

# Environmental monitoring along a planned cable route in Boknafjorden





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**Abstract:** Sampling of the sea bottom was conducted at four stations along the planned cable route in conjunction with offshore monitoring of oil- and gasfields. The cable will transport Direct Current power from Kårstø, Rogaland, to the Utsira area. There were no indications of chemical pollution of heavy metal or PCB in the area investigated. However, some PAH-compounds were present in high levels, though with a high measurement uncertainty. These compounds have a very low solubility in water; they are not readily degraded and have a high molecular weight. This may indicate a leakage or spill, but as the amount of light compounds was low, it has most likely been a while ago. A species of polychaets abundant on all stations may indicate external supply of organic material. However the levels of total organic matter (TOM) were average. The diversity of species and phyla was also high on all stations; hence there are no indicators of a negative disturbance in the area. The bottom fauna composition indicated good conditions at the sea bed.

Keywords: Environmental monitoring, Boknafjorden, cable	Emneord: Miljøundersøkelse, Boknafjorden, kabel
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## Uni Miljø - Sam Marin

### Utforming av sammendrag SAM-rapport

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#### Ikke akkreditert:

The benthos samples were primarily not fixated according to standard procedure.

#### LEVERANDØRER

**Toktfartøy:** MS Esvagt Connector

**Kjemiske analyser utført av:** Eurofins AS **akkrediteringsnummer** TEST 003

Akkreditert: Heavy metals (Pb, Cd, Cu, Cr, Zn, Hg, Ba), PAH-16, THC, PCB-7

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**Andre:** Geologiske undersøkelser (kornfordeling og TOM) gjennomført akkreditert av Molab AS, akkrediteringsnummer: TEST 032.

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### Sampling, cruise

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## 1 Introduction

Comissioned by Statoil Petroleum AS an environmental monitoring was conducted along a planned cable route i Boknafjorden, by Section of Applied Research (SAM-Marin), Uni Research AS. Sampling of the sea bottom was conducted at four stations along the planned cable route in conjunction with offshore monitoring of oil- and gassfields. The cable will transport Direct Current power from Kårstø, Rogaland, to the Utsira area with the fields Johan Sverdrup, Edvard Grieg (former Luno), Ivar Aasen (former Draupne) and Gina Krog (former Dagny). The route will lay parallel to the existing pipeline “Rogassrøret” from Kårstø and 17 km further.

SAM-Marin is accredited for marine benthic sampling, taxonomy analyses, as well as for assessment and interpretation of results (accreditation number Test157). Chemical analyses were conducted by Eurofins Environment Testing Norway AS (accreditation number Test003). Geological analyses were conducted by Molab AS (accreditation number Test032).

This report presents the results from sampling in Boknafjorden and a discussion of the results. For a thorough description of materials and methods, see the main report of SAM-Marin of the offshore survey of 2013 (Hatlen og Johansen 2014).

## 2 Materials and methods

Sampling, sample preparation and reporting were conducted following «Retningslinjer for miljøovervåking» (ta-2848-2011) and the sampling program for the cruise. Deviations are presented below.

Sampling was conducted 22-23th of May 2013 from M/S *Esvagt Connector* which was hired for the purpose by Statoil ASA. The sampling crew consisted of personnel from Uni Research AS and hired personnel from Kvitsøy Sjøtjenester AS. Figure 2.1-2.3 presents the sampling area with the stations marked.

Sampling was conducted at 4 stations. At each station five sea floor samples were analyzed for biodiversity, three for chemical parameters (THC, PAH, PCB and the heavy metals cadmium, chrome, copper, lead, zink, mercury and barium) and one mixed sub sample from three samples was analyzed for geological characteristics (total organic matter and grain size distribution).

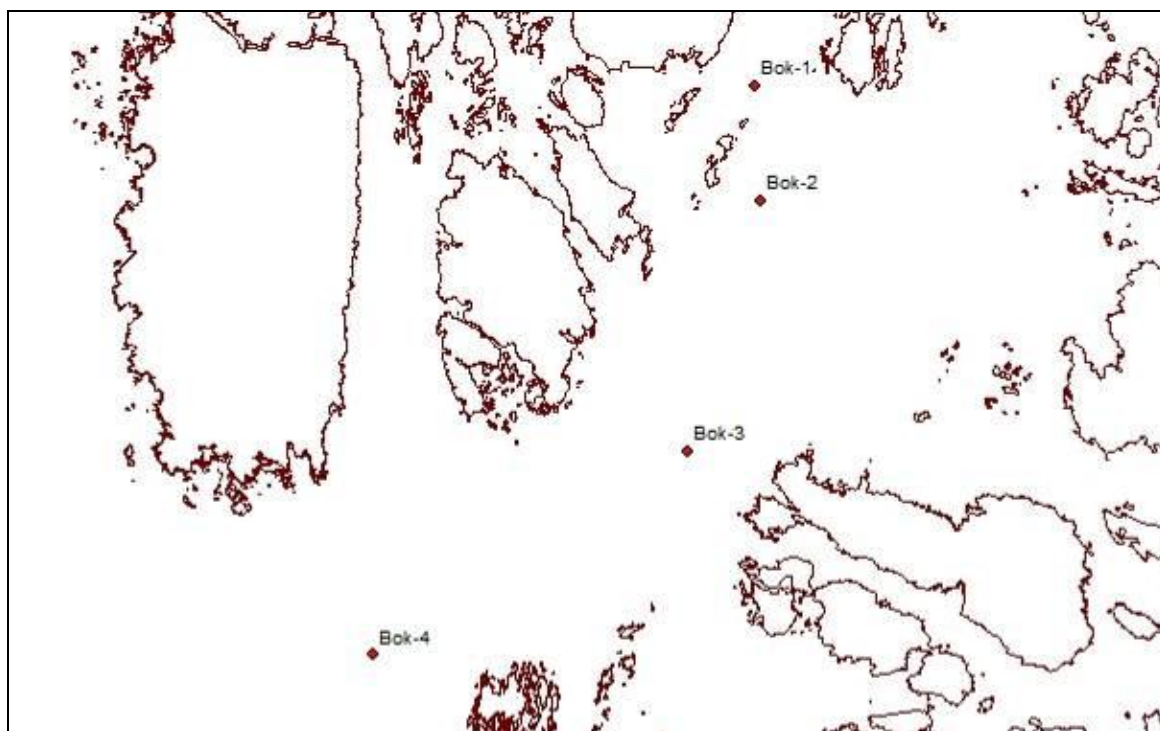
The PCB analyses was not part of the main program and is therefore presented here. Analyses of PCB In sediment was done according to a method developed from the reference method ISO/DIS-16703-Mod. About 60 g of each sample was wighed and extracted with a solvent

(fluid-fluid extraction). The extract was then pipetted out and analysed on GC-MS operating in SIM (single ion monitoring).

**Table 2.1.** Limit of quantification and measurement uncertainty (MU) for PCB.

Compound	Limit of quantification [mg/kg DW]	MU at limit of quantification [%]	MU at concentrations >0,0025 mg/kg DW [%]
<b>PCB 28</b>			
PCB 52	0,0005	40	25
PCB 101	0,0005	40	25
PCB 118	0,0005	40	25
PCB 153	0,0005	40	25
PCB 138	0,0005	40	25
PCB 180	0,0005	40	25
Sum PCB7	0,0005	40	25*

\*For sum PCB7 the MU is changed from 40 % to 25 % at concentrations >0,0175 mg/kg DW.



**Figure 2.1.** Map of Boknafjorden with the 4 stations sampled. Source: ArcGis.

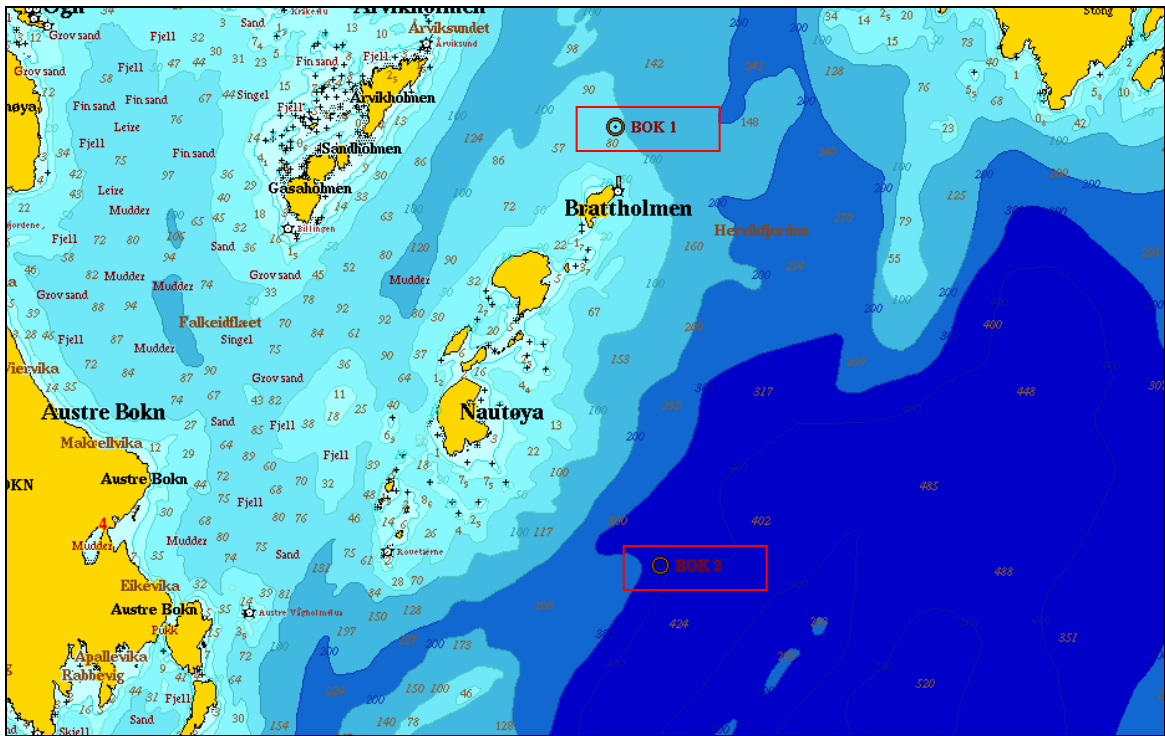


Figure 2.2. Map with depth of Boknafjorden with BOK 1 and BOK 2. Source: Olex.

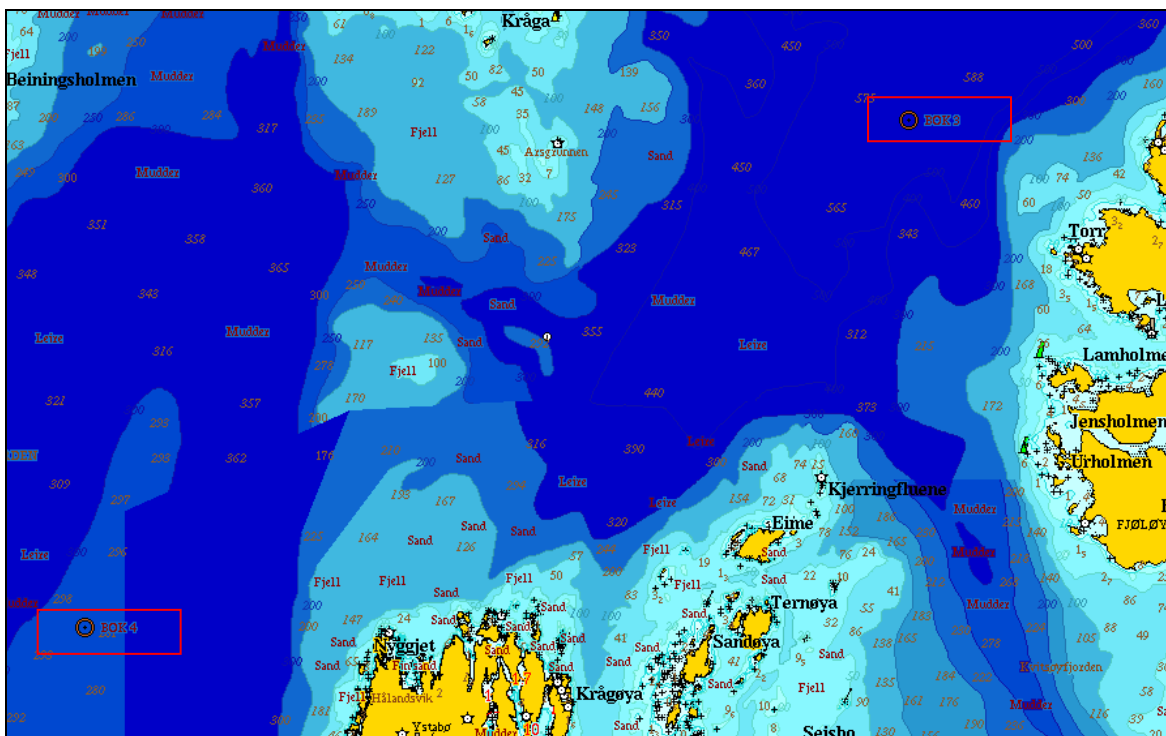


Figure 2.3. Map with depth of Boknafjorden with BOK 3 and BOK 4. Source: Olex.

