Final Report

FEHMARNBELT FIXED LINK
HYDROGRAPHIC SERVICES (FEHY)

Marine Soil – Impact Assessment

Sediment Spill during Construction of the Fehmarnbelt Fixed Link

E1TR0059 - Volume II

APPENDICES C-D-E-N-O-P

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A P P E N D I X   A

See A3 binder

A P P E N D I X   B

See A3 binder

A P P E N D I X   C

Short Description of MIKE 3 FM MT

MIKE 21 AND MIKE 3 FM
MUD TRANSPORT MODELLING

MIKE 21 & MIKE 3 MT FM – Mud Transport Modelling

Short Description

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MIKE213_MT_FM_ShortDesc/KLB/HKH/MSD2004-03-15

MIKE 21 & 3 MT FM

The mud transport module includes a state-of-the-art mud transport model developed by DHI Water & Environment. The model simulates the fate suspended cohesive materials in marine, brackish and freshwater areas.

The mud transport model included in MIKE 21 and MIKE 3 MT FM includes the following physical phenomena:

- Flocculation due to concentration
- Flocculation due to salinity
- Density effects at high concentrations
- Hindered settling
- Consolidation
- Morphological bed changes

Computational features

The main features in the in MIKE 21 and MIKE 3 MT FM mud transport module are:

- Multiple fractions
- Multiple layers
- Hindered settling
- Flocculation
- Non-cohesive sediments
- Inclusion of flocculation due to salinity
- Shear stress from combined wave and currents
- Wave database or 2D time series.
- Consolidation
- Morphological update of bed

Application areas

The mud transport model is used for a variety of cases where the spreading, erosion and deposition of cohesive sediments are of interest. Spreading of fine sediments may impact in various ways. It may shadow areas enough to kill the natural inhabitants. It may settle in areas with coral reefs and thereby damage the corals. The siltation of harbours and access channels is another application as well as estimations of long term morphological changes in, for instance, rehabilitation of natural environments. Finally, various pollutants such as heavy metals may hang on to the sediments making the sedimentation areas into possible risk areas for bathing. Thus, the module has many application areas and some of the most important ones are listed below:

- Spreading of dredged material
- Optimisation of dredging operations
- Cohesive sediment morphology
- Siltation of harbours
- Estuarine sediment dynamics
- Spreading of river plumes
- Erosion of material under combined waves and currents
- Studies of spreading of contaminated sediments
- Siltation in access channels

Example of spreading of dredged material in Øresund, Denmark

Example of dredging operation

Model Equations

The cohesive sediment transport module or mud transport (MT) module deals in general with the movement of mud in a fluid, and the interaction between the mud and the bed. The module is an add-on module to MIKE 21/3 FM, and requires a coupling to the hydrodynamic solver MIKE 21/3 HD FM as well as the transport solver for passive components MIKE 21/3 AD FM.

The transport of the mud is generally described by the following equation:

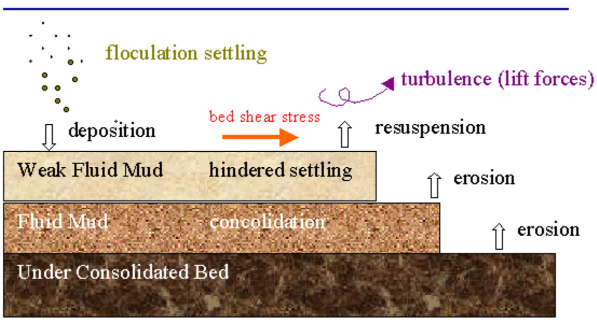
$$\frac{\partial c^i}{\partial t}+\frac{\partial uc^i}{\partial x}+\frac{\partial vc^i}{\partial y}+\frac{\partial wc^i}{\partial z}-\frac{\partial w_s c^i}{\partial z}=$$

$$\frac{\partial}{\partial x}\left(\frac{\upsilon_{Tx}}{\sigma^i_{Tx}}\frac{\partial c^i}{\partial x}\right)+\frac{\partial}{\partial y}\left(\frac{\upsilon_{Ty}}{\sigma^i_{Ty}}\frac{\partial c^i}{\partial y}\right)+\frac{\partial}{\partial z}\left(\frac{\upsilon_{Tz}}{\sigma^i_{Tz}}\frac{\partial c^i}{\partial z}\right)+S^i$$

where

t is time
x, y, z are Cartesian co-ordinates
u,v,w are velocity components
c^i is the i'th scalar component (defined as the mass concentration)
w_s^i is the fall velocity
σ_{Tx}^i is the turbulent Schmidt number
ν_{Tx} is the anisotropic eddy viscosity
S^i is a source term

The transport of mud is handled by a transport solver for passive components. The extra term $\frac{\partial w_s C^i}{\partial z}$ in the transport equation for mud, due to the fall velocity w_i^s, is considered to be a mud process and is handled separately using an operator splitting technique.



Example of modelled physical processes

The bed interaction/update and the settling velocity term are handled in the mud process module.

The mud effects on density and viscosity (concentrated near-bed suspensions) are not considered as part of the mud process module, but instead provided as separate sub-modules, which are incorporated in the appropriate places (where the density and eddy viscosity are calculated in the host program). For adequately low concentrations of mud, these effects can be neglected.

Example of sediment plume from a river near Malmö, Sweden

Erosion

Erosion features two modes.

Soft bed

For a soft, partly consolidated bed the erosion rate can be written as:

$$Se = E\left(e^{\alpha\sqrt{(\tau_b-\tau_c)}}\right) \qquad \tau_b > \tau_c$$

Hard bed

For a consolidated bed the erosion rate can be written as:

$$Se = E\left(\frac{\tau_b}{\tau_c} - 1\right)^n \qquad \tau_b > \tau_c$$

Where E is the erodibility, n is the power of erosion, τ_b is the shear stress at the bed and τ_{ce} is the critical shear stress for erosion. S_e is the erosion rate.

Example of resuspension in the nearshore zone. Caravelas, Brazil

Deposition

The deposition for the i´th mud fraction is described as (Krone, 1962):

$$D^i = w_s^i c_b^i p_D^i$$

where p_D^i is a probability ramp function of deposition:

$$p_D^i = \max\left(0, \min\left(1, 1 - \frac{\tau_b}{\tau_{cd}^i}\right)\right)$$

The mud concentration near the bed c_b^i is handled differently, depending upon if it's a 0D or 1D case.

1D case, for application in 3D model

The mud concentration c_b^i is simply equal to the concentration in the grid cell just above the bed.

0D case, Teeter profile (Teeter, 1986), for application in 2D horizontal model

The mud concentration c_b^i is related to the depth-averaged concentration $\bar{c}^i$ using the Teeter profile.

$$c_b = \bar{c}^i\left(1 + \frac{p_e^i}{1.25 + 4.75 p_D^{i\ 2.5}}\right)$$

where p_e^i is the peclet number, defined as

$$p_e^i = \frac{convective\ Courant\ number}{diffusive\ Courant\ number} =$$

$$\frac{w_s^i \frac{\Delta t}{H}}{\bar{D}z \frac{\Delta t}{H^2}} = \frac{w_s^i H}{\bar{D}z} = 6\frac{w_s^i}{\kappa U_f}$$

It has been used that the depth-averaged eddy diffusivity $\bar{D}_z$ corresponds to a standard logarithmic velocity profile, which gives $\bar{D}z = \frac{1}{6}\kappa U_f H$.

Example of muddy estuary. Caravelas, Brazil

0D case, Rouse profile

The mud concentration c_b^i is related to the depth-averaged concentration $\bar{c}^i$ using the Rouse profile

$$c_b = \bar{c}^i \cdot CentroidHeight$$

Settling velocity

The settling velocity can be divided into three parts:

Constant settling velocity
Constant settling velocity for the regime where the likelihood of two particles hitting each other is small.

$$Ws = Constant \qquad c < c_{floc}$$

In which Ws is the settling velocity and c is the total concentration and c_{floc} is the concentration at which flocculation occurs.

Flocculation
Increasing settling velocity for the regime with moderate concentrations where flocculation occurs.

$$Ws = W_0 \left(\frac{c}{\rho_{sediment}} \right)^r \qquad c_{floc} < c < c_{hinder}$$

In which W_0 is a constant, $\rho_{sediment}$ is the sediment density, usually 2650 kg/m^3 and γ is a coefficient.

Mud plains in Loire river (France)

Hindered settling
Hindered settling is where the concentrations are high enough for the flocs to interfere and hereby reducing the settling velocity. Two different expressions for the settling velocity are implemented:

Formulation by Richardson and Zaki (1954)
For a single mud fraction, the standard Richardson and Zaki formulation is

$$w_s = w_{s,r} \left(1 - \frac{c}{c_{gel}} \right)^{w_{s,n}}$$

In which c_{gel} is the concentration at the gelling point. For multiple mud fractions, the Richardson and Zaki formulation is extended to:

$$w_s^i = w_{s,r}^i \left(1 - \Phi_* \right)^{w_{s,n}^i}$$

where $W_{s,r}$ and $W_{s,n}$ are settling velocity coefficients and:

$$\Phi = \frac{\sum_i c^i}{c_{gel}}$$

$$\Phi_* = \min(1.0, \Phi)$$

Formulation by Winterwerp (1999)

$$w_s^i = w_{s,r}^i \frac{(1 - \Phi_*)(1 - \Phi_p)}{1 + 2.5\Phi}$$

where

$$\Phi_p = \frac{\sum_i c^i}{\rho_s}$$

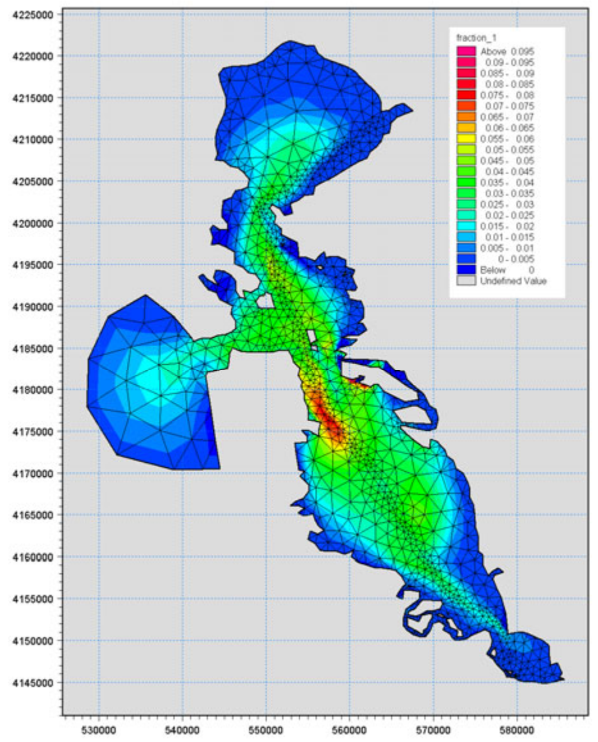
$$Ws = W_0 \left(\frac{c}{\rho_{sediment}} \right)^r \qquad c_{floc} < c < c_{hinder}$$

Consolidation

Consolidation can be an important parameter to model. Especially when making long term simulations. Consolidation times are often weeks or months or even years. Also in areas with much flooding and drying consolidation can be important.

Consolidation is taking into consideration by transferring mass from an upper layer to the lower layer at a constant rate.

Transition rate = Constant



The mud transport module is a tool for estuary sediment management in complex estuaries like San Francisco bay.

Model input

Mud transport modelling implies setting a lot of parameters. Some can be measured and some are calibration parameters. In the following the different parameters are given:

Measurable input

- Settling velocity
- Flocculation
- Dry density of bed layers
- Critical shear stress for erosion
- Thickness of bed layers or estimate of total amount of sediment in the system
- Concentration at open boundaries
- Salinity

Calibration parameters

- Dispersion coefficients
- Critical shear stresses
- Erosion coefficients
- Power of erosion
- Transition coefficients between bed layers

Model Output

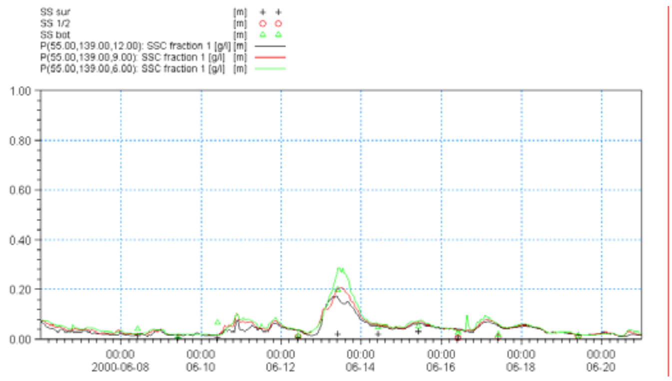
The main output possibilities are listed below:

- Suspended sediment concentrations in space and time
- Height or density of bed layers
- Net sedimentation rates
- Bed shear stress
- Bed masses
- Settling velocities
- Updated bathymetry

Validation

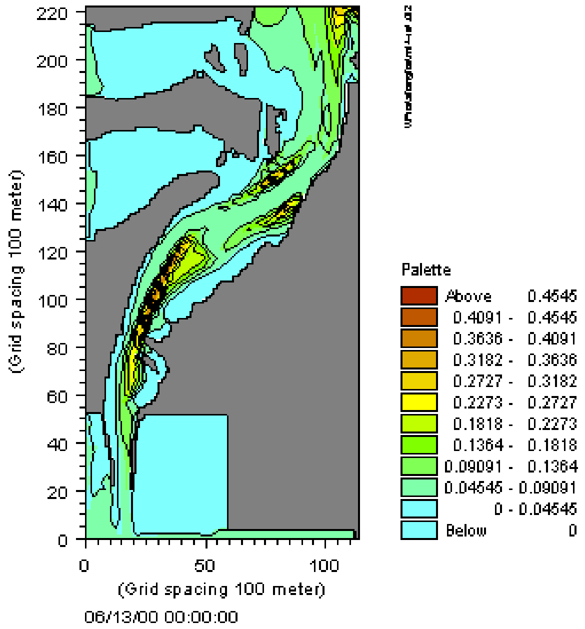
The model engine is well proven in numerous studies throughout the world.

In 2001, the model was applied for a 3D study in Rio Grande estuary (Brazil). The study was about a number of hydrodynamic issues, but on the sediment side it was about the possible changes in sedimentation patterns and dredging requirements when changing the Rio Grande Port layout.

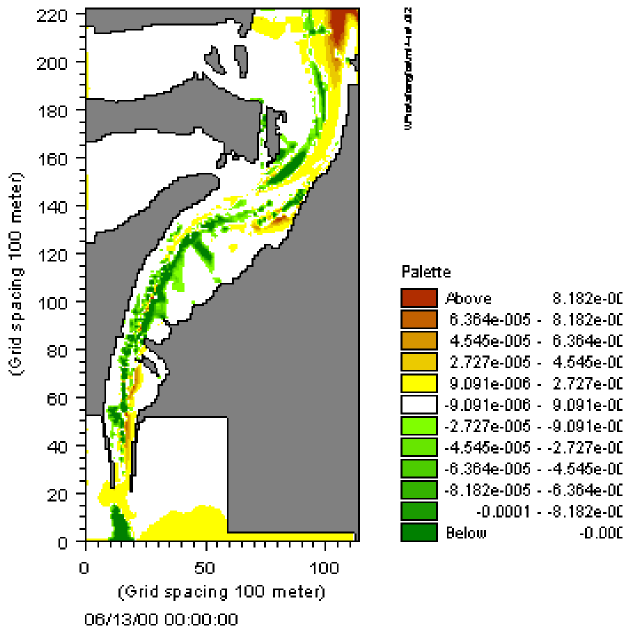


Suspended sediment concentrations, Rio Grande

The figure above shows the most common calibration parameter, which is the suspended sediment concentration (SSC). The results show reasonably good results given the large uncertainties always connected with mud transport modelling.

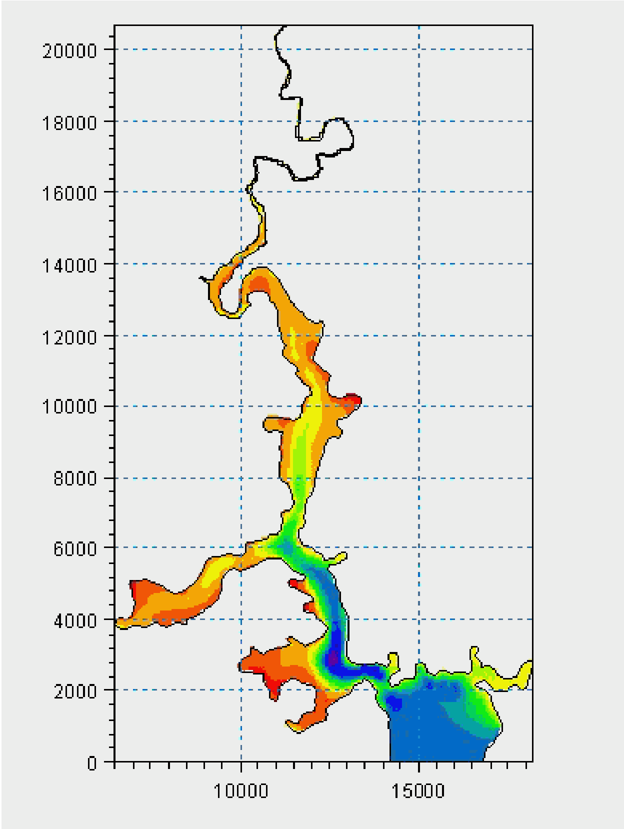


SSC in surface layer (kg/m^3) Rio Grande



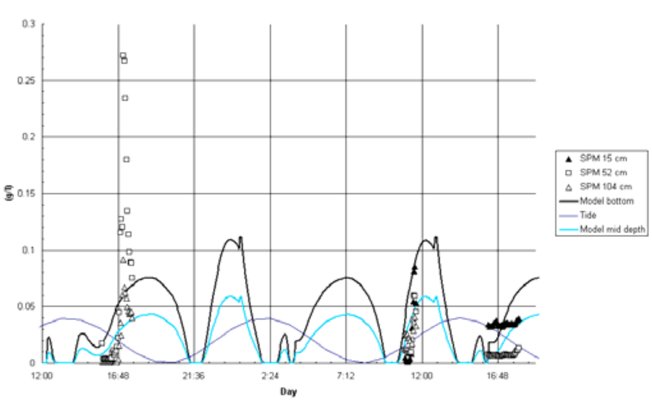
Instantaneous erosion Rio Grande (kg/m^2/s)

The model has also been applied in the Tamar Estuary (UK) Study.



The Tamar Estuary

Please note in the following figure how the erosion deposition terms work with little or no activity at high and low tide and massive erosion in between.



Results for suspended matter (SPM) during spring tide

Hardware and Operating System Requirements

The module support 98/2000/NT/XP. Microsoft Internet Explorer 4.0 (or higher) is required for network license management as well as for accessing the Online Help.

The recommended minimum hardware requirements for executing MIKE 21 and MIKE 3 MT FM are listed below

Processor	:	Pentium III, IV or M, 1 GHz (or higher)
Memory (RAM)	:	256 MB (or higher)
Hard disk	:	20 GB (or higher)
Monitor	:	SVGA, resolution 1024x768
Graphic card	:	32 MB RAM (or higher), 24 bit true colour
CD-ROM drive	:	20 x speed
File system	:	NTFS

Support

News about new features, applications, papers, updates, patches, etc. are available at the MIKE21 Website located at:

http://www.dhisoftware.com/mike21

For further information on MIKE 21 and MIKE 3 software please contact your local DHI Software agent or Software Support Centre at DHI:

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DHI Water & Environment
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Denmark

Tel: +4545169333
Fax: +4545169292
Web: www.dhisoftware.com
E-mail: software@dhi.dk

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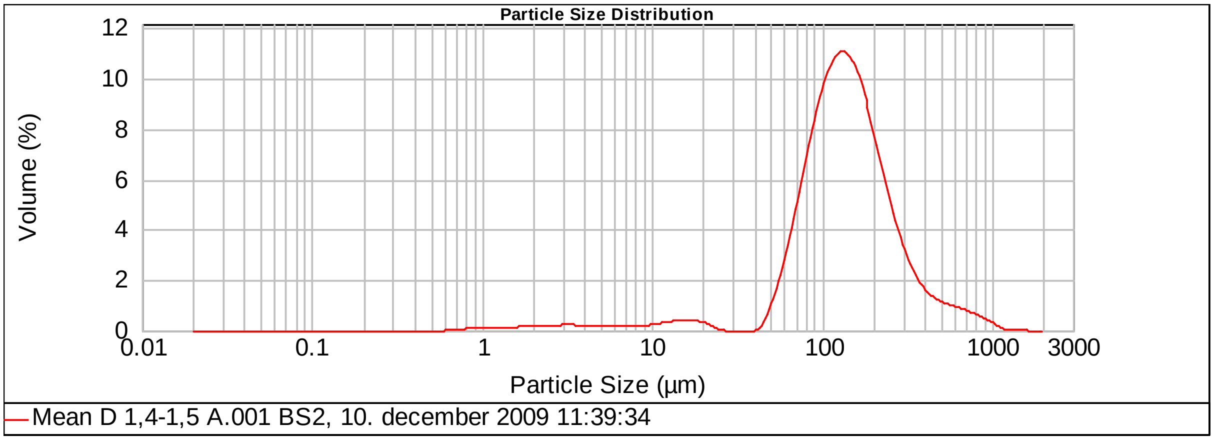
A P P E N D I X   D

Primary Grain Size Analysis

Sample 1 D 1,4-1,5 A.001 BS2



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.00
0.479	0.00
0.550	0.00
0.631	0.04
0.724	0.07
0.832	0.08
0.955	0.09
1.096	

Size (µm)	Volume In %
1.096	0.10
1.259	0.11
1.445	0.13
1.660	0.15
1.905	0.17
2.188	0.18
2.512	0.20
2.884	0.20
3.311	0.20
3.802	0.19
4.365	0.17
5.012	0.16
5.754	0.14
6.607	0.14
7.586	0.15
8.710	0.19
10.000	0.24
11.482	

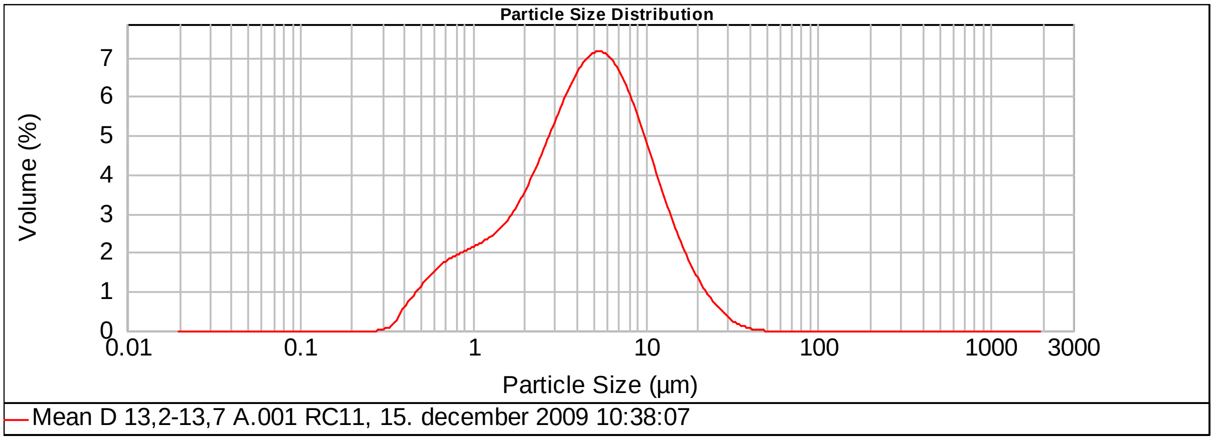
Size (µm)	Volume In %
11.482	0.31
13.183	0.36
15.136	0.39
17.378	0.35
19.953	0.25
22.909	0.07
26.303	0.00
30.200	0.00
34.674	0.00
39.811	0.04
45.709	0.77
52.481	1.87
60.256	3.35
69.183	5.09
79.433	6.89
91.201	8.44
104.713	9.54
120.226	

Size (µm)	Volume In %
120.226	9.98
138.038	9.72
158.489	8.85
181.970	7.53
208.930	6.03
239.883	4.54
275.423	3.27
316.228	2.29
363.078	1.63
416.869	1.24
478.630	1.03
549.541	0.89
630.957	0.78
724.436	0.62
831.764	0.45
954.993	0.25
1096.478	0.07
1258.925	

Size (µm)	Volume In %
1258.925	0.03
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 2 D13,2-13,7 A.001 RC11



Size (µm)	Volume In %
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0.011	0.00
0.013	0.00
0.015	0.00
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0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.01
0.316	0.10
0.363	0.43
0.417	0.75
0.479	1.06
0.550	1.33
0.631	1.54
0.724	1.70
0.832	1.82
0.955	1.93
1.096	

Size (µm)	Volume In %
1.096	2.06
1.259	2.24
1.445	2.50
1.660	2.86
1.905	3.30
2.188	3.82
2.512	4.39
2.884	4.98
3.311	5.54
3.802	6.01
4.365	6.33
5.012	6.44
5.754	6.33
6.607	6.00
7.586	5.48
8.710	4.82
10.000	4.09
11.482	

Size (µm)	Volume In %
11.482	3.36
13.183	2.66
15.136	2.04
17.378	1.50
19.953	1.06
22.909	0.70
26.303	0.44
30.200	0.23
34.674	0.12
39.811	0.03
45.709	0.00
52.481	0.00
60.256	0.00
69.183	0.00
79.433	0.00
91.201	0.00
104.713	0.00
120.226	

Size (µm)	Volume In %
120.226	0.00
138.038	0.00
158.489	0.00
181.970	0.00
208.930	0.00
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
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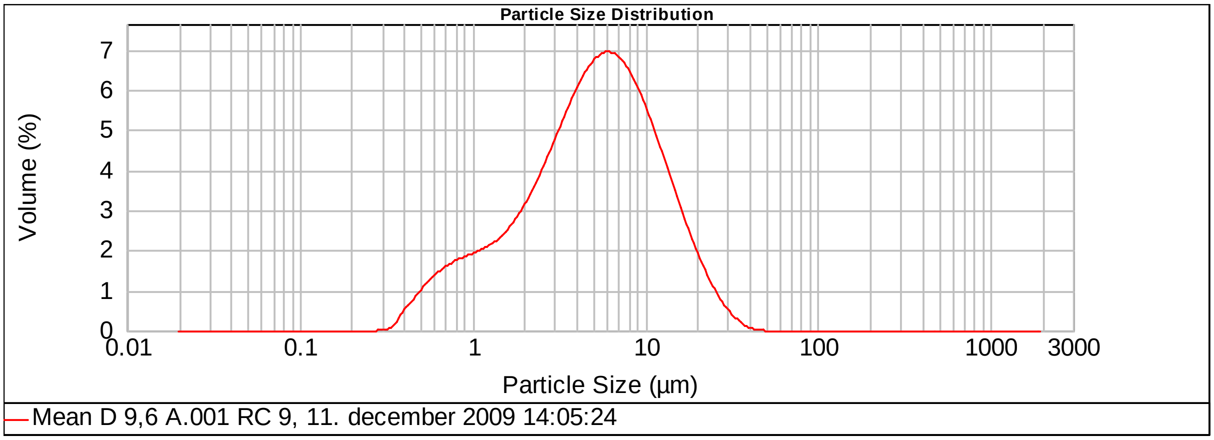
Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 3 D 9,6 A.001 RC9



Size (µm)	Volume In %
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0.011	0.00
0.013	0.00
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0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.06
0.363	0.36
0.417	0.66
0.479	0.94
0.550	1.19
0.631	1.39
0.724	1.54
0.832	1.65
0.955	1.75
1.096	

Size (µm)	Volume In %
1.096	1.85
1.259	2.01
1.445	2.23
1.660	2.53
1.905	2.92
2.188	3.37
2.512	3.89
2.884	4.45
3.311	5.01
3.802	5.51
4.365	5.93
5.012	6.19
5.754	6.27
6.607	6.15
7.586	5.84
8.710	5.37
10.000	4.78
11.482	

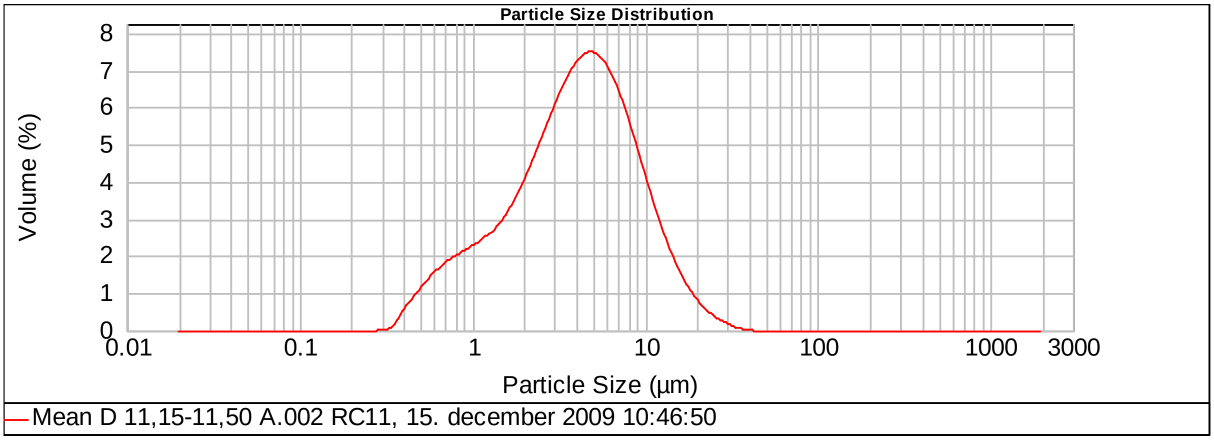
Size (µm)	Volume In %
11.482	4.12
13.183	3.42
15.136	2.75
17.378	2.10
19.953	1.53
22.909	1.04
26.303	0.65
30.200	0.35
34.674	0.14
39.811	0.04
45.709	0.00
52.481	0.00
60.256	0.00
69.183	0.00
79.433	0.00
91.201	0.00
104.713	0.00
120.226	

Size (µm)	Volume In %
120.226	0.00
138.038	0.00
158.489	0.00
181.970	0.00
208.930	0.00
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 4 D 11,15-11,50 A.002 RC11



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.01
0.316	0.08
0.363	0.42
0.417	0.76
0.479	1.07
0.550	1.36
0.631	1.59
0.724	1.78
0.832	1.93
0.955	2.08
1.096	

Size (µm)	Volume In %
1.096	2.25
1.259	2.49
1.445	2.82
1.660	3.26
1.905	3.79
2.188	4.39
2.512	5.03
2.884	5.65
3.311	6.19
3.802	6.58
4.365	6.76
5.012	6.69
5.754	6.35
6.607	5.79
7.586	5.05
8.710	4.22
10.000	3.38
11.482	

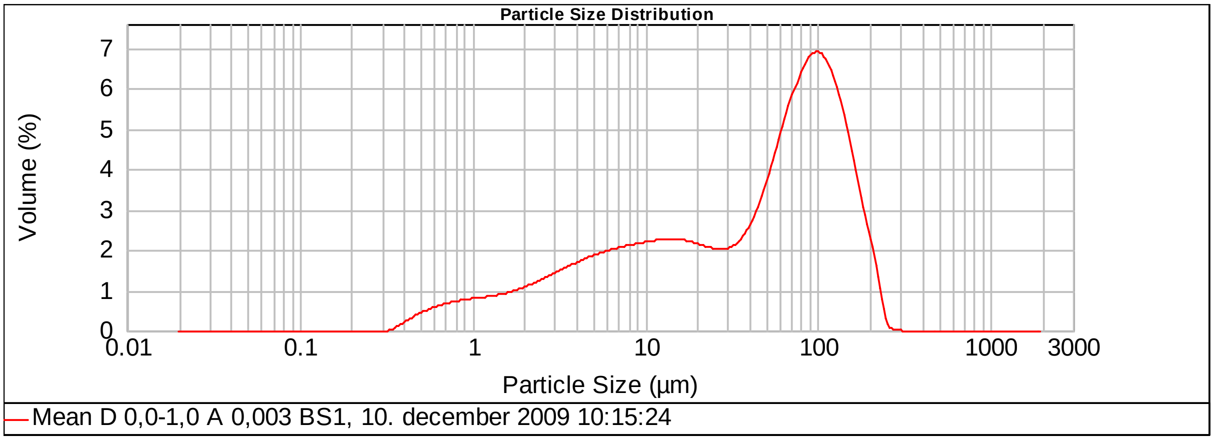
Size (µm)	Volume In %
11.482	2.60
13.183	1.92
15.136	1.37
17.378	0.94
19.953	0.62
22.909	0.39
26.303	0.23
30.200	0.11
34.674	0.04
39.811	0.00
45.709	0.00
52.481	0.00
60.256	0.00
69.183	0.00
79.433	0.00
91.201	0.00
104.713	0.00
120.226	

Size (µm)	Volume In %
120.226	0.00
138.038	0.00
158.489	0.00
181.970	0.00
208.930	0.00
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 5 D 0,0-1,0 A.003 BS1



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.15
0.417	0.29
0.479	0.41
0.550	0.51
0.631	0.59
0.724	0.64
0.832	0.69
0.955	0.72
1.096	

Size (µm)	Volume In %
1.096	0.75
1.259	0.79
1.445	0.84
1.660	0.91
1.905	0.99
2.188	1.09
2.512	1.20
2.884	1.31
3.311	1.43
3.802	1.54
4.365	1.64
5.012	1.72
5.754	1.79
6.607	1.85
7.586	1.91
8.710	1.96
10.000	2.00
11.482	

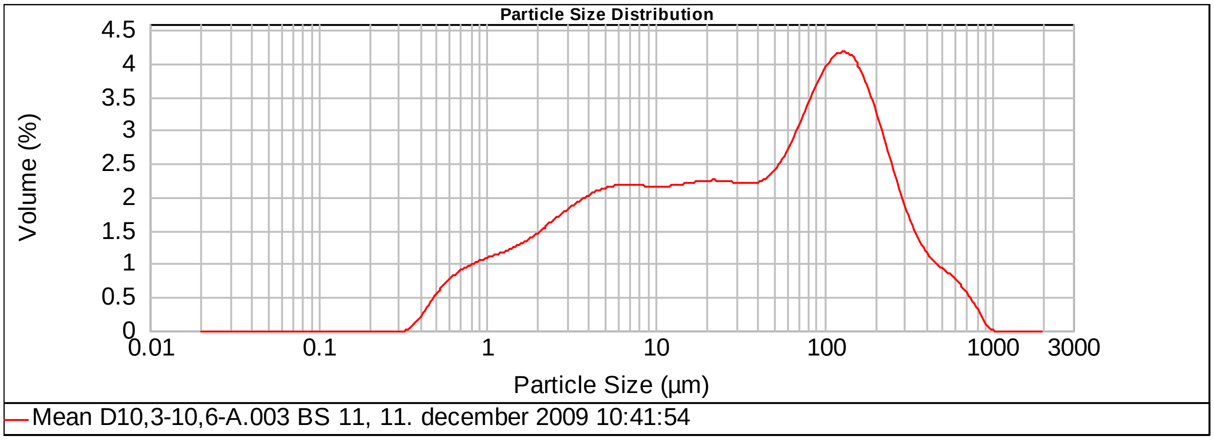
Size (µm)	Volume In %
11.482	2.03
13.183	2.05
15.136	2.03
17.378	1.98
19.953	1.91
22.909	1.84
26.303	1.82
30.200	1.89
34.674	2.10
39.811	2.51
45.709	3.11
52.481	3.87
60.256	4.71
69.183	5.47
79.433	6.02
91.201	6.23
104.713	6.02
120.226	

