

Research Group Analysis of  
Toxic and Explosive Substances

Analysis report EX 97. 468

page 1-2

Customer : Kummeneje  
Subject : Analysis of explosives  
Project no. : 214 197 612  
Test sample : Received on 8 September 1997  
Sample identification nr. : 12039 Lortvatnet, 12040 Porsvatnet  
Date : 22 September 1997

### Description test

Analysis of two water samples for the presence of the following explosives: pentrite, HMX, RDX, TNT, 2-amino and 4-amino-DNT, 2,4-DNT, 2,6-DNT, diethyleneglycol dinitrate, acardite and nitroglycerine.

### Experimental

#### *HPLC equipment*

Waters 600 Multi Solvent Delivery System, Waters 600 MS system controller, Waters 717 Autosampler, Waters Tuneable Absorbance Detector, Waters 990 Photodiode Array Detector. The HPLC column was packed with LiChrosorb RP18 (7µm) Merck, Germany.

#### *Conditions*

Analysis 1: UV wavelength 229 nm; injection volume, 20 µl; flow rate 0.7 ml/min; eluent composition, A, 47:53 methanol/water(MQ) and eluent B, 85:15 methanol/water(MQ). Both eluents were adjusted to pH 2 with sulphuric acid. A gradient elution was applied in 40 min. from 100% A to 100% B.

Analysis 2: UV wavelength 210 nm; injection volume, 100 µl; flow rate 0.7 ml/min; eluent composition, 59:40:1 methanol/water(MQ)/acetic acid (isocratic run).

#### *Procedure*

All explosives to be analysed were separated completely in two chromatographic runs. In chromatographic run 1, both water samples were compared against a blank MQ water and standard solution containing the following explosives: HMX, RDX, TNT, 2-amino DNT, 4-amino-DNT, 2,4-DNT, 2,6-DNT.

In the chromatographic run 2, both water samples were compared against a blank MQ water and standard solution containing: pentrite, diethyleneglycol dinitrate, acardite 1 and acardite 2 and nitroglycerine.

### Results


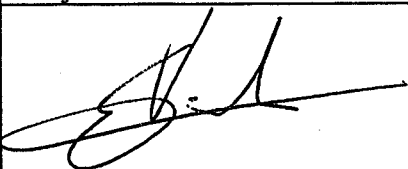
The two water samples show a comparable pattern indicating the presence of approximately four or five unknown UV absorbing compounds at low ppm level. Three of them were closely eluting with the reference standards RDX, DEGDN and acardite 1. The recorded diode array spectra, however, were not matching. This excludes the presence of these compounds at the respective detection levels (see Table 2).

Table 2: Detection levels

Explosive	DL (µg/ml)
HMX	0.5
RDX	0.5
TNT	0.6
2A-DNT	0.5
4A-DNT	0.5
2,4-DNT	0.6
2,6-DNT	0.6
DEGDN	0.1
NG	0.1
AK I	0.1
AK II	0.1
Pentrite	0.1

**Conclusion**

None of the investigated explosives are present in the water samples above their specified detection level (see Table 2) ranging from 0.1-0.6 µg/ml or parts per million(ppm).

Analyst	Project leader
	
Name: H.L. Lander	Name: Dr. Ch.E. Kientz

# TauwMilieu

Laboratorium

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Kummeneje  
For the attention of  
Dhr. O. Bryhn  
P.O. BOX 450  
0212 OSLO (NORWAY)

Our ref.:  
Lab/373997/ADO/pro/F

Date:  
10/09/97

Projectnumber : 6102201  
Your ref. : 12040  
Subject : Analytical Results  
Analytical code : 845986  
Handled by : Ms Ing. K. Schanssema-Kanbier (+ 31-570699762)  
Ms Ing. G.J. Stevens-Boorsma (+ 31-570699763)

We herewith send you the results of our laboratory tests. All analyses were carried out in accordance with the "Tauw Milieu Laboratory Survey of Analytical Methods", May 1997.

If you require further information, please do not hesitate to contact the laboratory coordination department.