**Tabell 2.2.** Information of samples collected 22.-23. of May 2013. Positioning of the vessel was done by DGPS and DP class 1. A van Veen grab was used, as well as a duograb, both with 0.1 m<sup>2</sup> sampling area. The duograb takes both biology samples and chemistry samples. A full 0.1 m<sup>2</sup> grab contains 16 liters of sediment, while a full duograb contains 21 liters. \*) Samples for analyses of chemistry and geology from Bok 3 are not accredited as the sediment reached the roof of the grab.

Station Date	Location Position wgs 84 utm 32N	Depth (m)	Grab number	Sample volume (l)	Other information
Bok 1 22.05.13	Boknafjorden 305246,94 Ø 6574452,44 N	141	1	8	Fine grained sediment with some gravel. Grab number 1, 2 and 7 were analyzed for THC, PAH, metals and geology. Grab number 2, 7 and 8 were analyzed for PCB. Grab 1, 4, 5, 6 and 7 were analyzed for biology. 3 grabs were discarded due to open device.
			2	8	
			3	16	
			4	16	
			5	16	
			6	16	
			7	6	
			8	12	
Bok 2 22.05.13	Boknafjorden 305077,69 Ø 6570263,5 N	430	1	16	Soft clay. Grab 2, 3 and 4 were analyzed for THC, PAH, metals, PCB and geology. Grab 1-5 were analyzed for biology. 1 grab was discarded due to open device.
			2	16	
			3	16	
			4	16	
			5	16	
Bok 3* 22.05.13	Boknafjorden 301586,91 Ø 6561335,56 N	585	1	Full	Soft clay. Grab 1-3 were used for analyzes for THC, PAH, metals, PCB and geology. Grab 1-5 were used for biology. *Deviation: The upper layer of the sediment was disturbed due to full grabs.
			2	Full	
			3	Full	
			4	Full	
			5	Full	
Bok 4 23.05.13	Boknafjorden 289443,22 Ø 6554946,38 N	300	1	16	Fine grained clay. Samples for analyzes of metals and PCB were taken from grab 1-3, for THC and PAH from grab 3-5 and for geology from grab 1, 2 and 4. Grab 1-5 were analyzed for biology samples.
			2	14	
			3	16	
			4	16	
			5	16	

## 2. 1 Deviations

Two deviations from national and interne standards were registered.

- Some of the samples had been preserved with diluted alcohol instead of formalin. These were immediately upon detection transformed to formalin and there were no sign of decay.
- Chemical samples from Bok 3 are not accredited as the sediment reached the roof of the grab and the top layer was disturbed.



### 3 Results and discussion

#### 3.1 Sediment description

The sediment was quite similar at all stations in Boknafjorden and consisted mainly of fine particles. Silt and clay dominated the samples, with a very small amount of sand present. Bok 1 stood out with a greater share of sand than the other stations and even with a minor amount of gravel. The amount of total organic matter (TOM) followed the same pattern, with low amounts on Bok 1 and moderate amounts on Bok, 2, Bok 3 and Bok 4. At Bok 3 the sediment reached the roof of the grab, preventing an undisturbed surface and correct information on the upper layers of the sediment may therefore be lacking.

**Table 3.1:** Overview of depth, organic content (% TOM) and grain size distribution in Boknafjorden May 2013.  
\*)At Bok 3 the sediment reached the roof of the grab, preventing an undisturbed surface.

Station	TOM		Grain size ditribution			Standard deviation	Skewness	Kurtosis	Median diameter
	(%)	Classification	Pelitt	Sand	Gravel	SD $\Phi$	Sk $\Phi$	K $\Phi$	MD $\Phi$
Bok 1	3,87	Silt and clay	71,6	26,5	1,8	1,75	-0,02	0,87	5,21
Bok 2	10,6	Silt and clay	98,3	1,7	0,0	1,25	0,00	0,74	5,97
Bok 3*	11,7	Silt and clay	96,8	3,2	0,0	1,27	0,00	0,74	5,93
Bok 4	11,4	Silt and clay	97,3	2,7	0,0	1,26	0,00	0,74	5,94
<b>Av</b>	<b>9,41</b>		<b>91,01</b>	<b>8,53</b>	<b>0,5</b>	<b>1,38</b>	<b>-0,01</b>	<b>0,77</b>	<b>5,76</b>
Sd	3,72		12,92	12,00	0,9	0,25	0,01	0,06	0,37
Min	3,87		71,65	1,69	0,0	1,25	-0,02	0,74	5,21
Max	11,70		98,31	26,51	1,8	1,75	0,00	0,87	5,97

#### 3.2 Chemistry

The results from analyses of petroleum hydrocarbons, heavy metals and PCB in Boknafjorden are presented below. At Bok 3 the sediment reached the roof of the grab, preventing an undisturbed surface. Information on the chemistry of the upper layers of the sediment may therefore be lacking.

For both petroleum hydrocarbons and metals, the concentrations were lower at Bok 1 compared to the rest of the stations. The sediment was coarser at Bok 1 and therefore has a smaller surface for the metal and hydrocarbons to bind to.

##### 3.2.1 Petroleum hydrocarbons

The method of analyzing PAH has the drawback of a high measurement uncertainty (ranging from 20 to 40%, see more information in Appendix). Following the standard of SFT 2229:2007 and the Water framework directive, the values are presented as given by the laboratory. However, caution should be taken when interpreting the results.

Levels of PAH (Polycyclic Aromatic Hydrocarbons) are low at all stations, ranging from background levels that are expected in Norwegian fjords (I) to small traces (II), indicating absence or limited amounts of PAH pollution. The exception are the two compounds Benzo(ghi)perylene and Indeno(1,2,3-cd)pyrene that have levels placing them in the class IV, Poor. Both compounds have high molecular weight and very low solubility in water and they are not readily degraded. That the lighter compounds are almost lacking from the samples, while the heavy compounds are found in large amounts, may indicate that there has been a previous leakage or spill.

**Table 3.2.** Concentration of PAH (Polycyclic Aromatic Hydrocarbons) presented in µg/kg and THC (Total Hydrocarbon) presented in mg/kg, in samples from Boknafjorden, May 2013. Degrees of pollution according to TA 2229/07 are given as roman numerals and colors: Blue (I): Background levels, Green (II): Good, Yellow (III): Moderate, Orange (IV): Poor, Red (V): Very poor.

\*)At Bok 3 the sediment reached the roof of the grab, and thus preventing an undisturbed surface.

Station		Naphtalene	Acenaftene	Acen- aphtylene	Anthra- cene	Pyrene	Benzo[a] antracene	Benzo[a] pyrene	Benzo[b,j,k] fluorantene	Benzo[ghi] perylene
Bok 1 141 m	Av	3,07	0,54	<0,5	1,77	13,67	12,83	12,67	70,00	45,67
	Std	0,68	0,27		0,29	2,89	2,93	2,89	13,23	10,26
	TK	II	I	I	II	II	II	II		IV
Bok 2 430 m	Av	13,67	2,33	0,83	5,03	48,00	39,00	31,67	173,33	87,33
	Std	2,31	0,38	0,02	0,87	10,82	4,00	4,93	28,87	11,59
	TK	II	I	I	II	II	II	II		IV
Bok 3* 585 m	Av	14,33	2,33	0,88	4,90	49,00	41,00	36,00	196,67	95,00
	Std	1,53	0,47	0,07	0,36	9,54	1,00	4,36	32,15	17,35
	TK	II	I	I	II	II	II	II		IV
Bok 4 300 m	Av	8,67	2,10	0,53	4,23	37,67	28,00	25,00	140,00	63,67
	Std	3,00	0,26	0,26	0,45	8,62	8,54	6,00	40,00	18,56
	TK	II	I	I	II	II	II	II		IV

**Table 3.2.** continued.

Station		Dibenzo [a,h] anthracene	Phenanthrene	Fluorantene	Fluorene	Indeno [1,2,3- cd] pyrene	Sum PAH(16) EPA	THC C12-C35
Bok 1 141 m	Av	7,93	8,90	18,33	1,37	76,67	286,67	9,50
	Std	2,34	1,82	4,04	0,38	20,84	50,33	1,80
	TK	I	II	II	I	IV	I	
Bok 2 430 m	Av	19,00	33,67	60,33	4,57	150,00	716,67	46,67
	Std	1,00	8,74	13,87	1,04	26,46	68,07	2,08
	TK	II	II	II	I	IV	II	
Bok 3 585 m	Av	20,67	34,33	61,33	4,97	163,33	770,00	37,00
	Std	1,53	6,43	11,55	0,84	15,28	79,37	4,36
	TK	II	II	II	I	IV	II	
Bok 4 300 m	Av	12,60	24,67	48,67	3,70	89,67	526,67	11,73
	Std	5,13	5,03	11,24	0,92	30,01	145,72	3,72
	TK	II	II	II	I	IV	II	

### 3.2.2 Heavy metals

The concentration of heavy metals was low (I-II) on all stations sampled in Boknafjorden.

**Table 3.3.** Concentration of heavy metals presented in mg/kg in samples from Boknafjorden, May 2013. Degrees of pollution according to TA 2229/07 are given as roman numerals and colors: Blue (I): Background levels, Green (II): Good, Yellow (III): Moderate, Orange (IV): Poor, Red (V): Very poor.

\*)At Bok 3 the sediment reached the roof of the grab, preventing an undisturbed surface.

Station		Cadmium (Cd)	Copper (Cu)	Lead (Pb)	Chrome (Cr)	Chrysene	Mercury (Hg)	Zink (Zn)	Barium (Ba)
Bok 1 141 m	Av	0,02	4,30	16,67	9,03	0,01	0,03	28,33	22,00
	Std	0,00	0,36	1,15	0,51	0,00	0,00	1,53	1,73
	TK	I	I	I	I		I	I	
Bok 2 430 m	Av	0,03	8,83	40,33	18,67	0,05	0,08	49,67	63,33
	Std	0,00	0,29	0,58	0,58	0,01	0,02	1,53	4,73
	TK	I	I	II	I		I	I	
Bok 3* 585 m	Av	0,03	7,73	34,00	17,33	0,05	0,08	43,33	59,67
	Std	0,00	0,25	3,00	0,58	0,01	0,01	1,53	1,15
	TK	I	I	II	I		I	I	
Bok 4 300 m	Av	0,03	7,80	34,33	18,33	0,04	0,07	43,67	49,67
	Std	0,00	0,53	0,58	0,58	0,01	0,00	1,15	2,08
	TK	I	I	II	I		I	I	

### 3.2.3 PCB (Polychlorinated biphenyls)

Amounts of PCBs were below detection levels on all stations investigated in Boknafjorden.

**Table 3.4.** Concentration of PCB presented in µg/kg in samples from Boknafjorden, May 2013. Degrees of pollution according to TA 2229/07 are given as roman numerals and colors: Blue (I): Background levels, Green (II): Good, Yellow (III): Moderate, Orange (IV): Poor, Red (V): Very poor.

\*)At Bok 3 the sediment reached the roof of the grab, preventing an undisturbed surface.