Size (µm)	Volume In %
120.226	5.40
138.038	4.46
158.489	3.35
181.970	2.24
208.930	1.15
239.883	0.09
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 6 D 10,3-10,6 A.003 BS11



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.15
0.417	0.35
0.479	0.52
0.550	0.66
0.631	0.78
0.724	0.87
0.832	0.94
0.955	0.99
1.096	

Size (µm)	Volume In %
1.096	1.04
1.259	1.09
1.445	1.16
1.660	1.24
1.905	1.34
2.188	1.44
2.512	1.55
2.884	1.65
3.311	1.75
3.802	1.84
4.365	1.90
5.012	1.95
5.754	1.97
6.607	1.97
7.586	1.96
8.710	1.95
10.000	1.95
11.482	

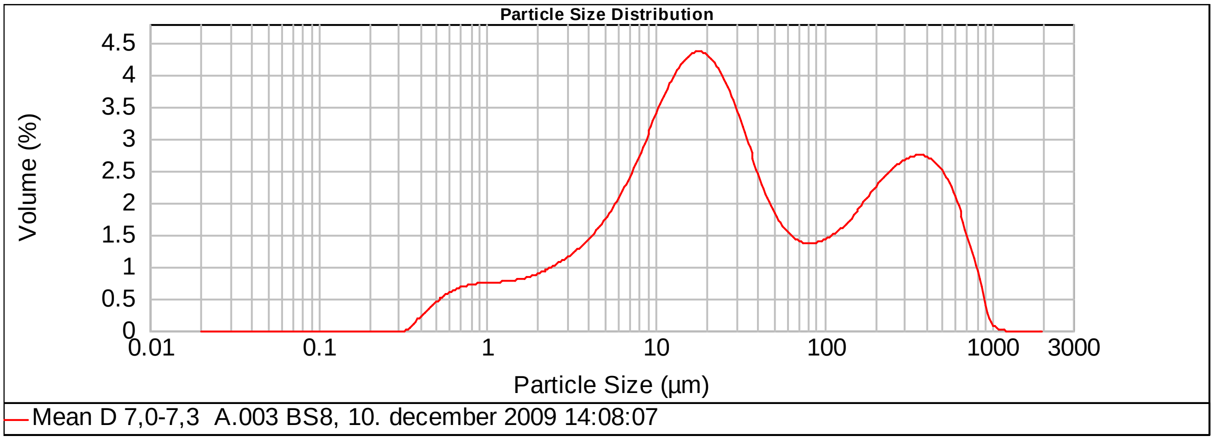
Size (µm)	Volume In %
11.482	1.95
13.183	1.97
15.136	2.00
17.378	2.02
19.953	2.03
22.909	2.03
26.303	2.01
30.200	1.99
34.674	1.98
39.811	2.02
45.709	2.12
52.481	2.30
60.256	2.55
69.183	2.87
79.433	3.20
91.201	3.49
104.713	3.69
120.226	

Size (µm)	Volume In %
120.226	3.77
138.038	3.70
158.489	3.48
181.970	3.12
208.930	2.68
239.883	2.20
275.423	1.76
316.228	1.39
363.078	1.12
416.869	0.94
478.630	0.82
549.541	0.72
630.957	0.58
724.436	0.39
831.764	0.14
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 7 D 7,0-7,3 A.003 BS8



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.17
0.417	0.31
0.479	0.43
0.550	0.52
0.631	0.59
0.724	0.64
0.832	0.67
0.955	0.68
1.096	

Size (µm)	Volume In %
1.096	0.69
1.259	0.70
1.445	0.72
1.660	0.76
1.905	0.81
2.188	0.88
2.512	0.95
2.884	1.05
3.311	1.16
3.802	1.30
4.365	1.47
5.012	1.67
5.754	1.91
6.607	2.19
7.586	2.50
8.710	2.84
10.000	3.18
11.482	

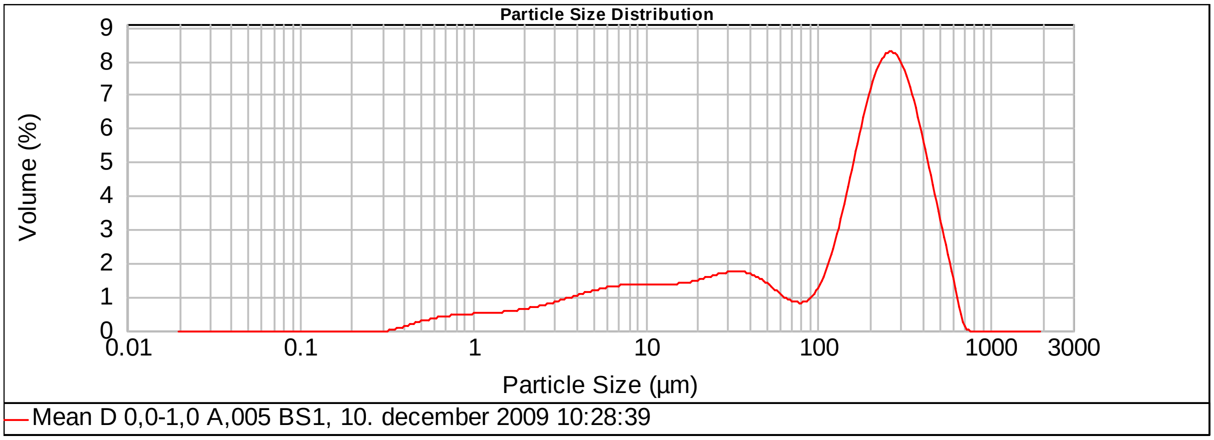
Size (µm)	Volume In %
11.482	3.48
13.183	3.73
15.136	3.89
17.378	3.93
19.953	3.84
22.909	3.62
26.303	3.30
30.200	2.91
34.674	2.50
39.811	2.10
45.709	1.76
52.481	1.50
60.256	1.33
69.183	1.25
79.433	1.23
91.201	1.27
104.713	1.35
120.226	

Size (µm)	Volume In %
120.226	1.46
138.038	1.61
158.489	1.78
181.970	1.96
208.930	2.14
239.883	2.29
275.423	2.40
316.228	2.46
363.078	2.47
416.869	2.39
478.630	2.21
549.541	1.92
630.957	1.51
724.436	1.05
831.764	0.49
954.993	0.07
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 8 D 0,0-1,0 A.005 BS1



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.09
0.417	0.18
0.479	0.25
0.550	0.32
0.631	0.37
0.724	0.41
0.832	0.44
0.955	0.45
1.096	

Size (µm)	Volume In %
1.096	0.47
1.259	0.49
1.445	0.51
1.660	0.55
1.905	0.59
2.188	0.65
2.512	0.71
2.884	0.79
3.311	0.87
3.802	0.95
4.365	1.04
5.012	1.11
5.754	1.17
6.607	1.20
7.586	1.23
8.710	1.23
10.000	1.23
11.482	

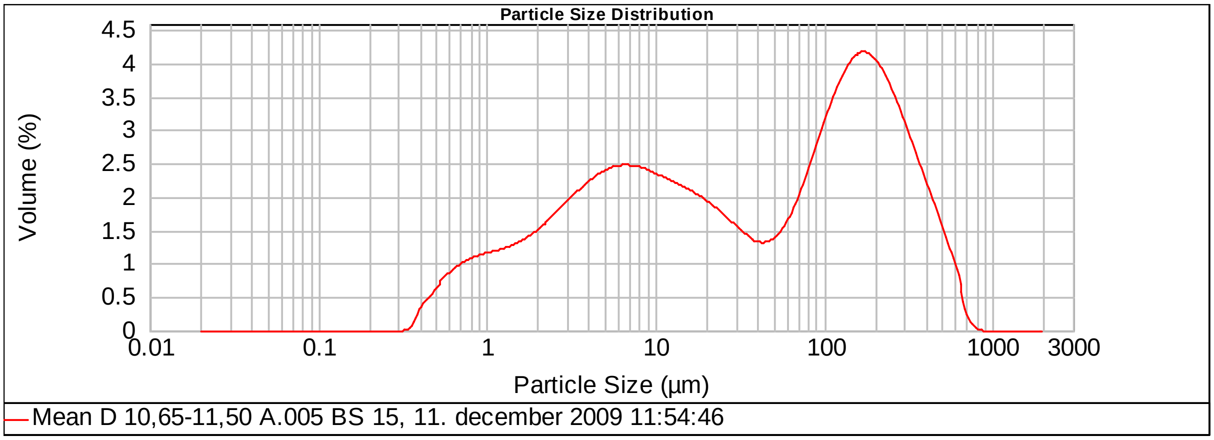
Size (µm)	Volume In %
11.482	1.23
13.183	1.24
15.136	1.27
17.378	1.31
19.953	1.38
22.909	1.46
26.303	1.54
30.200	1.58
34.674	1.58
39.811	1.49
45.709	1.33
52.481	1.12
60.256	0.91
69.183	0.77
79.433	0.79
91.201	1.08
104.713	1.69
120.226	

Size (µm)	Volume In %
120.226	2.62
138.038	3.81
158.489	5.08
181.970	6.26
208.930	7.09
239.883	7.45
275.423	7.26
316.228	6.56
363.078	5.50
416.869	4.23
478.630	2.94
549.541	1.70
630.957	0.41
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 9 D 10,65-11,50 A. 5 BS15



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.25
0.417	0.44
0.479	0.61
0.550	0.76
0.631	0.87
0.724	0.96
0.832	1.01
0.955	1.06
1.096	

Size (µm)	Volume In %
1.096	1.09
1.259	1.14
1.445	1.20
1.660	1.28
1.905	1.38
2.188	1.50
2.512	1.63
2.884	1.77
3.311	1.90
3.802	2.02
4.365	2.13
5.012	2.20
5.754	2.23
6.607	2.23
7.586	2.20
8.710	2.16
10.000	2.10
11.482	

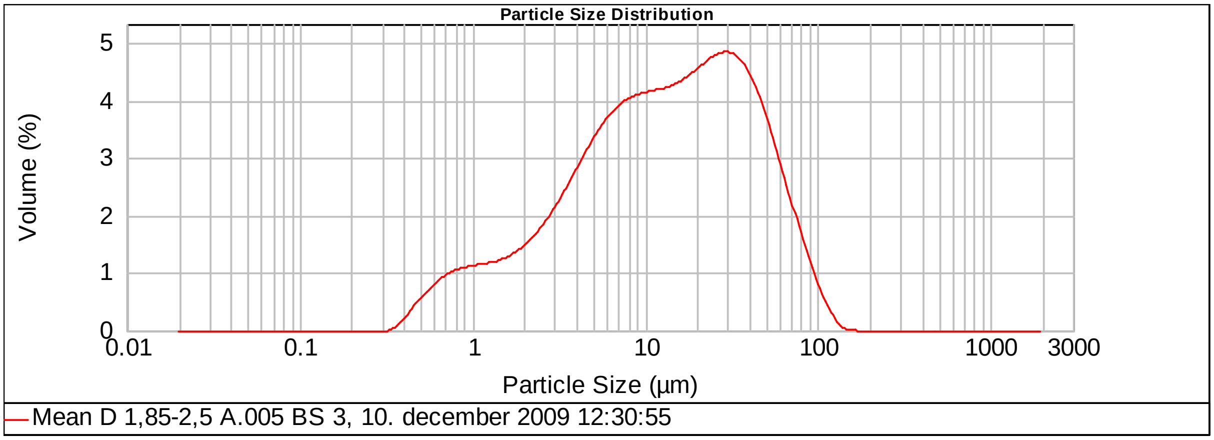
Size (µm)	Volume In %
11.482	2.03
13.183	1.96
15.136	1.89
17.378	1.81
19.953	1.71
22.909	1.60
26.303	1.47
30.200	1.34
34.674	1.24
39.811	1.19
45.709	1.22
52.481	1.35
60.256	1.59
69.183	1.93
79.433	2.33
91.201	2.75
104.713	3.14
120.226	

Size (µm)	Volume In %
120.226	3.46
138.038	3.68
158.489	3.76
181.970	3.70
208.930	3.52
239.883	3.23
275.423	2.88
316.228	2.50
363.078	2.11
416.869	1.73
478.630	1.33
549.541	0.95
630.957	0.39
724.436	0.07
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 10 D 1,85-2,5 A.005 BS3



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.14
0.417	0.34
0.479	0.53
0.550	0.70
0.631	0.84
0.724	0.93
0.832	0.99
0.955	1.03
1.096	

Size (µm)	Volume In %
1.096	1.05
1.259	1.09
1.445	1.15
1.660	1.24
1.905	1.37
2.188	1.54
2.512	1.76
2.884	2.01
3.311	2.29
3.802	2.59
4.365	2.89
5.012	3.16
5.754	3.38
6.607	3.55
7.586	3.66
8.710	3.72
10.000	3.76
11.482	

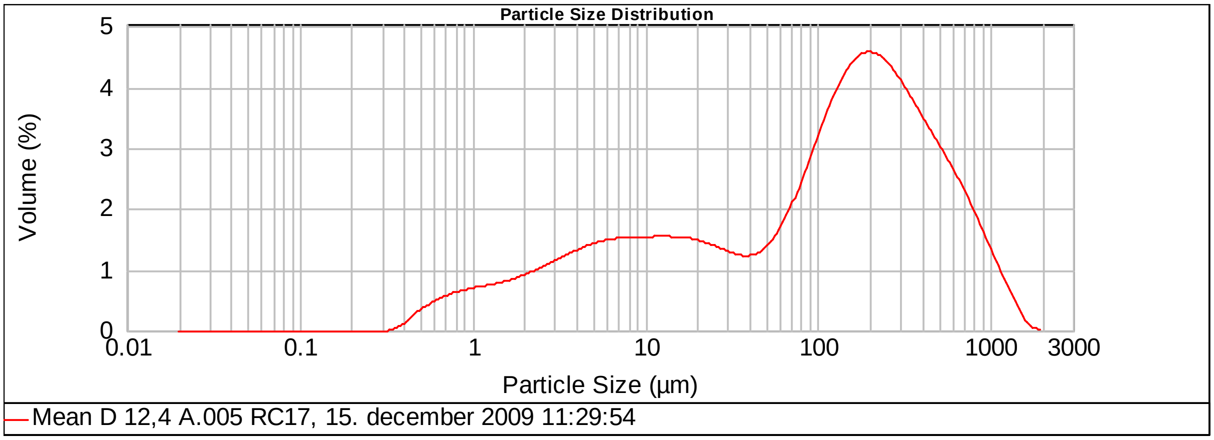
Size (µm)	Volume In %
11.482	3.80
13.183	3.85
15.136	3.93
17.378	4.04
19.953	4.17
22.909	4.30
26.303	4.37
30.200	4.36
34.674	4.21
39.811	3.93
45.709	3.50
52.481	2.98
60.256	2.40
69.183	1.82
79.433	1.26
91.201	0.78
104.713	0.41
120.226	

Size (µm)	Volume In %
120.226	0.13
138.038	0.02
158.489	0.00
181.970	0.00
208.930	0.00
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 11 D 12,4 A.005 RC17



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.08
0.417	0.21
0.479	0.32
0.550	0.42
0.631	0.50
0.724	0.56
0.832	0.60
0.955	0.63
1.096	

Size (µm)	Volume In %
1.096	0.66
1.259	0.70
1.445	0.74
1.660	0.79
1.905	0.84
2.188	0.91
2.512	0.98
2.884	1.06
3.311	1.13
3.802	1.20
4.365	1.26
5.012	1.31
5.754	1.35
6.607	1.37
7.586	1.38
8.710	1.39
10.000	1.39
11.482	

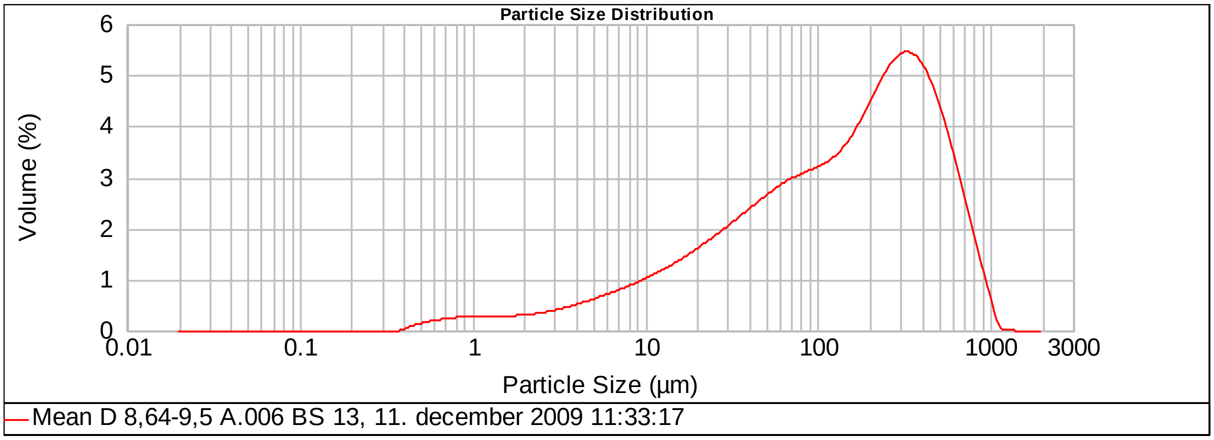
Size (µm)	Volume In %
11.482	1.40
13.183	1.39
15.136	1.39
17.378	1.36
19.953	1.33
22.909	1.27
26.303	1.21
30.200	1.15
34.674	1.11
39.811	1.13
45.709	1.21
52.481	1.38
60.256	1.65
69.183	2.00
79.433	2.41
91.201	2.84
104.713	3.25
120.226	

Size (µm)	Volume In %
120.226	3.61
138.038	3.89
158.489	4.07
181.970	4.13
208.930	4.09
239.883	3.95
275.423	3.74
316.228	3.50
363.078	3.24
416.869	2.98
478.630	2.72
549.541	2.46
630.957	2.18
724.436	1.86
831.764	1.52
954.993	1.17
1096.478	0.83
1258.925	

Size (µm)	Volume In %
1258.925	0.52
1445.440	0.21
1659.587	0.04
1905.461	0.01
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 12 D 8,64-9,5 A.006 BS13



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.08
0.479	0.13
0.550	0.17
0.631	0.20
0.724	0.23
0.832	0.24
0.955	0.25
1.096	

Size (µm)	Volume In %
1.096	0.25
1.259	0.25
1.445	0.26
1.660	0.27
1.905	0.28
2.188	0.31
2.512	0.34
2.884	0.37
3.311	0.42
3.802	0.47
4.365	0.53
5.012	0.59
5.754	0.66
6.607	0.72
7.586	0.80
8.710	0.87
10.000	0.96
11.482	

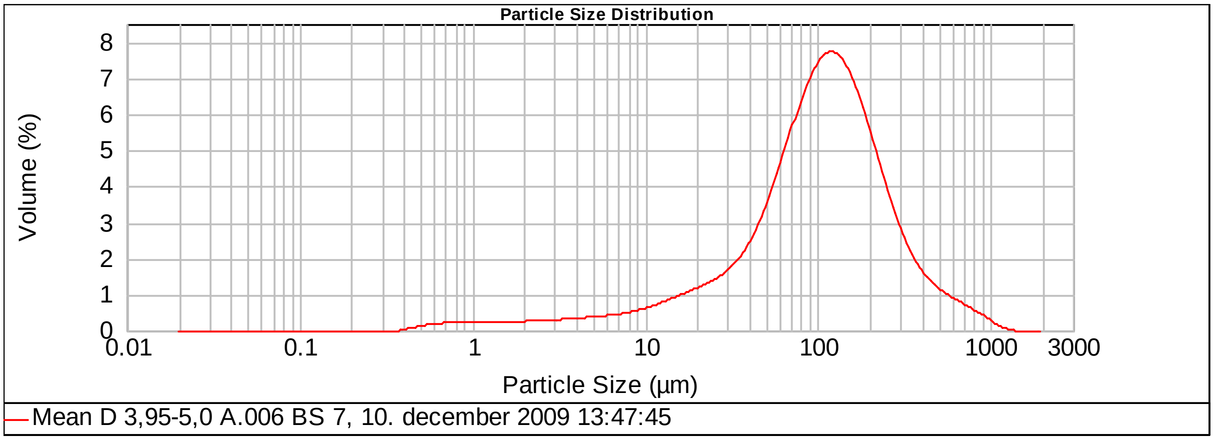
Size (µm)	Volume In %
11.482	1.05
13.183	1.16
15.136	1.26
17.378	1.38
19.953	1.51
22.909	1.64
26.303	1.78
30.200	1.92
34.674	2.06
39.811	2.21
45.709	2.35
52.481	2.49
60.256	2.62
69.183	2.72
79.433	2.81
91.201	2.89
104.713	2.98
120.226	

Size (µm)	Volume In %
120.226	3.13
138.038	3.34
158.489	3.64
181.970	3.99
208.930	4.35
239.883	4.67
275.423	4.87
316.228	4.92
363.078	4.77
416.869	4.44
478.630	3.94
549.541	3.31
630.957	2.60
724.436	1.87
831.764	1.16
954.993	0.48
1096.478	0.03
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 13 D 3,95-5,0 A.006 BS7



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.08
0.479	0.12
0.550	0.16
0.631	0.19
0.724	0.21
0.832	0.22
0.955	0.22
1.096	

Size (µm)	Volume In %
1.096	0.22
1.259	0.22
1.445	0.22
1.660	0.23
1.905	0.24
2.188	0.25
2.512	0.26
2.884	0.28
3.311	0.29
3.802	0.31
4.365	0.33
5.012	0.36
5.754	0.38
6.607	0.42
7.586	0.47
8.710	0.53
10.000	0.61
11.482	

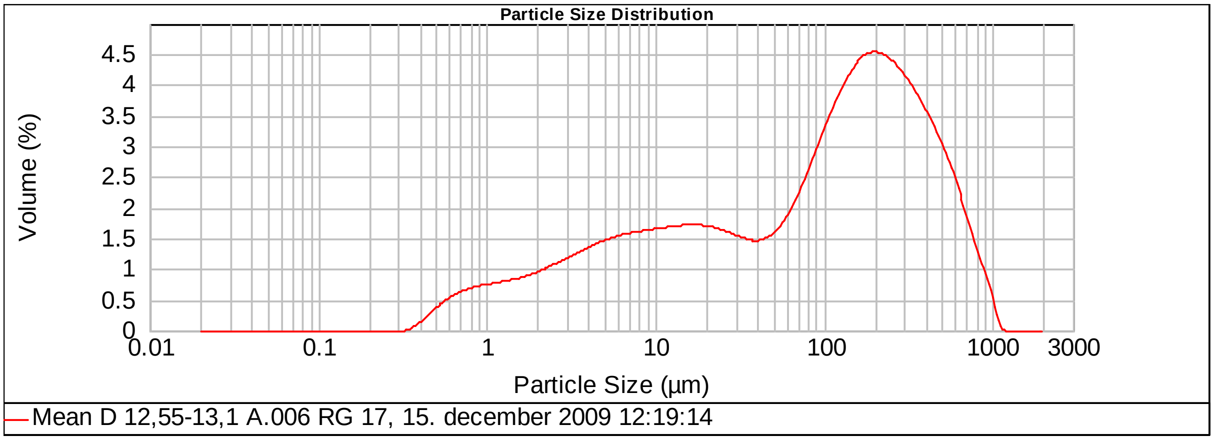
Size (µm)	Volume In %
11.482	0.70
13.183	0.80
15.136	0.90
17.378	1.01
19.953	1.13
22.909	1.25
26.303	1.41
30.200	1.63
34.674	1.95
39.811	2.39
45.709	2.98
52.481	3.71
60.256	4.53
69.183	5.36
79.433	6.11
91.201	6.67
104.713	6.96
120.226	

Size (µm)	Volume In %
120.226	6.92
138.038	6.57
158.489	5.96
181.970	5.16
208.930	4.29
239.883	3.42
275.423	2.66
316.228	2.03
363.078	1.57
416.869	1.25
478.630	1.02
549.541	0.86
630.957	0.71
724.436	0.56
831.764	0.40
954.993	0.24
1096.478	0.09
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 14 D 12,55-13,1 A.006 RG17



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.10
0.417	0.24
0.479	0.36
0.550	0.46
0.631	0.55
0.724	0.61
0.832	0.65
0.955	0.68
1.096	

Size (µm)	Volume In %
1.096	0.71
1.259	0.74
1.445	0.77
1.660	0.82
1.905	0.87
2.188	0.94
2.512	1.01
2.884	1.08
3.311	1.16
3.802	1.23
4.365	1.30
5.012	1.36
5.754	1.40
6.607	1.44
7.586	1.46
8.710	1.48
10.000	1.51
11.482	

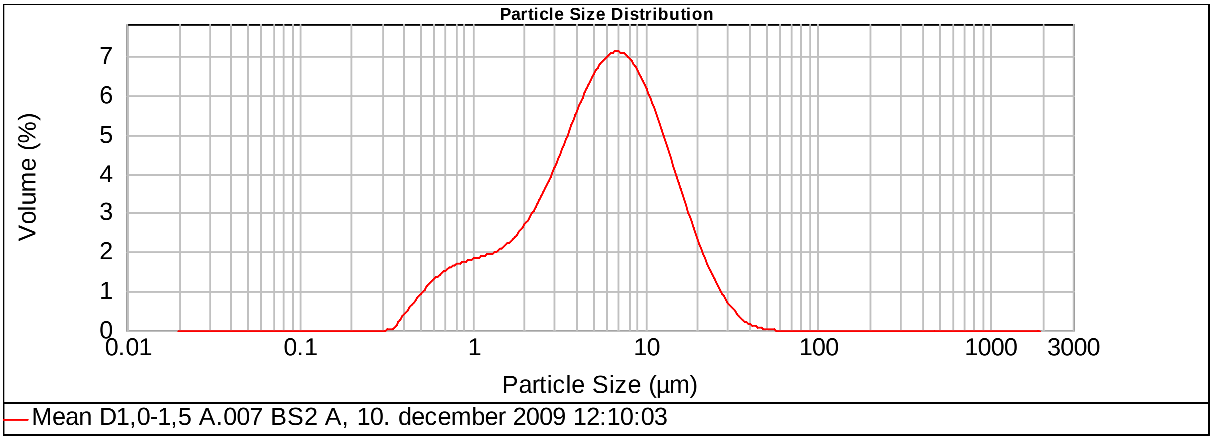
Size (µm)	Volume In %
11.482	1.53
13.183	1.55
15.136	1.56
17.378	1.55
19.953	1.53
22.909	1.49
26.303	1.43
30.200	1.37
34.674	1.33
39.811	1.33
45.709	1.40
52.481	1.56
60.256	1.81
69.183	2.13
79.433	2.51
91.201	2.90
104.713	3.28
120.226	

Size (µm)	Volume In %
120.226	3.60
138.038	3.86
158.489	4.02
181.970	4.09
208.930	4.07
239.883	3.96
275.423	3.79
316.228	3.57
363.078	3.31
416.869	3.01
478.630	2.67
549.541	2.29
630.957	1.85
724.436	1.37
831.764	0.92
954.993	0.43
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 15 D 1,0-1,5 A.007 BS2



Size (µm)	Volume In %
0.010	
	0.00
0.011	
	0.00
0.013	
	0.00
0.015	
	0.00
0.017	
	0.00
0.020	
	0.00
0.023	
	0.00
0.026	
	0.00
0.030	
	0.00
0.035	
	0.00
0.040	
	0.00
0.046	
	0.00
0.052	
	0.00
0.060	
	0.00
0.069	
	0.00
0.079	
	0.00
0.091	
	0.00
0.105	

Size (µm)	Volume In %
0.105	
	0.00
0.120	
	0.00
0.138	
	0.00
0.158	
	0.00
0.182	
	0.00
0.209	
	0.00
0.240	
	0.00
0.275	
	0.00
0.316	
	0.01
0.363	
	0.27
0.417	
	0.57
0.479	
	0.86
0.550	
	1.12
0.631	
	1.33
0.724	
	1.47
0.832	
	1.57
0.955	
	1.64
1.096	

Size (µm)	Volume In %
1.096	
	1.71
1.259	
	1.81
1.445	
	1.96
1.660	
	2.18
1.905	
	2.49
2.188	
	2.87
2.512	
	3.35
2.884	
	3.90
3.311	
	4.49
3.802	
	5.09
4.365	
	5.64
5.012	
	6.07
5.754	
	6.34
6.607	
	6.41
7.586	
	6.26
8.710	
	5.90
10.000	
	5.37
11.482	

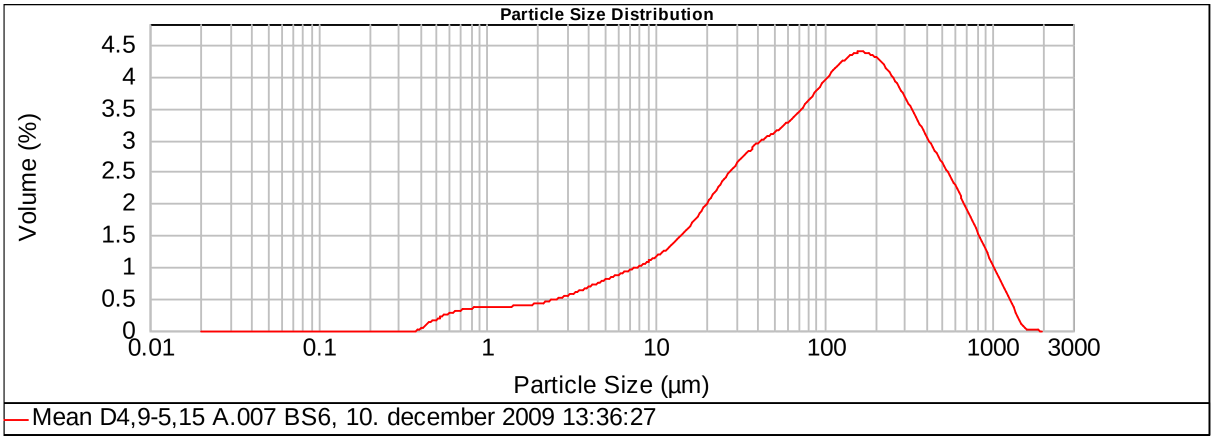
Size (µm)	Volume In %
11.482	
	4.71
13.183	
	3.98
15.136	
	3.24
17.378	
	2.51
19.953	
	1.86
22.909	
	1.30
26.303	
	0.85
30.200	
	0.50
34.674	
	0.25
39.811	
	0.11
45.709	
	0.03
52.481	
	0.00
60.256	
	0.00
69.183	
	0.00
79.433	
	0.00
91.201	
	0.00
104.713	
	0.00
120.226	

Size (µm)	Volume In %
120.226	
	0.00
138.038	
	0.00
158.489	
	0.00
181.970	
	0.00
208.930	
	0.00
239.883	
	0.00
275.423	
	0.00
316.228	
	0.00
363.078	
	0.00
416.869	
	0.00
478.630	
	0.00
549.541	
	0.00
630.957	
	0.00
724.436	
	0.00
831.764	
	0.00
954.993	
	0.00
1096.478	
	0.00
1258.925	

Size (µm)	Volume In %
1258.925	
	0.00
1445.440	
	0.00
1659.587	
	0.00
1905.461	
	0.00
2187.762	
	0.00
2511.886	
	0.00
2884.032	
	0.00
3311.311	
	0.00
3801.894	
	0.00
4365.158	
	0.00
5011.872	
	0.00
5754.399	
	0.00
6606.934	
	0.00
7585.776	
	0.00
8709.636	
	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 16 D 4,9-5,15 A.007 BS6



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.11
0.479	0.17
0.550	0.23
0.631	0.28
0.724	0.31
0.832	0.33
0.955	0.34
1.096	

Size (µm)	Volume In %
1.096	0.34
1.259	0.34
1.445	0.35
1.660	0.37
1.905	0.39
2.188	0.42
2.512	0.46
2.884	0.51
3.311	0.56
3.802	0.62
4.365	0.69
5.012	0.75
5.754	0.81
6.607	0.87
7.586	0.93
8.710	1.00
10.000	1.08
11.482	

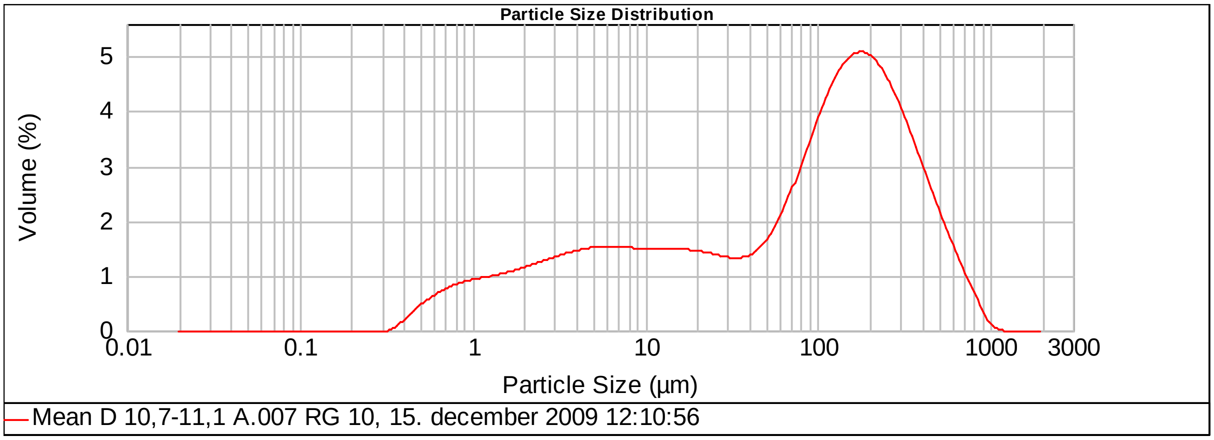
Size (µm)	Volume In %
11.482	1.19
13.183	1.33
15.136	1.50
17.378	1.69
19.953	1.89
22.909	2.10
26.303	2.29
30.200	2.45
34.674	2.58
39.811	2.69
45.709	2.78
52.481	2.88
60.256	3.01
69.183	3.16
79.433	3.33
91.201	3.51
104.713	3.68
120.226	