If the execution of the analyses is not to your expectations, you are requested to contact the undersigned (+31-570699758).

We trust that the enclosed information will meet with your requirements.

Yours sincerely,

Laboratory

La

Mr A.S.M.J. Doveren MSc  
Head Department of Analysis

Enc

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## ANALYTICAL RESULTS

Page 1 of 7

Projectnumber : 6102201  
Analytical code : 845986

Project/Location: Porsvatnet

Concerning : Various liquids  
Sampled by : Kummeneje  
Sampling Date :  
Investigation date : 04/09/97

Sample codes:-

1 : T1-25-3 28-08-97  
2 : T1-25-4 28-08-97

ANALYSIS		Units	1	2
PRETREATMENT FOR METAL ANALYSIS				
Q Digestion with aqua regia			+	+
ICP-TECHNIQUE (AES)				
Q Chromium (Cr)	ug/l	28000		32
Q Copper (Cu)	ug/l	<4		<4
Q Nickel (Ni)	ug/l	<2		<2
Q Lead (Pb)	ug/l	<10		10
Q Zinc (Zn)	ug/l	<4		130
Q Tin (Sn)	ug/l	<20		<20
AAS-COLD VAPOUR TECHNIQUE (CVAAS)				
Q Mercury (Hg) (NEN6449)	ug/l	<0.1		<0.1
AAS-GRAPHITE FURNACE TECHNIQUE (GFAAS)				
Q Cadmium (Cd)	ug/l	<0.2		<0.2
		X		↑

All analyses marked with a "Q" are accredited by STERLAB.

For an explanation of the letter codes given between brackets, please see "Supplementary Information", attached to this report.



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### ANALYTICAL RESULTS

Page 2 of 7

Projectnummer : 6102201  
Analytical code : 845986

Project/Location: Porsvatnet

Concerning : Various liquids  
Sampled by : Kummeneje  
Sampling Date :  
Investigation date : 04/09/97

Sample codes:-  
4 : T1-25-6 28-08-97

ANALYSIS		Units	4
POLYCYCLIC AROMATIC HYDROCARBONS			
by HPLC			
Q Naphthalene	ug/l	<0.05	
Q Acenaphthylene	ug/l	<0.05	
Q Acenaphthene	ug/l	<0.05	
Q Fluorene	ug/l	<0.01	
Q Fenanthrene	ug/l	<0.01	
Q Anthracene	ug/l	<0.01	
Q Fluoranthene	ug/l	<0.01	
Q Pyrene	ug/l	<0.01	
Q Benzo(a)anthracene	ug/l	<0.01	
Q Chrysene	ug/l	<0.01	
Q Benzo(b)fluoranthene	ug/l	<0.01	
Q Benzo(k)fluoranthene	ug/l	<0.01	
Q Benzo(a)pyrene	ug/l	<0.01	
Q Dibenz(a,h)anthracene	ug/l	<0.01	
Q Benzo(g,h,i)perylene	ug/l	<0.01	
Q Indeno(1,2,3-c,d)pyrene	ug/l	<0.01	
Q Total 6 (Borneff)	ug/l	n.a.	
Q Total 10 (Dutch Ministry)	ug/l	n.a.	
Q Total 16 (EPA)	ug/l	n.a.	
ORGANO HALOGENATED COMPOUNDS			
Q EOX as chlorine	ug/l	<1	



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### ANALYTICAL RESULTS

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Projectnummer : 6102201  
Analytical code : 845986

Project/Location: Porsvatnet

Sample codes:-

3 : T1-25-5 28-08-97

Concerning : Various liquids  
Sampled by : Kummeneje  
Sampling Date :  
Investigation date : 04/09/97

ANALYSIS	Units	3
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#### POLYCHLOROBIPHENYLS

by GC-ECD

Q PCB-28	ug/l	<0.01
Q PCB-52	ug/l	<0.01
Q PCB-101	ug/l	<0.01
Q PCB-118	ug/l	<0.01
Q PCB-138	ug/l	<0.01
Q PCB-153	ug/l	<0.01
Q PCB-180	ug/l	<0.01
Q Sum of 6 PCB (STI-list)	ug/l	n.a.
Q Sum of 7 PCB Ballschmiter	ug/l	n.a.