Station		PCB 101	PCB 118	PCB 138	PCB 153	PCB 180	PCB 28	PCB 52	Sum 7 PCB	% dry matter
Bok 1 141 m	Av	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	nd	52,75
	Std									11,03
	TK								I	
Bok 2 430 m	Av	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	nd	43,67
	Std									4,73
	TK								I	
Bok 3* 585 m	Av	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	nd	42,00
	Std									6,08
	TK								I	
Bok 4 300 m	Av	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	nd	46,40
	Std									4,04
	TK								I	

### 3.3 Bottom fauna

Results from analyses of bottom fauna are given in Figures 3.1 – 3.3, Tables 3.5 - 3.7 and Appendix Figure 1 and 2.

At all stations investigated there were in total 4512 specimens and 132 species. Animals of the taxonomic group Annelida were most numerous, accounting for 50% of the total amounts of individuals and taxa at the station. This is a normal condition in Norwegian fjords. *Heteromastus filiformis* is a species often found in areas influenced by organic material. It was abundant on all stations investigated.

Bok 1 is located in the outer parts of Hervikfjorden at 141 m depth. At this station there were 1321 individuals and 96 species present on 0,5m<sup>2</sup>. The most numerous species was the polychaet *Paramphinome jeffreysii* which constitutes for 16% of the total amount of individuals in the samples. Apart from that, the ten most numerous species consisted of two mollusks, one sipunculid while the rest were polychaets. The samples contained a high diversity ( $H'=4,6$  and  $ES100=32,5$ ) and high NQI value (0,75) indicating a diverse system with low sensitivity. All examined parameters point to the classification “Very good” (Blue), in the Water Framework Directive.

Bok 2 is located further south at 430 m depth. On 0,5m<sup>2</sup> 1058 individuals and 54 species were detected. Within the ten most abundant species there were five polychaets, two sipunculids, one echinoderm, one mollusk and one crustacean. This indicate a diverse composition of fauna, supported by the diversity values ( $H'=3,8$  and  $ES100=21,4$ ). The NQI values also indicate a robust faunal composition ( $NQI1=0,75$ ).

Further south and west, in more exposed waters, Bok 3 is placed at 585 m depth. At this station there were 926 individuals distributed on 60 species. Among the most abundant species two polychaets, one sipunculid, five mollusks, one crustacean and oligochates were present. As at Bok 2 this indicate a very diverse and robust ( $H'=4,0$  and  $ES100=24,5$ ,  $NQI1=0,76$ ) system. The faunal composition showed good conditions at this station.

Bok 4 is located in the mouth of Boknafjorden, at 300 m depth. The ten most abundant species consisted of two species of polychaets, five of molluscs, one crustacean species, one sipunculid species and one species of ribbon worms (*Nemertea*). All indexes point toward good diversity and robust species.

The figure presenting species in geometrical groups (figure 3.1), indicates quite good conditions at all stations, with many species containing few individuals and few species containing many individuals. This underpins table 3.7 which shows an absence of dominating species. Bok 1 stands out as the station which is least similar to the rest (figure 3.2 and 3.3). This is probably explained by the depth and position of the stations, with Bok 1 being the innermost and most shallow one, where influence from land is higher and influence from the open ocean is lower compared to the other stations.

**Table 3.5** Number of species in the samples from Boknafjorden i May 2013, divided on large taxonomic groups.

Large taxonomic groups	N.o. individuals	%	N.o. taxa	%
Annelida	2274	50	65	49
Arthropoda	214	5	26	20
Mollusca	1270	28	27	20
Echinodermata	161	4	5	4
Miscellaneous groups	593	13	9	7
<b>Total</b>	<b>4512</b>	<b>100</b>	<b>132</b>	<b>100</b>



**Table 3.6** Number of individuals and taxa (species), with diversity ( $H'$ ), evenness ( $J$ ),  $H'$ max and ES100 in the samples from Boknafjorden, collected in May 2013. Diversity ( $H'$ ), NQI's and ES100 are marked with color codes according to the Water Framework Directive (Veileder 01:2009). Blue: Very good, Green: Good, Yellow: Moderate, Orange: Bad, Red: Very bad.

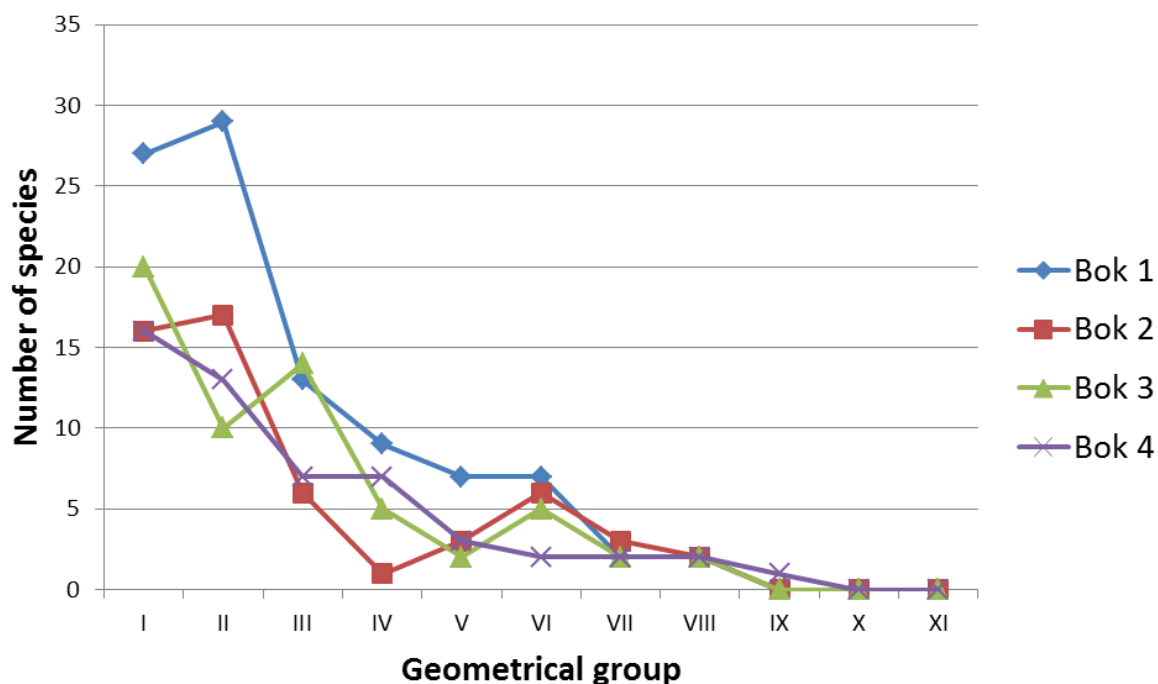
Station	Grab nr	Taxa	Individuals	Diversity ( $H'$ )	NQI1	NQI2	Es100	AMBI	Evenness ( $J$ )	$H'$ -max
<b>Bok 1</b>	1	47	219	4,8	0,78	0,76	33,8	1,9	0,9	5,6
	3	43	259	4,3	0,72	0,68	29,0	2,4	0,8	5,4
	4	49	278	4,4	0,74	0,70	29,8	2,4	0,8	5,6
	5	53	249	4,8	0,75	0,73	35,6	2,4	0,8	5,7
	6	56	316	4,7	0,76	0,73	34,3	2,2	0,8	5,8
	<b>Sum</b>	<b>96</b>	<b>1321</b>	<b>4,9</b>			33,2		<b>0,7</b>	<b>6,6</b>
	<b>Av</b>	<b>50</b>	<b>264</b>	<b>4,6</b>	<b>0,75</b>	<b>0,72</b>	<b>32,5</b>	<b>2,3</b>	<b>0,8</b>	<b>5,6</b>
<b>Bok 2</b>	1	27	133	3,8	0,74	0,68	23,9	1,9	0,8	4,8
	2	23	204	3,6	0,74	0,70	18,1	1,4	0,8	4,5
	3	36	316	4,0	0,76	0,72	22,6	1,6	0,8	5,2
	4	34	285	3,9	0,76	0,71	21,9	1,6	0,8	5,1
	5	22	120	3,7	0,74	0,70	20,4	1,5	0,8	4,5
	<b>Sum</b>	<b>54</b>	<b>1058</b>	<b>4,0</b>			21,7		<b>0,7</b>	<b>5,8</b>
	<b>Av</b>	<b>28</b>	<b>212</b>	<b>3,8</b>	<b>0,75</b>	<b>0,70</b>	<b>21,4</b>	<b>1,6</b>	<b>0,8</b>	<b>4,8</b>
<b>Bok 3*</b>	1	33	184	4,0	0,75	0,70	24,9	1,8	0,8	5,0
	2	39	243	4,2	0,79	0,75	25,6	1,4	0,8	5,3
	3	37	237	4,3	0,80	0,78	25,9	1,2	0,8	5,2
	4	24	149	3,6	0,73	0,68	20,4	1,7	0,8	4,6
	5	27	113	3,8	0,73	0,67	25,5	2,1	0,8	4,8
	<b>Sum</b>	<b>60</b>	<b>926</b>	<b>4,2</b>			24,8		<b>0,7</b>	<b>5,9</b>
	<b>Av</b>	<b>32</b>	<b>185</b>	<b>4,0</b>	<b>0,76</b>	<b>0,72</b>	<b>24,5</b>	<b>1,6</b>	<b>0,8</b>	<b>5,0</b>
<b>Bok 4</b>	1	29	300	3,0	0,65	0,55	15,9	2,8	0,6	4,9
	2	31	253	3,4	0,68	0,59	19,6	2,6	0,7	5,0
	3	24	191	3,4	0,65	0,59	19,9	2,7	0,7	4,6
	4	26	266	3,0	0,63	0,53	17,6	3,0	0,6	4,7
	5	29	197	3,5	0,69	0,62	22,2	2,5	0,7	4,9
	<b>Sum</b>	<b>53</b>	<b>1207</b>	<b>3,5</b>			20,1		<b>0,6</b>	<b>5,7</b>
	<b>Av</b>	<b>28</b>	<b>241</b>	<b>3,3</b>	<b>0,66</b>	<b>0,58</b>	<b>19,1</b>	<b>2,7</b>	<b>0,7</b>	<b>4,8</b>

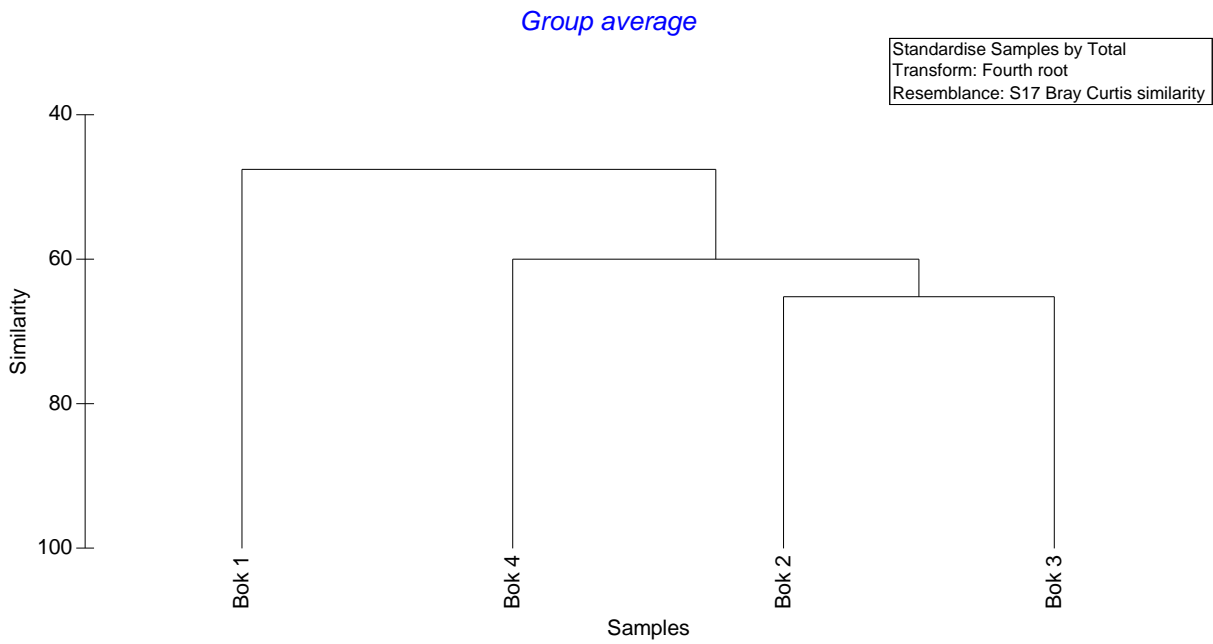
**Table 3.7** The ten most numerous taxa at each station in Boknafjorden, May 2013.