Size (µm)	Volume In %
120.226	3.83
138.038	3.92
158.489	3.96
181.970	3.91
208.930	3.79
239.883	3.60
275.423	3.36
316.228	3.10
363.078	2.83
416.869	2.58
478.630	2.33
549.541	2.08
630.957	1.82
724.436	1.53
831.764	1.22
954.993	0.90
1096.478	0.60
1258.925	

Size (µm)	Volume In %
1258.925	0.31
1445.440	0.04
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

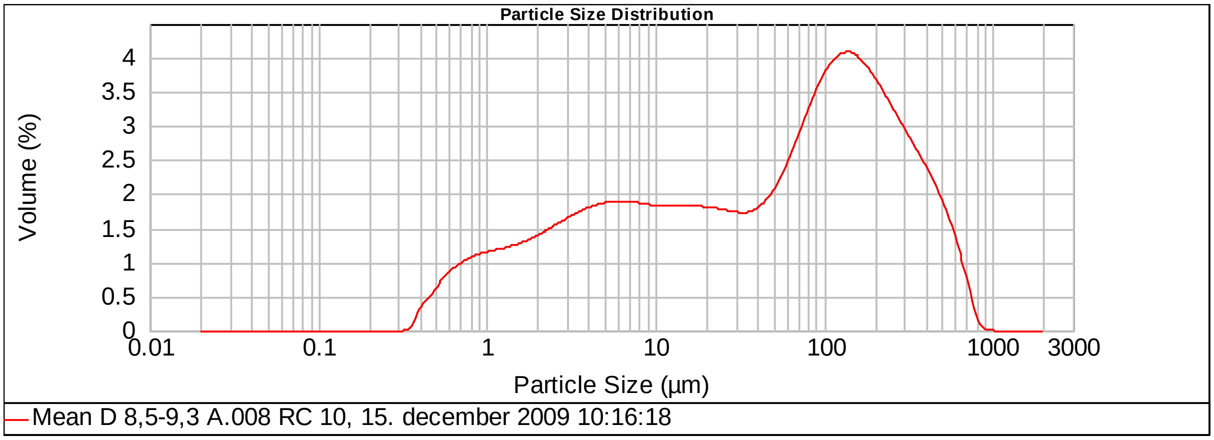
Sample 17 D 10,7-11,1 A.007 RG10



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.010	0.00	0.105	0.00	1.096	0.88	11.482	1.34	120.226	4.23	1258.925	0.00
0.011	0.00	0.120	0.00	1.259	0.91	13.183	1.34	138.038	4.47	1445.440	0.00
0.013	0.00	0.138	0.00	1.445	0.95	15.136	1.34	158.489	4.58	1659.587	0.00
0.015	0.00	0.158	0.00	1.660	1.00	17.378	1.33	181.970	4.55	1905.461	0.00
0.017	0.00	0.182	0.00	1.905	1.05	19.953	1.30	208.930	4.39	2187.762	0.00
0.020	0.00	0.209	0.00	2.188	1.11	22.909	1.27	239.883	4.10	2511.886	0.00
0.023	0.00	0.240	0.00	2.512	1.17	26.303	1.23	275.423	3.73	2884.032	0.00
0.026	0.00	0.275	0.00	2.884	1.23	30.200	1.20	316.228	3.30	3311.311	0.00
0.030	0.00	0.316	0.01	3.311	1.28	34.674	1.21	363.078	2.85	3801.894	0.00
0.035	0.00	0.363	0.14	3.802	1.33	39.811	1.28	416.869	2.38	4365.158	0.00
0.040	0.00	0.417	0.29	4.365	1.36	45.709	1.43	478.630	1.93	5011.872	0.00
0.046	0.00	0.479	0.44	5.012	1.38	52.481	1.68	549.541	1.50	5754.399	0.00
0.052	0.00	0.550	0.56	5.754	1.38	60.256	2.04	630.957	1.09	6606.934	0.00
0.060	0.00	0.631	0.66	6.607	1.38	69.183	2.48	724.436	0.73	7585.776	0.00
0.069	0.00	0.724	0.74	7.586	1.37	79.433	2.96	831.764	0.36	8709.636	0.00
0.079	0.00	0.832	0.80	8.710	1.35	91.201	3.44	954.993	0.10	10000.000	
0.091	0.00	0.955	0.84	10.000	1.35	104.713	3.88	1096.478	0.00		
0.105		1.096		11.482		120.226		1258.925			

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 18 D 8,5-9,3 A.008 RC 10



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.25
0.417	0.43
0.479	0.60
0.550	0.75
0.631	0.86
0.724	0.95
0.832	1.01
0.955	1.04
1.096	

Size (µm)	Volume In %
1.096	1.08
1.259	1.11
1.445	1.15
1.660	1.21
1.905	1.27
2.188	1.34
2.512	1.42
2.884	1.50
3.311	1.57
3.802	1.63
4.365	1.68
5.012	1.70
5.754	1.71
6.607	1.70
7.586	1.68
8.710	1.66
10.000	1.65
11.482	

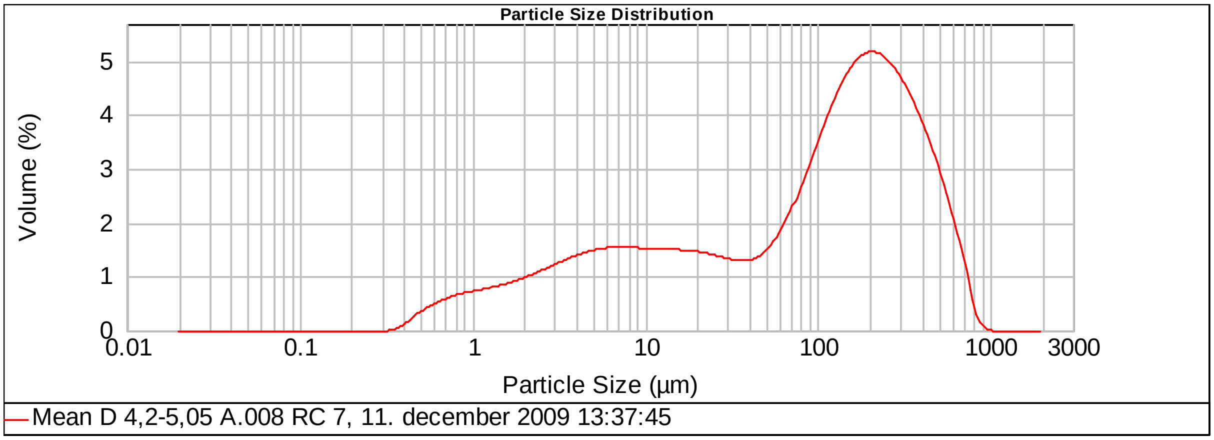
Size (µm)	Volume In %
11.482	1.64
13.183	1.64
15.136	1.65
17.378	1.64
19.953	1.63
22.909	1.60
26.303	1.58
30.200	1.56
34.674	1.58
39.811	1.65
45.709	1.81
52.481	2.04
60.256	2.36
69.183	2.71
79.433	3.06
91.201	3.35
104.713	3.57
120.226	

Size (µm)	Volume In %
120.226	3.67
138.038	3.67
158.489	3.57
181.970	3.40
208.930	3.18
239.883	2.94
275.423	2.70
316.228	2.47
363.078	2.23
416.869	1.97
478.630	1.66
549.541	1.28
630.957	0.86
724.436	0.34
831.764	0.04
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 19 D 4,2-5,05 A.008 RC7



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.08
0.417	0.21
0.479	0.33
0.550	0.43
0.631	0.51
0.724	0.58
0.832	0.63
0.955	0.66
1.096	

Size (µm)	Volume In %
1.096	0.70
1.259	0.74
1.445	0.78
1.660	0.84
1.905	0.90
2.188	0.97
2.512	1.05
2.884	1.13
3.311	1.20
3.802	1.27
4.365	1.33
5.012	1.37
5.754	1.39
6.607	1.40
7.586	1.39
8.710	1.38
10.000	1.37
11.482	

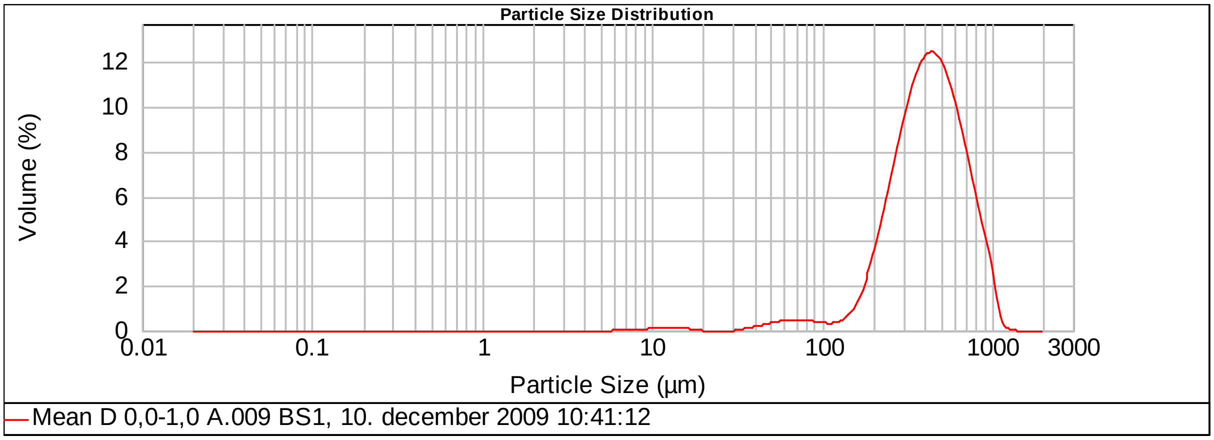
Size (µm)	Volume In %
11.482	1.37
13.183	1.36
15.136	1.35
17.378	1.34
19.953	1.31
22.909	1.28
26.303	1.23
30.200	1.19
34.674	1.17
39.811	1.20
45.709	1.30
52.481	1.50
60.256	1.80
69.183	2.18
79.433	2.64
91.201	3.11
104.713	3.58
120.226	

Size (µm)	Volume In %
120.226	3.99
138.038	4.33
158.489	4.55
181.970	4.66
208.930	4.64
239.883	4.51
275.423	4.28
316.228	3.97
363.078	3.59
416.869	3.15
478.630	2.64
549.541	2.03
630.957	1.40
724.436	0.60
831.764	0.11
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 20 D 0,0-1,0 A.009 BS1



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.00
0.479	0.00
0.550	0.00
0.631	0.00
0.724	0.00
0.832	0.00
0.955	0.00
1.096	

Size (µm)	Volume In %
1.096	0.00
1.259	0.00
1.445	0.00
1.660	0.00
1.905	0.00
2.188	0.00
2.512	0.00
2.884	0.00
3.311	0.00
3.802	0.00
4.365	0.00
5.012	0.00
5.754	0.01
6.607	0.06
7.586	0.07
8.710	0.08
10.000	0.08
11.482	

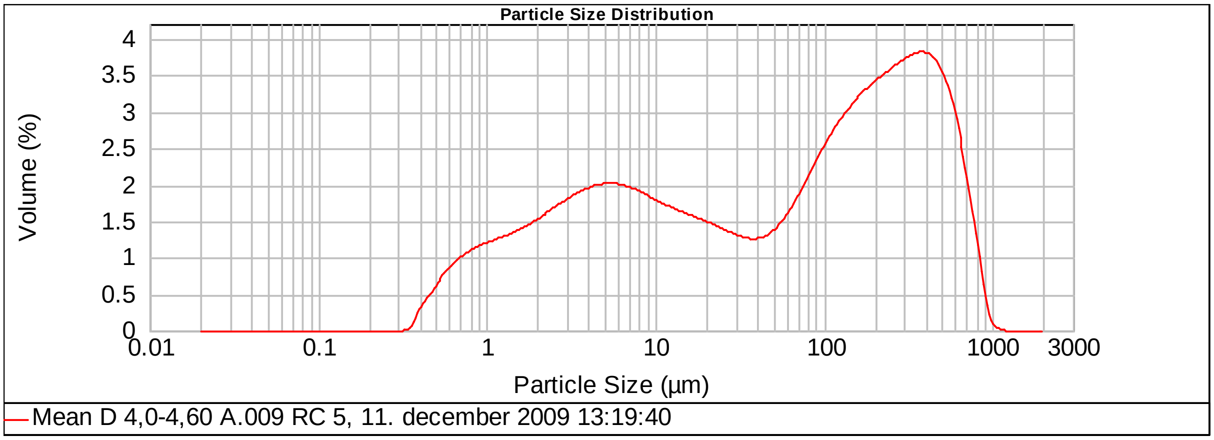
Size (µm)	Volume In %
11.482	0.09
13.183	0.08
15.136	0.08
17.378	0.02
19.953	0.00
22.909	0.00
26.303	0.00
30.200	0.01
34.674	0.12
39.811	0.20
45.709	0.29
52.481	0.38
60.256	0.44
69.183	0.45
79.433	0.40
91.201	0.33
104.713	0.30
120.226	

Size (µm)	Volume In %
120.226	0.40
138.038	0.77
158.489	1.52
181.970	2.71
208.930	4.30
239.883	6.19
275.423	8.10
316.228	9.77
363.078	10.88
416.869	11.24
478.630	10.79
549.541	9.60
630.957	7.91
724.436	5.95
831.764	4.09
954.993	2.08
1096.478	0.18
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 21 D 4,0-4,60 A.009 RC5



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.23
0.417	0.42
0.479	0.60
0.550	0.75
0.631	0.88
0.724	0.97
0.832	1.04
0.955	1.10
1.096	

Size (µm)	Volume In %
1.096	1.14
1.259	1.19
1.445	1.25
1.660	1.32
1.905	1.40
2.188	1.48
2.512	1.56
2.884	1.64
3.311	1.71
3.802	1.77
4.365	1.81
5.012	1.83
5.754	1.81
6.607	1.78
7.586	1.72
8.710	1.66
10.000	1.59
11.482	

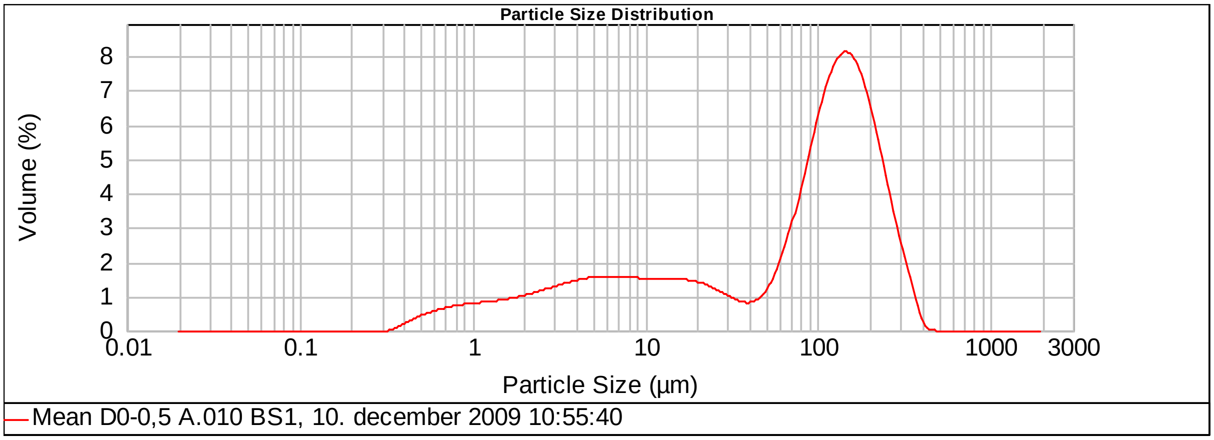
Size (µm)	Volume In %
11.482	1.54
13.183	1.48
15.136	1.43
17.378	1.38
19.953	1.33
22.909	1.27
26.303	1.21
30.200	1.16
34.674	1.14
39.811	1.15
45.709	1.22
52.481	1.34
60.256	1.53
69.183	1.76
79.433	2.01
91.201	2.25
104.713	2.47
120.226	

Size (µm)	Volume In %
120.226	2.66
138.038	2.82
158.489	2.95
181.970	3.06
208.930	3.16
239.883	3.26
275.423	3.36
316.228	3.43
363.078	3.45
416.869	3.37
478.630	3.15
549.541	2.75
630.957	2.15
724.436	1.42
831.764	0.58
954.993	0.07
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 22 D 0-0,5 A.010 BS1



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.15
0.417	0.28
0.479	0.40
0.550	0.50
0.631	0.58
0.724	0.65
0.832	0.69
0.955	0.72
1.096	

Size (µm)	Volume In %
1.096	0.75
1.259	0.79
1.445	0.83
1.660	0.88
1.905	0.95
2.188	1.03
2.512	1.11
2.884	1.19
3.311	1.27
3.802	1.34
4.365	1.39
5.012	1.42
5.754	1.43
6.607	1.42
7.586	1.41
8.710	1.38
10.000	1.37
11.482	

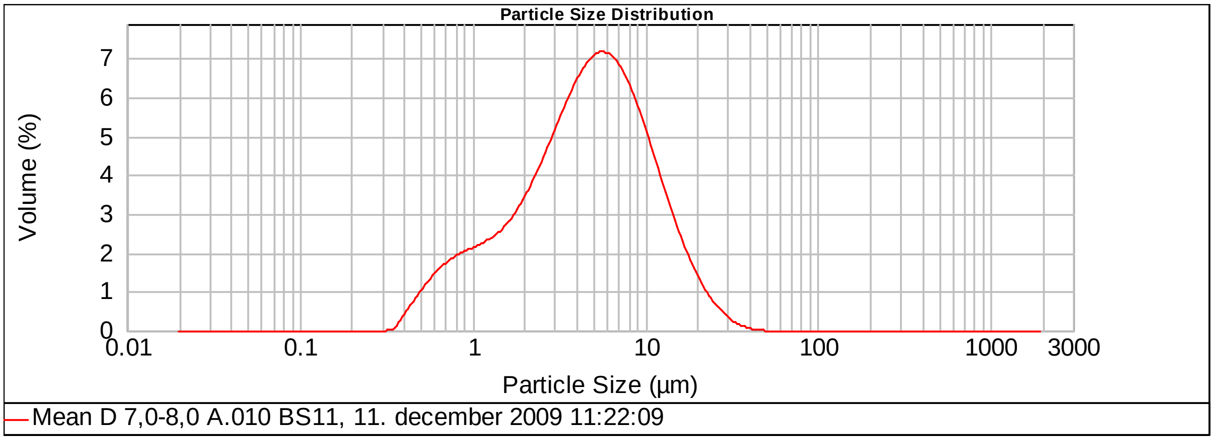
Size (µm)	Volume In %
11.482	1.36
13.183	1.36
15.136	1.35
17.378	1.32
19.953	1.26
22.909	1.15
26.303	1.01
30.200	0.86
34.674	0.75
39.811	0.76
45.709	0.97
52.481	1.43
60.256	2.18
69.183	3.18
79.433	4.35
91.201	5.52
104.713	6.53
120.226	

Size (µm)	Volume In %
120.226	7.17
138.038	7.33
158.489	6.97
181.970	6.13
208.930	4.98
239.883	3.69
275.423	2.49
316.228	1.46
363.078	0.46
416.869	0.01
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 23 D 7,0-8,0 A.010 BS11



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.28
0.417	0.62
0.479	0.95
0.550	1.26
0.631	1.50
0.724	1.69
0.832	1.82
0.955	1.93
1.096	

Size (µm)	Volume In %
1.096	2.05
1.259	2.22
1.445	2.45
1.660	2.78
1.905	3.19
2.188	3.68
2.512	4.23
2.884	4.81
3.311	5.39
3.802	5.89
4.365	6.26
5.012	6.45
5.754	6.43
6.607	6.17
7.586	5.70
8.710	5.08
10.000	4.35
11.482	

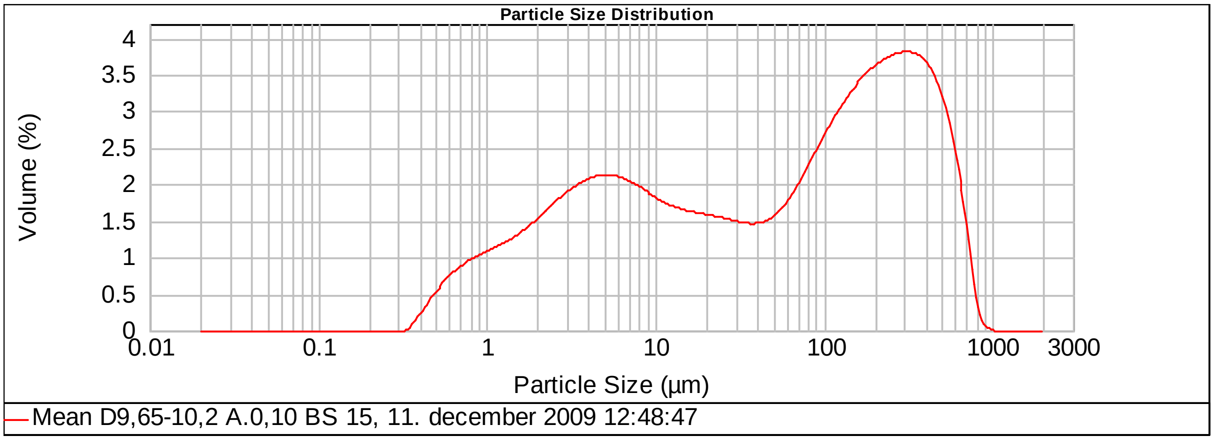
Size (µm)	Volume In %
11.482	3.59
13.183	2.84
15.136	2.17
17.378	1.58
19.953	1.10
22.909	0.72
26.303	0.44
30.200	0.23
34.674	0.11
39.811	0.03
45.709	0.00
52.481	0.00
60.256	0.00
69.183	0.00
79.433	0.00
91.201	0.00
104.713	0.00
120.226	

Size (µm)	Volume In %
120.226	0.00
138.038	0.00
158.489	0.00
181.970	0.00
208.930	0.00
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 24 D 9,65-10,2 A.010 BS15



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.18
0.417	0.35
0.479	0.51
0.550	0.65
0.631	0.76
0.724	0.86
0.832	0.93
0.955	0.99
1.096	

Size (µm)	Volume In %
1.096	1.05
1.259	1.12
1.445	1.20
1.660	1.30
1.905	1.40
2.188	1.52
2.512	1.63
2.884	1.73
3.311	1.82
3.802	1.88
4.365	1.92
5.012	1.92
5.754	1.90
6.607	1.84
7.586	1.77
8.710	1.69
10.000	1.62
11.482	

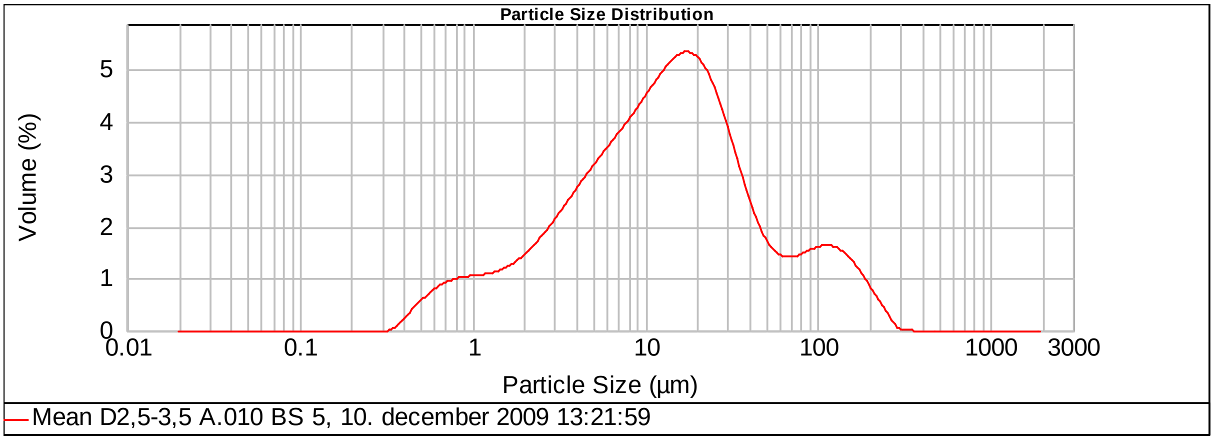
Size (µm)	Volume In %
11.482	1.55
13.183	1.51
15.136	1.47
17.378	1.45
19.953	1.42
22.909	1.40
26.303	1.37
30.200	1.34
34.674	1.32
39.811	1.33
45.709	1.39
52.481	1.50
60.256	1.68
69.183	1.89
79.433	2.13
91.201	2.38
104.713	2.60
120.226	

Size (µm)	Volume In %
120.226	2.81
138.038	2.98
158.489	3.13
181.970	3.25
208.930	3.34
239.883	3.40
275.423	3.44
316.228	3.43
363.078	3.35
416.869	3.16
478.630	2.82
549.541	2.28
630.957	1.59
724.436	0.65
831.764	0.09
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 25 D 2,5-3,5 A.010 BS5



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.16
0.417	0.35
0.479	0.54
0.550	0.69
0.631	0.80
0.724	0.88
0.832	0.93
0.955	0.95
1.096	

Size (µm)	Volume In %
1.096	0.98
1.259	1.02
1.445	1.09
1.660	1.21
1.905	1.36
2.188	1.54
2.512	1.76
2.884	1.99
3.311	2.24
3.802	2.50
4.365	2.75
5.012	2.98
5.754	3.21
6.607	3.44
7.586	3.67
8.710	3.92
10.000	4.19
11.482	

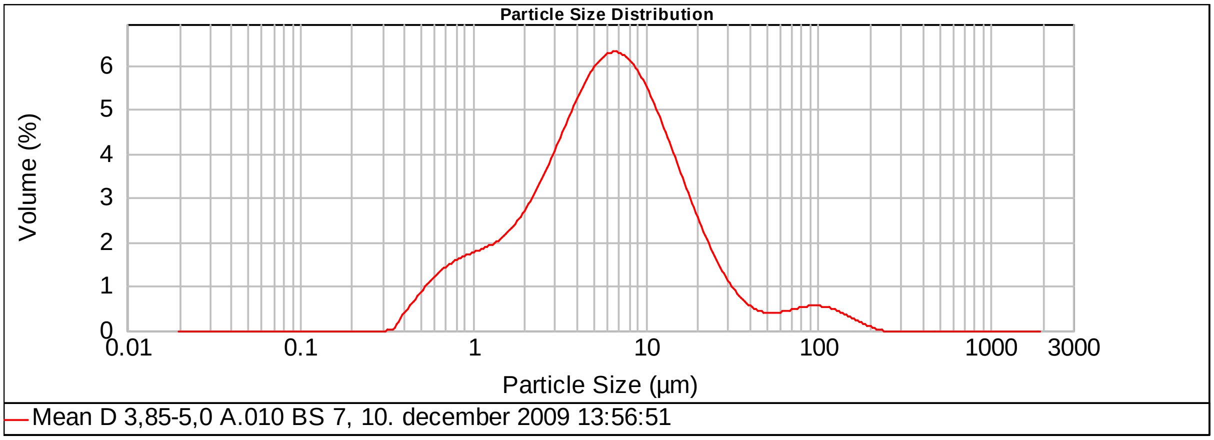
Size (µm)	Volume In %
11.482	4.44
13.183	4.66
15.136	4.80
17.378	4.81
19.953	4.65
22.909	4.31
26.303	3.83
30.200	3.24
34.674	2.63
39.811	2.08
45.709	1.66
52.481	1.39
60.256	1.28
69.183	1.29
79.433	1.37
91.201	1.45
104.713	1.48
120.226	

Size (µm)	Volume In %
120.226	1.43
138.038	1.29
158.489	1.08
181.970	0.81
208.930	0.53
239.883	0.27
275.423	0.03
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 26 D 3,85-5,0 A.010 BS7



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.27
0.417	0.54
0.479	0.80
0.550	1.05
0.631	1.24
0.724	1.40
0.832	1.50
0.955	1.59
1.096	

Size (µm)	Volume In %
1.096	1.68
1.259	1.80
1.445	1.97
1.660	2.21
1.905	2.51
2.188	2.88
2.512	3.32
2.884	3.79
3.311	4.29
3.802	4.76
4.365	5.18
5.012	5.48
5.754	5.65
6.607	5.66
7.586	5.51
8.710	5.22
10.000	4.80
11.482	

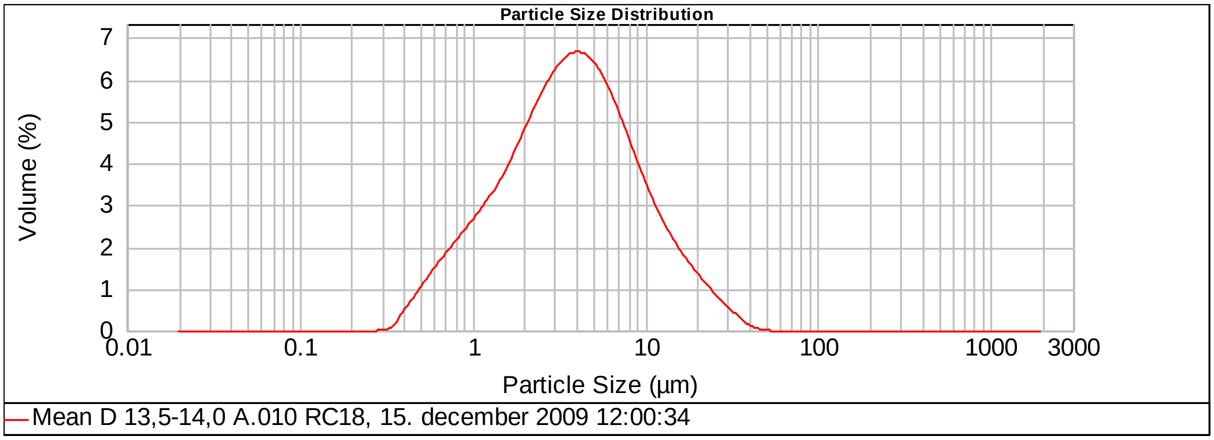
Size (µm)	Volume In %
11.482	4.31
13.183	3.76
15.136	3.20
17.378	2.64
19.953	2.11
22.909	1.63
26.303	1.22
30.200	0.88
34.674	0.63
39.811	0.47
45.709	0.38
52.481	0.36
60.256	0.39
69.183	0.45
79.433	0.49
91.201	0.51
104.713	0.47
120.226	

Size (µm)	Volume In %
120.226	0.40
138.038	0.31
158.489	0.19
181.970	0.10
208.930	0.01
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 27 D 13,5-14,0 A.010 RC18



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.06
0.363	0.36
0.417	0.66
0.479	0.97
0.550	1.29
0.631	1.58
0.724	1.86
0.832	2.13
0.955	2.41
1.096	

Size (µm)	Volume In %
1.096	2.72
1.259	3.07
1.445	3.49
1.660	3.95
1.905	4.44
2.188	4.92
2.512	5.36
2.884	5.71
3.311	5.94
3.802	6.01
4.365	5.91
5.012	5.65
5.754	5.23
6.607	4.70
7.586	4.10
8.710	3.51
10.000	2.96
11.482	

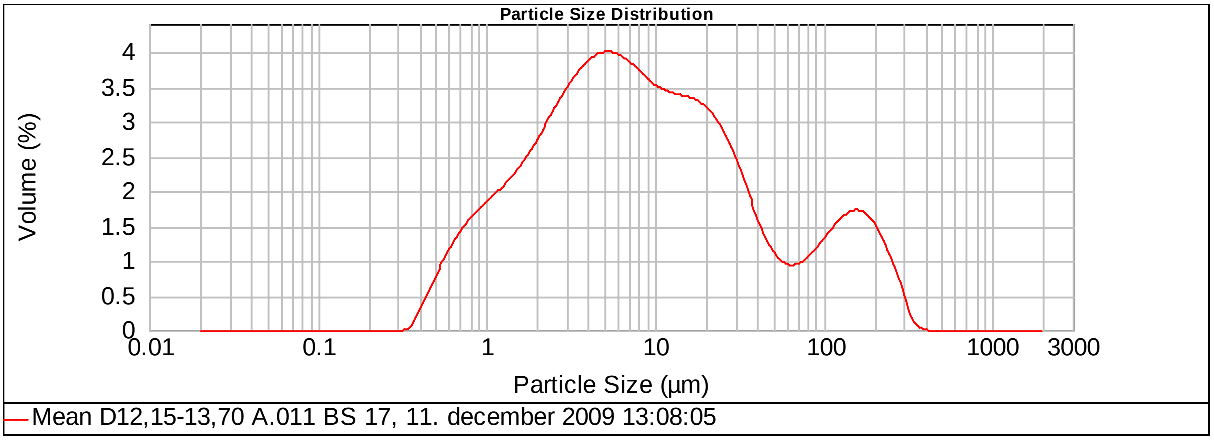
Size (µm)	Volume In %
11.482	2.48
13.183	2.06
15.136	1.71
17.378	1.40
19.953	1.12
22.909	0.87
26.303	0.63
30.200	0.42
34.674	0.22
39.811	0.09
45.709	0.01
52.481	0.00
60.256	0.00
69.183	0.00
79.433	0.00
91.201	0.00
104.713	0.00
120.226	

Size (µm)	Volume In %
120.226	0.00
138.038	0.00
158.489	0.00
181.970	0.00
208.930	0.00
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 28 D 12,15-13,70 A.011 BS17



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.22
0.417	0.48
0.479	0.75
0.550	1.01
0.631	1.22
0.724	1.41
0.832	1.56
0.955	1.69
1.096	

Size (µm)	Volume In %
1.096	1.81
1.259	1.95
1.445	2.11
1.660	2.31
1.905	2.52
2.188	2.74
2.512	2.97
2.884	3.19
3.311	3.37
3.802	3.52
4.365	3.60
5.012	3.62
5.754	3.57
6.607	3.48
7.586	3.36
8.710	3.25
10.000	3.16
11.482	

