200	---	<0.0200	---		
Barium	W-METMSFX6	0.00050	mg/L	0.00371	± 10.0%	0.00433	± 10.0%	<0.00050	---		



Sub-Matrix: INDUSTRIAL LIQUID				Client sample ID		07.01.20-10:00-E7A		04.02.20-10:00-E8A		05.02.20-16:00-BL1	
				Laboratory sample ID		PR2013097-007		PR2013097-008		PR2013097-009	
				Client sampling date / time		07-Jan-2020 10:00		04-Feb-2020 10:00		05-Feb-2020 16:00	
Parameter	Method	LOR	Unit	Result	MU	Result	MU	Result	MU		
Total Metals / Major Cations - Continued											
Silver	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0020	---	<0.0020	---	<0.0020	---
Iron	W-METMSFX6	0.0020	mg/L	0.0062	± 10.0%	0.0048	± 10.0%	<0.0040	---	<0.0040	---
Cadmium	W-METMSFX6	0.00040	mg/L	<0.00040	---	<0.00040	---	<0.00040	---	<0.00040	---
Calcium	W-METMSFX6	0.0500	mg/L	6.78	± 10.0%	6.91	± 10.0%	<0.100	---	<0.100	---
Beryllium	W-METMSFX6	0.00020	mg/L	<0.00040	---	<0.00040	---	<0.00040	---	<0.00040	---
Arsenic	W-METMSFX6	0.0050	mg/L	<0.0050	---	<0.0050	---	<0.0050	---	<0.0050	---
Aluminium	W-METMSFX6	0.0100	mg/L	0.0152	± 10.0%	0.0102	± 10.0%	<0.0100	---	<0.0100	---
Zinc	W-METMSFX6	0.0020	mg/L	0.0071	± 10.0%	0.0203	± 10.0%	0.0056	± 10.0%	0.0056	± 10.0%
Vanadium	W-METMSFX6	0.0010	mg/L	<0.0010	---	<0.0010	---	<0.0010	---	<0.0010	---
Potassium	W-METMSFX6	0.0500	mg/L	1.05	± 10.0%	1.01	± 10.0%	<0.100	---	<0.100	---
Nickel	W-METMSFX6	0.0020	mg/L	0.0086	± 10.0%	0.0110	± 10.0%	<0.0020	---	<0.0020	---
Manganese	W-METMSFX6	0.00050	mg/L	0.0506	± 10.0%	0.0589	± 10.0%	<0.00050	---	<0.00050	---
Antimony	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---	<0.0100	---
Thallium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---	<0.0100	---
Strontium	W-METMSFX6	0.0010	mg/L	0.0044	± 10.0%	0.0039	± 10.0%	<0.0010	---	<0.0010	---
Bismuth	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---	<0.0100	---
Silicon	W-METMSFX6	0.0100	mg/L	0.386	± 10.0%	0.351	± 10.0%	<0.0200	---	<0.0200	---
Titanium	W-METMSFX6	0.0010	mg/L	<0.0020	---	<0.0020	---	<0.0020	---	<0.0020	---
Sulphur	W-METMSFX6	0.500	mg/L	1.51	± 10.0%	1.90	± 10.0%	<1.00	---	<1.00	---
Tin	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---	<0.0100	---
Tellurium	W-METMSFX6	0.0100	mg/L	<0.0100	---	<0.0100	---	<0.0100	---	<0.0100	---
Polycyclic Aromatics Hydrocarbons (PAHs)											
Naphthalene	W-PAHGMS01	0.100	µg/L	<0.100	---	<0.100	---	<0.100	---	<0.100	---
Acenaphthylene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---	<0.010	---
Acenaphthene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---	<0.010	---
Fluorene	W-PAHGMS01	0.020	µg/L	<0.020	---	<0.020	---	<0.020	---	<0.020	---
Phenanthrene	W-PAHGMS01	0.030	µg/L	<0.030	---	<0.030	---	<0.030	---	<0.030	---
Anthracene	W-PAHGMS01	0.020	µg/L	<0.020	---	<0.020	---	<0.020	---	<0.020	---
Fluoranthene	W-PAHGMS01	0.030	µg/L	<0.030	---	<0.030	---	<0.030	---	<0.030	---
Pyrene	W-PAHGMS01	0.060	µg/L	<0.060	---	<0.060	---	<0.060	---	<0.060	---
Benz(a)anthracene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---	<0.010	---
Chrysene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---	<0.010	---
Benzo(b)fluoranthene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---	<0.010	---
Benzo(k)fluoranthene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---	<0.010	---
Benzo(a)pyrene	W-PAHGMS01	0.020	µg/L	<0.020	---	<0.020	---	<0.020	---	<0.020	---
Indeno(1.2.3.cd)pyrene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---	<0.010	---
Benzo(g,h,i)perylene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---	<0.010	---
Dibenz(a,h)anthracene	W-PAHGMS01	0.010	µg/L	<0.010	---	<0.010	---	<0.010	---	<0.010	---
Sum of 16 PAH	W-PAHGMS01	0.370	µg/L	<0.370	---	<0.370	---	<0.370	---	<0.370	---
Sum of PAH (MoE)	W-PAHGMS01	0.19	µg/L	<0.19	---	<0.19	---	<0.19	---	<0.19	---
Sum of 6 PAH (WHO)	W-PAHGMS01	0.090	µg/L	<0.090	---	<0.090	---	<0.090	---	<0.090	---
Sum of 4 PAH	W-PAHGMS01	0.040	µg/L	<0.040	---	<0.040	---	<0.040	---	<0.040	---