Bok 1	N.o. species	%	Kum.%	Bok 2	N.o. species	%	Kum.%
<i>Paramphinome jeffreysii</i>	207	15,7	15,7	<i>Heteromastus filiformis</i>	218	20,6	20,6
<i>Heteromastus filiformis</i>	179	13,6	29,2	<i>Onchnesoma steenstrupi</i>	167	15,8	36,4
<i>Lumbrineridae indet.</i>	77	5,8	35,0	<i>Nephasoma cf. minutum</i>	99	9,4	45,7
<i>Polydora spp.</i>	66	5,0	40,0	<i>Amphilepis norvegica</i>	96	9,1	54,8
<i>Eclysippe vanelli</i>	61	4,6	44,7	<i>Ceratocephale loveni</i>	64	6,0	60,9
<i>Abra nitida</i>	60	4,5	49,2	<i>Terebellides stroemii</i>	47	4,4	65,3
<i>Praxillella affinis</i>	59	4,5	53,7	<i>Caudofoveata indet.</i>	44	4,2	69,5
<i>Nephasoma cf. minutum</i>	55	4,2	57,8	<i>Eriopisa elongata</i>	44	4,2	73,6
<i>Thyasira equalis</i>	53	4,0	61,8	<i>Paramphinome jeffreysii</i>	41	3,9	77,5
<i>Galathowenia oculata</i>	45	3,4	65,3	<i>Lumbrineridae indet.</i>	37	3,5	81,0

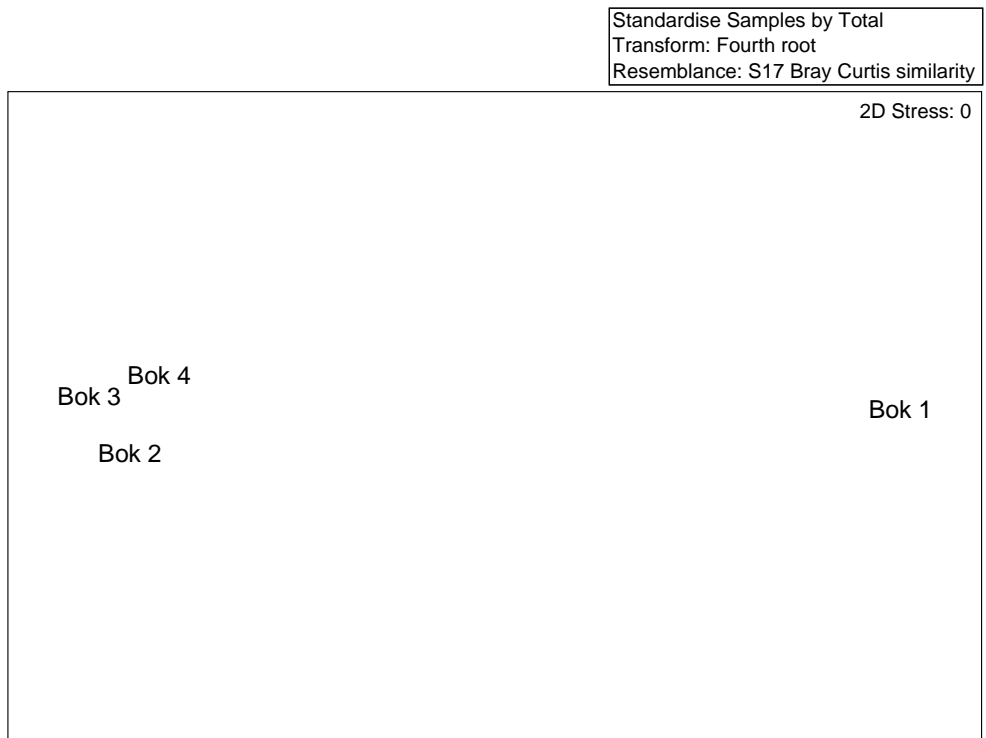
  

Bok 3	N.o. species	%	Kum.%	Bok 4	N.o. species	%	Kum.%
<i>Heteromastus filiformis</i>	167	18,0	18,0	<i>Heteromastus filiformis</i>	400	33,1	33,1
<i>Onchnesoma steenstrupi</i>	136	14,7	32,7	<i>Abra nitida</i>	181	15,0	48,1
<i>Nucula tumidula</i>	101	10,9	43,6	<i>Kelliella abyssicola</i>	135	11,2	59,3
<i>Thyasira equalis</i>	66	7,1	50,8	<i>Thyasira equalis</i>	120	9,9	69,3
<i>Eriopisa elongate</i>	56	6,0	56,8	<i>Paramphinome jeffreysii</i>	71	5,9	75,1
<i>Thyasira obsolete</i>	48	5,2	62,0	<i>Eriopisa elongate crust</i>	37	3,1	78,2
<i>Kelliella abyssicola</i>	45	4,9	66,8	<i>Thyasira sarsii</i>	32	2,7	80,9
<i>Yoldiella lucida</i>	43	4,6	71,5	<i>Yoldiella lucida</i>	29	2,4	83,3
<i>Lumbrineridae indet.</i>	41	4,4	75,9	<i>Onchnesoma steenstrupi</i>	21	1,7	85,0
<i>Oligochaeta indet.</i>	31	3,3	79,3	<i>Nemertea indet.</i>	19	1,6	86,6

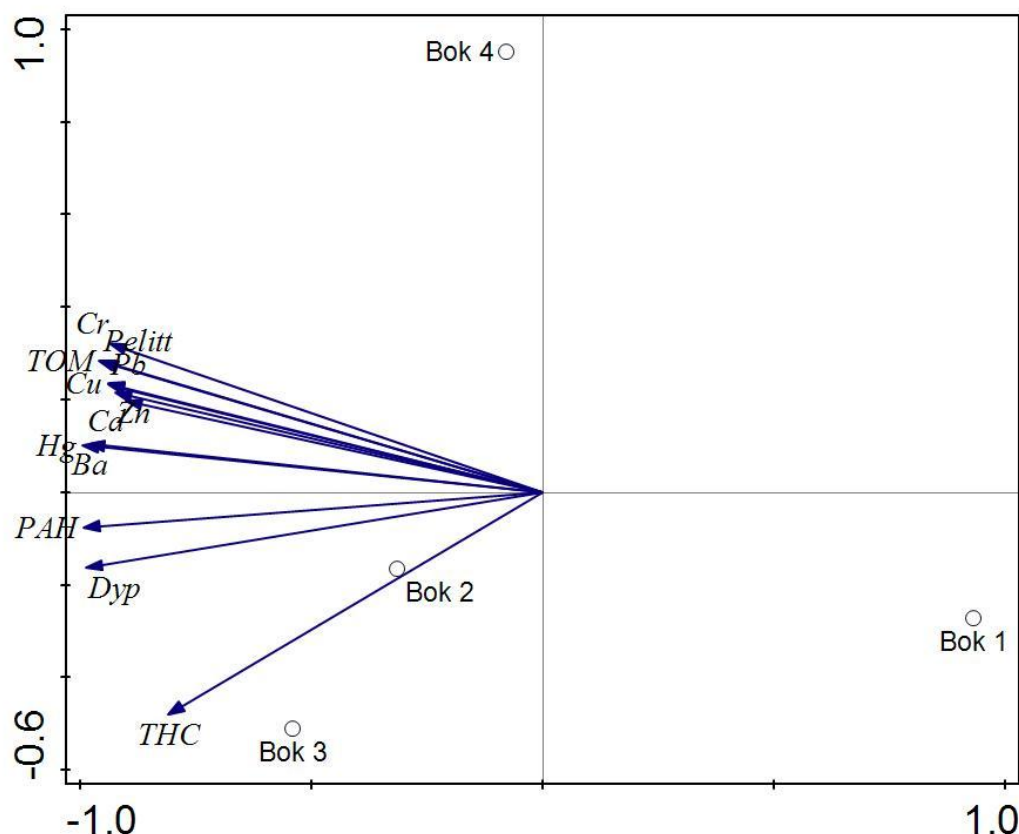

**Figure 3.1** Number of species per geometrical group.



**Figure 3.2** Dendrogram showing the similarity of fauna between the different stations in Boknafjorden in May 2013. A dendrogram including each grab sample is available in appendix.



**Figure 3.3** MDS plot showing the similarity of fauna between the different stations in Boknafjorden in May 2013. AMDS plot including each grab number is available in appendix.



**Figure 3.4 PCA** showing the similarity of fauna between the different stations in Boknafjorden in May 2013.

According to the Canoco-RDA-analysis, there were no significant correlations between the fauna and the environmental parameters. However, the PCA-plot shows that the correlation of environmental parameters is highest between the environmental parameters and the two deepest stations.

## 4 Summary and conclusion

There were no indications of chemical pollution of heavy metal or PCB in the area investigated. However, some PAH-compounds were present in high levels, though with a high measurement uncertainty. These compounds have a very low solubility in water; they are not readily degraded and have a high molecular weight. This may indicate a leakage or spill, but as the amount of light compounds was low, it has most likely been a while ago.

A species of polychaets abundant on all stations may indicate external supply of organic material. However the levels of total organic matter (TOM) were average. The diversity of species and phyla was also high on all stations; hence there are no indicators of a negative

disturbance in the area. The bottom fauna composition indicated good conditions at the sea bed.

## 5 References

Hatlen K., Johansen P.O. 2014 Miljøovervåkning av olje- og gassfelt i region I og II i 2013. SAM-rapport.

Veileder 01:2009. Klassifisering av miljøtilstand i vann. Økologisk og kjemisk klassifiseringssystem for kystvann, innsjøer og elver i henhold til vannforskriften.

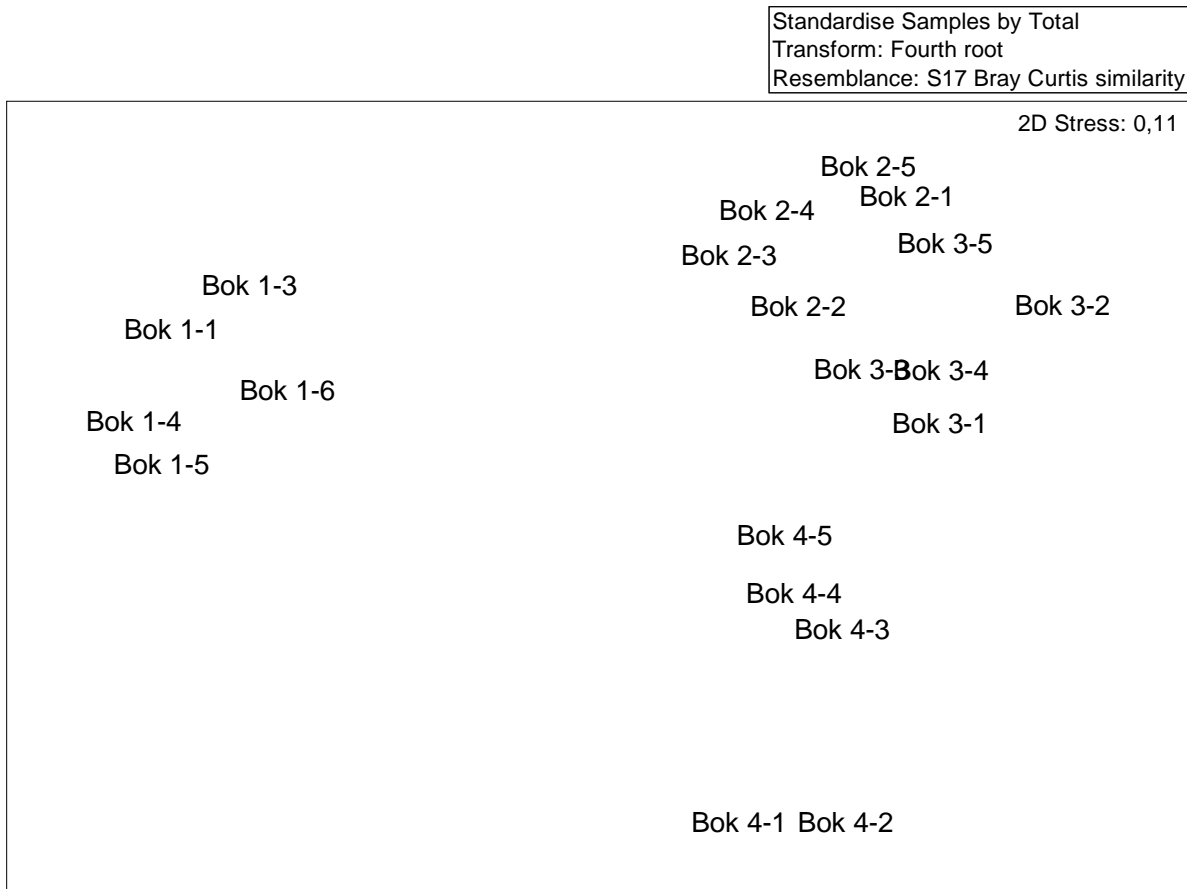
TA 2848: 2011 Guidelines for offshore environmental monitoring on the Norwegian continental shelf. Iversen, Vik Green, Juel Lind, Rønn Hedegaard Petersen, Bakke, Lichtenthaler, Klungsøyr, Grafert, Natvig and Ersvik.