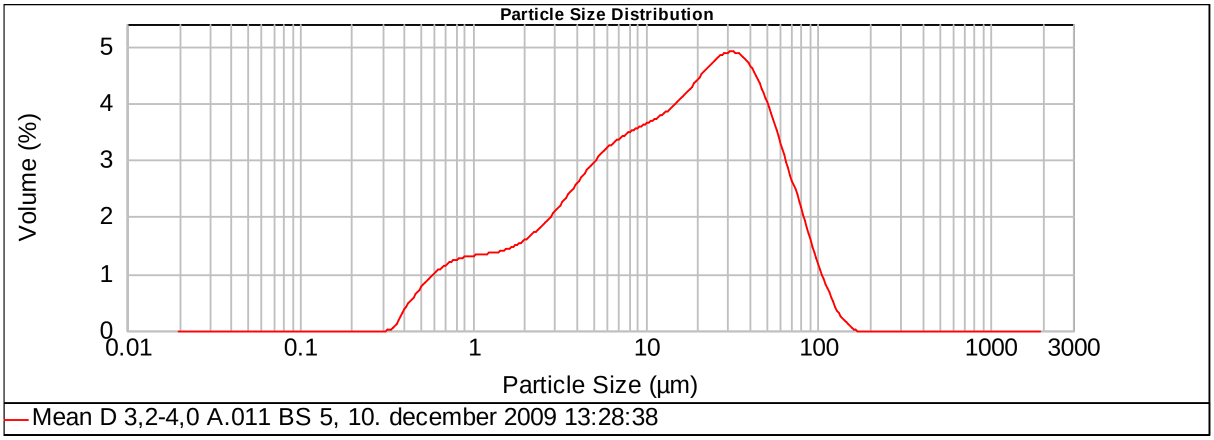
Size (µm)	Volume In %
11.482	3.10
13.183	3.06
15.136	3.02
17.378	2.96
19.953	2.84
22.909	2.65
26.303	2.38
30.200	2.04
34.674	1.69
39.811	1.35
45.709	1.08
52.481	0.91
60.256	0.85
69.183	0.89
79.433	1.01
91.201	1.17
104.713	1.34
120.226	

Size (µm)	Volume In %
120.226	1.48
138.038	1.56
158.489	1.55
181.970	1.44
208.930	1.21
239.883	0.89
275.423	0.53
316.228	0.12
363.078	0.01
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 29 D 3,2-4,0 A.011 BS5



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.25
0.417	0.49
0.479	0.70
0.550	0.88
0.631	1.01
0.724	1.10
0.832	1.16
0.955	1.19
1.096	

Size (µm)	Volume In %
1.096	1.21
1.259	1.24
1.445	1.28
1.660	1.36
1.905	1.46
2.188	1.59
2.512	1.75
2.884	1.94
3.311	2.14
3.802	2.36
4.365	2.57
5.012	2.76
5.754	2.92
6.607	3.04
7.586	3.14
8.710	3.23
10.000	3.31
11.482	

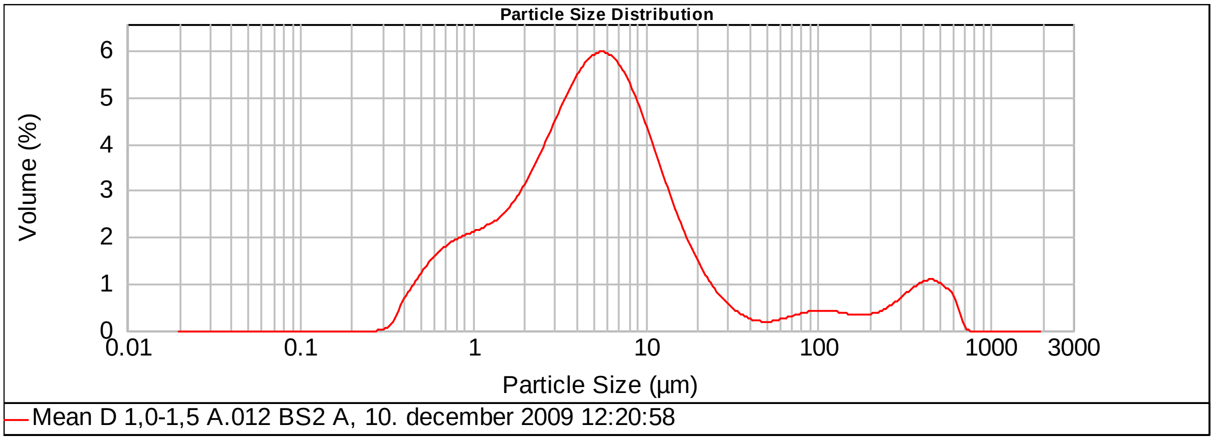
Size (µm)	Volume In %
11.482	3.40
13.183	3.52
15.136	3.68
17.378	3.86
19.953	4.06
22.909	4.24
26.303	4.37
30.200	4.42
34.674	4.34
39.811	4.12
45.709	3.77
52.481	3.31
60.256	2.78
69.183	2.21
79.433	1.64
91.201	1.11
104.713	0.68
120.226	

Size (µm)	Volume In %
120.226	0.31
138.038	0.11
158.489	0.00
181.970	0.00
208.930	0.00
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 30 D 1,0-1,5 A.012 BS2



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.01
0.316	0.11
0.363	0.51
0.417	0.84
0.479	1.13
0.550	1.39
0.631	1.58
0.724	1.72
0.832	1.83
0.955	1.91
1.096	

Size (µm)	Volume In %
1.096	2.00
1.259	2.12
1.445	2.31
1.660	2.57
1.905	2.89
2.188	3.28
2.512	3.71
2.884	4.16
3.311	4.60
3.802	4.97
4.365	5.24
5.012	5.37
5.754	5.34
6.607	5.14
7.586	4.78
8.710	4.30
10.000	3.74
11.482	

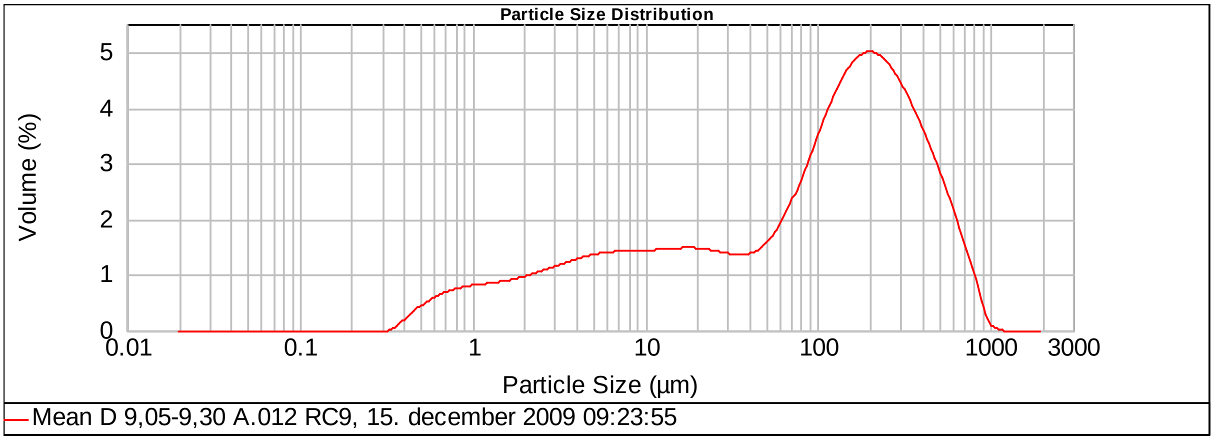
Size (µm)	Volume In %
11.482	3.16
13.183	2.59
15.136	2.06
17.378	1.59
19.953	1.20
22.909	0.88
26.303	0.63
30.200	0.43
34.674	0.29
39.811	0.21
45.709	0.18
52.481	0.19
60.256	0.24
69.183	0.31
79.433	0.36
91.201	0.39
104.713	0.39
120.226	

Size (µm)	Volume In %
120.226	0.36
138.038	0.33
158.489	0.30
181.970	0.31
208.930	0.36
239.883	0.47
275.423	0.61
316.228	0.78
363.078	0.92
416.869	0.99
478.630	0.92
549.541	0.75
630.957	0.25
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 31 D 9,05-9,30 A.012 RC9



Size (µm)	Volume In %
0.010	
	0.00
0.011	
	0.00
0.013	
	0.00
0.015	
	0.00
0.017	
	0.00
0.020	
	0.00
0.023	
	0.00
0.026	
	0.00
0.030	
	0.00
0.035	
	0.00
0.040	
	0.00
0.046	
	0.00
0.052	
	0.00
0.060	
	0.00
0.069	
	0.00
0.079	
	0.00
0.091	
	0.00
0.105	

Size (µm)	Volume In %
0.105	
	0.00
0.120	
	0.00
0.138	
	0.00
0.158	
	0.00
0.182	
	0.00
0.209	
	0.00
0.240	
	0.00
0.275	
	0.00
0.316	
	0.01
0.363	
	0.15
0.417	
	0.29
0.479	
	0.41
0.550	
	0.52
0.631	
	0.60
0.724	
	0.67
0.832	
	0.71
0.955	
	0.74
1.096	

Size (µm)	Volume In %
1.096	
	0.76
1.259	
	0.78
1.445	
	0.81
1.660	
	0.85
1.905	
	0.89
2.188	
	0.95
2.512	
	1.00
2.884	
	1.06
3.311	
	1.12
3.802	
	1.17
4.365	
	1.22
5.012	
	1.25
5.754	
	1.28
6.607	
	1.29
7.586	
	1.30
8.710	
	1.30
10.000	
	1.31
11.482	

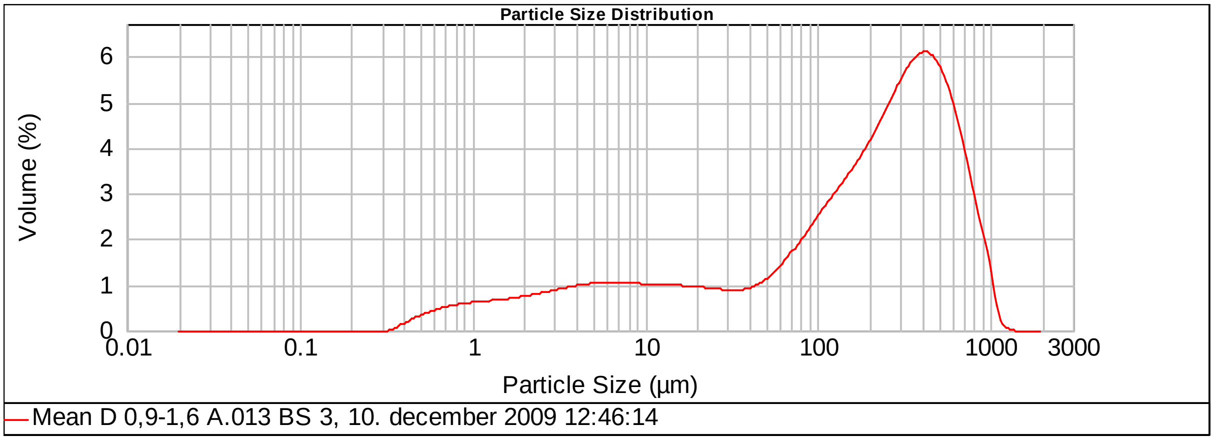
Size (µm)	Volume In %
11.482	
	1.32
13.183	
	1.33
15.136	
	1.35
17.378	
	1.35
19.953	
	1.34
22.909	
	1.31
26.303	
	1.28
30.200	
	1.24
34.674	
	1.24
39.811	
	1.27
45.709	
	1.38
52.481	
	1.58
60.256	
	1.87
69.183	
	2.24
79.433	
	2.68
91.201	
	3.13
104.713	
	3.57
120.226	

Size (µm)	Volume In %
120.226	
	3.95
138.038	
	4.26
158.489	
	4.45
181.970	
	4.53
208.930	
	4.49
239.883	
	4.32
275.423	
	4.07
316.228	
	3.76
363.078	
	3.39
416.869	
	2.99
478.630	
	2.56
549.541	
	2.09
630.957	
	1.58
724.436	
	1.06
831.764	
	0.49
954.993	
	0.08
1096.478	
	0.00
1258.925	

Size (µm)	Volume In %
1258.925	
	0.00
1445.440	
	0.00
1659.587	
	0.00
1905.461	
	0.00
2187.762	
	0.00
2511.886	
	0.00
2884.032	
	0.00
3311.311	
	0.00
3801.894	
	0.00
4365.158	
	0.00
5011.872	
	0.00
5754.399	
	0.00
6606.934	
	0.00
7585.776	
	0.00
8709.636	
	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 32 D 0,9-1,6 A.013 BS3



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.12
0.417	0.22
0.479	0.31
0.550	0.39
0.631	0.46
0.724	0.50
0.832	0.54
0.955	0.56
1.096	

Size (µm)	Volume In %
1.096	0.58
1.259	0.60
1.445	0.63
1.660	0.66
1.905	0.69
2.188	0.73
2.512	0.77
2.884	0.82
3.311	0.86
3.802	0.90
4.365	0.93
5.012	0.94
5.754	0.95
6.607	0.95
7.586	0.94
8.710	0.93
10.000	0.92
11.482	

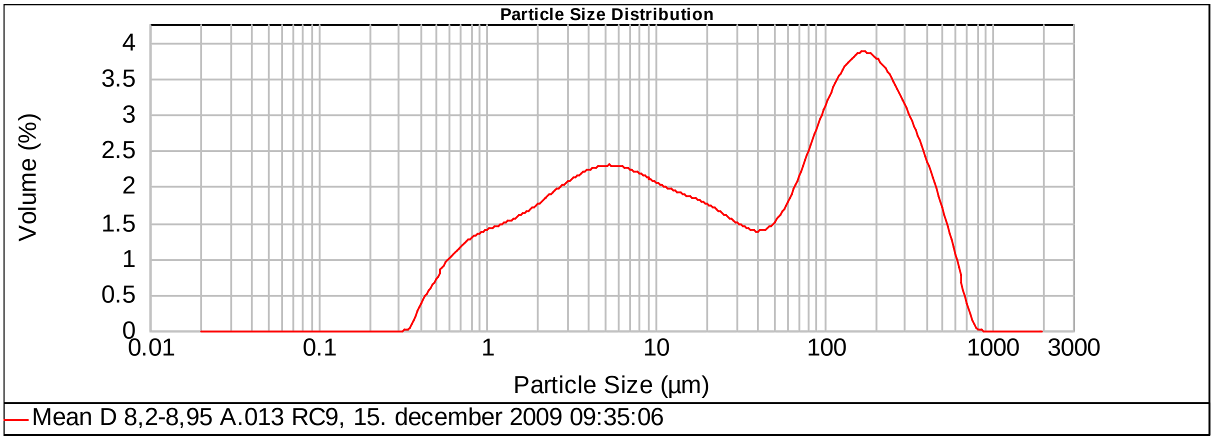
Size (µm)	Volume In %
11.482	0.91
13.183	0.90
15.136	0.89
17.378	0.88
19.953	0.86
22.909	0.84
26.303	0.82
30.200	0.80
34.674	0.82
39.811	0.87
45.709	0.98
52.481	1.15
60.256	1.38
69.183	1.65
79.433	1.94
91.201	2.24
104.713	2.53
120.226	

Size (µm)	Volume In %
120.226	2.80
138.038	3.08
158.489	3.37
181.970	3.71
208.930	4.09
239.883	4.50
275.423	4.92
316.228	5.27
363.078	5.48
416.869	5.48
478.630	5.21
549.541	4.66
630.957	3.89
724.436	2.96
831.764	2.03
954.993	1.06
1096.478	0.14
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 33 D 8,2-8,95 A.013 RC9



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.27
0.417	0.49
0.479	0.69
0.550	0.88
0.631	1.02
0.724	1.13
0.832	1.21
0.955	1.27
1.096	

Size (µm)	Volume In %
1.096	1.32
1.259	1.38
1.445	1.44
1.660	1.52
1.905	1.60
2.188	1.69
2.512	1.78
2.884	1.87
3.311	1.95
3.802	2.02
4.365	2.06
5.012	2.08
5.754	2.06
6.607	2.02
7.586	1.96
8.710	1.90
10.000	1.83
11.482	

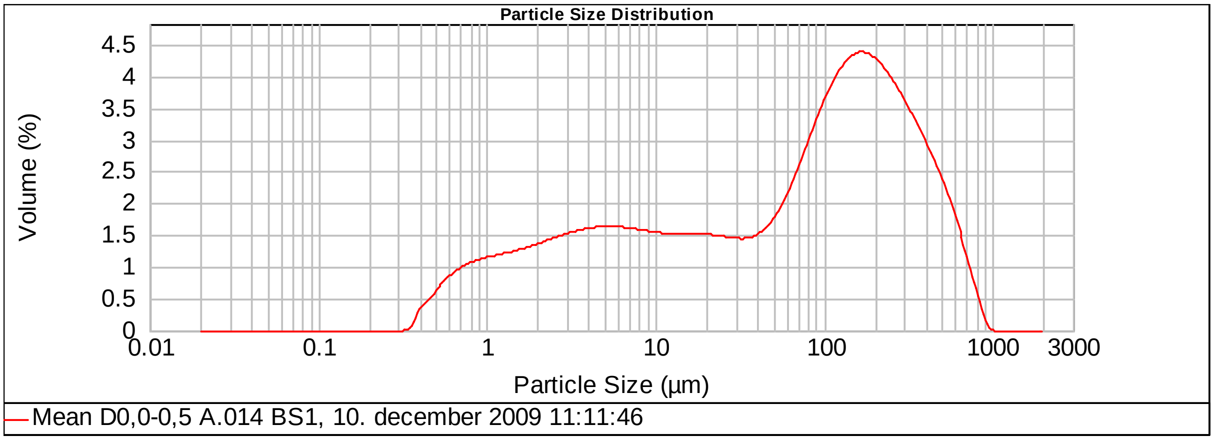
Size (µm)	Volume In %
11.482	1.78
13.183	1.73
15.136	1.68
17.378	1.62
19.953	1.56
22.909	1.48
26.303	1.40
30.200	1.32
34.674	1.26
39.811	1.25
45.709	1.32
52.481	1.47
60.256	1.71
69.183	2.03
79.433	2.38
91.201	2.73
104.713	3.04
120.226	

Size (µm)	Volume In %
120.226	3.28
138.038	3.43
158.489	3.49
181.970	3.46
208.930	3.34
239.883	3.14
275.423	2.89
316.228	2.58
363.078	2.25
416.869	1.87
478.630	1.46
549.541	1.00
630.957	0.52
724.436	0.10
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 34 D 0,0-0,5 A.014 BS1



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.26
0.417	0.44
0.479	0.60
0.550	0.75
0.631	0.86
0.724	0.95
0.832	1.01
0.955	1.05
1.096	

Size (µm)	Volume In %
1.096	1.08
1.259	1.11
1.445	1.15
1.660	1.19
1.905	1.24
2.188	1.29
2.512	1.34
2.884	1.38
3.311	1.42
3.802	1.45
4.365	1.47
5.012	1.48
5.754	1.47
6.607	1.45
7.586	1.43
8.710	1.41
10.000	1.39
11.482	

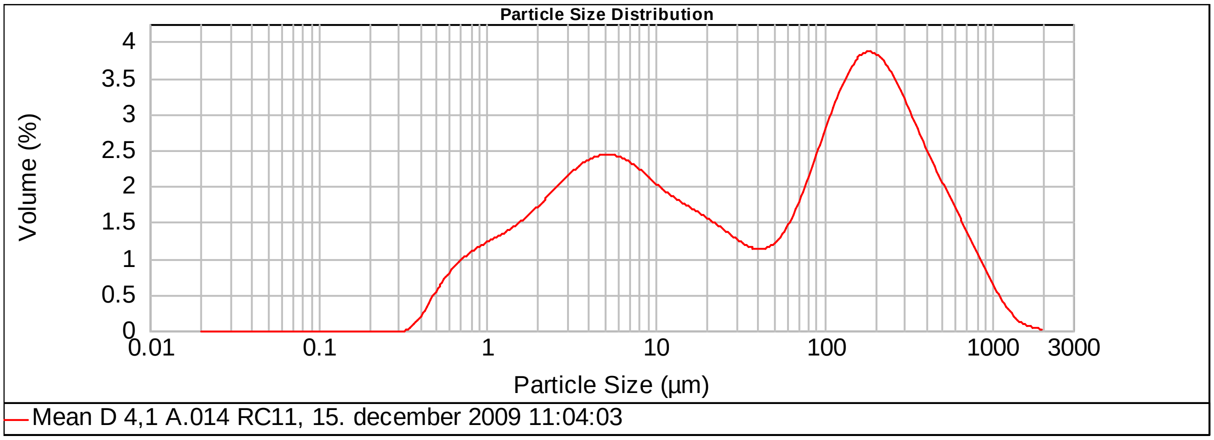
Size (µm)	Volume In %
11.482	1.38
13.183	1.38
15.136	1.38
17.378	1.38
19.953	1.36
22.909	1.34
26.303	1.32
30.200	1.31
34.674	1.32
39.811	1.40
45.709	1.54
52.481	1.77
60.256	2.08
69.183	2.45
79.433	2.84
91.201	3.21
104.713	3.53
120.226	

Size (µm)	Volume In %
120.226	3.77
138.038	3.91
158.489	3.95
181.970	3.90
208.930	3.76
239.883	3.56
275.423	3.31
316.228	3.04
363.078	2.75
416.869	2.43
478.630	2.08
549.541	1.68
630.957	1.22
724.436	0.73
831.764	0.22
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 35 D 4,1 A.014 RC11



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.14
0.417	0.34
0.479	0.52
0.550	0.69
0.631	0.83
0.724	0.95
0.832	1.04
0.955	1.11
1.096	

Size (µm)	Volume In %
1.096	1.18
1.259	1.26
1.445	1.35
1.660	1.45
1.905	1.57
2.188	1.70
2.512	1.82
2.884	1.95
3.311	2.06
3.802	2.14
4.365	2.19
5.012	2.20
5.754	2.17
6.607	2.10
7.586	2.00
8.710	1.90
10.000	1.79
11.482	

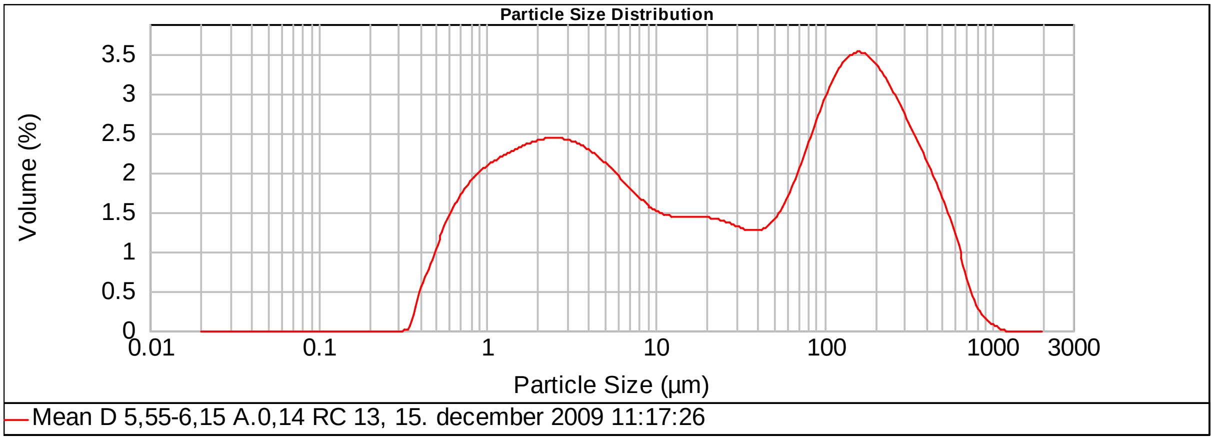
Size (µm)	Volume In %
11.482	1.70
13.183	1.61
15.136	1.53
17.378	1.46
19.953	1.37
22.909	1.28
26.303	1.19
30.200	1.10
34.674	1.04
39.811	1.02
45.709	1.06
52.481	1.19
60.256	1.40
69.183	1.70
79.433	2.05
91.201	2.42
104.713	2.78
120.226	

Size (µm)	Volume In %
120.226	3.09
138.038	3.32
158.489	3.45
181.970	3.47
208.930	3.38
239.883	3.19
275.423	2.94
316.228	2.64
363.078	2.35
416.869	2.06
478.630	1.81
549.541	1.56
630.957	1.32
724.436	1.07
831.764	0.81
954.993	0.56
1096.478	0.34
1258.925	

Size (µm)	Volume In %
1258.925	0.18
1445.440	0.08
1659.587	0.03
1905.461	0.01
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 36 D 5,55-6,15 A.014 RC13



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.38
0.417	0.70
0.479	1.00
0.550	1.27
0.631	1.49
0.724	1.67
0.832	1.80
0.955	1.90
1.096	

Size (µm)	Volume In %
1.096	1.97
1.259	2.04
1.445	2.09
1.660	2.15
1.905	2.19
2.188	2.20
2.512	2.20
2.884	2.18
3.311	2.13
3.802	2.07
4.365	1.98
5.012	1.87
5.754	1.75
6.607	1.62
7.586	1.51
8.710	1.41
10.000	1.35
11.482	

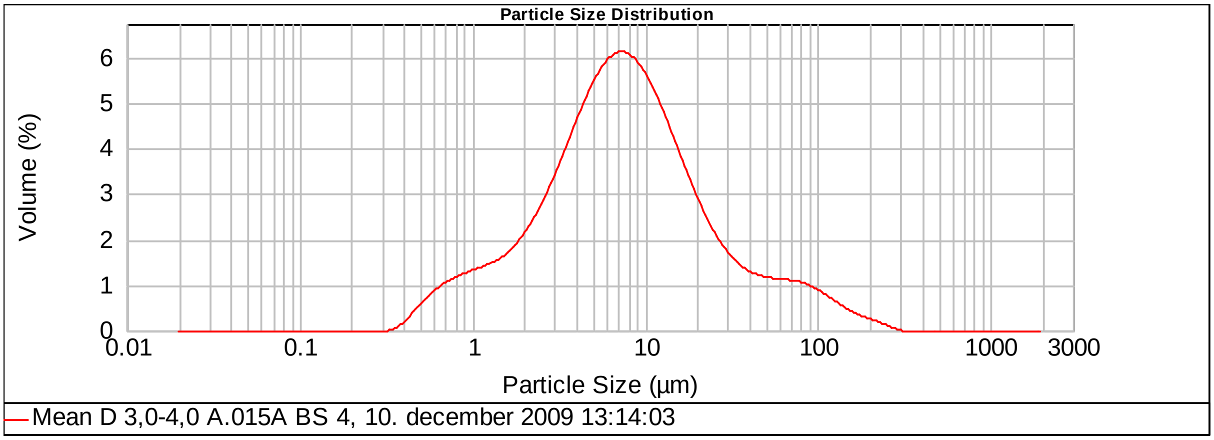
Size (µm)	Volume In %
11.482	1.31
13.183	1.30
15.136	1.30
17.378	1.30
19.953	1.29
22.909	1.26
26.303	1.22
30.200	1.17
34.674	1.14
39.811	1.15
45.709	1.23
52.481	1.39
60.256	1.63
69.183	1.93
79.433	2.27
91.201	2.59
104.713	2.87
120.226	

Size (µm)	Volume In %
120.226	3.07
138.038	3.17
158.489	3.18
181.970	3.10
208.930	2.95
239.883	2.75
275.423	2.51
316.228	2.27
363.078	2.02
416.869	1.76
478.630	1.47
549.541	1.14
630.957	0.75
724.436	0.37
831.764	0.16
954.993	0.07
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 37 D 3,0-4,0 A.015A BS4



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.12
0.417	0.34
0.479	0.56
0.550	0.75
0.631	0.91
0.724	1.04
0.832	1.13
0.955	1.20
1.096	

Size (µm)	Volume In %
1.096	1.28
1.259	1.38
1.445	1.52
1.660	1.73
1.905	2.00
2.188	2.34
2.512	2.75
2.884	3.22
3.311	3.74
3.802	4.25
4.365	4.73
5.012	5.13
5.754	5.40
6.607	5.52
7.586	5.48
8.710	5.27
10.000	4.93
11.482	

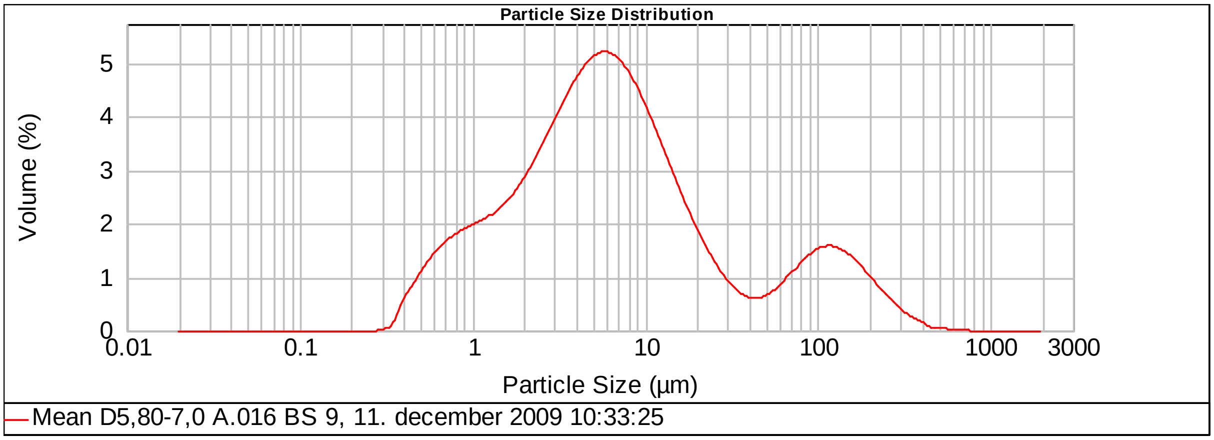
Size (µm)	Volume In %
11.482	4.49
13.183	3.98
15.136	3.45
17.378	2.93
19.953	2.45
22.909	2.04
26.303	1.70
30.200	1.45
34.674	1.26
39.811	1.14
45.709	1.07
52.481	1.04
60.256	1.02
69.183	0.99
79.433	0.93
91.201	0.82
104.713	0.69
120.226	

Size (µm)	Volume In %
120.226	0.55
138.038	0.43
158.489	0.32
181.970	0.24
208.930	0.17
239.883	0.09
275.423	0.01
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 38 D 5,80 7,0 A.016 BS9



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.01
0.316	0.08
0.363	0.44
0.417	0.74
0.479	1.02
0.550	1.26
0.631	1.45
0.724	1.60
0.832	1.70
0.955	1.79
1.096	

Size (µm)	Volume In %
1.096	1.88
1.259	2.00
1.445	2.16
1.660	2.38
1.905	2.65
2.188	2.96
2.512	3.30
2.884	3.66
3.311	4.01
3.802	4.32
4.365	4.55
5.012	4.68
5.754	4.69
6.607	4.58
7.586	4.34
8.710	4.02
10.000	3.62
11.482	

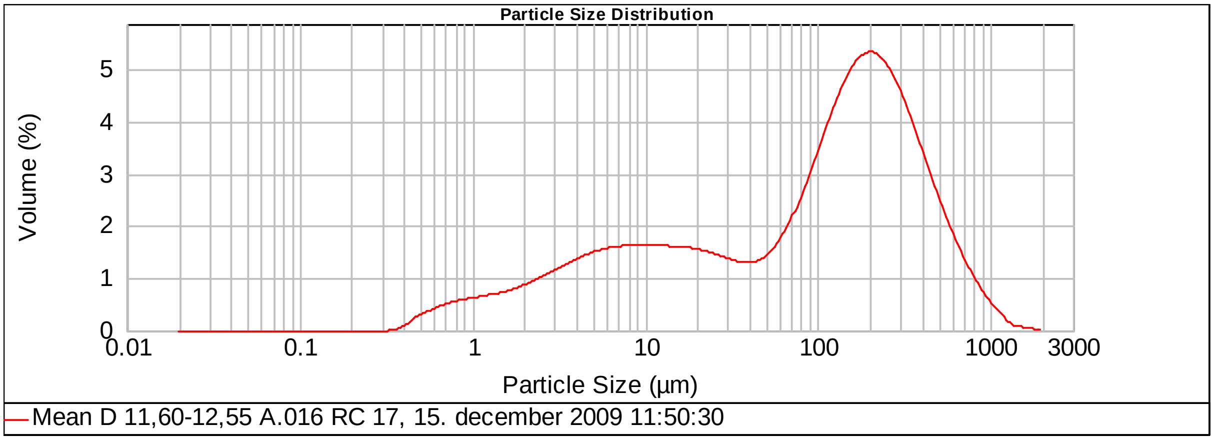
Size (µm)	Volume In %
11.482	3.19
13.183	2.75
15.136	2.33
17.378	1.92
19.953	1.56
22.909	1.24
26.303	0.96
30.200	0.75
34.674	0.61
39.811	0.55
45.709	0.57
52.481	0.68
60.256	0.85
69.183	1.05
79.433	1.24
91.201	1.37
104.713	1.43
120.226	

Size (µm)	Volume In %
120.226	1.40
138.038	1.30
158.489	1.14
181.970	0.95
208.930	0.75
239.883	0.55
275.423	0.39
316.228	0.25
363.078	0.16
416.869	0.06
478.630	0.04
549.541	0.03
630.957	0.01
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 39 D 11,60-12,55 A.016 RC17



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.06
0.417	0.18
0.479	0.28
0.550	0.37
0.631	0.44
0.724	0.50
0.832	0.54
0.955	0.57
1.096	

Size (µm)	Volume In %
1.096	0.60
1.259	0.64
1.445	0.68
1.660	0.74
1.905	0.81
2.188	0.89
2.512	0.98
2.884	1.07
3.311	1.17
3.802	1.25
4.365	1.33
5.012	1.39
5.754	1.43
6.607	1.46
7.586	1.47
8.710	1.47
10.000	1.47
11.482	

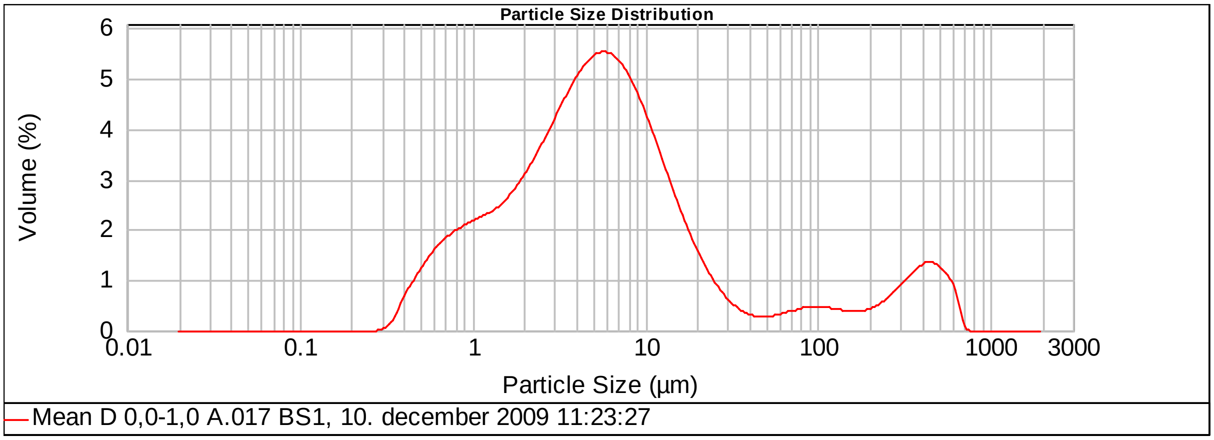
Size (µm)	Volume In %
11.482	1.47
13.183	1.46
15.136	1.45
17.378	1.43
19.953	1.39
22.909	1.34
26.303	1.28
30.200	1.22
34.674	1.18
39.811	1.19
45.709	1.26
52.481	1.43
60.256	1.71
69.183	2.09
79.433	2.55
91.201	3.05
104.713	3.56
120.226	