Sub-Matrix: INDUSTRIAL LIQUID				Client sample ID		06.02.20-16:00-BL2		----		----	
				Laboratory sample ID		PR2013097-010		----		----	
				Client sampling date / time		06-Feb-2020 16:00		----		----	
Parameter	Method	LOR	Unit	Result	MU	Result	MU	Result	MU		
Physical Parameters											
Electrical Conductivity @ 25°C	W-CON-PCT	0.10	mS/m	561	± 10.0%	----	----	----	----	----	----
pH Value	W-PH-PCT	1.00	-	1.84	± 4.4%	----	----	----	----	----	----
Nonmetallic Inorganic Parameters											
Bromide	W-ANI-ENV	0.050	mg/L	<0.500	---	----	----	----	----	----	----
Chloride	W-ANI-ENV	0.500	mg/L	<0.600	---	----	----	----	----	----	----
Fluoride	W-ANI-ENV	0.020	mg/L	<0.200	---	----	----	----	----	----	----
Nitrates	W-ANI-ENV	0.040	mg/L	902	± 15.0%	----	----	----	----	----	----
Nitrites	W-ANI-ENV	0.040	mg/L	<0.300	---	----	----	----	----	----	----



Sub-Matrix: INDUSTRIAL LIQUID				Client sample ID		06.02.20-16:00-BL2		----		----	
				Laboratory sample ID		PR2013097-010		----		----	
				Client sampling date / time		06-Feb-2020 16:00		----		----	
Parameter	Method	LOR	Unit	Result	MU	Result	MU	Result	MU	Result	MU
Nonmetallic Inorganic Parameters - Continued											
Sulphate as SO4 2-	W-ANI-ENV	0.500	mg/L	<0.600	---	----	---	----	---	----	---
Nitrate as N	W-ANI-ENV	0.010	mg/L	204	± 15.0%	----	---	----	---	----	---
Nitrite as N	W-ANI-ENV	0.010	mg/L	<0.075	---	----	---	----	---	----	---
Total Metals / Major Cations											
Lithium	W-METMSFX6	0.0010	mg/L	<0.0020	---	----	---	----	---	----	---
Sodium	W-METMSFX6	0.0300	mg/L	<0.0600	---	----	---	----	---	----	---
Selenium	W-METMSFX6	0.0100	mg/L	<0.0100	---	----	---	----	---	----	---
Phosphorus	W-METMSFX6	0.0500	mg/L	<0.100	---	----	---	----	---	----	---
Molybdenum	W-METMSFX6	0.0020	mg/L	<0.0020	---	----	---	----	---	----	---
Magnesium	W-METMSFX6	0.0030	mg/L	<0.0060	---	----	---	----	---	----	---
Lead	W-METMSFX6	0.0050	mg/L	<0.0050	---	----	---	----	---	----	---
Copper	W-METMSFX6	0.0010	mg/L	<0.0020	---	----	---	----	---	----	---
Chromium	W-METMSFX6	0.0010	mg/L	<0.0010	---	----	---	----	---	----	---
Cobalt	W-METMSFX6	0.0020	mg/L	<0.0020	---	----	---	----	---	----	---
Boron	W-METMSFX6	0.0100	mg/L	<0.0200	---	----	---	----	---	----	---
Barium	W-METMSFX6	0.00050	mg/L	<0.00050	---	----	---	----	---	----	---
Silver	W-METMSFX6	0.0010	mg/L	<0.0020	---	----	---	----	---	----	---
Iron	W-METMSFX6	0.0020	mg/L	<0.0040	---	----	---	----	---	----	---
Cadmium	W-METMSFX6	0.00040	mg/L	<0.00040	---	----	---	----	---	----	---
Calcium	W-METMSFX6	0.0500	mg/L	<0.100	---	----	---	----	---	----	---
Beryllium	W-METMSFX6	0.00020	mg/L	<0.00040	---	----	---	----	---	----	---