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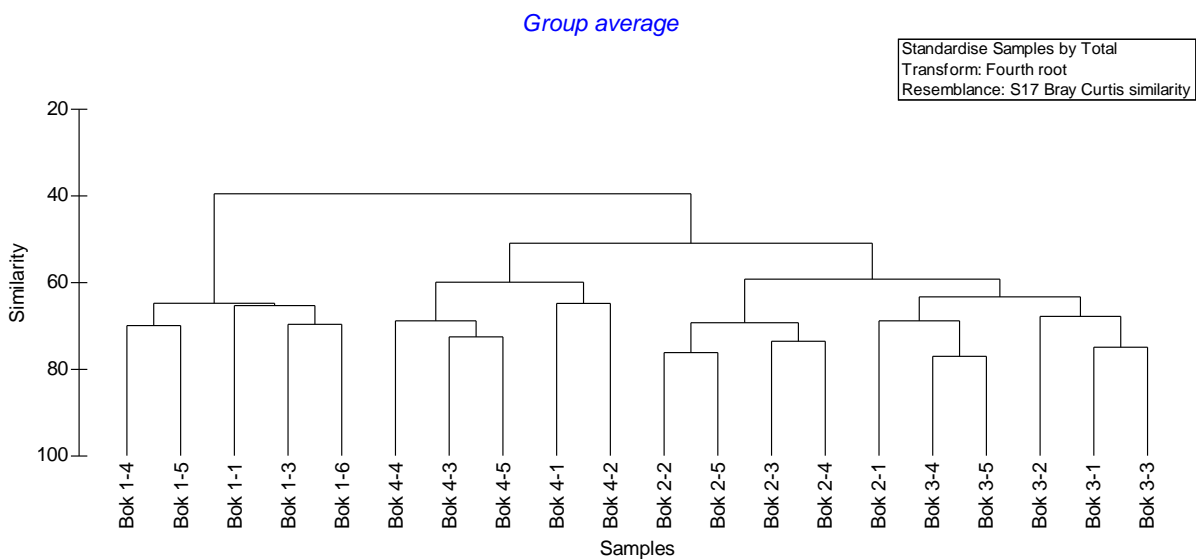


## 6 Appendix

### Figures of multivariate fauna analysis



**App. figure 1:** MDS plot showing the similarity of fauna between the different grab samples in Boknafjorden in May 2013.



**App. figure 2:** Dendrogram showing the similarity of fauna between the different grabs samples in Boknafjorden in May 2013.

## Taxonomy report

Vedlegg SF-SAM-505.5

BENTHOS ARTSLISTE

SAM-Marin



SAM-Marin  
Thormøhlensgate 55, 5008 Bergen  
Telefon: 55 58 43 41 Telefaks: 55 58 45 25



Test 157

Oppdragsgiver (navn og adresse): Statoil AS

Prosjekt nr.: 807299

Prøvetakingssted (område): Boknafjorden, Rogaland

Dato for prøvetaking: 22-23/5-2013

Ansvarlig for prøvetaking (firma): SAM-Marin, Uni Reserach AS

Avvik/forhold med mulig påvirkning på resultatet: Some of the samples had been preserved with diluted alcohol instead of formalin. These were immediately upon detection transformed to formalin and there were no sign of decay.

Artene er identifisert av: Tom Alvestad (Polychaeta), Frøydis Lygre (Molluska), Jon Anders Kongsrud (Maldanidea), Per-Otto Johansen (Crustacea), Per Johannessen (Varia)

	Akkreditert	I henhold til standard	Evt. akkrediteringsnummer	Ikke akkreditert
Prøvetaking	<input checked="" type="checkbox"/>	ISO-5667-19	Test 157	<input type="checkbox"/>
Sortering	<input checked="" type="checkbox"/>	ISO-5667-19	Test 157	<input type="checkbox"/>
Identifisering	<input checked="" type="checkbox"/>	ISO-5667-19	Test 157	<input type="checkbox"/>

## Opplysninger om merker i artslisten:

For hver stasjon er nr. på grabbhuuggene angitt, og under hvert nummer de dyrene som ble funnet i prøvene.

- + i tabellen angir at det var dyr til stede i prøven, men at de ikke er kvantifisert.
- / i tabellen betyr en deling i voksne og unge individer (eksempel 4/2 betyr 4 voksne og 2 unge).
- cf. mellom slekts- og artsnavn betyr at slektsbestemmelsen er sikker, men at artsbestemmelsen er usikker.
- \* ved arter eller grupper av arter angir arter eller grupper av arter som ikke er med i eventuelle analyser.
- \* ved huggnummer angir at det er knyttet avvik til prøven

## Andre opplysninger:

Tabellen starter på neste side og består av:6 sider.

Artslisten skal ikke kopieres i ufullstendig form, uten skriftlig godkjenning fra SAM.

Signatur: *Tom Alvestad*  
Godkjent taksonom

## Environmental monitoring along a planned cable route in Boknafjorden

Dato: 22-23/5-13											
Side 1 av 6	Stasjon	Bok 1	Bok 1	Bok 1	Bok 1	Bok 1	Bok 2	Bok 2	Bok 2	Bok 2	Bok 2
Art	Huggn	1	3	4	5	6	1	2	3	4	5
* PORIFERA indet.											
* HYDROZOA											
* Hydrozoa indet.		+	+	+	+	+				+	
ANTHOZOA											
Virgularia mirabilis			1	1		1					
Virgularia tuberculata											
Cerianthus lloydii							1			1	
PLATYHELMINTES indet.											
NEMERTINI indet.		5	3	10	3	10		1	4	1	
* NEMATODA indet.		9	6	5	3	5	3	1	1	1	1
PRIAPULIDA											
POLYCHAETA											
Paramphinome jeffreysii		34	58	54	32	29	1	2	18	15	5
Polynoidae indet.				1							
Pholoe baltica				2							
Pholoe pallida			2	1		1	1				1
Neoleanira tetragona								1		1	1
Gyptis rosea							1		1		
Nereimyra cf. Woodshoela				1							
Glyphohesione klatti											
Exogone sp.										1	
Ceratocephale loveni			5		3		8	17	18	10	11
Nephtys hystricis		1	0/1		2	3		1	0/1	0/1	
Nephtys paradoxa		2	1		1	1			0/1		
Nephtys pulchra											
Glycera unicornis			1								
Glycera lapidum							0/1				
Paradiopatra fiordica										1	
Paradiopatra quadricuspis		0/1		0/1						0/1	
Lumbrineridae indet.		8	20	25	8	16	6	5	8	13	5
Phylo norvegicus				0/1	0/1	0/1		1	1	0/2	
Polydora spp.		13	15	9	13	16					
Prionospio cirrifer			1								
Prionospio dubia		1	3	2	2	7			0/1	0/1	
Prionospio sp.									3	1	
Spiophanes kroyeri				1	0/2	0/1					
Spiochaetopterus typicus											
Aricidea catherinae			1		1		1			1	
Levinsenia gracilis		6	3	5	5	5	4	1	2	3	1
Paradoneis sp.					1						
Aphelochaeta sp.			2	2	1	1					
Cirratulus caudatus				1							
Brada villosa											
Diplocirrus glaucus		3	1	1	2	2					
Ophelina norvegica								1	1		1
Scalibregma inflatum						1					
Capitella capitata		1									
Heteromastus filiformis		12	34	36	33	64	36	42	58	62	20
Notomastus latericeus				1	2						
Clymenura borealis											
Praxillella affinis		15	12	14	11	7					
Microclymene acirrata									1		1
Microclymene tricirrata			1			1					
Lumbriclymene sp.		1									
Chirimia biceps				1							
Rhodine loveni		4	3	6	3	9	8	3	5	2	1

## Environmental monitoring along a planned cable route in Boknafjorden

Dato: 22-23/5-13 Side 2 av 6 Art	Stasjon Huggn	Bok 1 1	Bok 1 3	Bok 1 4	Bok 1 5	Bok 1 6	Bok 2 1	Bok 2 2	Bok 2 3	Bok 2 4	Bok 2 5
Myriochele danielsseni					0/7						
Galathowenia oculata		10	10	5	10	10					
Pectinaria auricoma		0/1									0/1
Lagis koreni				1							
Pectinaria belgica						1					
Ampharete falcata			1								
Sabellides octocirrata		1	0/1						1		
Anobothrus sp.							1		1		
Mugga wahrbergi		2	2		2						
Amythasides macroglossus		8	8	4	6	6	2		1		
Eclysippe vanelli		8	12	16	10	15					
Pista cristata				1							
Streblosoma intestinale		1									
Polycirrus latidens		1	1			1					
Polycirrus plumosus			0/1			2					
Amaeana trilobata		2		1	1	1					
Trichobranchus roseus				1	1						
Terebellides stroemii				1	1	1	1/3	8	12/1	12	7/3
Sabellidae indet.				1	1						
Euchone sp.		1				1					
* POGONOPHORA indet.											
OLIGOCHAETA indet.						2	1				
ECHIURA											
SIPUNCULA indet											
Phascolion strombus					0/1	0/2			0/1		
Onchnesoma steenstrupi		2		2	1	1	18	36	38	51	24
Nephasoma cf. minutum		16	6	12	3	18	7	19	38	26	9
CRUSTACEA											
* Calanus finmarchicus				1			164	80	14	14	3
* Aetideus armatus											
* Aetideopsis armatus					1	1				1	
* Euchaeta norvegica		1					6	3	3		
* Metridia lucens		1									
* Candacia armata								2			
Balanus sp.		1				1					
Philomedes lilljeborgi									1		
Macrocypris minna					1				2		
* Mysidacea indet.											
Leucon sp.						1					
Eudorella emarginata		1		1							
Eudorella truncatula		1	1						1		
Eudorella hirsuta											1
Diastylis cornuta		6		2	2	3					
Diastylis biplicata					1						
Diastylis serrata						1					
Campylaspis sulcata											
Apseudes spinosus											
Eurycope sp.							1			1	
Themisto sp.										1	
Ampelisca sp.				1							
Neohela monstrosa											
Gammaropsis maculata					1						
Eriopisa elongata			1			1	3	10	12	12	7
Bathymedon longimanus											
Oediceropsis brevicornis				1							
Synchelidium sp.											