Size (µm)	Volume In %
120.226	4.03
138.038	4.43
158.489	4.69
181.970	4.81
208.930	4.76
239.883	4.54
275.423	4.19
316.228	3.74
363.078	3.24
416.869	2.72
478.630	2.22
549.541	1.77
630.957	1.36
724.436	1.01
831.764	0.71
954.993	0.46
1096.478	0.27
1258.925	

Size (µm)	Volume In %
1258.925	0.10
1445.440	0.06
1659.587	0.03
1905.461	0.01
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 40 D 0,0-1,0 A.017 BS1



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.01
0.316	0.13
0.363	0.52
0.417	0.84
0.479	1.14
0.550	1.40
0.631	1.60
0.724	1.76
0.832	1.88
0.955	1.97
1.096	

Size (µm)	Volume In %
1.096	2.06
1.259	2.19
1.445	2.35
1.660	2.58
1.905	2.86
2.188	3.18
2.512	3.54
2.884	3.91
3.311	4.27
3.802	4.60
4.365	4.84
5.012	4.98
5.754	4.98
6.607	4.84
7.586	4.55
8.710	4.16
10.000	3.68
11.482	

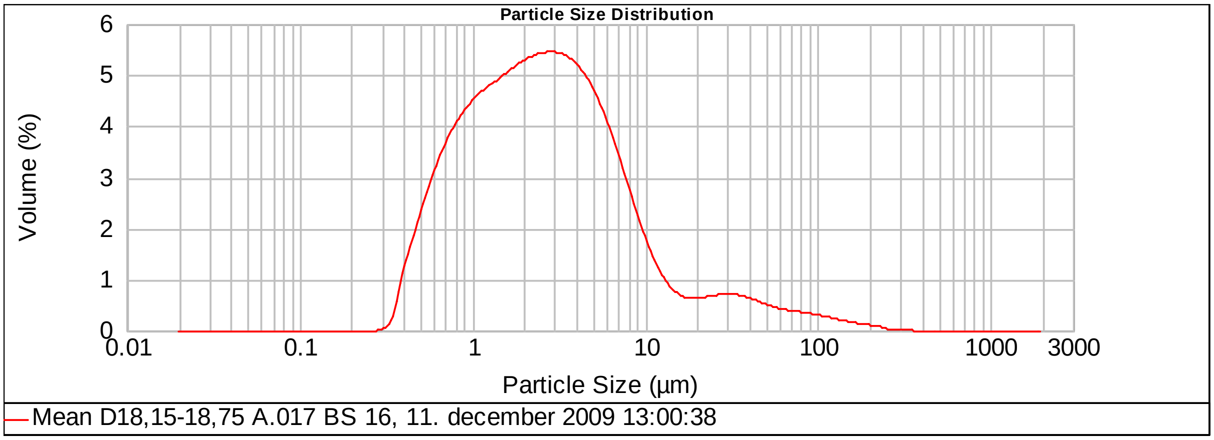
Size (µm)	Volume In %
11.482	3.17
13.183	2.64
15.136	2.14
17.378	1.68
19.953	1.28
22.909	0.95
26.303	0.68
30.200	0.48
34.674	0.35
39.811	0.27
45.709	0.25
52.481	0.27
60.256	0.32
69.183	0.37
79.433	0.42
91.201	0.43
104.713	0.42
120.226	

Size (µm)	Volume In %
120.226	0.38
138.038	0.35
158.489	0.35
181.970	0.38
208.930	0.47
239.883	0.61
275.423	0.80
316.228	1.00
363.078	1.16
416.869	1.23
478.630	1.13
549.541	0.92
630.957	0.30
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 41 D 18,15-18,75 A.017 BS16



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.01
0.316	0.16
0.363	0.90
0.417	1.54
0.479	2.16
0.550	2.72
0.631	3.19
0.724	3.57
0.832	3.86
0.955	4.08
1.096	

Size (µm)	Volume In %
1.096	4.26
1.259	4.41
1.445	4.55
1.660	4.69
1.905	4.80
2.188	4.88
2.512	4.92
2.884	4.91
3.311	4.84
3.802	4.68
4.365	4.43
5.012	4.07
5.754	3.61
6.607	3.07
7.586	2.49
8.710	1.93
10.000	1.43
11.482	

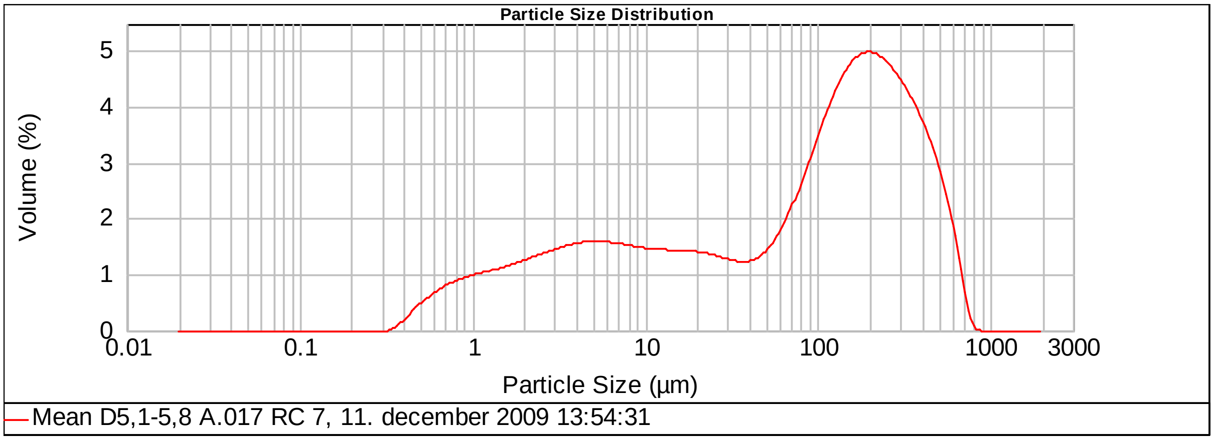
Size (µm)	Volume In %
11.482	1.04
13.183	0.77
15.136	0.62
17.378	0.57
19.953	0.58
22.909	0.62
26.303	0.64
30.200	0.64
34.674	0.61
39.811	0.55
45.709	0.48
52.481	0.42
60.256	0.37
69.183	0.34
79.433	0.31
91.201	0.28
104.713	0.24
120.226	

Size (µm)	Volume In %
120.226	0.20
138.038	0.16
158.489	0.13
181.970	0.10
208.930	0.08
239.883	0.03
275.423	0.01
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 42 D 5,1-5,8 A.017 RC7



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.13
0.417	0.30
0.479	0.45
0.550	0.59
0.631	0.70
0.724	0.78
0.832	0.85
0.955	0.90
1.096	

Size (µm)	Volume In %
1.096	0.94
1.259	0.99
1.445	1.03
1.660	1.09
1.905	1.15
2.188	1.21
2.512	1.27
2.884	1.32
3.311	1.37
3.802	1.41
4.365	1.43
5.012	1.44
5.754	1.43
6.607	1.40
7.586	1.37
8.710	1.34
10.000	1.32
11.482	

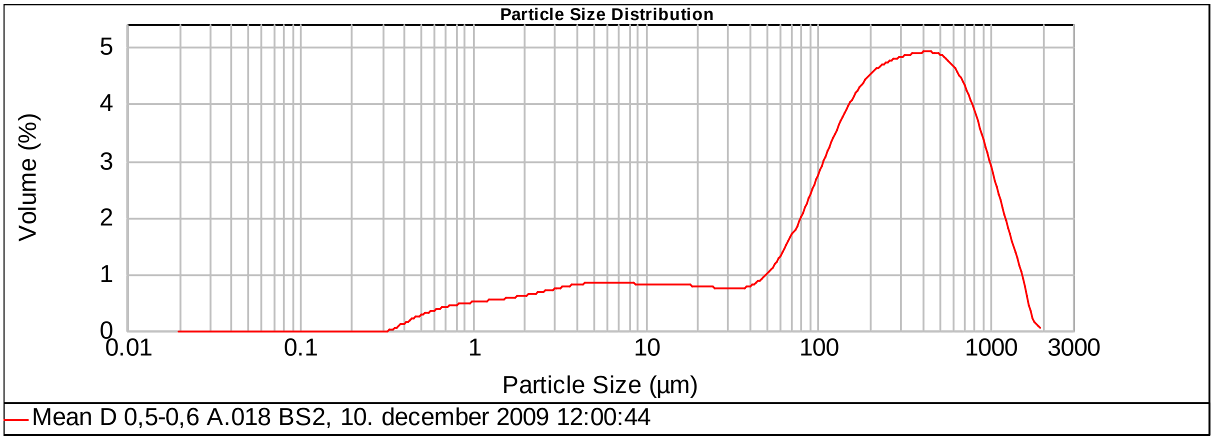
Size (µm)	Volume In %
11.482	1.31
13.183	1.30
15.136	1.29
17.378	1.28
19.953	1.26
22.909	1.22
26.303	1.18
30.200	1.13
34.674	1.11
39.811	1.14
45.709	1.24
52.481	1.44
60.256	1.74
69.183	2.14
79.433	2.60
91.201	3.08
104.713	3.54
120.226	

Size (µm)	Volume In %
120.226	3.94
138.038	4.24
158.489	4.42
181.970	4.49
208.930	4.43
239.883	4.29
275.423	4.07
316.228	3.80
363.078	3.47
416.869	3.07
478.630	2.54
549.541	1.88
630.957	0.99
724.436	0.16
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 43 D 0,5-0,6 A.018 BS2



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.10
0.417	0.18
0.479	0.25
0.550	0.32
0.631	0.37
0.724	0.41
0.832	0.43
0.955	0.45
1.096	

Size (µm)	Volume In %
1.096	0.47
1.259	0.49
1.445	0.51
1.660	0.54
1.905	0.57
2.188	0.60
2.512	0.64
2.884	0.67
3.311	0.71
3.802	0.74
4.365	0.76
5.012	0.77
5.754	0.77
6.607	0.77
7.586	0.75
8.710	0.74
10.000	0.73
11.482	

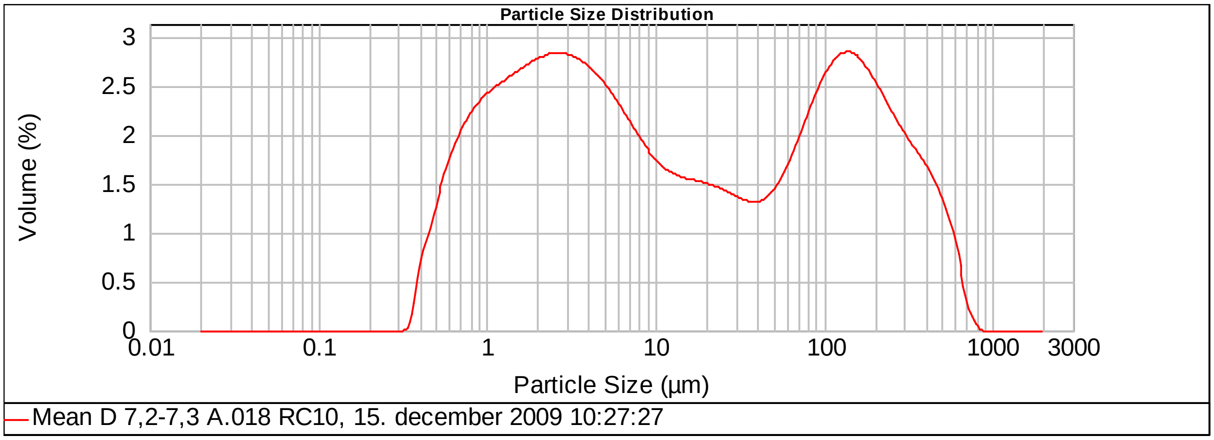
Size (µm)	Volume In %
11.482	0.73
13.183	0.73
15.136	0.72
17.378	0.72
19.953	0.71
22.909	0.69
26.303	0.68
30.200	0.67
34.674	0.68
39.811	0.73
45.709	0.85
52.481	1.03
60.256	1.30
69.183	1.63
79.433	2.02
91.201	2.43
104.713	2.84
120.226	

Size (µm)	Volume In %
120.226	3.22
138.038	3.56
158.489	3.83
181.970	4.04
208.930	4.19
239.883	4.29
275.423	4.35
316.228	4.40
363.078	4.43
416.869	4.43
478.630	4.39
549.541	4.26
630.957	4.01
724.436	3.64
831.764	3.14
954.993	2.56
1096.478	1.97
1258.925	

Size (µm)	Volume In %
1258.925	1.39
1445.440	0.84
1659.587	0.17
1905.461	0.02
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 44 D 7,2-7,3-A.018 RC10



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.52
0.417	0.89
0.479	1.23
0.550	1.53
0.631	1.78
0.724	1.97
0.832	2.11
0.955	2.20
1.096	

Size (µm)	Volume In %
1.096	2.28
1.259	2.35
1.445	2.41
1.660	2.47
1.905	2.53
2.188	2.56
2.512	2.57
2.884	2.55
3.311	2.51
3.802	2.44
4.365	2.34
5.012	2.22
5.754	2.08
6.607	1.92
7.586	1.77
8.710	1.64
10.000	1.54
11.482	

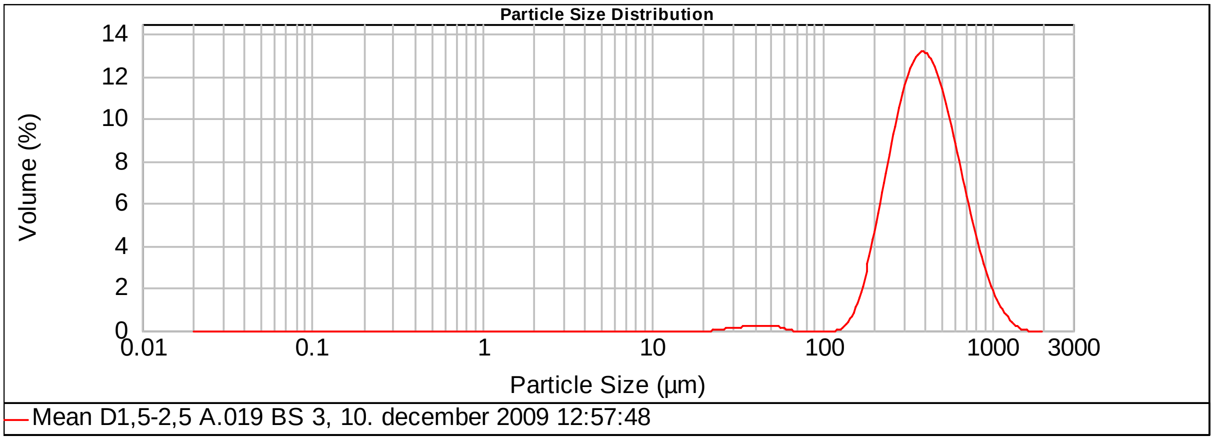
Size (µm)	Volume In %
11.482	1.47
13.183	1.43
15.136	1.40
17.378	1.38
19.953	1.35
22.909	1.31
26.303	1.26
30.200	1.22
34.674	1.19
39.811	1.20
45.709	1.27
52.481	1.41
60.256	1.62
69.183	1.86
79.433	2.11
91.201	2.33
104.713	2.49
120.226	

Size (µm)	Volume In %
120.226	2.57
138.038	2.57
158.489	2.49
181.970	2.36
208.930	2.19
239.883	2.01
275.423	1.85
316.228	1.71
363.078	1.57
416.869	1.40
478.630	1.17
549.541	0.88
630.957	0.41
724.436	0.12
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 45 D 1,5-2,5 A.019 BS3



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.00
0.479	0.00
0.550	0.00
0.631	0.00
0.724	0.00
0.832	0.00
0.955	0.00
1.096	

Size (µm)	Volume In %
1.096	0.00
1.259	0.00
1.445	0.00
1.660	0.00
1.905	0.00
2.188	0.00
2.512	0.00
2.884	0.00
3.311	0.00
3.802	0.00
4.365	0.00
5.012	0.00
5.754	0.00
6.607	0.00
7.586	0.00
8.710	0.00
10.000	0.00
11.482	

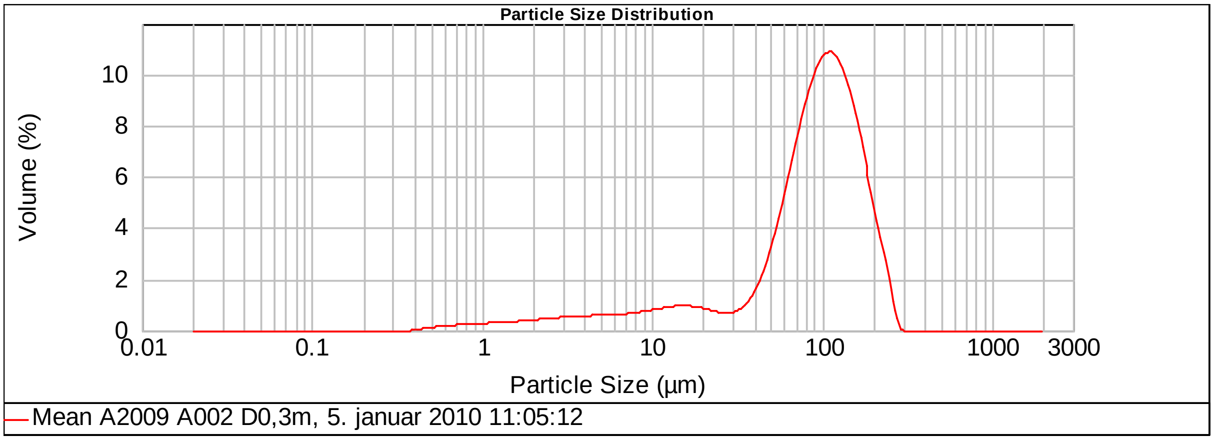
Size (µm)	Volume In %
11.482	0.00
13.183	0.00
15.136	0.00
17.378	0.00
19.953	0.00
22.909	0.02
26.303	0.09
30.200	0.14
34.674	0.19
39.811	0.22
45.709	0.22
52.481	0.16
60.256	0.01
69.183	0.00
79.433	0.00
91.201	0.00
104.713	0.00
120.226	

Size (µm)	Volume In %
120.226	0.06
138.038	0.60
158.489	1.71
181.970	3.40
208.930	5.51
239.883	7.81
275.423	9.86
316.228	11.31
363.078	11.88
416.869	11.49
478.630	10.27
549.541	8.48
630.957	6.47
724.436	4.52
831.764	2.87
954.993	1.62
1096.478	0.78
1258.925	

Size (µm)	Volume In %
1258.925	0.28
1445.440	0.01
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 47prøver nov 2009.mea

Sample 46 A 2009 A 002 D 0,3m



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.08
0.479	0.12
0.550	0.16
0.631	0.19
0.724	0.22
0.832	0.24
0.955	0.25
1.096	

Size (µm)	Volume In %
1.096	0.27
1.259	0.29
1.445	0.32
1.660	0.34
1.905	0.38
2.188	0.41
2.512	0.45
2.884	0.48
3.311	0.50
3.802	0.52
4.365	0.53
5.012	0.55
5.754	0.57
6.607	0.60
7.586	0.64
8.710	0.70
10.000	0.76
11.482	

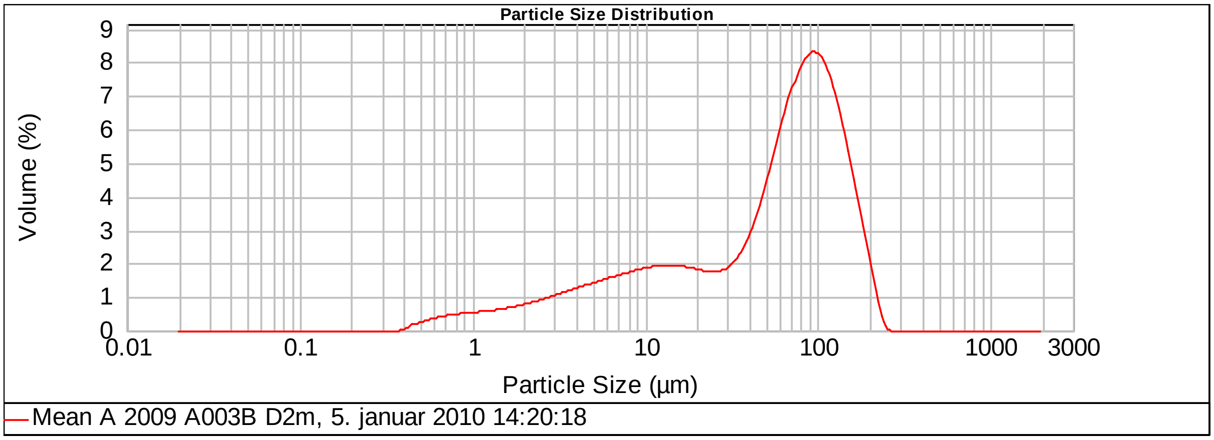
Size (µm)	Volume In %
11.482	0.83
13.183	0.87
15.136	0.87
17.378	0.83
19.953	0.75
22.909	0.65
26.303	0.61
30.200	0.71
34.674	1.04
39.811	1.69
45.709	2.71
52.481	4.06
60.256	5.64
69.183	7.24
79.433	8.63
91.201	9.54
104.713	9.79
120.226	

Size (µm)	Volume In %
120.226	9.33
138.038	8.22
158.489	6.67
181.970	4.91
208.930	3.24
239.883	1.57
275.423	0.04
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

Sample 47 2009 A003B D 2m



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.15
0.479	0.24
0.550	0.32
0.631	0.38
0.724	0.43
0.832	0.46
0.955	0.49
1.096	

Size (µm)	Volume In %
1.096	0.52
1.259	0.56
1.445	0.60
1.660	0.66
1.905	0.72
2.188	0.80
2.512	0.89
2.884	0.97
3.311	1.07
3.802	1.16
4.365	1.25
5.012	1.33
5.754	1.42
6.607	1.50
7.586	1.58
8.710	1.65
10.000	1.71
11.482	

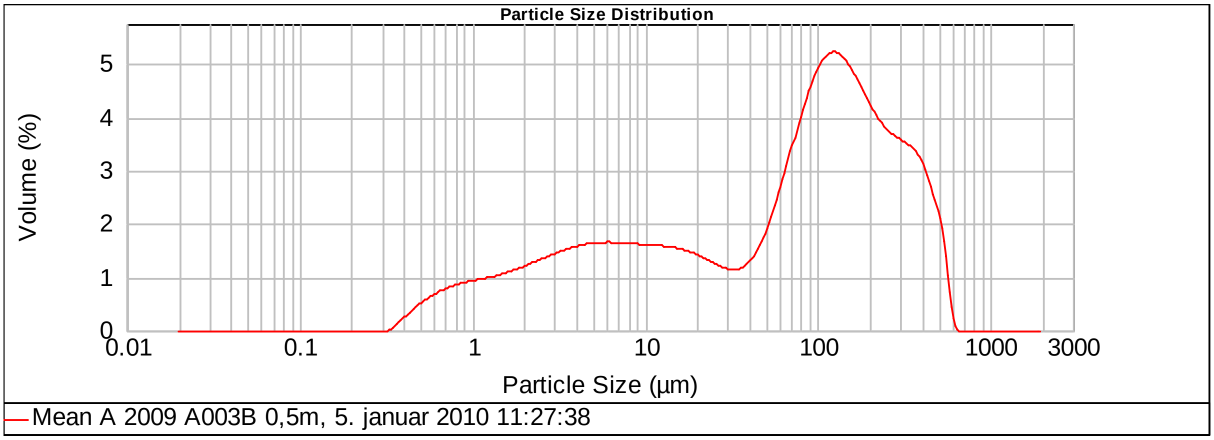
Size (µm)	Volume In %
11.482	1.76
13.183	1.77
15.136	1.75
17.378	1.69
19.953	1.62
22.909	1.58
26.303	1.62
30.200	1.81
34.674	2.21
39.811	2.85
45.709	3.73
52.481	4.77
60.256	5.85
69.183	6.78
79.433	7.37
91.201	7.49
104.713	7.06
120.226	

Size (µm)	Volume In %
120.226	6.15
138.038	4.89
158.489	3.51
181.970	2.12
208.930	0.76
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

Sample 48 A 2009 A003B 0,5m



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.19
0.417	0.34
0.479	0.48
0.550	0.59
0.631	0.69
0.724	0.76
0.832	0.81
0.955	0.85
1.096	

Size (µm)	Volume In %
1.096	0.88
1.259	0.93
1.445	0.98
1.660	1.04
1.905	1.11
2.188	1.18
2.512	1.25
2.884	1.32
3.311	1.38
3.802	1.43
4.365	1.47
5.012	1.49
5.754	1.50
6.607	1.49
7.586	1.48
8.710	1.46
10.000	1.45
11.482	

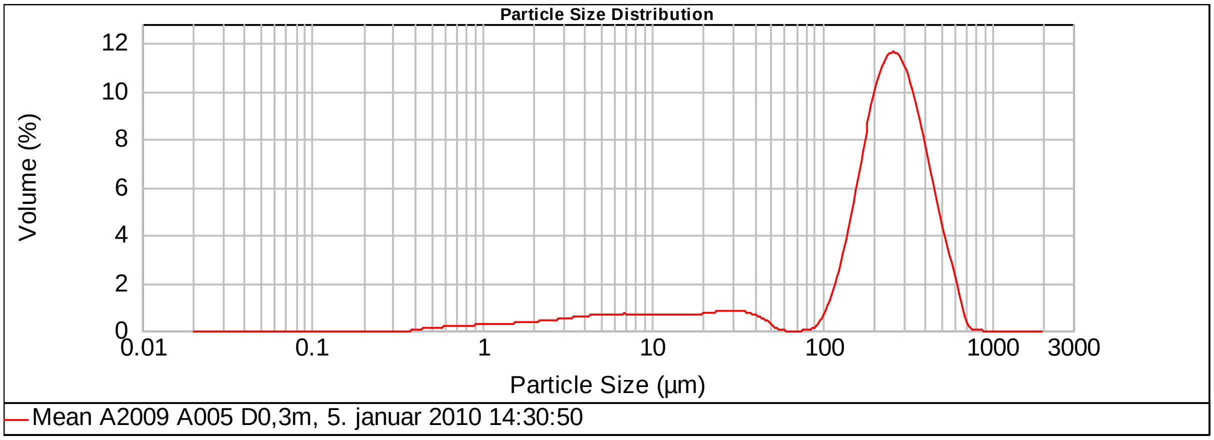
Size (µm)	Volume In %
11.482	1.44
13.183	1.42
15.136	1.38
17.378	1.33
19.953	1.25
22.909	1.16
26.303	1.07
30.200	1.03
34.674	1.08
39.811	1.25
45.709	1.57
52.481	2.05
60.256	2.66
69.183	3.32
79.433	3.93
91.201	4.40
104.713	4.67
120.226	

Size (µm)	Volume In %
120.226	4.70
138.038	4.53
158.489	4.22
181.970	3.88
208.930	3.58
239.883	3.37
275.423	3.25
316.228	3.13
363.078	2.94
416.869	2.47
478.630	1.90
549.541	0.49
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

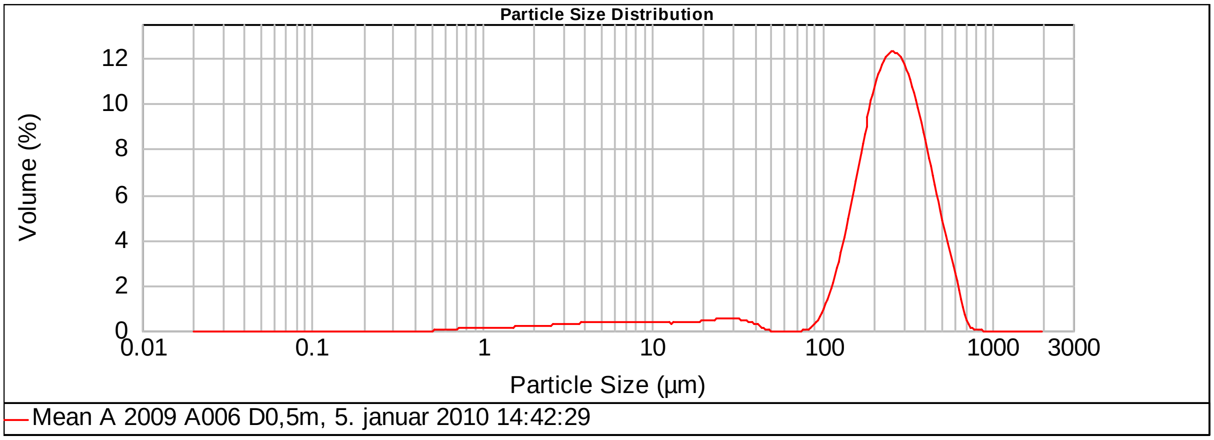
Sample 49 A 2009 A005 D 0,3m



Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %	Size (µm)	Volume In %
0.010	0.00	0.105	0.00	1.096	0.24	11.482	0.57	120.226	2.62	1258.925	0.00
0.011	0.00	0.120	0.00	1.259	0.26	13.183	0.57	138.038	4.44	1445.440	0.00
0.013	0.00	0.138	0.00	1.445	0.28	15.136	0.58	158.489	6.47	1659.587	0.00
0.015	0.00	0.158	0.00	1.660	0.31	17.378	0.62	181.970	8.41	1905.461	0.00
0.017	0.00	0.182	0.00	1.905	0.34	19.953	0.67	208.930	9.83	2187.762	0.00
0.020	0.00	0.209	0.00	2.188	0.38	22.909	0.72	239.883	10.50	2511.886	0.00
0.023	0.00	0.240	0.00	2.512	0.42	26.303	0.76	275.423	10.26	2884.032	0.00
0.026	0.00	0.275	0.00	2.884	0.46	30.200	0.75	316.228	9.21	3311.311	0.00
0.030	0.00	0.316	0.00	3.311	0.51	34.674	0.68	363.078	7.61	3801.894	0.00
0.035	0.00	0.363	0.00	3.802	0.55	39.811	0.53	416.869	5.76	4365.158	0.00
0.040	0.00	0.417	0.07	4.365	0.59	45.709	0.32	478.630	3.95	5011.872	0.00
0.046	0.00	0.479	0.11	5.012	0.62	52.481	0.03	549.541	2.42	5754.399	0.00
0.052	0.00	0.550	0.14	5.754	0.64	60.256	0.00	630.957	0.77	6606.934	0.00
0.060	0.00	0.631	0.17	6.607	0.64	69.183	0.00	724.436	0.04	7585.776	0.00
0.069	0.00	0.724	0.19	7.586	0.63	79.433	0.04	831.764	0.00	8709.636	0.00
0.079	0.00	0.832	0.21	8.710	0.61	91.201	0.41	954.993	0.00	10000.000	
0.091	0.00	0.955	0.23	10.000	0.59	104.713	1.27	1096.478	0.00		
0.105		1.096		11.482		120.226		1258.925			

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

Sample 50 A 2009 A006 D 0,5m



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.00
0.479	0.00
0.550	0.01
0.631	0.06
0.724	0.08
0.832	0.10
0.955	0.11
1.096	

Size (µm)	Volume In %
1.096	0.12
1.259	0.13
1.445	0.15
1.660	0.16
1.905	0.18
2.188	0.21
2.512	0.23
2.884	0.26
3.311	0.29
3.802	0.31
4.365	0.34
5.012	0.35
5.754	0.36
6.607	0.36
7.586	0.34
8.710	0.33
10.000	0.31
11.482	

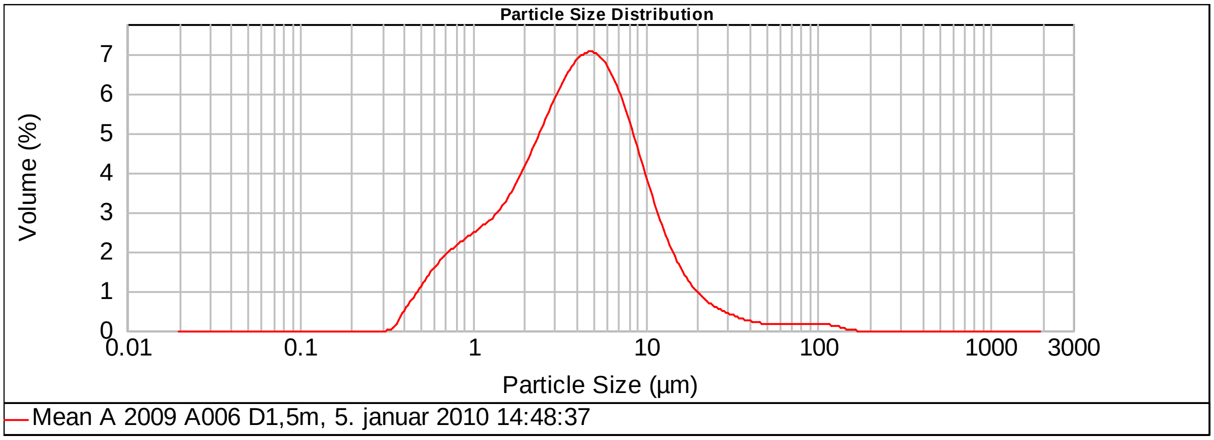
Size (µm)	Volume In %
11.482	0.30
13.183	0.30
15.136	0.32
17.378	0.36
19.953	0.41
22.909	0.46
26.303	0.48
30.200	0.46
34.674	0.37
39.811	0.21
45.709	0.00
52.481	0.00
60.256	0.00
69.183	0.00
79.433	0.09
91.201	0.61
104.713	1.65
120.226	

Size (µm)	Volume In %
120.226	3.16
138.038	5.09
158.489	7.14
181.970	9.05
208.930	10.43
239.883	11.06
275.423	10.83
316.228	9.81
363.078	8.20
416.869	6.30
478.630	4.38
549.541	2.72
630.957	0.92
724.436	0.08
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

Sample 51 A 2009 A006 D 1,5m



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.35
0.417	0.70
0.479	1.05
0.550	1.37
0.631	1.65
0.724	1.87
0.832	2.06
0.955	2.23
1.096	

Size (µm)	Volume In %
1.096	2.41
1.259	2.65
1.445	2.96
1.660	3.36
1.905	3.84
2.188	4.36
2.512	4.91
2.884	5.43
3.311	5.89
3.802	6.21
4.365	6.35
5.012	6.28
5.754	5.97
6.607	5.45
7.586	4.76
8.710	4.00
10.000	3.21
11.482	