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## ANALYTICAL RESULTS

Page 4 of 7

Projectnummer : 6102201  
Analytical code : 845986

Project/Location: Porsvatnet

Concerning : Various liquids  
Sampled by : Kummeneje  
Sampling Date :  
Investigation date : 04/09/97

Sample codes:-

5 : T1-25-7 28-08-97  
8 : T2-25-1 27-08-97  
11: T2-25-2 27-08-97

ANALYSIS		Units	5	8	11
PRETREATMENT FOR METAL ANALYSIS					
Q	Digestion with aqua regia			+	+
ICP-TECHNIQUE (AES)					
Q	Chromium (Cr)	ug/l		30000	33
Q	Copper (Cu)	ug/l		<4	<4
Q	Nickel (Ni)	ug/l		<2	<2
Q	Lead (Pb)	ug/l		<10	<10
Q	Zinc (Zn)	ug/l		<4	50
Q	Tin (Sn)	ug/l		<20	<20
AAS-COLD VAPOUR TECHNIQUE (CVAAS)					
Q	Mercury (Hg) (NEN6449)	ug/l		<0.1	<0.1
AAS-GRAPHITE FURNACE TECHNIQUE (GFAAS)					
Q	Cadmium (Cd)	ug/l		<0.2	<0.2
OILS (GC)					
Q	by GC-FID				
	Hydrocarbon Fraction C10-C40	ug/l	<50		
	Hydrocarbon Fraction C10-C12	ug/l	<10		
	Hydrocarbon Fraction C12-C16	ug/l	<10		
	Hydrocarbon Fraction C16-C20	ug/l	<5		
	Hydrocarbon Fraction C20-C24	ug/l	<5		
	Hydrocarbon Fraction C24-C28	ug/l	<5		
	Hydrocarbon Fraction C28-C32	ug/l	<5		
	Hydrocarbon Fraction C32-C36	ug/l	<5		
	Hydrocarbon Fraction C36-C40	ug/l	<5		



X

X

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## ANALYTICAL RESULTS

Page 5 of 7

Projectnumber : 6102201  
Analytical code : 845986

Project/Location: Porsvatnet

Concerning : Various liquids  
Sampled by : Kummeneje  
Sampling Date :  
Investigation date : 04/09/97

Sample codes:-  
6 : T1-25-8 28-08-97

### ANALYSIS

Units

6

#### GC/MS-ANALYSIS NON-VOLATILE COMPOUNDS

Non-volatile compounds ug/l n.a.



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## ANALYTICAL RESULTS

Page 6 of 7

Projectnumber : 6102201  
Analytical code : 845986

Project/Location: Porsvatnet

Concerning : Various liquids  
Sampled by : Kummeneje  
Sampling Date :  
Investigation date : 04/09/97

Sample codes:-  
13: T2-25-4 27-08-97

ANALYSIS Units 13

### POLYCYCLIC AROMATIC HYDROCARBONS

by HPLC

Q Naphthalene	ug/l	<0.05
Q Acenaphthylene	ug/l	<0.05
Q Acenaphthene	ug/l	<0.05
Q Fluorene	ug/l	<0.01
Q Fenanthrene	ug/l	<0.01
Q Anthracene	ug/l	<0.01
Q Fluoranthene	ug/l	<0.01
Q Pyrene	ug/l	<0.01
Q Benzo(a)anthracene	ug/l	<0.01
Q Chrysene	ug/l	<0.01
Q Benzo(b)fluoranthene	ug/l	<0.01
Q Benzo(k)fluoranthene	ug/l	<0.01
Q Benzo(a)pyrene	ug/l	<0.01
Q Dibenzo(a,h)anthracene	ug/l	<0.01
Q Benzo(g,h,i)perylene	ug/l	<0.01
Q Indeno(1,2,3-c,d)pyrene	ug/l	<0.01
Q Total 6 (Borneff)	ug/l	n.a.
Q Total 10 (Dutch Ministry)	ug/l	n.a.
Q Total 16 (EPA)	ug/l	n.a.