## Environmental monitoring along a planned cable route in Boknafjorden

Dato: 22-23/5-13 Side 3 av 6		Stasjon	Bok 1	Bok 1	Bok 1	Bok 1	Bok 1	Bok 2	Bok 2	Bok 2	Bok 2	Bok 2
Art	Huggm	1	3	4	5	6	1	2	3	4	5	
Westwoodilla caecula		1										
Nicippe tumida		1		1		2						
Harpinia sp.												
Decapoda indet.		0/2							0/3	0/2		
Calocarides coronatus									1	2		
MOLLUSCA												
Caudofoveata indet.		2	4/1	2/2	3	3/1	5	7	19/3	8/1	1	
Haliella stenostoma		1		1/1	1							
Cylichnina umbilicata					2							
Philine scabra			0/1									
* Limacina retroversa								1				
Nucula tumidula		2/2	3/1			2/1	1/2	3/6	2/1	4/5	2	
Yoldiella lucida								1	0/1			
Yoldiella nana												
Yoldiella philippiana		4	5	6	3/1	7						
Bathyarca pectunculoides												
Limatula gwyni		1		1	1							
Thyasira obsoleta			1/1			1	1		2	3		
Thyasira sarsii						1/1						
Thyasira equalis		9	10/1	9/1	16	6/1	3	4/1	9/1	6/1	6/1	
Adontorhina similis						3	1					
Axinulus croulinensis					0/1	1						
Axinulus eumyariius												
Mendicula ferruginosa		2/1	0/2		2	1			3	1		
Kurtiella bidentata		1										
Kurtiella tumidula					4					1		
Parvicardium minimum												
Abra longicallus							1					1/1
Abra nitida		8/1	6/2	16/1	17/2	7						
Kelliella abyssicola		4		3	3	8	2	3	9	9	3/1	
Cuspidaria cuspidata												
Antalis occidentalis								1				
Entalina tetragona		1	3	2	3	4		2		0/1		
Pulsellum lofotense					1							
BRACHIOPODA indet.												
PHORONIDA indet.												
* BRYOZOA												
* Bryozoa grenet						+						
ECHINODERMATA												
Amphipholis squamata		2/3		0/2	2/2	1/1						
Amphiura chiajei			2	1	0/2	2/8						
Amphilepis norvegica						0/3	4/8	13/15	6/24	8/13	0/5	
Ophiura sarsi					0/1	0/2						
Echinocardium flavescens		1/1	2/1	0/3	3/2	1/3						
ENTEROPNEUSTA indet.			1		2	1						
* CHAETOGNATHA indet.												
ASCIDIACEA												
CHORDATA												
* PISCES indet.												
* Fiske egg.							1					
* VARIA				+		+	+					



## Environmental monitoring along a planned cable route in Boknafjorden

Dato: 22-23/5-13	Stasjon	Bok 3	Bok 3	Bok 3	Bok 3	Bok 3	Bok 4	Bok 4	Bok 4	Bok 4	Bok 4
Side 4 av 6	Huggn	1	2	3	4	5	1	2	3	4	5
Art											
* PORIFERA indet.											
* HYDROZOA											
* Hydrozoa indet.		+	+	+			+			+	+
ANTHOZOA											
Virgularia mirabilis											
Virgularia tuberculata			1								
Cerianthus lloydii		1		2	1						
PLATYHELMINTES indet.											
NEMERTINI indet.		3		3		2	4		3	9	3
* NEMATODA indet.		4	1	2	3	4	2	1		1	1
PRIAPULIDA											
POLYCHAETA											
Paramphinome jeffreysii		1		4	1		5	5	29	22	10
Polynoidea indet.			1							1	
Pholoe baltica											
Pholoe pallida			1								
Neoleanira tetragona							1	2		1	1
Gyptis rosea		1	2			1		2			
Nereimyra cf. Woodshoela		1		1			1	2			
Glyphohesione klatti		1									
Exogone sp.				1					2	1	
Ceratocephale loveni		2	3	5	2	3	2	1		2	5
Nephtys hystricis								0/1			
Nephtys paradoxa		1	1				1	1			
Nephtys pulchra									0/1		
Glycera unicornis											
Glycera lapidum					0/1	0/1		0/2	0/1		
Paradiopatra fiordica											
Paradiopatra quadricuspis											
Lumbrineridae indet.		9	12	7	6	7	1	1	3		4
Phylo norvegicus			1					0/1		1/1	
Polydora spp.											
Prionospio cirrifera											
Prionospio dubia							1				0/1
Prionospio sp.		1	1			1					
Spiophanes kroyeri								0/1			
Spiochaetopterus typicus		1/1	1/2		1	0/1					
Aricidea catherinae			1		2	1	1				
Levinsenia gracilis		3	3	3	2	2	1		2	2	2
Paradoneis sp.											
Aphelochaeta sp.											1
Cirratulus caudatus											
Brada villosa				1	1						1
Diplocirrus glaucus							0/1			0/2	
Ophelina norvegica							2	2	3	2	
Scalibregma inflatum											
Capitella capitata											
Heteromastus filiformis		42	36	22	39	28	74	72	63	130	61
Notomastus latericeus											
Clymenura borealis			1								
Praxillella affinis											
Microclymene acirrata		1	1	1							
Microclymene tricirrata											
Lumbriclymene sp.											
Chirimia biceps											
Rhodine loveni				1	1	2	1		3	5	6

## Environmental monitoring along a planned cable route in Boknafjorden

Dato: 22-23/5-13		Stasjon					Stasjon				
Side 5av6		Huggn					Huggn				
Art		Bok 3 1	Bok 3 2	Bok 3 3	Bok 3 4	Bok 3 5	Bok 4 1	Bok 4 2	Bok 4 3	Bok 4 4	Bok 4 5
Myriochele danielsseni											
Galathowenia oculata		2	2		1	1	1	1	2		1
Pectinaria auricoma											
Lagis koreni											
Pectinaria belgica											
Ampharete falcata											
Sabellides octocirrata											
Anobothrus sp.											
Mugga wahrbergi											
Amythasides macroglossus				2							
Eclysippe vanelli											
Pista cristata											
Streblosoma intestinale											
Polycirrus latidens						1					
Polycirrus plumosus											
Amaeana trilobata			1	1				1	1		1
Trichobranchus roseus											
Terebellides stroemii				1				1			1
Sabellidae indet.											
Euchone sp.											
* POGONOPHORA indet.											
OLIGOCHAETA indet.		8	8	11	2	2		1	4	1	3
ECHIURA											
SIPUNCULA indet				1							
Phascolion strombus											
Onchnesoma stenstrupi		26	37	40	17	16			10	9	2
Nephasoma cf. minutum		8	10	6	1	1					
CRUSTACEA											
* Calanus finmarchicus		25	166	76	104	150	9		34	39	27
* Aetideus armatus			2								
* Aetideopsis armatus											
* Euchaeta norvegica			7	2	3	5			1	1	2
* Metridia lucens					2					1	1
* Candacia armata											
Balanus sp.											
Philomedes lilljeborgi		1	2	2							
Macrocypris minna											
* Mysidacea indet.			1			1					
Leucon sp.											
Eudorella emarginata							1				
Eudorella truncatula							2				
Eudorella hirsuta											
Diastylis cornuta			1							1	
Diastylodes biplicata								1			
Diastylodes serrata											
Campylaspis sulcata									1		
Apseudes spinosus				1							
Eurycope sp.										1	
Themisto sp.											
Ampelisca sp.											
Neohela monstrosa							2	2			
Gammaropsis maculata											
Eriopisa elongata		8	19	10	11	8	7	5	9	12	4
Bathymedon longimanus			1								
Oediceropsis brevicornis											
Synchelidium sp.			1				1				

## Environmental monitoring along a planned cable route in Boknafjorden

Dato: 22-23/5-13		Bok 3					Bok 4				
Side	Stasjon	1	2	3	4	5	1	2	3	4	5
Art	Huggn										
Westwoodilla caecula											
Nicippe tumida											
Harpinia sp.			1								
Decapoda indet.				0/1	0/1	0/2					
Calocarides coronatus											
MOLLUSCA											
Caudofoveata indet.		1	2	1/1	2	1		4	2	2	7
Haliella stenostoma			1								
Cylichnina umbilicata											
Philine scabra											
* Limacina retroversa						1					
Nucula tumidula		13/2	25/2	35/5	14	5	1		0/1	2/1	2
Yoldiella lucida		9/2	11/2	12/2	3/2		0/3	7/3	2/4	4/3	1/2
Yoldiella nana		2	1/1	3				0/3	0/4		0/3
Yoldiella philippiana											
Bathyarca pectunculoides			1								
Limatula gwyni											
Thyasira obsoleta		4	6/1	19/1	8/2	7	0/1				0/1
Thyasira sarsii							6/8	6/7	0/2	0/1	0/2
Thyasira equalis		4/4	16/3	15/3	6/3	9/3	47/17	15/10	3/2	11/1	12/2
Adontorhina similis		1	1	3							
Axinulus croulinensis											
Axinulus eumyrius						1					
Mendicula ferruginosa		1		1		1/1					
Kurtiella bidentata											
Kurtiella tumidula		1		2						1	
Parvicardium minimum		0/1					0/1	1/2			
Abra longicallus			1/1	1		1					
Abra nitida		1/1		1			14/65	7/46	5/15	5/8	5/11
Kelliella abyssicola		14	11/2	14	16/1	1	24/2	32/2	14	23	38
Cuspidaria cuspidata							0/1	0/1			0/2
Antalis occidentalis											1
Entalina tetragona			2	1/1				1			
Pulsellum lofotense											
BRACHIOPODA indet.											
PHORONIDA indet.											
* BRYOZOA											
* Bryozoa grenet											
ECHINODERMATA											
Amphipholis squamata											
Amphiura chiajei											
Amphilepis norvegica		1	1/1	2	2	2/1		1		0/1	1
Ophiura sarsi				0/1							
Echinocardium flavescens											
ENTEROPNEUSTA indet.											
* CHAETOGNATHA indet.			4	1		2		1			
ASCIDIACEA											
CHORDATA											
* PISCES indet.											
* Fiske egg.											
* VARIA		+		+	+	+	+	+		+	+

**Measurement uncertainties for PAH analyses**

## A. Estimated measurement uncertainties for low values

Component	Quantification limit [mg/kg DW]	M.U [%]
<b>THC:</b>		
THC	1,0	40
<b>PAH:</b>		
Naphthalen	0,0005	40
Acenaphtylene	0,0005	40
Acenaphthene	0,0005	40
Fluorene	0,0005	40
Dibenzothiophene	0,0005	40
Phenanthrene	0,0005	40
Anthracene	0,0005	40
Fluoranthene	0,0005	40
Pyrene	0,0005	40
Benzantracene	0,0005	40
Chrysene/triphenylene	0,0005	40
Benzo[bjk]fluoranthenes	0,0005	40
Benzo[a]pyrene	0,0005	40
Indeno(1,2,3-cd)pyrene	0,0005	40
Dibenzo[ah]anthracene	0,0005	40
Benzo[ghi]perylene	0,0005	40

B. Estimated measurement uncertainties for high values [ $\geq 0,05$  mg/kg DW]

Component	Quantification limit [mg/kg DW]	M.U [%]
<b>PAH:</b>		
Naftalen	0,0005	30
Acenaftylen	0,0005	40
Acenaften	0,0005	20
Fluoren	0,0005	25
Fenantren	0,0005	20
Antracen	0,0005	20
Fluoranten	0,0005	20
Pyren	0,0005	20
Benzantracen	0,0005	30
Krysen/Trifenylen	0,0005	30
Benzo[bjk]fluoranten	0,0005	30
Benzo[a]pyren	0,0005	30
Indeno(1,2,3-cd)pyren	0,0005	40
Dibenzo[ah]antracen	0,0005	20
Benzo[ghi]perylen	0,0005	30
Naftalen	0,0005	30

Measurement uncertainties for high values are based on results from control charts for reference material:

"Harbour Marine Sediment Reference Material HS-4B" levert av Institute for Marine Biosciences Canada, plottet in the period 2009-2011 as well as results from SLP Setoc Wepal 2012.

The reference material HS-4B contains all PAH and NPD, SLP Setoc Wepal contains PAH.