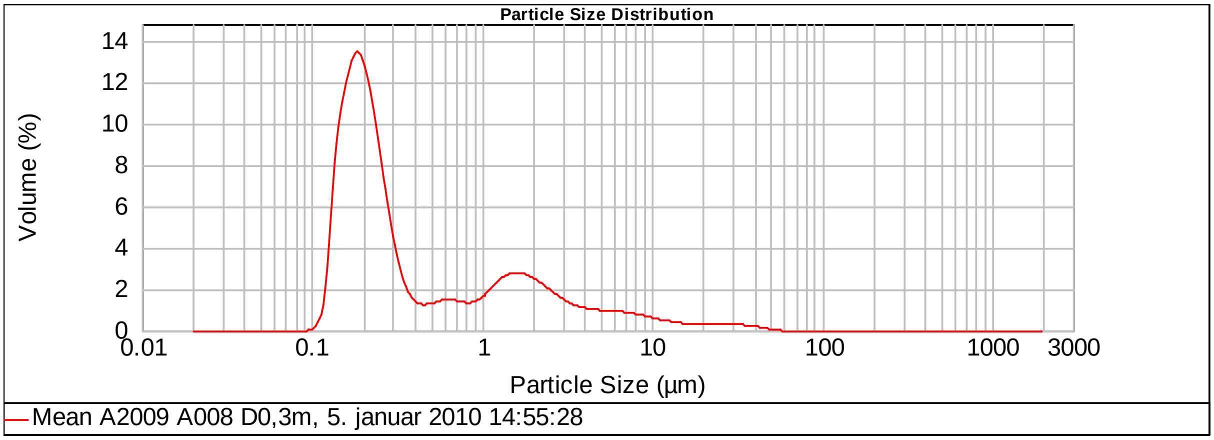
Size (µm)	Volume In %
11.482	2.50
13.183	1.89
15.136	1.41
17.378	1.04
19.953	0.78
22.909	0.59
26.303	0.46
30.200	0.35
34.674	0.27
39.811	0.20
45.709	0.16
52.481	0.14
60.256	0.14
69.183	0.15
79.433	0.16
91.201	0.17
104.713	0.14
120.226	

Size (µm)	Volume In %
120.226	0.10
138.038	0.03
158.489	0.00
181.970	0.00
208.930	0.00
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

Sample 53 A 2009 A008 D 0,3m



Size (µm)	Volume In %
0.010	
	0.00
0.011	
	0.00
0.013	
	0.00
0.015	
	0.00
0.017	
	0.00
0.020	
	0.00
0.023	
	0.00
0.026	
	0.00
0.030	
	0.00
0.035	
	0.00
0.040	
	0.00
0.046	
	0.00
0.052	
	0.00
0.060	
	0.00
0.069	
	0.00
0.079	
	0.00
0.091	
	0.00
0.105	

Size (µm)	Volume In %
0.105	
	0.50
0.120	
	4.35
0.138	
	9.50
0.158	
	11.65
0.182	
	12.05
0.209	
	10.27
0.240	
	7.36
0.275	
	4.44
0.316	
	2.39
0.363	
	1.42
0.417	
	1.15
0.479	
	1.21
0.550	
	1.35
0.631	
	1.34
0.724	
	1.24
0.832	
	1.26
0.955	
	1.53
1.096	

Size (µm)	Volume In %
1.096	
	1.96
1.259	
	2.35
1.445	
	2.54
1.660	
	2.49
1.905	
	2.29
2.188	
	1.98
2.512	
	1.63
2.884	
	1.33
3.311	
	1.12
3.802	
	0.98
4.365	
	0.92
5.012	
	0.88
5.754	
	0.85
6.607	
	0.80
7.586	
	0.72
8.710	
	0.62
10.000	
	0.52
11.482	

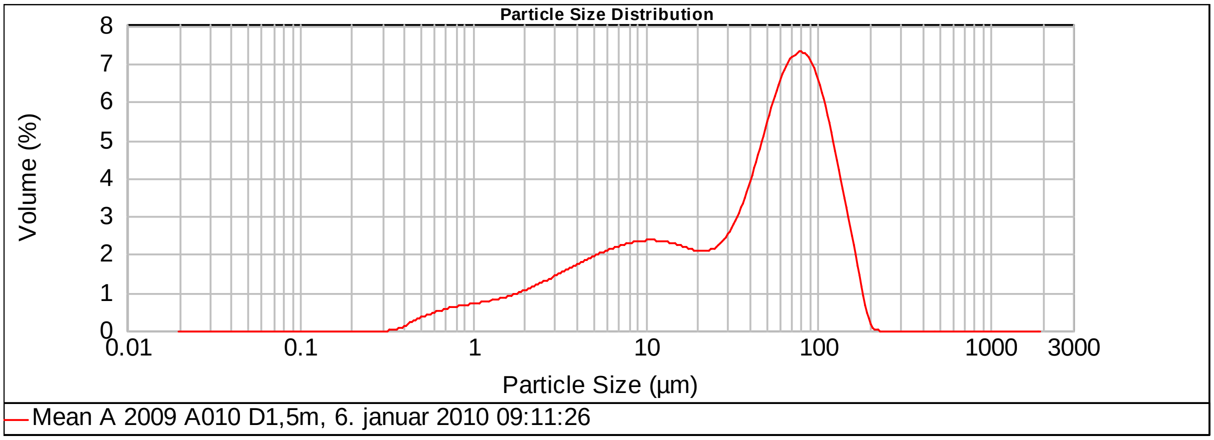
Size (µm)	Volume In %
11.482	
	0.42
13.183	
	0.35
15.136	
	0.31
17.378	
	0.29
19.953	
	0.29
22.909	
	0.29
26.303	
	0.29
30.200	
	0.27
34.674	
	0.23
39.811	
	0.16
45.709	
	0.08
52.481	
	0.00
60.256	
	0.00
69.183	
	0.00
79.433	
	0.00
91.201	
	0.00
104.713	
	0.00
120.226	

Size (µm)	Volume In %
120.226	
	0.00
138.038	
	0.00
158.489	
	0.00
181.970	
	0.00
208.930	
	0.00
239.883	
	0.00
275.423	
	0.00
316.228	
	0.00
363.078	
	0.00
416.869	
	0.00
478.630	
	0.00
549.541	
	0.00
630.957	
	0.00
724.436	
	0.00
831.764	
	0.00
954.993	
	0.00
1096.478	
	0.00
1258.925	

Size (µm)	Volume In %
1258.925	
	0.00
1445.440	
	0.00
1659.587	
	0.00
1905.461	
	0.00
2187.762	
	0.00
2511.886	
	0.00
2884.032	
	0.00
3311.311	
	0.00
3801.894	
	0.00
4365.158	
	0.00
5011.872	
	0.00
5754.399	
	0.00
6606.934	
	0.00
7585.776	
	0.00
8709.636	
	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

Sample 57 A 2009 A010 D 1,5m



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.08
0.417	0.20
0.479	0.32
0.550	0.41
0.631	0.49
0.724	0.55
0.832	0.60
0.955	0.64
1.096	

Size (µm)	Volume In %
1.096	0.68
1.259	0.73
1.445	0.80
1.660	0.88
1.905	0.97
2.188	1.08
2.512	1.20
2.884	1.32
3.311	1.45
3.802	1.58
4.365	1.70
5.012	1.81
5.754	1.92
6.607	2.00
7.586	2.07
8.710	2.12
10.000	2.14
11.482	

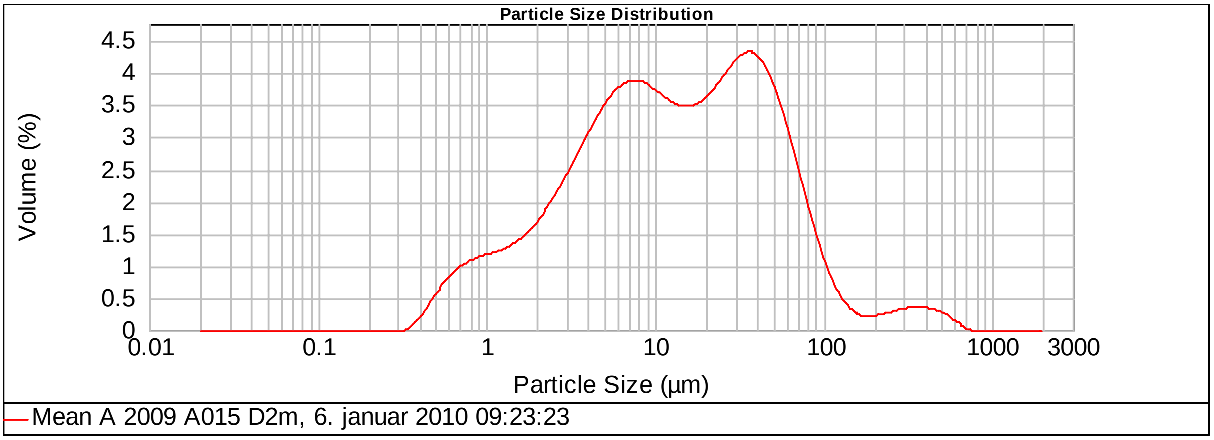
Size (µm)	Volume In %
11.482	2.12
13.183	2.08
15.136	2.00
17.378	1.93
19.953	1.88
22.909	1.92
26.303	2.10
30.200	2.46
34.674	3.02
39.811	3.76
45.709	4.62
52.481	5.46
60.256	6.16
69.183	6.55
79.433	6.52
91.201	6.03
104.713	5.14
120.226	

Size (µm)	Volume In %
120.226	3.98
138.038	2.74
158.489	1.48
181.970	0.30
208.930	0.00
239.883	0.00
275.423	0.00
316.228	0.00
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

Sample 58 A 2009 A015 D 2m



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.15
0.417	0.35
0.479	0.55
0.550	0.72
0.631	0.86
0.724	0.96
0.832	1.02
0.955	1.07
1.096	

Size (µm)	Volume In %
1.096	1.12
1.259	1.18
1.445	1.27
1.660	1.40
1.905	1.56
2.188	1.76
2.512	1.98
2.884	2.24
3.311	2.51
3.802	2.79
4.365	3.05
5.012	3.27
5.754	3.43
6.607	3.50
7.586	3.50
8.710	3.43
10.000	3.33
11.482	

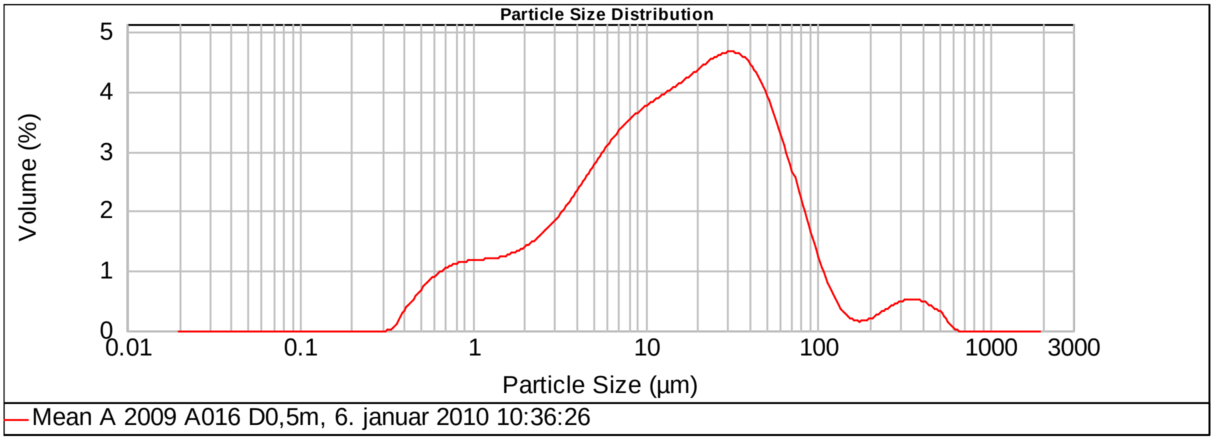
Size (µm)	Volume In %
11.482	3.23
13.183	3.16
15.136	3.14
17.378	3.21
19.953	3.34
22.909	3.53
26.303	3.72
30.200	3.87
34.674	3.91
39.811	3.81
45.709	3.55
52.481	3.15
60.256	2.64
69.183	2.10
79.433	1.56
91.201	1.08
104.713	0.70
120.226	

Size (µm)	Volume In %
120.226	0.43
138.038	0.28
158.489	0.21
181.970	0.20
208.930	0.23
239.883	0.27
275.423	0.30
316.228	0.33
363.078	0.32
416.869	0.29
478.630	0.25
549.541	0.15
630.957	0.06
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

Sample 59 A 2009 A016 D 0,5m



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.01
0.363	0.23
0.417	0.44
0.479	0.63
0.550	0.79
0.631	0.91
0.724	0.99
0.832	1.04
0.955	1.06
1.096	

Size (µm)	Volume In %
1.096	1.08
1.259	1.10
1.445	1.13
1.660	1.19
1.905	1.28
2.188	1.39
2.512	1.54
2.884	1.71
3.311	1.91
3.802	2.14
4.365	2.37
5.012	2.61
5.754	2.83
6.607	3.02
7.586	3.18
8.710	3.32
10.000	3.44
11.482	

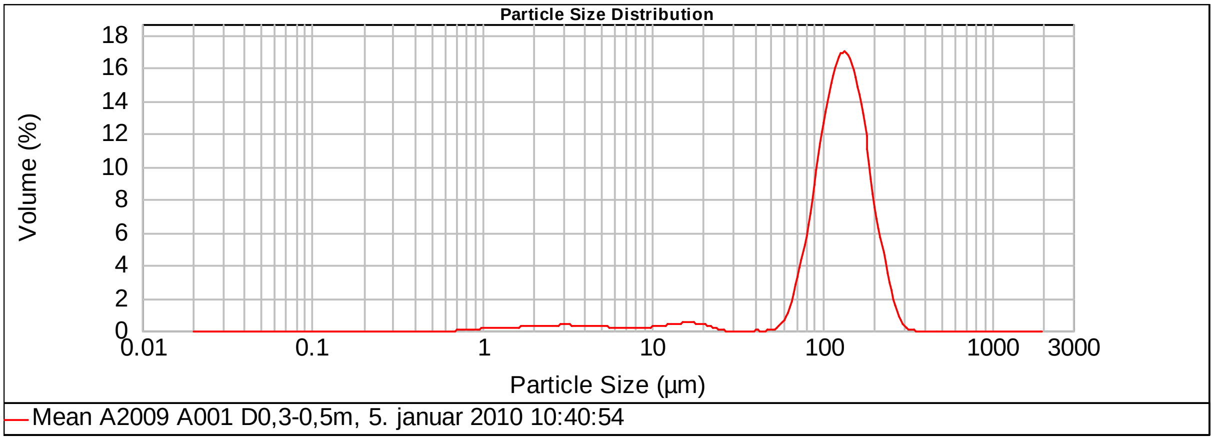
Size (µm)	Volume In %
11.482	3.54
13.183	3.64
15.136	3.74
17.378	3.86
19.953	3.98
22.909	4.10
26.303	4.18
30.200	4.20
34.674	4.14
39.811	3.97
45.709	3.68
52.481	3.28
60.256	2.80
69.183	2.26
79.433	1.71
91.201	1.19
104.713	0.74
120.226	

Size (µm)	Volume In %
120.226	0.42
138.038	0.22
158.489	0.14
181.970	0.17
208.930	0.25
239.883	0.35
275.423	0.43
316.228	0.47
363.078	0.46
416.869	0.38
478.630	0.28
549.541	0.07
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

Sample 71 A 2009 A001 D 0,3-0,5m



Size (µm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (µm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.00
0.316	0.00
0.363	0.00
0.417	0.00
0.479	0.00
0.550	0.00
0.631	0.00
0.724	0.04
0.832	0.10
0.955	0.11
1.096	

Size (µm)	Volume In %
1.096	0.13
1.259	0.16
1.445	0.19
1.660	0.22
1.905	0.25
2.188	0.28
2.512	0.30
2.884	0.31
3.311	0.31
3.802	0.28
4.365	0.25
5.012	0.21
5.754	0.18
6.607	0.15
7.586	0.15
8.710	0.18
10.000	0.24
11.482	

Size (µm)	Volume In %
11.482	0.32
13.183	0.39
15.136	0.43
17.378	0.40
19.953	0.29
22.909	0.09
26.303	0.00
30.200	0.00
34.674	0.00
39.811	0.00
45.709	-0.00
52.481	0.29
60.256	1.26
69.183	3.63
79.433	6.34
91.201	10.44
104.713	13.50
120.226	

Size (µm)	Volume In %
120.226	15.22
138.038	14.67
158.489	12.29
181.970	8.50
208.930	5.08
239.883	2.30
275.423	0.50
316.228	0.01
363.078	0.00
416.869	0.00
478.630	0.00
549.541	0.00
630.957	0.00
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (µm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 11 prøver 17 dec 2009.mea