Arsenic	W-METMSFX6	0.0050	mg/L	<0.0050	---	----	---	----	---	----	---
Aluminium	W-METMSFX6	0.0100	mg/L	<0.0100	---	----	---	----	---	----	---
Zinc	W-METMSFX6	0.0020	mg/L	0.0099	± 10.0%	----	---	----	---	----	---
Vanadium	W-METMSFX6	0.0010	mg/L	<0.0010	---	----	---	----	---	----	---
Potassium	W-METMSFX6	0.0500	mg/L	<0.100	---	----	---	----	---	----	---
Nickel	W-METMSFX6	0.0020	mg/L	<0.0020	---	----	---	----	---	----	---
Manganese	W-METMSFX6	0.00050	mg/L	<0.00050	---	----	---	----	---	----	---
Antimony	W-METMSFX6	0.0100	mg/L	<0.0100	---	----	---	----	---	----	---
Thallium	W-METMSFX6	0.0100	mg/L	<0.0100	---	----	---	----	---	----	---
Strontium	W-METMSFX6	0.0010	mg/L	<0.0010	---	----	---	----	---	----	---
Bismuth	W-METMSFX6	0.0100	mg/L	<0.0100	---	----	---	----	---	----	---
Silicon	W-METMSFX6	0.0100	mg/L	<0.0200	---	----	---	----	---	----	---
Titanium	W-METMSFX6	0.0010	mg/L	<0.0020	---	----	---	----	---	----	---
Sulphur	W-METMSFX6	0.500	mg/L	<1.00	---	----	---	----	---	----	---
Tin	W-METMSFX6	0.0100	mg/L	<0.0100	---	----	---	----	---	----	---
Tellurium	W-METMSFX6	0.0100	mg/L	<0.0100	---	----	---	----	---	----	---
Polycyclic Aromatics Hydrocarbons (PAHs)											
Naphthalene	W-PAHGMS01	0.100	µg/L	<0.100	---	----	---	----	---	----	---
Acenaphthylene	W-PAHGMS01	0.010	µg/L	<0.010	---	----	---	----	---	----	---
Acenaphthene	W-PAHGMS01	0.010	µg/L	<0.010	---	----	---	----	---	----	---
Fluorene	W-PAHGMS01	0.020	µg/L	<0.020	---	----	---	----	---	----	---
Phenanthrene	W-PAHGMS01	0.030	µg/L	<0.030	---	----	---	----	---	----	---
Anthracene	W-PAHGMS01	0.020	µg/L	<0.020	---	----	---	----	---	----	---
Fluoranthene	W-PAHGMS01	0.030	µg/L	<0.030	---	----	---	----	---	----	---
Pyrene	W-PAHGMS01	0.060	µg/L	<0.060	---	----	---	----	---	----	---
Benz(a)anthracene	W-PAHGMS01	0.010	µg/L	<0.010	---	----	---	----	---	----	---
Chrysene	W-PAHGMS01	0.010	µg/L	<0.010	---	----	---	----	---	----	---
Benzo(b)fluoranthene	W-PAHGMS01	0.010	µg/L	<0.010	---	----	---	----	---	----	---
Benzo(k)fluoranthene	W-PAHGMS01	0.010	µg/L	<0.010	---	----	---	----	---	----	---
Benzo(a)pyrene	W-PAHGMS01	0.020	µg/L	<0.020	---	----	---	----	---	----	---
Indeno(1,2,3.cd)pyrene	W-PAHGMS01	0.010	µg/L	<0.010	---	----	---	----	---	----	---
Benzo(g,h,i)perylene	W-PAHGMS01	0.010	µg/L	<0.010	---	----	---	----	---	----	---
Dibenz(a,h)anthracene	W-PAHGMS01	0.010	µg/L	<0.010	---	----	---	----	---	----	---
Sum of 16 PAH	W-PAHGMS01	0.370	µg/L	<0.370	---	----	---	----	---	----	---
Sum of PAH (MoE)	W-PAHGMS01	0.19	µg/L	<0.19	---	----	---	----	---	----	---
Sum of 6 PAH (WHO)	W-PAHGMS01	0.090	µg/L	<0.090	---	----	---	----	---	----	---
Sum of 4 PAH	W-PAHGMS01	0.040	µg/L	<0.040	---	----	---	----	---	----	---