## Analytical report – Heavy metals



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**AR-13-MM-014348-01**



**EUNOMO-00077246**

Prøvemottak: 20.06.2013  
Temperatur:  
Analyseperiode: 20.06.2013-03.09.2013  
Referanse: 807299/38/13  
BOKNAFJORDEN  
(metaller)

### ANALYSERAPPORT

Prøvenr.: <b>439-2013-06200334</b>	Prøvetakingsdato: 22.05.2013
Prøvetype: Sedimenter	Prøvetaker: Oppdragsgiver
Prøvemerkning: Bok 1	Analysedato: 20.06.2013
Hugg 1	

Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Bly (Pb)	18	mg/kg TS	25%	NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.020	mg/kg TS	40%	NS EN ISO 17294-2	0.01	
Kobber (Cu)	4.6	mg/kg TS	25%	NS EN ISO 17294-2	0.8	
Krom (Cr)	9.6	mg/kg TS	25%	NS EN ISO 17294-2	0.3	
Sink (Zn)	30	mg/kg TS	40%	NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.031	mg/kg TS	20%	NS-EN ISO 12846	0.001	
Barium (Ba)	23	mg/kg TS	30%	NS EN ISO 11885	0.5	

Prøvenr.: <b>439-2013-06200335</b>	Prøvetakingsdato: 22.05.2013
Prøvetype: Sedimenter	Prøvetaker: Oppdragsgiver
Prøvemerkning: Bok 1	Analysedato: 20.06.2013
Hugg 2	

Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Bly (Pb)	16	mg/kg TS	25%	NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.017	mg/kg TS	40%	NS EN ISO 17294-2	0.01	
Kobber (Cu)	3.9	mg/kg TS	40%	NS EN ISO 17294-2	0.8	
Krom (Cr)	8.6	mg/kg TS	25%	NS EN ISO 17294-2	0.3	
Sink (Zn)	27	mg/kg TS	40%	NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.032	mg/kg TS	20%	NS-EN ISO 12846	0.001	
Barium (Ba)	20	mg/kg TS	30%	NS EN ISO 11885	0.5	

Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)  
< :lindre enn, > :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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Prøvenr.:	<b>439-2013-06200336</b>	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerking:	Bok 1 Hugg 7	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Bly (Pb)	16	mg/kg TS	25%	NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.019	mg/kg TS	40%	NS EN ISO 17294-2	0.01	
Kobber (Cu)	4.4	mg/kg TS	25%	NS EN ISO 17294-2	0.8	
Krom (Cr)	8.9	mg/kg TS	25%	NS EN ISO 17294-2	0.3	
Sink (Zn)	28	mg/kg TS	40%	NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.032	mg/kg TS	20%	NS-EN ISO 12846	0.001	
Barium (Ba)	23	mg/kg TS	30%	NS EN ISO 11885	0.5	

Prøvenr.:	<b>439-2013-06200337</b>	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerking:	Bok 2 Hugg 6	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Bly (Pb)	40	mg/kg TS	25%	NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.035	mg/kg TS	40%	NS EN ISO 17294-2	0.01	
Kobber (Cu)	8.5	mg/kg TS	25%	NS EN ISO 17294-2	0.8	
Krom (Cr)	18	mg/kg TS	25%	NS EN ISO 17294-2	0.3	
Sink (Zn)	48	mg/kg TS	40%	NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.088	mg/kg TS	20%	NS-EN ISO 12846	0.001	
Barium (Ba)	58	mg/kg TS	30%	NS EN ISO 11885	0.5	

Prøvenr.:	<b>439-2013-06200338</b>	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerking:	Bok 2 Hugg 7	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Bly (Pb)	41	mg/kg TS	25%	NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.033	mg/kg TS	40%	NS EN ISO 17294-2	0.01	
Kobber (Cu)	9.0	mg/kg TS	25%	NS EN ISO 17294-2	0.8	
Krom (Cr)	19	mg/kg TS	25%	NS EN ISO 17294-2	0.3	
Sink (Zn)	51	mg/kg TS	25%	NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.050	mg/kg TS	20%	NS-EN ISO 12846	0.001	
Barium (Ba)	65	mg/kg TS	30%	NS EN ISO 11885	0.5	

**Tegnforklaring:**

\* : (Ikke omfattet av akkrediteringen)  
 < : Mindre enn, > : Større enn, nd : Ikke påvist, MPN : Most Probable Number, cfu : Colony Forming Units, MU : Uncertainty of Measurement, LOQ : Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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EUNOMO-00077246



Prøvenr.:	<b>439-2013-06200339</b>	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 2 Hugg 8	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Bly (Pb)	40	mg/kg TS	25%	NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.031	mg/kg TS	40%	NS EN ISO 17294-2	0.01	
Kobber (Cu)	9.0	mg/kg TS	25%	NS EN ISO 17294-2	0.8	
Krom (Cr)	19	mg/kg TS	25%	NS EN ISO 17294-2	0.3	
Sink (Zn)	50	mg/kg TS	25%	NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.088	mg/kg TS	20%	NS-EN ISO 12846	0.001	
Barium (Ba)	67	mg/kg TS	30%	NS EN ISO 11885	0.5	

Prøvenr.:	<b>439-2013-06200340</b>	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 3 Hugg 6	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Bly (Pb)	37	mg/kg TS	25%	NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.026	mg/kg TS	40%	NS EN ISO 17294-2	0.01	
Kobber (Cu)	8.0	mg/kg TS	25%	NS EN ISO 17294-2	0.8	
Krom (Cr)	18	mg/kg TS	25%	NS EN ISO 17294-2	0.3	
Sink (Zn)	45	mg/kg TS	40%	NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.089	mg/kg TS	20%	NS-EN ISO 12846	0.001	
Barium (Ba)	61	mg/kg TS	30%	NS EN ISO 11885	0.5	

Prøvenr.:	<b>439-2013-06200341</b>	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 3 Hugg 7	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Bly (Pb)	34	mg/kg TS	25%	NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.030	mg/kg TS	40%	NS EN ISO 17294-2	0.01	
Kobber (Cu)	7.5	mg/kg TS	25%	NS EN ISO 17294-2	0.8	
Krom (Cr)	17	mg/kg TS	25%	NS EN ISO 17294-2	0.3	
Sink (Zn)	42	mg/kg TS	40%	NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.081	mg/kg TS	20%	NS-EN ISO 12846	0.001	
Barium (Ba)	59	mg/kg TS	30%	NS EN ISO 11885	0.5	

Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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Prøvenr.:	<b>439-2013-06200342</b>	Prøvetakingsdato:	22.05.2013		
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver		
Prøvemerkning:	Bok 3 Hugg 8	Analysestartdato:	20.06.2013		
Analyse	Resultat:	Enhet:	MU Metode:	LOQ:	Grenseverdi
Bly (Pb)	31	mg/kg TS	25% NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.030	mg/kg TS	40% NS EN ISO 17294-2	0.01	
Kobber (Cu)	7.7	mg/kg TS	25% NS EN ISO 17294-2	0.8	
Krom (Cr)	17	mg/kg TS	25% NS EN ISO 17294-2	0.3	
Sink (Zn)	43	mg/kg TS	40% NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.077	mg/kg TS	20% NS-EN ISO 12846	0.001	
Barium (Ba)	59	mg/kg TS	30% NS EN ISO 11885	0.5	

Prøvenr.:	<b>439-2013-06200343</b>	Prøvetakingsdato:	23.05.2013		
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver		
Prøvemerkning:	Bok 4 Hugg 1	Analysestartdato:	20.06.2013		
Analyse	Resultat:	Enhet:	MU Metode:	LOQ:	Grenseverdi
Bly (Pb)	34	mg/kg TS	25% NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.028	mg/kg TS	40% NS EN ISO 17294-2	0.01	
Kobber (Cu)	8.4	mg/kg TS	25% NS EN ISO 17294-2	0.8	
Krom (Cr)	19	mg/kg TS	25% NS EN ISO 17294-2	0.3	
Sink (Zn)	45	mg/kg TS	40% NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.073	mg/kg TS	20% NS-EN ISO 12846	0.001	
Barium (Ba)	52	mg/kg TS	30% NS EN ISO 11885	0.5	

Prøvenr.:	<b>439-2013-06200344</b>	Prøvetakingsdato:	23.05.2013		
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver		
Prøvemerkning:	Bok 4 Hugg 2	Analysestartdato:	20.06.2013		
Analyse	Resultat:	Enhet:	MU Metode:	LOQ:	Grenseverdi
Bly (Pb)	34	mg/kg TS	25% NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.026	mg/kg TS	40% NS EN ISO 17294-2	0.01	
Kobber (Cu)	7.4	mg/kg TS	25% NS EN ISO 17294-2	0.8	
Krom (Cr)	18	mg/kg TS	25% NS EN ISO 17294-2	0.3	
Sink (Zn)	43	mg/kg TS	40% NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.069	mg/kg TS	20% NS-EN ISO 12846	0.001	
Barium (Ba)	49	mg/kg TS	30% NS EN ISO 11885	0.5	

**Teqnforklaring:**

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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EUNOMO-00077246



Prøvenr.:	<b>439-2013-06200345</b>	Prøvetaksdato:	23.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 4 Hugg 3	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Bly (Pb)	35	mg/kg TS	25%	NS EN ISO 17294-2	0.5	
Kadmium (Cd)	0.033	mg/kg TS	40%	NS EN ISO 17294-2	0.01	
Kobber (Cu)	7.6	mg/kg TS	25%	NS EN ISO 17294-2	0.8	
Krom (Cr)	18	mg/kg TS	25%	NS EN ISO 17294-2	0.3	
Sink (Zn)	43	mg/kg TS	40%	NS EN ISO 17294-2	10	
Kvikksølv (Hg)	0.071	mg/kg TS	20%	NS-EN ISO 12846	0.001	
Barium (Ba)	48	mg/kg TS	30%	NS EN ISO 11885	0.5	

**Kopi til:**

Uni Miljø (sam-marin@uni.no)

**Moss 03.09.2013**-----  
Grethe Arnestad

ASM/Cand.Mag. Kjemi

**Tegnforklaring:**

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om målesikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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## Analytical report – Petroleum hydrocarbons and PCB



**Eurofins Environment Testing Norway**

**AS (Moss)**

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HiB, Seksjon for anvendt miljøforskning (SAM)  
5006 BERGEN

Attn: Kristin Hatlen

**AR-13-MM-014269-01**



**EUNOMO-00077248**

Prøvemottak: 20.06.2013

Temperatur:

Analyseperiode: 20.06.2013-30.08.2013

Referanse: 807299/38/13

BOKNAFJORDEN

## ANALYSERAPPORT

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Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)

< :Mindre enn, > :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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AR-13-MM-014269-01



EUNOMO-00077248



Prøvenr.:	439-2013-06200346	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 1 Hugg 1	Analysestartdato:	20.06.2013			
Analyse	Resultat	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	63	%	12%	NS 4764	0.02	
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.0033	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftylen	<0.0005	mg/kg TS		Annon. 1982 -intern KG.58	0.0005	
Acenaften	<0.0005	mg/kg TS		Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0012	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.0080	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0016	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.016	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.012	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.014	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.014	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.060	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.011	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.095	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.010	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylen	0.037	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.28	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	11	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

**Tegnforklaring:**

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om målesikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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AR-13-MM-014269-01



EUNOMO-00077248



Prøvenr.:	<b>439-2013-06200347</b>	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 1 Hugg 2	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	38	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.0036	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftylen	<0.0005	mg/kg TS		Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.00078	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0018	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.011	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracene	0.0021	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.023	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.017	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracene	0.015	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.018	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.085	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.016	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.081	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracene	0.0084	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.057	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.34	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	10	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

Teqnforklaring:

\* (Ikke omfattet av akkrediteringen)

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Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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AR-13-MM-014269-01



EUNOMO-00077248



Prøvenr.:	439-2013-06200348	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 1 Hugg 7	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	51	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.0023	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftylen	<0.0005	mg/kg TS		Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.00059	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0011	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.0077	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracene	0.0016	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.016	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.012	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracene	0.0095	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.012	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.065	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.011	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.054	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracene	0.0054	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.043	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.24	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	7.5	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

Tegnforklaring:

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Opplysninger om målesikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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AR-13-MM-014269-01



EUNOMO-00077248



Prøvenr.:	<b>439-2013-06200349</b>	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 1 Hugg 8	Analysestartdato:	20.06.2013			
Analyse	Resultat	Enhet	MU	Metode	LOQ	Grenseverdi
Total tørrstoff	59	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		

Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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AR-13-MM-014269-01



EUNOMO-00077248



Prøvenr.:	439-2013-06200350	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 2 Hugg 6	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	49	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.011	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftylen	0.00083	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.0019	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0034	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.024	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0043	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.045	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.036	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.035	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.038	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.14	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.026	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.18	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.020	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.074	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.64	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	45	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

Teanforklaring:

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Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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AR-13-MM-014269-01



EUNOMO-00077248



Prøvenr.:	439-2013-06200351	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerking:	Bok 2 Hugg 7	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	40	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.015	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftylen	0.00085	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.0026	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0054	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.041	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0060	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.072	mg/kg TS	20%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.057	mg/kg TS	20%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.043	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.056	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.19	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.034	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.14	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.019	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylen	0.095	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.77	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	49	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