APPENDIX E

Owen Tube Tests

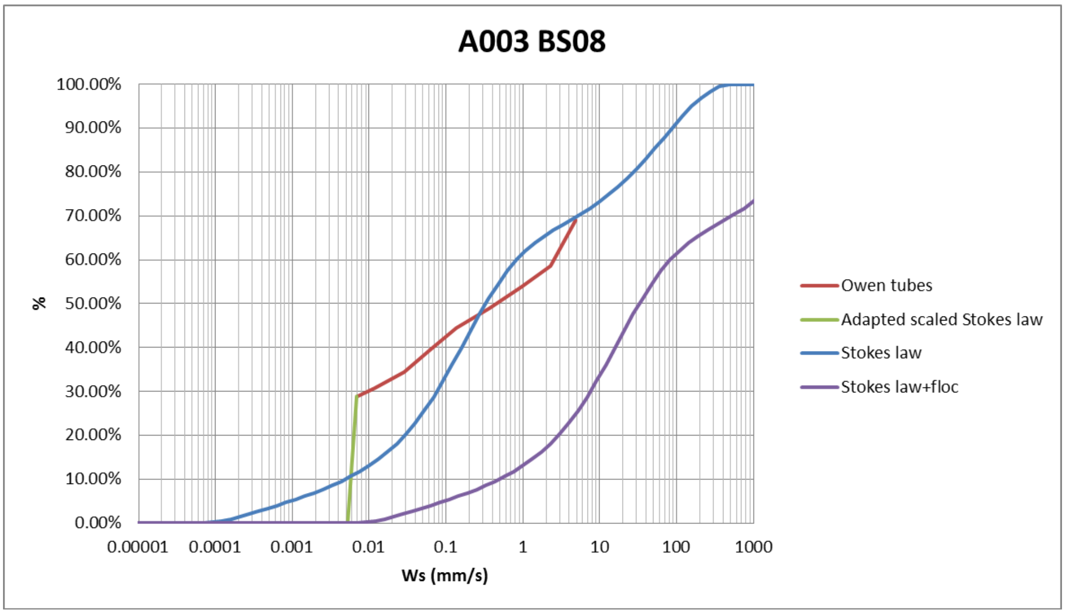


Figure E1 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

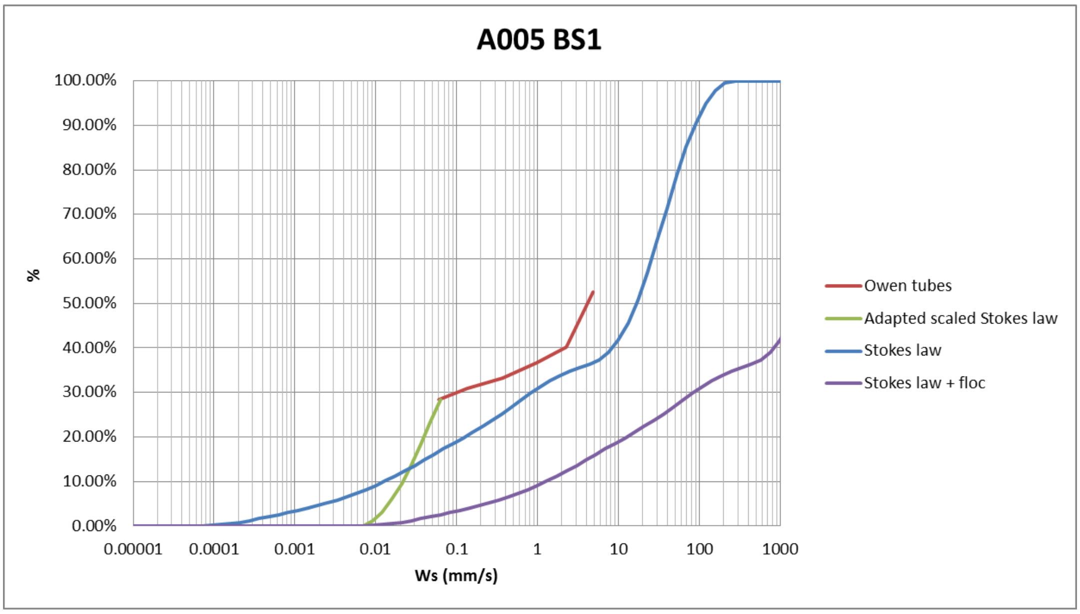


Figure E2 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

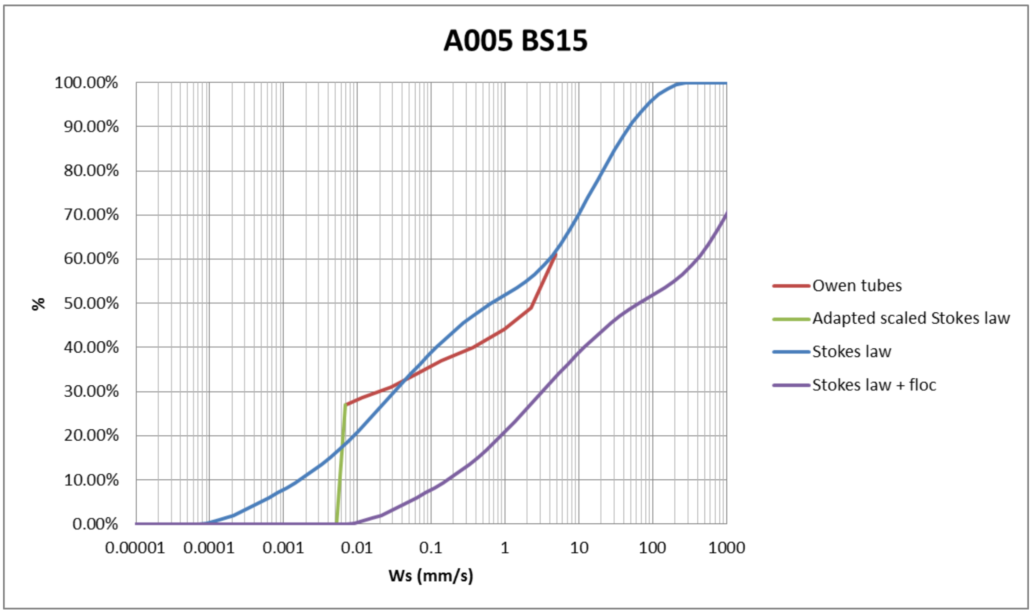


Figure E3 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

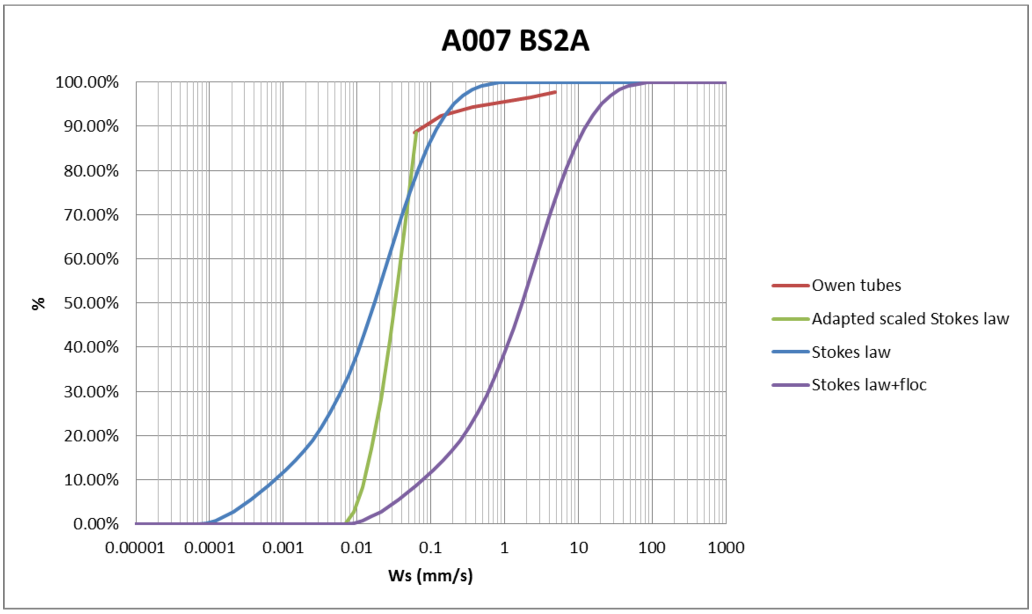


Figure E4 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

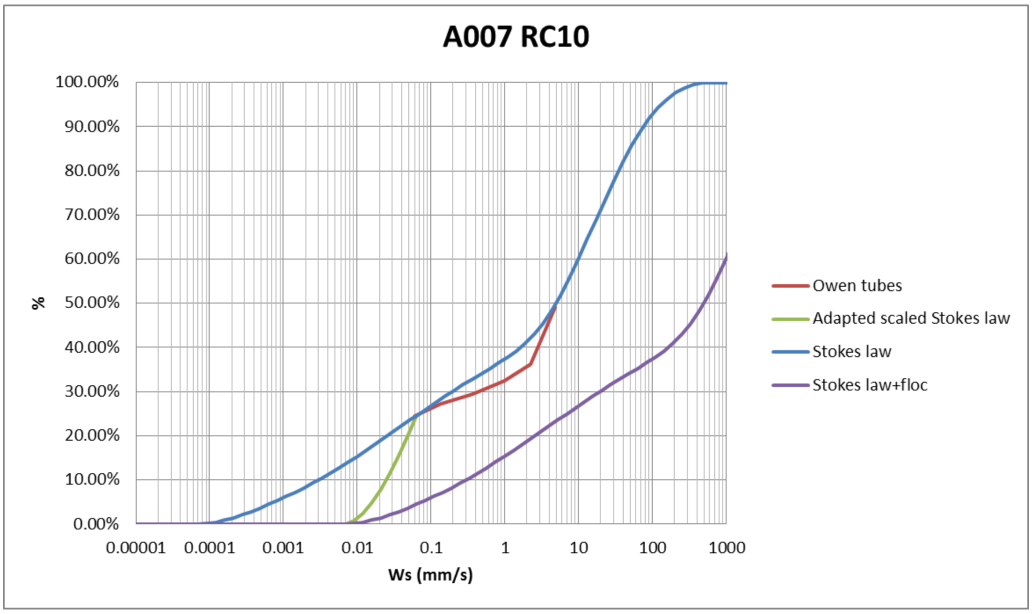


Figure E5 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

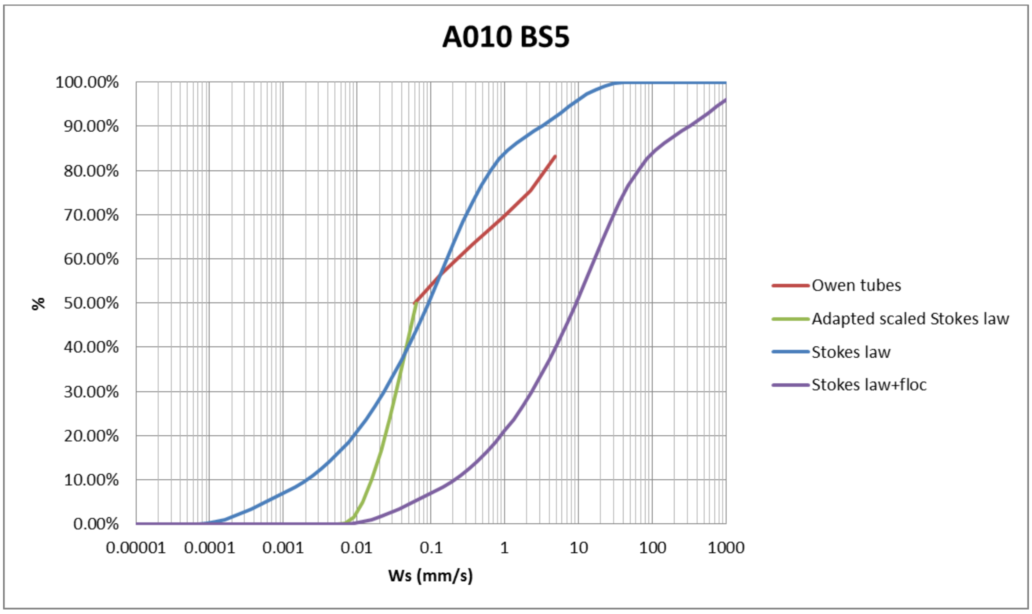


Figure E6 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

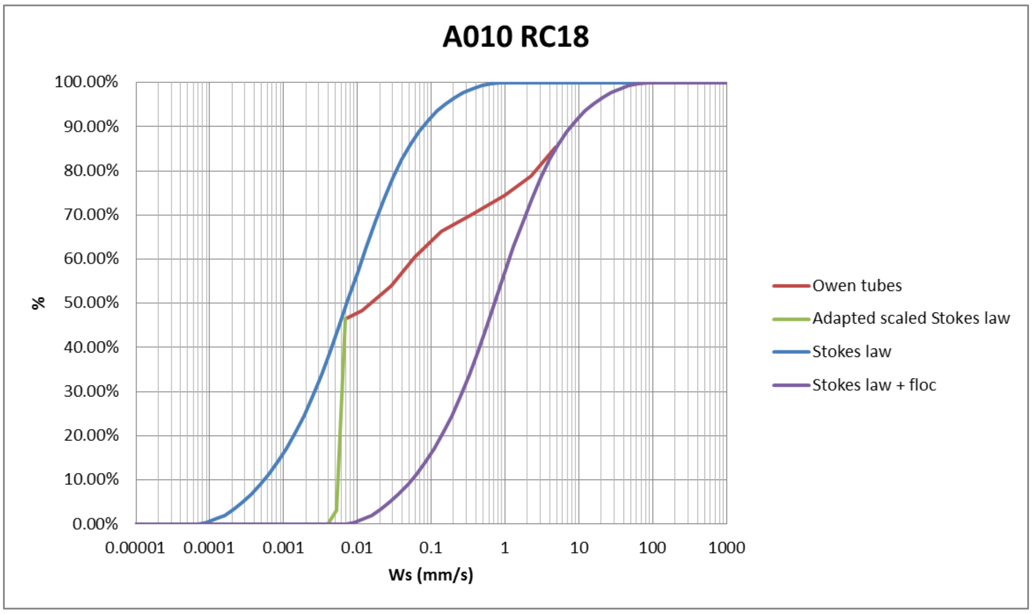


Figure E7 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

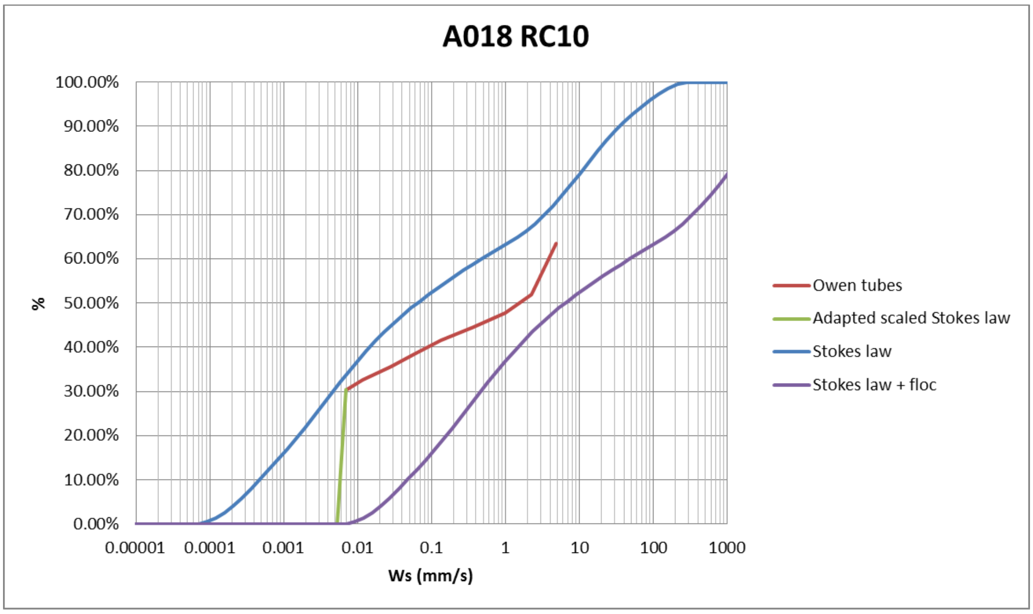


Figure E8 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

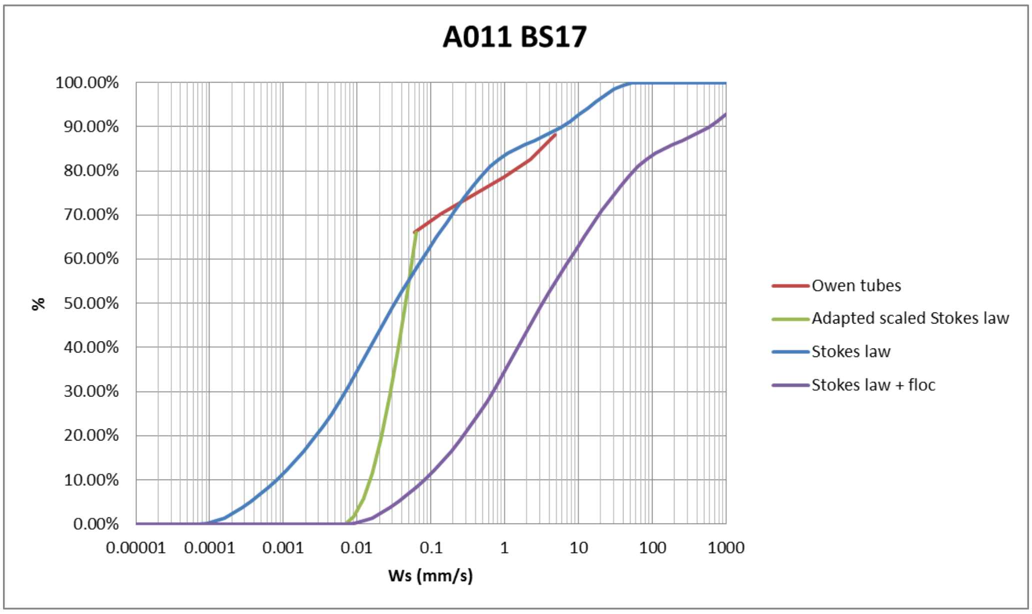


Figure E9 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

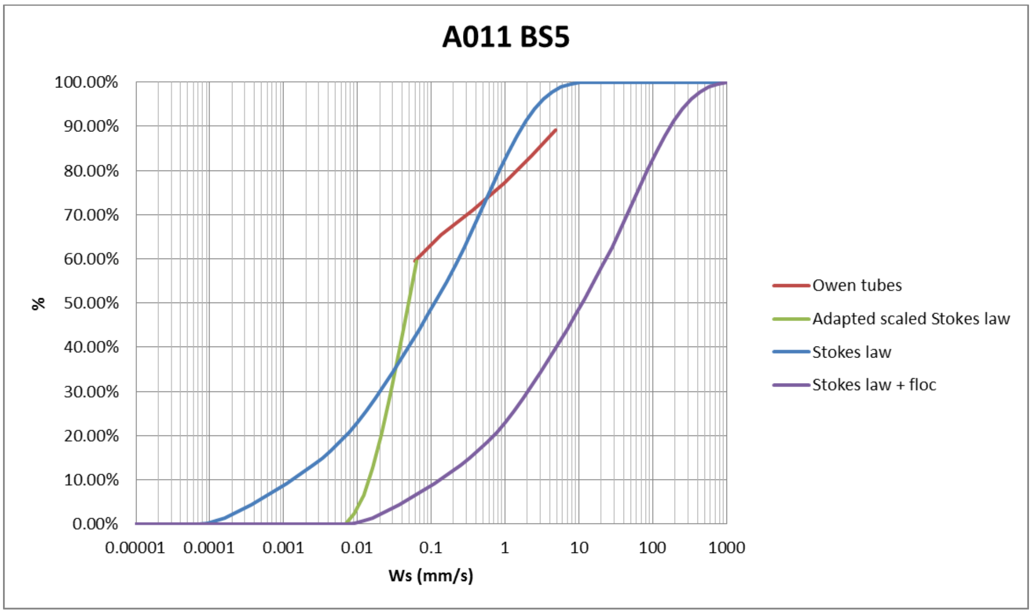


Figure E10 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

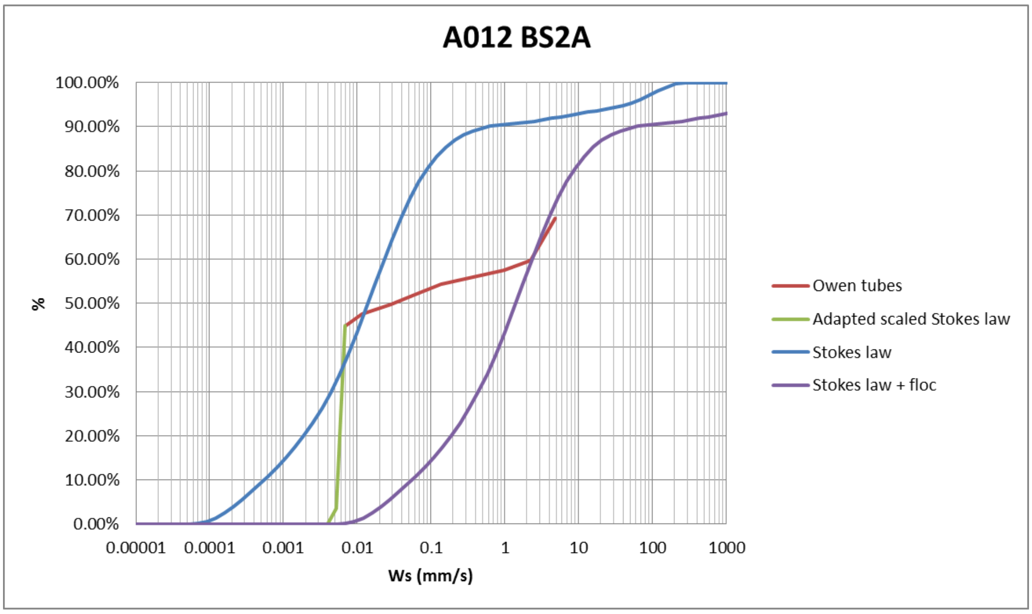


Figure E11 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

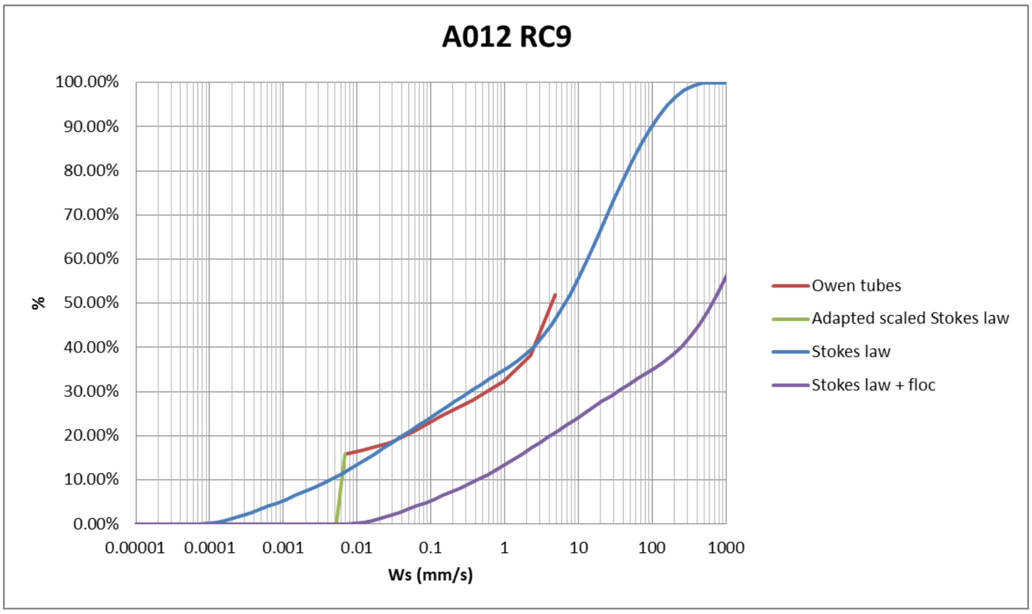


Figure E12 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

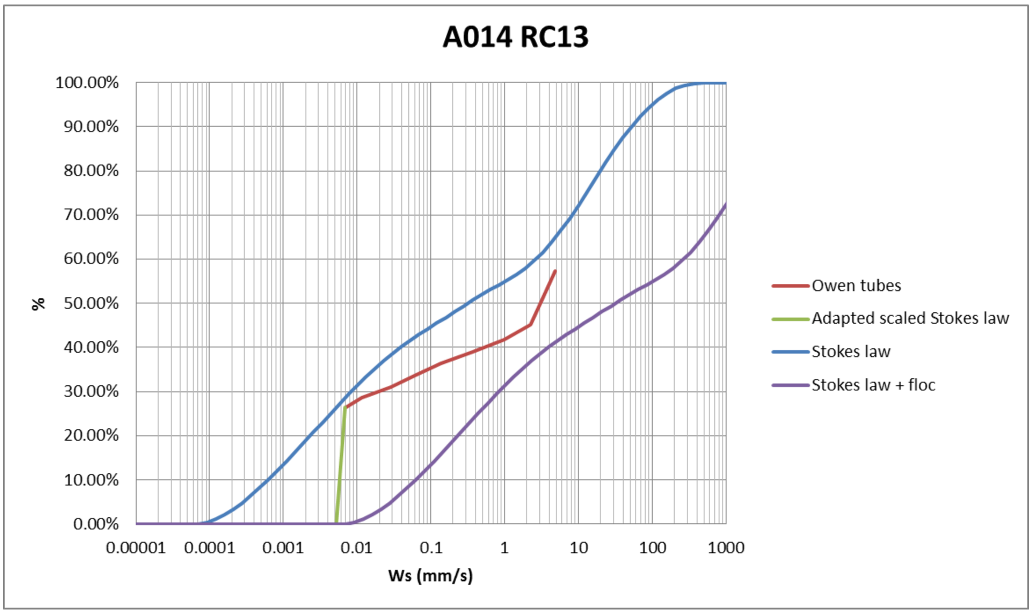


Figure E13 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type.

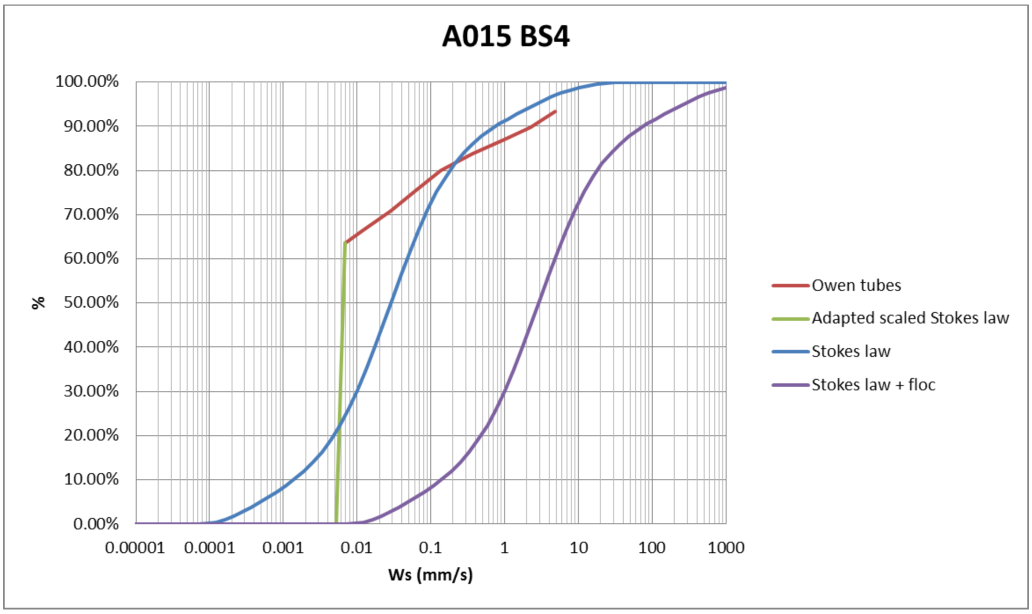


Figure E14 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

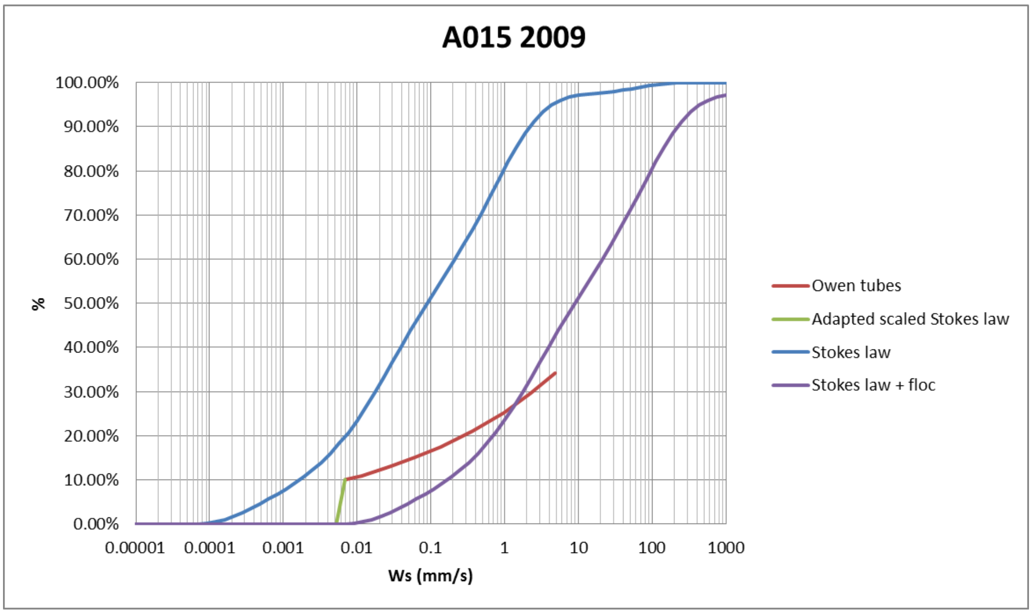


Figure E15 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

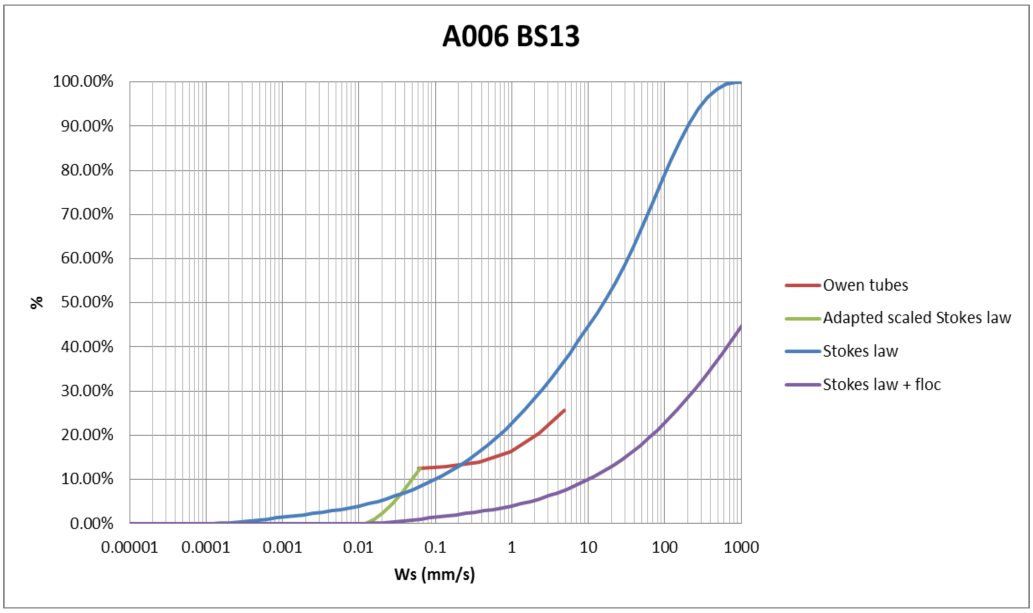


Figure E16 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

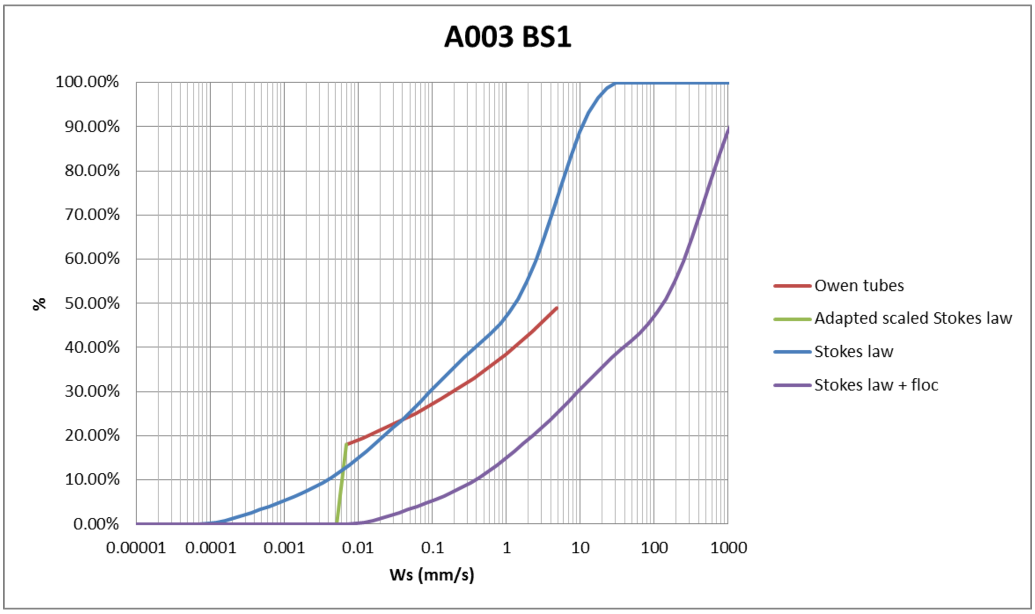


Figure E17 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

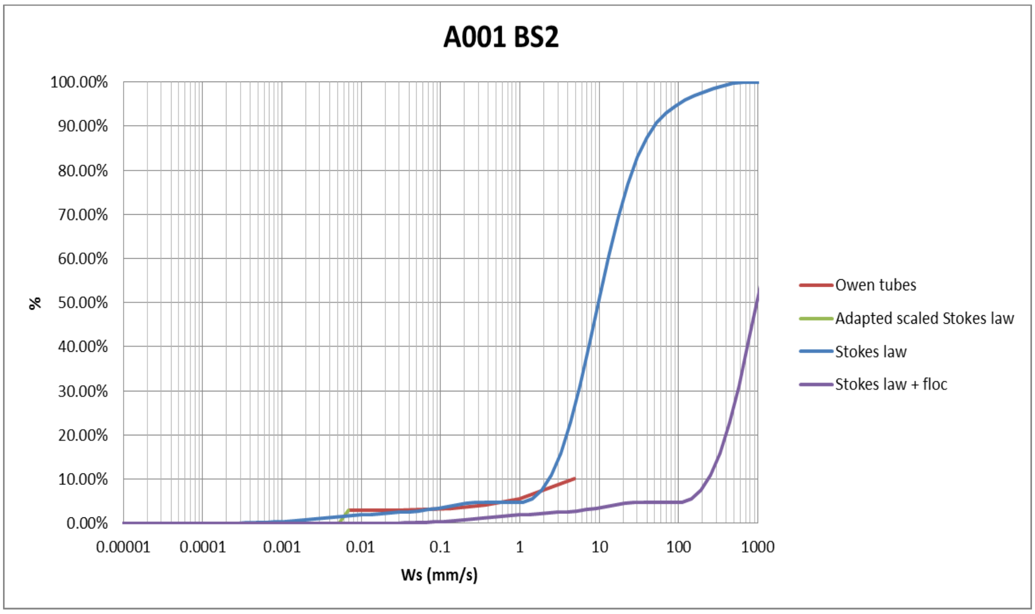


Figure E18 Result of settling velocity tests. The red line represents results from 180-min Owen tube test. The blue line shows the settling velocities for primary particles calculated using Stoke's law with a density of 2650 kg/m^3. Purple line shows the settling velocities for primary particles calculated using Stoke's law and grain sizes corrected for flocculation/breakup mode (factor 10) and a density of 2650 kg/m^3. Green line shows the settling velocities for primary particles calculated using Stoke's law, corrected for flocculation and scaled to match the results from the Owen type

A P P E N D I X F

See A3 binder

A P P E N D I X G

See A3 binder

A P P E N D I X   H

See A3 binder

A P P E N D I X   I

See A3 binder

A P P E N D I X   J

See A3 binder

A P P E N D I X   K

See A3 binder

A P P E N D I X L

See A3 binder

A P P E N D I X   M

See A3 binder

A P P E N D I X N

Statistical Analysis of Time Series for Bridge Solution

Table N1 Fractiles and exceedance times for E-ME tunnel solution with production facility at Rødby-havn 2014-2019. No background concentration included

Stations	f_{10}	f_{50}	f_{75}	f_{95}	E_2	E_5	E_{10}	E_{15}	E_{20}	E_{50}
NS01	0.00	0.02	0.09	0.29	1.2	0.3	0.1	0.0	0.0	0.0
NS02	0.00	0.02	0.11	0.50	1.2	0.1	0.1	0.0	0.0	0.0
NS03	0.00	0.03	0.13	0.52	1.5	0.3	0.0	0.0	0.0	0.0
NS04	0.00	0.05	0.43	2.21	10.6	5.6	3.0	1.9	1.3	0.3
NS05	0.00	0.03	0.14	0.67	3.1	1.1	0.3	0.1	0.1	0.0
NS06	0.00	0.00	0.01	0.03	0.0	0.0	0.0	0.0	0.0	0.0
NS07	0.00	0.00	0.02	0.08	0.1	0.0	0.0	0.0	0.0	0.0
NS08	0.00	0.00	0.02	0.07	0.2	0.0	0.0	0.0	0.0	0.0
NS09	0.00	0.00	0.01	0.04	0.3	0.1	0.0	0.0	0.0	0.0
NS10	0.00	0.00	0.01	0.05	0.0	0.0	0.0	0.0	0.0	0.0
MS01	0.00	0.01	0.03	0.08	0.1	0.0	0.0	0.0	0.0	0.0
MS02	0.00	0.01	0.02	0.08	0.3	0.0	0.0	0.0	0.0	0.0

Table N2 Fractiles and exceedance times for E-ME tunnel solution without local production facility 2014-2019. No background concentration included

Stations	f_{10}	f_{50}	f_{75}	f_{95}	E_2	E_5	E_{10}	E_{15}	E_{20}	E_{50}
NS01	0.00	0.02	0.07	0.23	0.9	0.3	0.1	0.0	0.0	0.0
NS02	0.00	0.02	0.09	0.36	0.7	0.1	0.0	0.0	0.0	0.0
NS03	0.00	0.02	0.11	0.41	1.1	0.2	0.0	0.0	0.0	0.0
NS04	0.00	0.04	0.34	1.74	9.0	4.7	2.5	1.6	1.1	0.3
NS05	0.00	0.02	0.11	0.51	2.6	0.9	0.3	0.1	0.1	0.0
NS06	0.00	0.00	0.01	0.03	0.0	0.0	0.0	0.0	0.0	0.0
NS07	0.00	0.00	0.02	0.08	0.1	0.0	0.0	0.0	0.0	0.0
NS08	0.00	0.00	0.02	0.06	0.1	0.0	0.0	0.0	0.0	0.0
NS09	0.00	0.00	0.01	0.04	0.3	0.0	0.0	0.0	0.0	0.0
NS10	0.00	0.00	0.01	0.04	0.0	0.0	0.0	0.0	0.0	0.0
MS01	0.00	0.00	0.02	0.07	0.0	0.0	0.0	0.0	0.0	0.0
MS02	0.00	0.01	0.02	0.06	0.3	0.0	0.0	0.0	0.0	0.0

Table N3 *Fractiles and exceedance times for nearshore measurements 01.01.2009 – 01.04.2011 (NS01-03 01.01.2009 – 01.11.2010)*

Stations	f_{10}	f_{50}	f_{75}	f_{95}	E_2	E_5	E_{10}	E_{15}	E_{20}	E_{50}
NS01	0.63	1.14	1.93	12.54	24.2	12.3	6.7	3.9	2.3	0.5
NS02	0.76	1.49	3.82	27.99	38.2	21.4	13.8	10.2	7.9	1.8
NS03	0.97	2.16	6.38	23.91	52.9	30.1	16.5	9.5	6.6	1.6
NS04	1.15	2.39	5.98	33.22	60.1	28.3	17.4	12.3	9.2	2.8
NS05	1.56	4.96	15.34	51.88	79.9	49.8	33.5	25.4	19.8	5.4
NS06	0.82	1.26	1.89	4.98	22.6	5.0	1.3	0.4	0.2	0.0
NS07	0.82	1.46	2.69	9.60	34.2	12.4	4.7	2.5	1.3	0.1
NS08	0.86	1.48	2.44	7.90	32.4	9.1	3.8	2.1	1.4	0.3
NS09	0.81	1.26	1.87	5.83	22.4	6.0	2.6	1.3	0.9	0.1
NS10	0.80	1.23	1.97	6.51	24.6	7.7	2.1	1.0	0.6	0.1
MS01	0.1	0.7	1.1	3.0	9.4	2.2	0.3	0.1	0.0	0.0
MS02	0.1	0.7	1.0	2.3	6.4	1.1	0.3	0.1	0.0	0.0

Table N4 *Fractiles and exceedance times for E-ME tunnel solution without local production facility 2015. No background concentration included*

Stations	f_{10}	f_{50}	f_{75}	f_{95}	E_2	E_5	E_{10}	E_{15}	E_{20}	E_{50}
NS01	0.01	0.11	0.28	0.64	3.4	1.1	0.3	0.1	0.0	0.0
NS02	0.01	0.17	0.49	0.95	2.4	0.3	0.1	0.1	0.1	0.0
NS03	0.01	0.20	0.63	1.23	4.7	1.0	0.1	0.1	0.0	0.0
NS04	0.01	0.26	1.37	6.51	20.4	12.3	7.5	5.3	3.8	1.2
NS05	0.00	0.11	0.51	1.43	6.8	2.4	0.8	0.3	0.2	0.0
NS06	0.00	0.00	0.01	0.04	0.2	0.0	0.0	0.0	0.0	0.0
NS07	0.00	0.01	0.03	0.32	0.3	0.0	0.0	0.0	0.0	0.0
NS08	0.00	0.01	0.03	0.16	0.5	0.0	0.0	0.0	0.0	0.0
NS09	0.00	0.00	0.01	0.04	0.0	0.0	0.0	0.0	0.0	0.0
NS10	0.00	0.00	0.01	0.03	0.0	0.0	0.0	0.0	0.0	0.0
MS01	0.00	0.03	0.10	0.22	0.2	0.0	0.0	0.0	0.0	0.0
MS02	0.00	0.02	0.06	0.33	1.2	0.1	0.0	0.0	0.0	0.0

Table N5 Fractiles and exceedance times for E-ME tunnel solution with production facility at Rødbyhavn 2015. No background concentration included

Stations	f_{10}	f_{50}	f_{75}	f_{95}	E_2	E_5	E_{10}	E_{15}	E_{20}	E_{50}
NS01	0.02	0.13	0.33	0.76	3.9	1.3	0.4	0.2	0.0	0.0
NS02	0.02	0.21	0.70	1.34	4.6	0.3	0.1	0.1	0.1	0.0
NS03	0.01	0.25	0.74	1.48	5.8	1.1	0.1	0.1	0.0	0.0
NS04	0.01	0.37	1.97	8.50	24.9	14.8	9.0	6.3	4.5	1.5
NS05	0.01	0.15	0.74	1.80	8.7	3.3	0.8	0.3	0.2	0.0
NS06	0.00	0.00	0.01	0.05	0.2	0.0	0.0	0.0	0.0	0.0
NS07	0.00	0.01	0.04	0.34	0.3	0.0	0.0	0.0	0.0	0.0
NS08	0.00	0.01	0.04	0.18	0.6	0.0	0.0	0.0	0.0	0.0
NS09	0.00	0.00	0.01	0.04	0.0	0.0	0.0	0.0	0.0	0.0
NS10	0.00	0.00	0.01	0.03	0.0	0.0	0.0	0.0	0.0	0.0
MS01	0.01	0.04	0.11	0.24	0.2	0.0	0.0	0.0	0.0	0.0
MS02	0.00	0.02	0.06	0.34	1.2	1.2	0.1	0.0	0.0	0.0

A P P E N D I X O

Statistical Analysis of Time Series for Bridge Solution

Table O1 Fractiles and exceedance times for bridge solution 2014-2016. No background concentration included

Stations	f_{10}	f_{50}	f_{75}	f_{95}	E_2	E_5	E_{10}	E_{15}	E_{20}	E_{50}
NS01	0.00	0.00	0.01	0.05	0.1	0.0	0.0	0.0	0.0	0.0
NS02	0.00	0.00	0.01	0.04	0.2	0.0	0.0	0.0	0.0	0.0
NS03	0.00	0.00	0.02	0.07	0.3	0.1	0.0	0.0	0.0	0.0
NS04	0.00	0.01	0.06	0.52	3.8	1.2	0.4	0.0	0.0	0.0
NS05	0.00	0.00	0.03	0.14	0.1	0.0	0.0	0.0	0.0	0.0
NS06	0.00	0.00	0.00	0.01	0.0	0.0	0.0	0.0	0.0	0.0
NS07	0.00	0.00	0.00	0.02	0.0	0.0	0.0	0.0	0.0	0.0
NS08	0.00	0.00	0.00	0.02	0.0	0.0	0.0	0.0	0.0	0.0
NS09	0.00	0.00	0.00	0.01	0.0	0.0	0.0	0.0	0.0	0.0
NS10	0.00	0.00	0.00	0.01	0.0	0.0	0.0	0.0	0.0	0.0
MS01	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
MS02	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Table O2 Fractiles and exceedance times for nearshore measurements 01.01.2009 – 01.04.2011 (NS01-03 01.01.2009 – 01.11.2010)

Stations	f_{10}	f_{50}	f_{75}	f_{95}	E_2	E_5	E_{10}	E_{15}	E_{20}	E_{50}
NS01	0.63	1.14	1.93	12.54	24.2	12.3	6.7	3.9	2.3	0.5
NS02	0.76	1.49	3.82	27.99	38.2	21.4	13.8	10.2	7.9	1.8
NS03	0.97	2.16	6.38	23.91	52.9	30.1	16.5	9.5	6.6	1.6
NS04	1.15	2.39	5.98	33.22	60.1	28.3	17.4	12.3	9.2	2.8
NS05	1.56	4.96	15.34	51.88	79.9	49.8	33.5	25.4	19.8	5.4
NS06	0.82	1.26	1.89	4.98	22.6	5.0	1.3	0.4	0.2	0.0
NS07	0.82	1.46	2.69	9.60	34.2	12.4	4.7	2.5	1.3	0.1
NS08	0.86	1.48	2.44	7.90	32.4	9.1	3.8	2.1	1.4	0.3
NS09	0.81	1.26	1.87	5.83	22.4	6.0	2.6	1.3	0.9	0.1
NS10	0.80	1.23	1.97	6.51	24.6	7.7	2.1	1.0	0.6	0.1
MS01	0.1	0.7	1.1	3.0	9.4	2.2	0.3	0.1	0.0	0.0
MS02	0.1	0.7	1.0	2.3	6.4	1.1	0.3	0.1	0.0	0.0

APPENDIX P
Field Tests

Work in Progress

Fehmarnbelt Fixed Link

Hydrographic Services for Fehmarnbelt Fixed Link

Baseline for Suspended Sediment, Sediment Spill, related Surveys and Field Experiment

ATR ENV010017 - The Spill Experiment

Femern A/S
Draft Report
February 2011

DHI/IOW Consortium in association with LICengineering, Bolding & Burchard and Risø DTU

Work in Progress

Fehmarnbelt Fixed Link

Hydrographic Services for Fehmarnbelt Fixed Link

Baseline for Suspended Sediment, Sediment Spill, related Surveys and Field Experiment

ATR ENV010017 - The Spill Experiment

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Project	Project No
Baseline for Suspended Sediment, Sediment Spill, related Surveys and Field Experiment. The Spill Experiment	11802650-23 **Doc No E1TR0038**

Authors	Date
Klavs Bundgaard Thorbjørn Joest Andersen	11 February 2011
	Approved by: Ian Sehested Hansen, Project Director, FEHY

Revision	Description	By	Checked	QA	Date
B	Draft Report (Extra spill experiment)	KLB	IBH	IBH	11/02/11
A	Draft Report	KLB	IBH	IBH	18/06/10

Key words	Classification
Fehmarnbelt Primary particles Plume measurements LISST Dredging Spill test	☐ Open ☐ Internal ☒ Proprietary

Distribution		No of copies
Femern A/S	Anders Jensen	PDF
DHI	IBH, KLB, JAO	PDF

CONTENTS

List of Abbreviations

Grt: Gross tonnage

Nt: Net tonnage

Tdw: Total dead weight

Loa: Length overall

Br: Width

Dr: Draft

ADCP: Acoustic Doppler Current Profiler

MS01: Main station 1

MS02: Main station 2

SSC: Suspended Sediment Concentration

Ws: Settling velocity

Ws_{50}: Median settling velocity

d_{50}: Median grain size

UTC: Coordinated Universal time

GMT: Greenwich Mean Time

1 INTRODUCTION

The ATR ENV010017 “Baseline for Suspended Sediment, Sediment Spill, related Surveys and Field Experiment” was sent to Femern A/S on 15 June 2009 and approved on 29 June 2009.

The overall objective of this ATR is to assess the possible impact from sediment spill during construction of the fixed link between Denmark and Germany on the natural suspended concentration levels and deposition patterns.

Four activities are defined:

1. Determination of baseline conditions with respect to sediment suspension and sedimentation in the Fehmarnbelt

2. Field studies to measure the behaviour of sediment spills in the Fehmarnbelt

3. Establishment of spill budgets for the bridge and the tunnel solution based on geotechnical information and earth budgets for the two solutions

4. Establishment and calibration of a spill assessment model and simulation of spills for the two solutions

This report covers activity 2.

A spill experiment was undertaken in September 2009.

The current speeds during the spill experiment were very low and were unfortunately not representative for the normal conditions. The results achieved during the experiment are unsuitable for model calibration.

Additional spill measurements were therefore conducted in October 2010. The measurements were conducted in connection with Rambøll/Arups geotechnical test pit.

The present report includes the outcome of both experiments.

2 THE SPILL EXPERIMENT, SEPTEMBER 2009

2.1 General

The dredger ("Kronos") with a tank of 370 m^3 was used for the spill experiment. Based on the geotechnical investigations from Rambøll Arup, Ref. /2/, two positions on the Danish side of the Fehmarnbelt, A008 and A014, were chosen for dredging of bed material for the experiments. The coordinates are presented in Table 2-1. The two positions were chosen because of a relatively high content of fines in the bed material.

Table 2-1 Coordinates for stations A008 and A014. Coordinates in UTM-32

Station	Easting (m)	Northing (m)	Water depth (m)	Description
A008	650457	6050595	25.1	Clay, high plasticity, with laminations of grey silt, dark grey calcious
A014	651929	6055787	10.3	Clay till, silty, sandy, gravelly, calcareous

This sediment was mixed with water to slurry with the ratio of approximately 9:1 between water and sediment (in situ). The sediment was kept in suspension by six propellers in the tank and by stirring the tank with a grab, see Figure 2-1.

Figure 2-1 Grab stirring in the tank

The spill experiments were undertaken with release of sediment at position (652505E; 6052255N) in UTM-32. The spill position is shown in Figure 2-2.

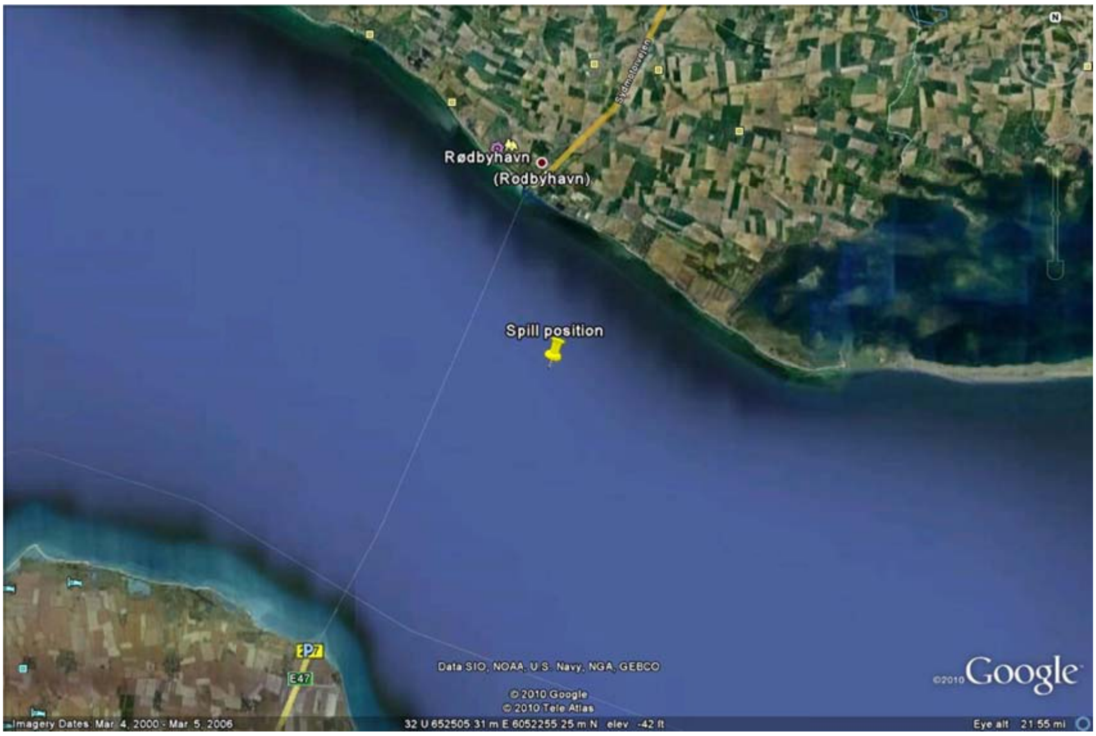


Figure 2-2 Overview of spill position

During the release the discharge rate and the concentrations in the discharged water were monitored. A photo from the discharged water is shown in Figure 2-3.