If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, delivery date in brackets without a time component will be displayed instead. Measurement uncertainty is expressed as expanded measurement uncertainty with coverage factor k = 2, representing 95% confidence level.

Key: LOR = Limit of reporting; MU = Measurement Uncertainty. The MU does not include sampling uncertainty.

The end of result part of the certificate of analysis

Brief Method Summaries

<i>Analytical Methods</i>	<i>Method Descriptions</i>
<i>Location of test performance: Na Harfe 336/9 Prague 9 - Vysocany Czech Republic 190 00</i>	
W-ANI-ENV	CZ_SOP_D06_02_068 (CSN EN ISO 10304-1, CSN EN 16192) Determination of dissolved fluoride, chloride, nitrite, bromide, nitrate and sulphate by ion liquid chromatography and determination of nitrite nitrogen and nitrate nitrogen and sulfate sulfur by calculation from measured values including the calculation of total mineralization.
W-CON-PCT	CZ_SOP_D06_02_075 (ČSN EN 27 888, SM 2520 B, ČSN EN 16192) Determination of electrical conductivity by conductometer and calculation of salinity.
W-METMSFX6	CZ_SOP_D06_02_002 (US EPA 200.8, CSN EN ISO 17294-2, US EPA 6020A, CSN EN 16192, CSN 75 7358, samples prepared as per CZ_SOP_D06_02_J02 chap. 10.1, 10.2) - Determination of elements by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values including the calculation of total mineralization and calculating the sum of Ca+Mg. Sample was fixed by nitric acid addition prior to analysis.
W-PAHGMS01	CZ_SOP_D06_03_161 (US EPA 8270D, US EPA 8082A, CSN EN ISO 6468, US EPA 8000D, samples preparation as per CZ_SOP_D06_03_P01 chap. 9.1, 9.4.1). Determination of semi volatile organic compounds by gas chromatography method with MS or MS/MS detection and calculation of semi volatile organic compounds sums from measured values
W-PH-PCT	CZ_SOP_D06_02_105 (ČSN ISO 10523, US EPA 150.1, ČSN EN 16192, SM 4500-H+ B) Determination of pH by potentiometry

A `` symbol preceding any method indicates laboratory or subcontractor non-accredited test. In the case when a procedure belonging to an accredited method was used for non-accredited matrix, would apply that the reported results are non-accredited. Please refer to General Comment section on front page for information. If the report contains subcontracted analysis, those are made in a subcontracted laboratory outside the laboratories ALS Czech Republic, s.r.o.

The calculation methods of summation parameters are available on request in the client service.