### ORGANO HALOGENATED COMPOUNDS

Q EOX as chlorine	ug/l	<1
-------------------	------	----

X



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## ANALYTICAL RESULTS

Page 7 of 7

Projectnummer : 6102201  
Analytical code : 845986

Project/Location: Porsvatnet

Concerning : Various liquids  
Sampled by : Kummeneje  
Sampling Date :  
Investigation date : 04/09/97

Sample codes:-

12: T2-25-3 27-08-97

14: T2-25-5 27-08-97

15: T2-25-6 27-08-97

### ANALYSIS

Units

12

14

15

#### OILS (GC)

Q by GC-FID

Hydrocarbon Fraction C10-C40	ug/l	<50		
Hydrocarbon Fraction C10-C12	ug/l	<10		
Hydrocarbon Fraction C12-C16	ug/l	<10		
Hydrocarbon Fraction C16-C20	ug/l	<5		
Hydrocarbon Fraction C20-C24	ug/l	<5		
Hydrocarbon Fraction C24-C28	ug/l	<5		
Hydrocarbon Fraction C28-C32	ug/l	<5		
Hydrocarbon Fraction C32-C36	ug/l	<5		
Hydrocarbon Fraction C36-C40	ug/l	<5		

#### POLYCHLOROBIPHENYLS

by GC-ECD

Q PCB-28	ug/l	<0.01		
Q PCB-52	ug/l	<0.01		
Q PCB-101	ug/l	<0.01		
Q PCB-118	ug/l	<0.01		
Q PCB-138	ug/l	<0.01		
Q PCB-153	ug/l	<0.01		
Q PCB-180	ug/l	<0.01		
Q Sum of 6 PCB (STI-list)	ug/l	n.a.		
Q Sum of 7 PCB Ballschmiter	ug/l	n.a.		

#### GC/MS-ANALYSIS NON-VOLATILE COMPOUNDS

Non-volatile compounds ug/l n.a.

X

X

X

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Kummeneje  
For the attention of  
Dhr. O. Bryhn  
P.O. BOX 450  
0212 OSLO (NORWAY)

Our ref.:  
Lab/382202/ADO/vdn/F

Date:  
10/10/97

Projectnumber : 6102201  
Your ref. : 12040  
Subject : Analytical Results  
Analytical code : 848756  
Handled by : Ms Ing. K. Schanssema-Kanbier (+ 31-570699762)  
Ms Ing. G.J. Stevens-Boorsma (+ 31-570699763)

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Yours sincerely,

Laboratory

Mr A.S.M.J. Doveren MSc  
Head of the Laboratory

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### ANALYTICAL RESULTS

Page 1 of 1

Projectnumber : 6102201  
Analytical code : 848756

Project/Location: Porsvatnet  
addition 845986.02+11

Concerning : Various liquids  
Sampled by : Kummeneje  
Sampling Date :  
Investigation date : 03/10/97

Sample codes:-

1 : T1-25-4 28-08-97  
2 : T2-25-2 27-08-97

### ANALYSIS

Units

1

2

#### PRETREATMENT FOR METAL ANALYSIS

Q Digestion with aqua regia

+

+

#### AAS-GRAPHITE FURNACE TECHNIQUE (GFAAS)

Q Chromium (Cr)

ug/l

1.0

1.0

Q Copper (Cu)

ug/l

3.0

3.0

Q Nickel (Ni)

ug/l

<2

3

Q Lead (Pb)