Tegnforklaring:

\* (ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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AR-13-MM-014269-01



EUNOMO-00077248



Prøvenr.:	439-2013-06200352	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 2 Hugg 8	Analysedato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	42	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.015	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftilen	0.00081	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.0025	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0049	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.036	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0048	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.064	mg/kg TS	20%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.051	mg/kg TS	20%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.039	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.052	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.19	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.035	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.13	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.018	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.093	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.74	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	46	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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EUNOMO-00077248



Prøvenr.:	439-2013-06200353	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 3 Hugg 6	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	39	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.016	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftylene	0.00093	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.0025	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0054	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.039	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0050	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.068	mg/kg TS	20%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.054	mg/kg TS	20%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.042	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.056	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.22	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.038	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.16	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.021	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.11	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.83	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	35	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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EUNOMO-00077248



Prøvenr.:	439-2013-06200354	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerking:	Bok 3 Hugg 7	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	49	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.013	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftylen	0.00080	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.0018	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0040	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.027	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0045	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.048	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.038	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.040	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.042	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.16	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.031	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.18	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.022	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.076	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.68	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	42	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

Teorforklaring:

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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EUNOMO-00077248



Prøvenr.:	439-2013-06200355	Prøvetakingsdato:	22.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 3 Hugg 8	Analysedato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	38	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.014	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftylen	0.00092	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.0027	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0055	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.037	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0052	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.068	mg/kg TS	20%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.055	mg/kg TS	20%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.041	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.054	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.21	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.039	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.15	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.019	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.099	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.80	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	34	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

**Tegnforklaring:**

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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Prøvenr.:	<b>439-2013-06200356</b>	Prøvetakingsdato:	23.05.2013		
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver		
Prøvemerkning:	Bok 4 Hugg 1	Analysestartdato:	20.06.2013		
Analyse	Resultat:	Enhet:	MU Metode:	LOQ:	Grenseverdi
Total tørrstoff	49	%	12% NS 4764	0.02	
<b>PCB 7</b>					
PCB 28	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS	ISO/DIS 16703-Mod		

Prøvenr.:	<b>439-2013-06200357</b>	Prøvetakingsdato:	23.05.2013		
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver		
Prøvemerkning:	Bok 4 Hugg 2	Analysestartdato:	20.06.2013		
Analyse	Resultat:	Enhet:	MU Metode:	LOQ:	Grenseverdi
Total tørrstoff	50	%	12% NS 4764	0.02	
<b>PCB 7</b>					
PCB 28	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS	ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS	ISO/DIS 16703-Mod		

Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om målesikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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EUNOMO-00077248



Prøvenr.:	439-2013-06200358	Prøvetakingsdato:	23.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 4 Hugg 3	Analysestartdato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	45	%	12%	NS 4764	0.02	
<b>PCB 7</b>						
PCB 28	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 52	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 101	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 118	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 138	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 153	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
PCB 180	<0.0005	mg/kg TS		ISO/DIS 16703-Mod	0.0005	
Sum 7 PCB	nd	mg/kg TS		ISO/DIS 16703-Mod		
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.012	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftilen	0.00075	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.0023	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0047	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.030	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0047	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.061	mg/kg TS	20%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.047	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.037	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.048	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.18	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.031	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.12	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.018	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.083	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.68	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	16	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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EUNOMO-00077248



Prøvenr.:	439-2013-06200359	Prøvetakingsdato:	23.05.2013			
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver			
Prøvemerkning:	Bok 4 Hugg 4	Analysedato:	20.06.2013			
Analyse	Resultat:	Enhet:	MU	Metode:	LOQ:	Grenseverdi
Total tørrstoff	40	%	12%	NS 4764	0.02	
<b>PAH 16 (SEDIMENT)</b>						
Naftalen	0.0062	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Acenaftalen	<0.0005	mg/kg TS		Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.0018	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0029	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.020	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0042	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.039	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Pyren	0.030	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.020	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Krysen	0.027	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.10	mg/kg TS	30%	Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.019	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.060	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.0078	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.046	mg/kg TS	40%	Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.39	mg/kg TS		Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>						
THC C12-C35	10	mg/kg TS	40%	Annon. 1982 -intern KG.58	1	

Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)

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Opplysninger om målesikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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Prøvenr.:	439-2013-06200360	Prøvetakingsdato:	23.05.2013		
Prøvetype:	Sedimenter	Prøvetaker:	Oppdragsgiver		
Prøvemerking:	Bok 4 Hugg 5	Analysedato:	20.06.2013		
Analyse	Resultat:	Enhet:	MU Metode:	LOQ:	Grenseverdi
Total tørrstoff	48	%	12% NS 4764	0.02	
<b>PAH 16 (SEDIMENT)</b>					
Naftalen	0.0078	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Acenaftalen	0.00059	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Acenaften	0.0022	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Fluoren	0.0035	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Fenantren	0.024	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Antracen	0.0038	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Fluoranten	0.046	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Pyren	0.036	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Benzo[a]antracen	0.027	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Krysen	0.035	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Benzo[b,j,k]fluoranten	0.14	mg/kg TS	30% Annon. 1982 -intern KG.58	0.0005	
Benzo[a]pyren	0.025	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Indeno[1,2,3-cd]pyren	0.089	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Dibenzo[a,h]antracen	0.012	mg/kg TS	40% Annon. 1982 -intern KG.58	0.0005	
Benzo[ghi]perylene	0.062	mg/kg TS	30% Annon. 1982 -intern KG.58	0.0005	
Sum PAH(16) EPA	0.51	mg/kg TS	Annon. 1982 -intern KG.58		
<b>Oljekomponenter (THC C12 - C35) (SEDIMENT)</b>					
THC C12-C35	9.2	mg/kg TS	40% Annon. 1982 -intern KG.58	1	

**Kopi til:**

Uni Miljø (sam-marin@uni.no)

**Tegnforklaring:**

\* (Ikke omfattet av akkrediteringen)

&lt; :Mindre enn, &gt; :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om måleusikkerhet fås ved henvendelse til laboratoriet.

Rapporten må ikke gjengis, unntatt i sin helhet, uten laboratoriets skriftlige godkjenning. Resultatene gjelder kun for de(n) undersøkte prøven(e).

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EUNOMO-00077248



Moss 30.08.2013

*Stig Tjomsland*

-----  
Stig Tjomsland

ASM/Bachelor Kjemi

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Tegnforklaring:

\* (Ikke omfattet av akkrediteringen)

< :Mindre enn, > :Større enn, nd :Ikke påvist, MPN :Most Probable Number, cfu :Colony Forming Units, MU :Uncertainty of Measurement, LOQ :Kvantifiseringsgrense

Opplysninger om målesikkerhet fås ved henvendelse til laboratoriet.

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## Analytical report – Grain size distribution and TOM (Total Organic Matter)

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		<b>RAPPORT</b>  <b>Sedimentprøver SAM-Marin</b>		
Kunde: Uni Research AS Att: Kristin Hatlen Sentralt fakturamottak Postboks 7800 5020 BERGEN		Ordre nr.: <b>51311</b>	Antall sider + bilag: <b>3</b>	
		Rapport referanse: <b>KR-17520</b>	Dato: <b>04.09.2013</b>	
Rev. nr. <b>0</b>	Kundens bestillingsnr./ ref.: <b>611101</b>	Utført: <b>Terje Kolberg</b>	Ansvarlig signatur: <b>Terje Kolberg</b> 	

Prøver mottatt dato: 28.06.2013

## RESULTATER

Prøve merket:			807299/ 50/13 pr Bok 1 (Bland- prøve)	807299/ 50/13 pr Bok 2 (Bland- prøve)	807299/ 50/13 pr Bok 3 (Bland- prøve)	807299/ 50/13 pr Bok 4 (Bland- prøve)
Parameter	Enhet	Ana.dato	KA- 081326	KA- 081327	KA- 081328	KA- 081329
TOM (480 °C)	%	19.08.13	3,87	10,6	11,7	11,4

## Kornfordeling

Analysedato: 16.08.13

Bok 1		KA- 081326						
Diameter(µm)	F	Vekt (g)	Vekt (%)	Kum. Vekt(%)				
>2000	-1	0,11	1,8	1,8	MdΦ	Silt og leire	71,6	
1000	0	0,06	1,0	2,9	5,21	Sand	26,5	
500	1	0,06	1,0	3,9		Grus	1,8	
355	1,5	0,02	0,3	4,2	SdΦ			
250	2	0,05	0,8	5,0	1,75			
180	2,5	0,07	1,2	6,2				
125	3	0,13	2,2	8,4	SkΦ			
90	3,5	0,29	4,9	13,3	-0,02			
63	4	0,90	15,1	28,4				
<63	8	4,27	71,6	100,0	KΦ			
		5,96	100,0		0,87			

Prøveresultatene gjelder utelukkende de prøvede objekter. Selve rapporten representerer eller inneholder ingen produktgodkjennelse. Rapporteres i henhold Molabs standard leveringsbetingelser dersom ikke annet er avtalt. Se www.molab.no for disse betingelser.



Bok 2		KA-081327								
Diameter( $\mu\text{m}$ )	F	Vekt (g)	Vekt (%)	Kum. Vekt(%)						
>2000	-1	0,00	0,0	0,0	Md $\Phi$	Silt og leire			98,3	
1000	0	0,00	0,0	0,0	5,97	Sand			1,7	
500	1	0,01	0,3	0,3		Grus			0,0	
355	1,5	0,01	0,3	0,7	Sd $\Phi$					
250	2	0,00	0,0	0,7		1,25				
180	2,5	0,00	0,0	0,7						
125	3	0,00	0,0	0,7	Sk $\Phi$					
90	3,5	0,01	0,3	1,0		0,00				
63	4	0,02	0,7	1,7						
<63	8	2,90	98,3	100,0	K $\Phi$					
		2,95	100,0			0,74				

Bok 3		KA-081328								
Diameter( $\mu\text{m}$ )	F	Vekt (g)	Vekt (%)	Kum. Vekt(%)						
>2000	-1	0,00	0,0	0,0	Md $\Phi$	Silt og leire			96,8	
1000	0	0,00	0,0	0,0	5,93	Sand			3,2	
500	1	0,00	0,0	0,0		Grus			0,0	
355	1,5	0,00	0,0	0,0	Sd $\Phi$					
250	2	0,00	0,0	0,0		1,27				
180	2,5	0,01	0,3	0,3						
125	3	0,01	0,3	0,6	Sk $\Phi$					
90	3,5	0,01	0,3	1,0		0,00				
63	4	0,07	2,3	3,2						
<63	8	3,00	96,8	100,0	K $\Phi$					
		3,10	100,0			0,74				

Bok 4		KA-081329								
Diameter( $\mu\text{m}$ )	F	Vekt (g)	Vekt (%)	Kum. Vekt(%)						
>2000	-1	0,00	0,0	0,0	Md $\Phi$	Silt og leire			97,3	
1000	0	0,00	0,0	0,0	5,94	Sand			2,7	
500	1	0,01	0,3	0,3		Grus			0,0	
355	1,5	0,01	0,3	0,5	Sd $\Phi$					
250	2	0,01	0,3	0,8		1,26				
180	2,5	0,04	1,1	1,9						
125	3	0,02	0,5	2,4	Sk $\Phi$					
90	3,5	0,00	0,0	2,4		0,00				
63	4	0,01	0,3	2,7						
<63	8	3,62	97,3	100,0	K $\Phi$					
		3,72	100,0			0,74				

Prøveresultatene gjelder utelukkende de prøvede objekter. Selve rapporten representerer eller inneholder ingen produktgodkjenning. Rapporteres i henhold Molabs standard leveringsbetingelser dersom ikke annet er avtalt. Se [www.molab.no](http://www.molab.no) for disse betingelser.

**ANALYSEINFORMASJON**

Parameter	Metode/Analyseteknikk	Akkrediterings-status	Relativ usikkerhet (%)	Deteksjons-grense	Enhet
TOM (480 °C)	NS-4764	A	20	0,30	%
Kornfordeling	NS-9423	A	10	-	%

A = Akkreditert prøving. Dersom ikke annet er oppgitt angis usikkerheten med 95 % konfidensnivå.

**ANMERKNINGER**

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