ug/l

7

8

↑

X

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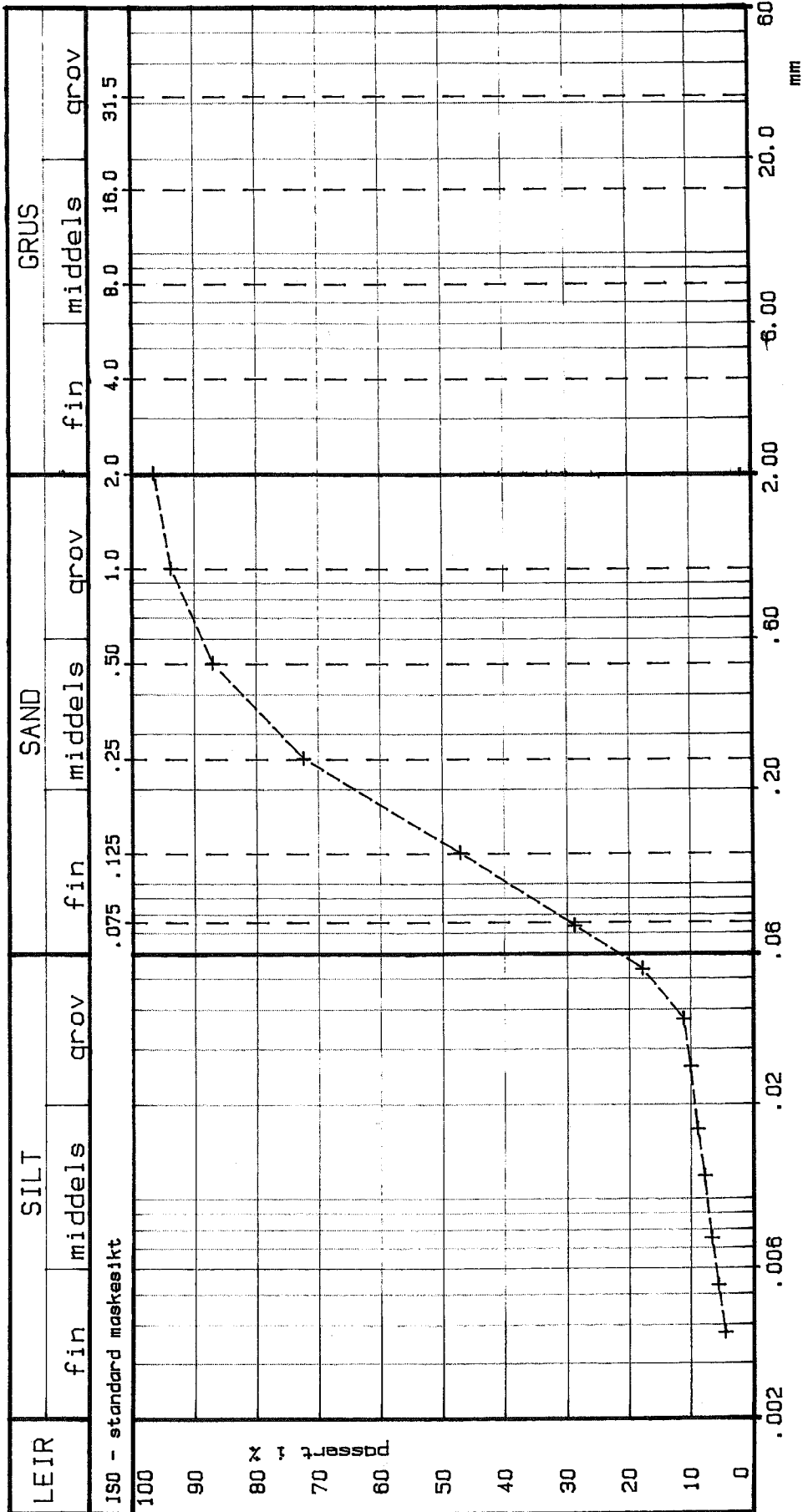


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## Bilag 7

### Geotekniske laboratorieundersøkelser



SAND, siltig

dybde X

lab. 7

hull T3-60-2

+

**Kommune**

Rådgivende ingeniører i  
Geoteknikk og Ingeniørgeologi

PORSVATN

KORNFORDELING

MÅLESTOKK

TEGNET AV

DATO

OPPDRAK

12040

BILAG

TEGN. NR