During the test the measuring ship ("Amigo") performed measurements of the plume characteristics including currents, mapping of concentrations, profiles of concentrations and velocities, settling velocities and grain size distributions.

The spill test was repeated for two vertical outlet positions and two different soil types to cover spatial variations in soil types and different types of dredging methods.

Figure 2-3 The discharged water from Kronos

2.2 Ships

Two ships were used for the spill tests - a dredger for gathering and releasing the sediment and a vessel for the measuring campaign.

The dredger “Kronos” is shown in Figure 2-4.

Figure 2-4 Kronos

The technical specifications for "Kronos" are shown in Table 2-2.

Table 2-2 Properties for the dredger Kronos

IMO no.:	**7338767**
Call sign:	**OZ2015**
Flag:	**Faeroe Island**
Port:	**Thorshavn**
Built:	**1964**
Grt:	**407**
Nt:	**122**
Tdw:	**700**
Loa:	**48.13 m**
Br:	**9.20 m**
Dr:	**3.80 m**
Speed:	**10.00 kn**

The dredger was equipped with a suction pipe able to reach down to 15 m of water depth. Above the tank a powerful water cannon was mounted. It was used for filling the tank and to stir up the sediment in the tank, see Figure 2-4.

Figure 2-5 Illustration of equipment. Note also the grab located at the bottom of the tank

The dredger was also equipped with a 2 m^3 grab mounted on a 30 m wire. This made the dredger able to grab sediment at water depths up to 25 m.

The tank of the dredger was equipped with six propellers mounted at the sections. The lower one was mounted 70 cm above the bottom and the upper one was mounted approximately 1.5 m above the bottom. The propellers were placed asymmetrically to enhance circulation.

Figure 2-6 The propellers used

The propellers were powerful propellers of the type usually used for slurry tanks. The test outlet was a flexible rubber tube of the type used in the fishing industry for sucking up herring and bristles. The tube was attached to the suction pipe. This can also be seen in Figure 2-4 to the right. At the end of the tube a depth measuring sensor was mounted to monitor the outlet level.

The measurements in the plume were undertaken from M/S Amigo which is a fishing vessel built in Skagen in 1962. Amigo is equipped with a 110 hk 6-cylinder Gardner, capable of supplying a speed of 7.5 knots. DGPS navigator system with a plotter is available. Furthermore, Amigo is equipped with daylight radar - vhf radio and autopilot. MS Amigo is shown in Figure 2-6.

Figure 2-7 MS Amigo

2.3 Sediment Spill Rates

Spill rates from the most probable dredging equipment are used in the spill experiments. In Table 2-3 and Table 2-4 the basis for the choice of spill rates is given, see Ref /4/. The tables show the typical spill rates and equipment for different operations.

Table 2-3 Dredging activities for immersed tunnel solution

Dredging activity	Production rate (m^3/h)	Spill rate (%)	Spill Volume (m^3/h)
Cutter suction dredger excavating in water depths less than 20 m	625	2 %	12.5
Cutter suction dredger excavating in water depths above 20 m	400	2%	8
Sand mining	612	6.6 %	40.4
Disposal of sediment	625	1 %	6.25

Table 2-4 Dredging activities for bridge solution

Dredging activity	Production rate (m^3/h)	Spill rate (%)	Spill Volume (m^3/h)
Backhoe excavating in water depths less than 20 m	220	4 %	8.8
Backhoe excavating in water depths above 20 m	180	4%	7.2
Sand mining	612	6.6 %	40.4
Disposal of sediment	625	1 %	6.25
Reclamation of anchor blocks	625	7%	43.75
Reclamations at land falls	540	2%	10.8

Most of the operations cause a spill in the order of 10 m^3/h. Only the disposal of sediment, the sand mining and the operations for reclamation of anchor blocks cause larger spills. It was therefore chosen to select a discharge rate in the order of 8-12 m^3/h. After the test has been conducted more knowledge of expected equipment and spillage rates has become available from Rambøll, Ref /3/.

2.4 Spill Experiments

The tests were carried out on the 17th-18th of September 2009. An overview of the tests is given in Table 2-5.

Table 2-5 Overview of performed tests

Test	Date/ Time (UTC)	Current speed (m/s) *	Soil origin and description **	Outlet type and depth	Test duration	Volumes ***	Comments
1	16/9 2009 06:49	West bound 5 cm/s	Grey plastic mud from location A008	Surface outlet	1 h 37 min	10 m^3 sediment 100 m^3 water	Dredged material hard and lumpy. Test meant as pilot but partly OK. Weather, sunny. Wind, weak, shifting NE
2	16/9 2009 08:42	West bound 25 cm/s	Grey plastic mud from location A008	Surface outlet	1 h 11min	12 m^3 sediment 100 m^3 water	Test ok. Very visible but short plume. Weather, sunny with weak shifting winds from NE
3	16/9 2009 12:22	South bound 10 cm/s	Grey plastic mud from location A008	Submerged outlet (-15m)	42 min	11 m^3 sediment 110 m^3 water	Test ok. Plume small, short and well defined on ADCP. Weather, sunny with weak shifting winds from NE
4	16/9 2009 14:09	South bound 5 cm/s	Grey plastic mud from location A008	Submerged outlet (-15 m)	55 min	14 m^3 sediment 125 m water	Test ok. Plume small, short and well defined on ADCP. Hard to locate. Weather, sunny, weak shifting winds from NE
5	17/09 2009 06:54	South west bound 15 cm/s	Clay till (grey or brown) from location A014	Surface outlet	1 h 11 min	9 m^3 sediment 110 m^3 water	Test conducted partially with ship sailing backwards (Lagrangsk approach) due to very weak currents at the beginning of the test. Weather, sunny with weak shifting winds from NE and few clouds. Test not ok due to turbulence etc.
6	17/09 2009 09:46	West bound 12 cm/s	Clay till (grey or brown) from location A014	Surface outlet	59 min	10.5 m^3 sediment 110 m^3 water	Test ok but very weak current gives small plume. Weather, sunny with weak shifting winds from NE and few clouds
7	17/09 2009 13.30	West bound 12 cm/s	Grey plastic mud from location A008	Surface outlet	3 h 55 min	35.5 m^3 sediment 300 m^3 water	First part of the experiment had very low currents. Last two hours with increasing currents. Weather, sunny with weak shifting winds from NE and few clouds.

*Measured at the beginning of the test by ADCP at the spill level.
** Locations and descriptions are identical to those used in the geotechnical investigations /2/.
***Volumes are bulk volumes measured in the grab.

The first test showed that it was necessary to test shorter periods than originally anticipated because it proved harder than expected to break up the sediment and form the slurry without lumps. Therefore smaller amounts of sediment were used in order to be able to create the necessary slurry. For test seven the sediment used was easier to break up and thus it was possible to perform a long test. This also served the purpose of counteracting the weak current conditions. In Table 2-6 the spill rates and the durations of the tests are given.

Table 2-6 Outlet rates of sediment for the individual scenarios and duration of tests

Test	Volumes of sediment in the tank* [m^3]	Spill rate [m^3/h] *	Duration
1	10	6.2	1 h 37 min
2	12	10.1	1 h 11min
3	11	15.7	42 min
4	14	15.3	55 min
5	9	7.6	1 h 11 min
6	10.5	10.7	59 min
7	35.5	11.5	3h 55min

*Volumes calculated based on the volumes from the grab.

2.5 Hydrodynamic and Meteorological Test Conditions

Wind and current conditions in the test period were mild. The wind speeds varied between 0 m/s and 5 m/s from shifting directions but mostly from northerly directions. The air temperature was between 16 and 22 degrees and the sun was shining. In some periods a thin cloud layer was present.

A slight swell of 10-20 cm was detected in the beginning of the test period but otherwise no significant waves were present.

In the days up to the test period the currents had been strong, up to 1 m/s. But as the weather got better the current speed levelled out below 20 cm/sec and below 10 cm/sec on the second test day. Visual observations at the site indicated very local variations in the current patterns. In Figure 2-8 the measured current speeds from MS01 in the test period are shown.

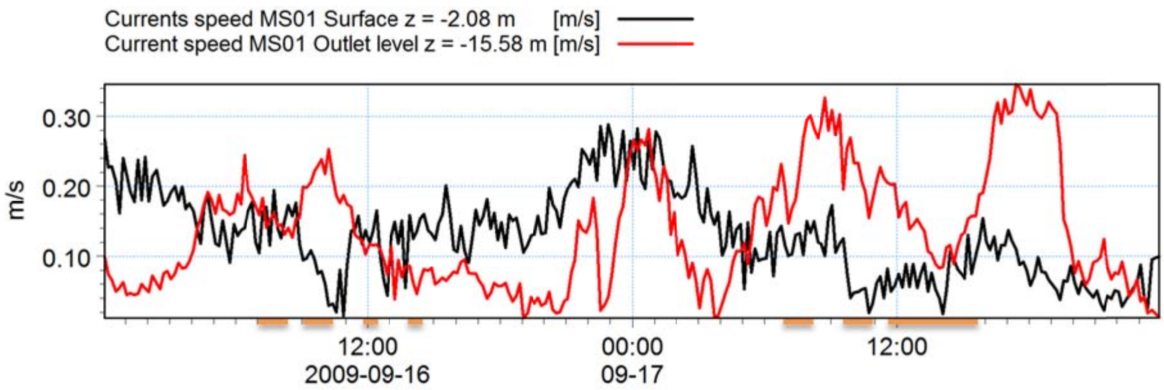


Figure 2-8 *Measured current speeds at station MS01 (approximately 500 m from the test location). Orange markings are test periods*

The water temperature and salinities during the test period varied. During the first test day the water column appeared well mixed with a temperature around 16.6 degrees and a salinity at around 12-13 PSU. However, during the test period an inflow of saline water from the Kattegat arrived. This led to a decrease in bottom temperatures to around 15.2 degrees and an increase in salinity to around 20 PSU.

An overview of the test conditions for temperature and salinity is given in Figure 2-9. A full overview of the test conditions for hydrodynamics and meteorology is given in Table 2-7.

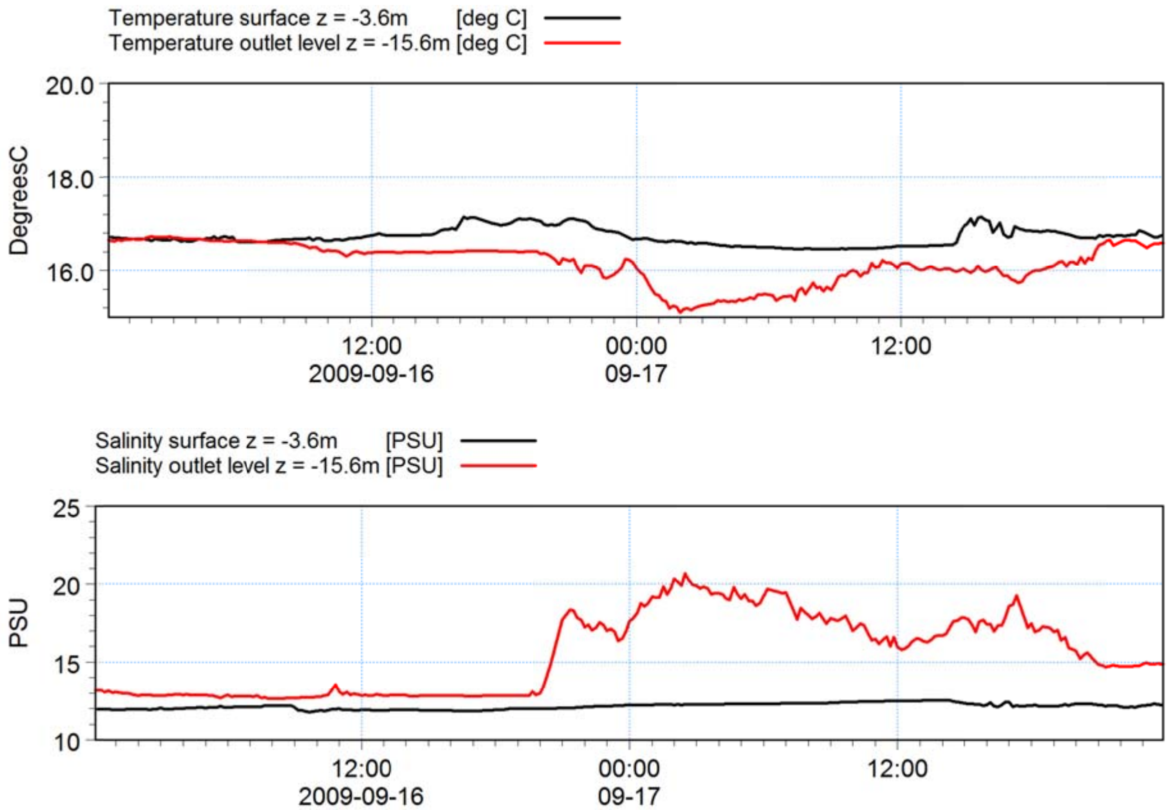


Figure 2-9 *Test conditions for salinity and temperature*

Table 2-7 Overview of test conditions from MS01

Date	Wind speed	Wind direction	Air temp °C	Cloudiness	Surface current speed and direction	Salinity	Temperature °C
16 September 2009	Less than 5 m/s	Shifting mostly NE	16 – 22	Clear sky few high clouds	0 – 25 cm/s West going	12 – 13 PSU	16 – 17
17 September 2009	Less than 5 m/s	Shifting mostly NE	16 – 22	Clear sky with some high clouds	0 – 30 cm/s Shifting	12 – 20 PSU	15 – 17

2.6 Settling Velocity Measurements

A total of 18 settling velocity tests were carried out in situ. The tests were Owen tube tests. Most of the tests showed very low SSC and low settling velocity, W_s, which made it impossible to determine a median settling velocity, W_{s50}. For six tests it was possible to calculate W_{s50} - for the remaining tests W_{s50} was below 0.05 mm/s which is the lower analytical limit using a maximum settling time of 64 min. It was possible to calculate W_{s50} for four settling tubes sampled about 0.5 m above the bed in a situation with spill at the bed as well as for two settling tubes taken 1 and 4 m below the surface in situations with spill at the surface. The results are given in Table 2-8.

Table 2-8 Overview of settling velocities determined in Owen Tube tests

Test no.	Tube no.	Time (UTC)	Depth below surface (m)	Concentration (mg/l)	Settling velocity Ws_{50} (mm/s)
3	8.1	16/9 2009 12:49	14	72.6	0.43
3	8.2	16/9 2009 12:53	14	29.7	3.66
4	9.1	16/9 2009 14:36	14	170.6	0.05
4	9.2	16/9 2009 14:36	14	167.8	0.06
5	10.2	17/9 2009 07:47	1	4.6	1.04
6	11.2	17/9 2009 10:08	4	5.0	0.17

The results show median settling velocities between 0.05 mm/s up to 3.66 mm/s. Results also show 12 tests with median settling velocities below 0.05 mm/s.

The settling velocity of fine-grained suspended material can also be calculated using Stokes law (eq1) if particle diameter, d, effective particle density, ρ_{floc}, and viscosity of the water are known. The effective density, ρ_{floc}, is defined as density of the flocs. The settling velocity can be calculated as:

1) $W_s = \frac{d^2 \cdot (s-1) \cdot g}{18\nu}$

In which:

$$S - 1 = \frac{\rho_{floc} - \rho}{\rho}$$

Simultaneously with the Owen tube tests a series of measurements using the LISTT 100 was done at the same locations. The LISST instrument provides measurements of d and volume concentration, v_c. An estimate of the effective density can be found from the measured SSC and v_c. If most of the material is un-flocculated the calculated density will be the actual density of the particles.

2) $\rho_{floc} \approx \frac{SSC}{v_c}$

The settling velocities measured with settling tubes and estimated on the basis of LISST-data are given in Table 2-9 and plotted in Figure 2-10 and Figure 2-11.

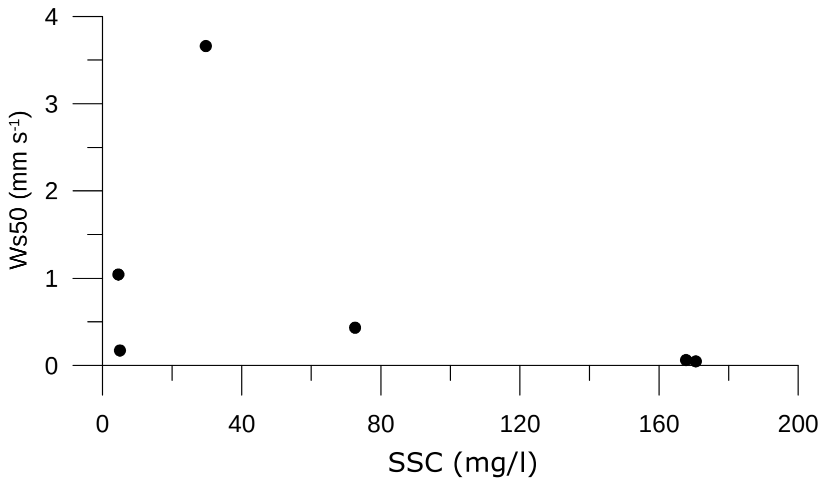


Figure 2-10 Ws_{50} versus SSC

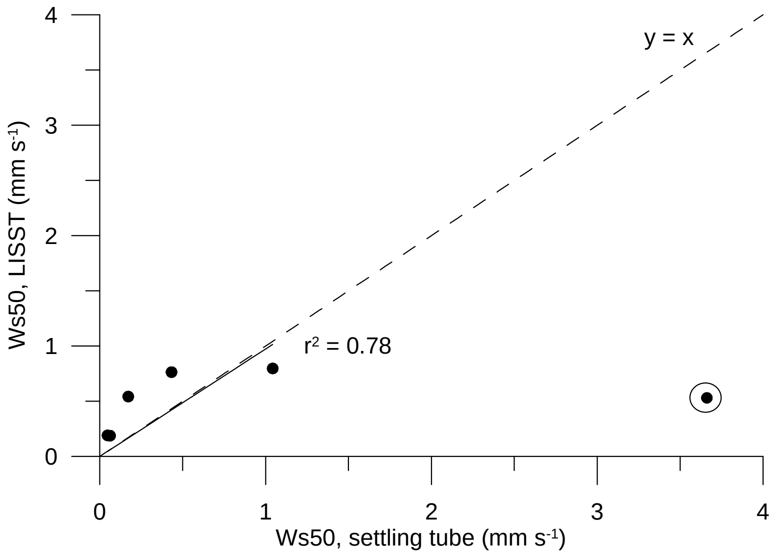


Figure 2-11 Comparison of measured and estimated W_{s50} based on settling tube and LISST measurements, respectively. Circle: outlier dominated by single sand grains

The measured settling velocities varied by almost two orders of magnitude. The high settling velocities observed in one test were obviously related to settling of sand and silt particles whereas the majority of the samples showed slowly settling particulate matter. It has to be kept in mind that 12 tests not listed in Table 2-9 showed settling velocities below 0.05 mm s^{-1}. No clear correlation between SSC and W_{s50} was observed.

Table 2-9 Overview of data measured using LISST and Owen tubes

Test no.	Time (UTC)	Depth below surface (m)	Concen-tration (mg/l)	Settling velocity Ws_{50} (mm/s)	Mean grain size, LISST (µm)	Eff. density, LISST (g/ cm^3)	Vol conc, LISST (µl/l)	Ws_{50}, LISST (mm/ s)
3	12:49	14	72.6	0.43	44	0.80	91	0.76
3	12:53	14	29.7	3.66	50	0.42	70	0.53
4	14:36	14	170.6	0.05	22	0.78	220	0.19
4	14:36	14	167.8	0.06	22	0.76	220	0.19
5	07:47	1	4.6	1.04	51	0.62	7	0.80
6	10:08	4	5.0	0.17	41	0.64	8	0.54
7	14.50	2.6	Varying	Varying	Varying	Varying	Varying	Varying
7	16.32	2.6	Varying	Varying	Varying	Varying	Varying	Varying

Figure 2-11 shows a comparison of W_{s50} based on settling tube and LISST measurements, respectively. The velocities are in the same order of magnitude except for one outlier (tube 8.2) related to settling of primary particles in the sand-range. If this outlier is omitted in the analysis a correlation coefficient of 0.82 is found but due to the few observations (n = 5) this is not significant.

Based on the calculation procedures outlined above it is possible to estimate the temporal variation of effective density and settling velocity for the Lagrangian experiments where the instrument is floating and following the plume. The LISST was tied to a buoy and left in the plume over a period of time measuring the change in plume properties over time. The Lagrangian tests were performed twice during Test 7. In total two Lagrangian experiments were carried out. The results are given in Figure 2-12 and Figure 2-13.

Both experiments showed an increase in d_{50}, decrease in effective density and increase in W_s with time. This is consistent with the expected evolution under a gradual shift from a largely un-flocculated to a largely flocculated suspension. The two experiments did not show the same d_{50}, W_s and effective densities. The first experiment (exp1) showed smaller grain sizes, higher effective density and lower settling velocity than exp2 both at the beginning and at the end of the experiment. Approximate values are listed in Table 2-10. The reason for the different result in absolute numbers is not known but it is most likely related to variations in the texture and aggregation of the spill material.

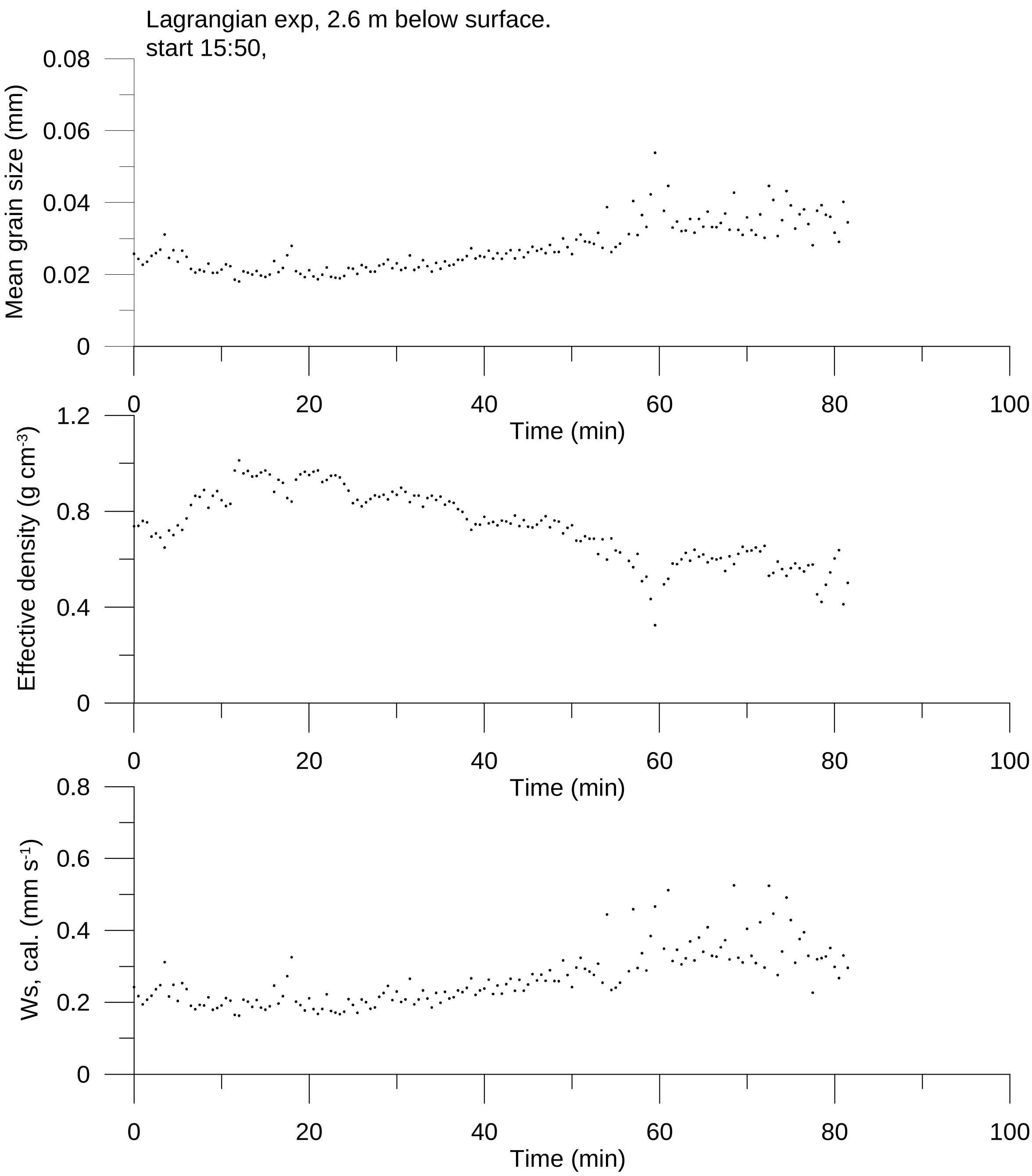


Figure 2-12 Calculated effective density, mean grain size and W_{s50}, Langrangian exp. 1 performed during Test 7. Start time is UTC+2h

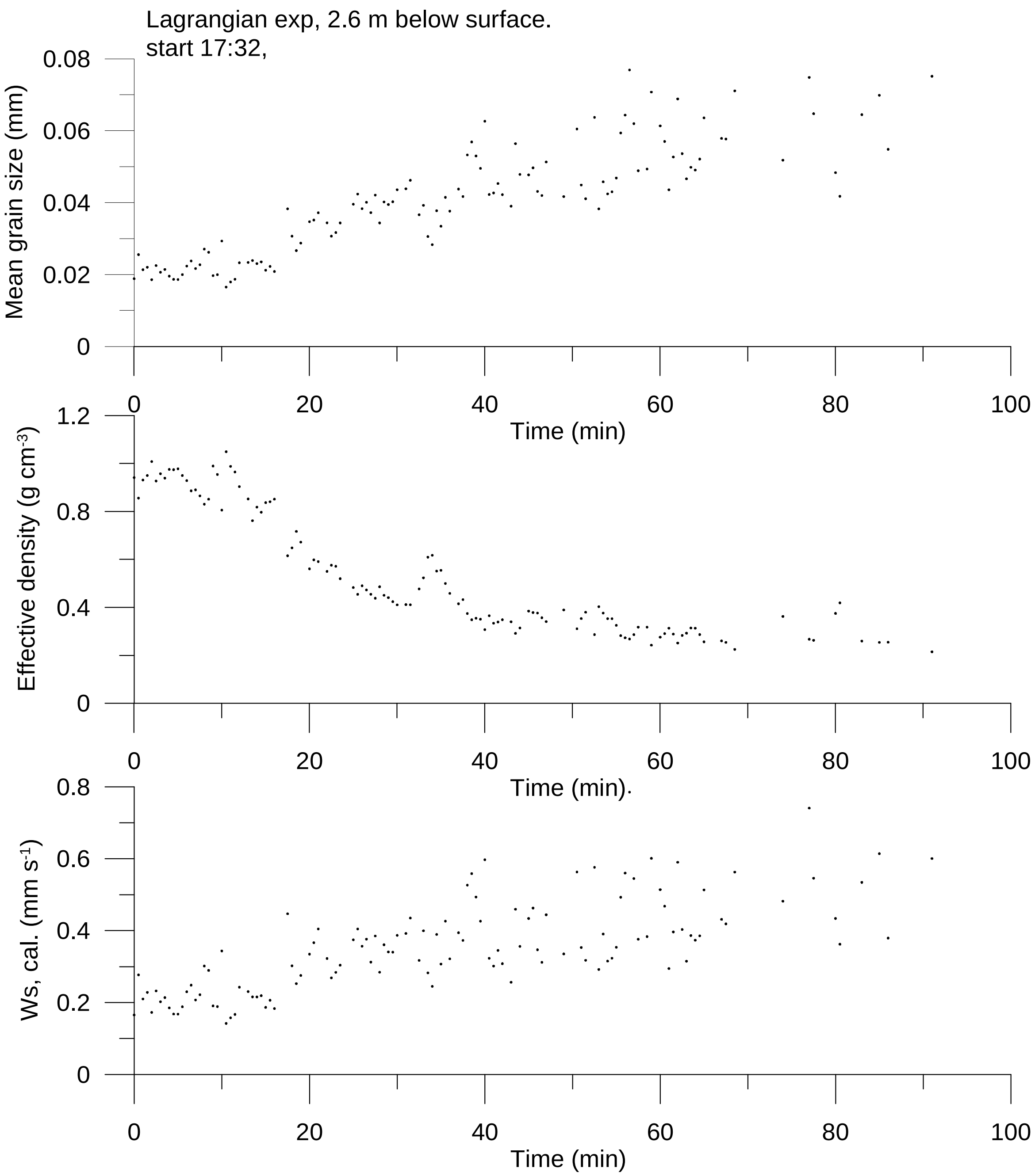


Figure 2-13 Calculated effective density, mean grain size and W_{s50}, Langrangian exp. 2 performed during Test 7. Start time is UTC+2h

Table 2-10 Overview of results for Lagrangian experiments

	d_{50}, start microns	d_{50}, end microns	Δρ, start g/cm^3	Δρ, end g/cm^3	Ws_{50}, start mm/s	Ws_{50}, end mm/s
exp 1	25	40	0.8	0.5	0.2	0.3
exp 2	20	60	1	0.3	0.2	0.5

2.7 Examples of Plumes

In the following ADCP mappings of concentrations for selected tests are presented.

The ADCP was mounted in an over-the-side frame at the vessel. The ADCP was set up to collect current speed and direction as well as the backscatter signals. The signals were collected with ViSea Data Acquisition Software developed by AquaVision in the Netherlands. The backscatter signal is a measure of the content of suspended sediments in the water. The backscatter signal was converted to suspended sediment concentration using the Plume Detection Toolbox also part of the ViSea suite. In real time the backscatter data was converted to suspended sediment concentrations by means of calibration measurements of SSC and CTD (conductivity, temperature, depth). The conversion method takes into account the influences of sound absorption by variable sediment concentrations in different layers. The sediment attenuation was calculated using an iterative process. The water absorption coefficient was calculated using CTD data where conductivity was converted to salinity. During the post processing the real time coefficients were adjusted to the results of the filtered water samples and grain size distributions.

During the measurements CTD profiles were taken approximately every half hour and during the full experiment a total of 19 2L water samples were collected. Shortly after the campaign it was possible to issue a first order result of the sediment flux but as the calibration is sensitive to a number of parameters including sediment grain size distribution it was necessary to refine it further. A selection of the filters from the water samples was selected and analysed for grain size distribution using laser diffraction technique. After input of these results and complete reprocessing of all data the final result was available.

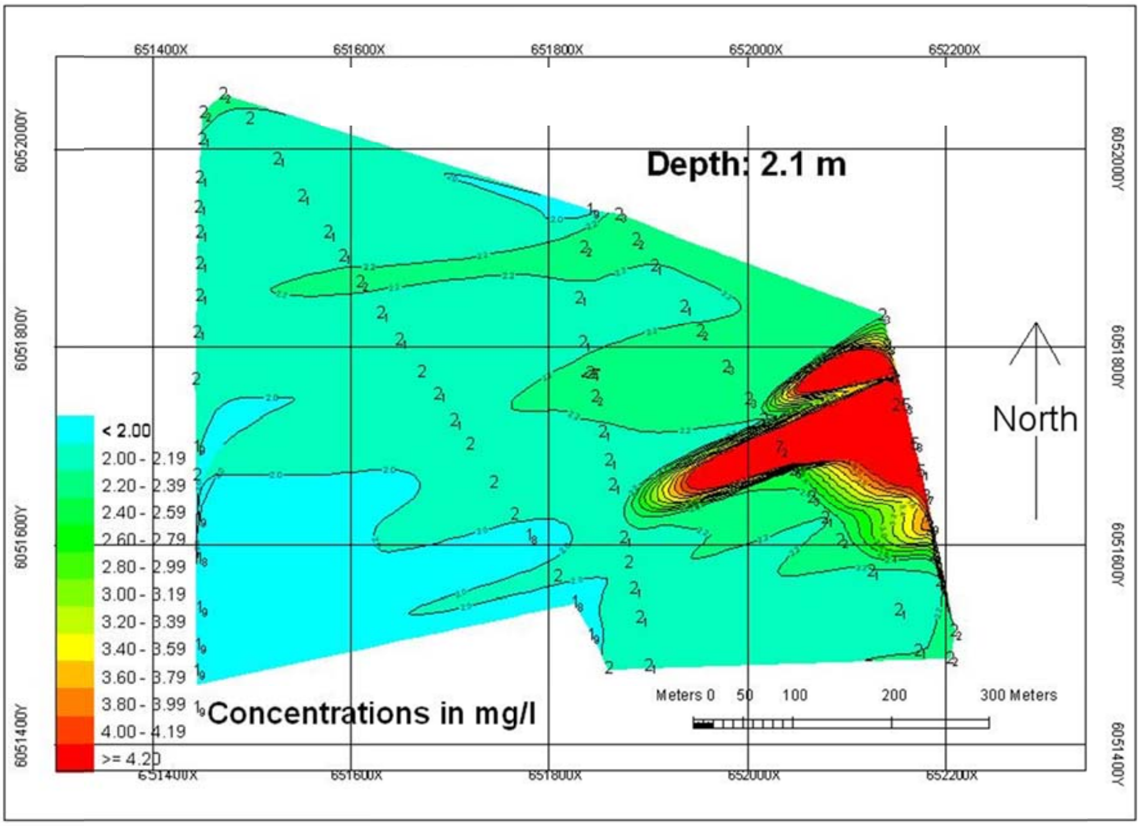


Figure 2-14 Results from Test 1 on 16 September 2009. Results in mg/l. Concentrations measured 2.1 m below the surface between 07:27 UTC and 07:55 UTC

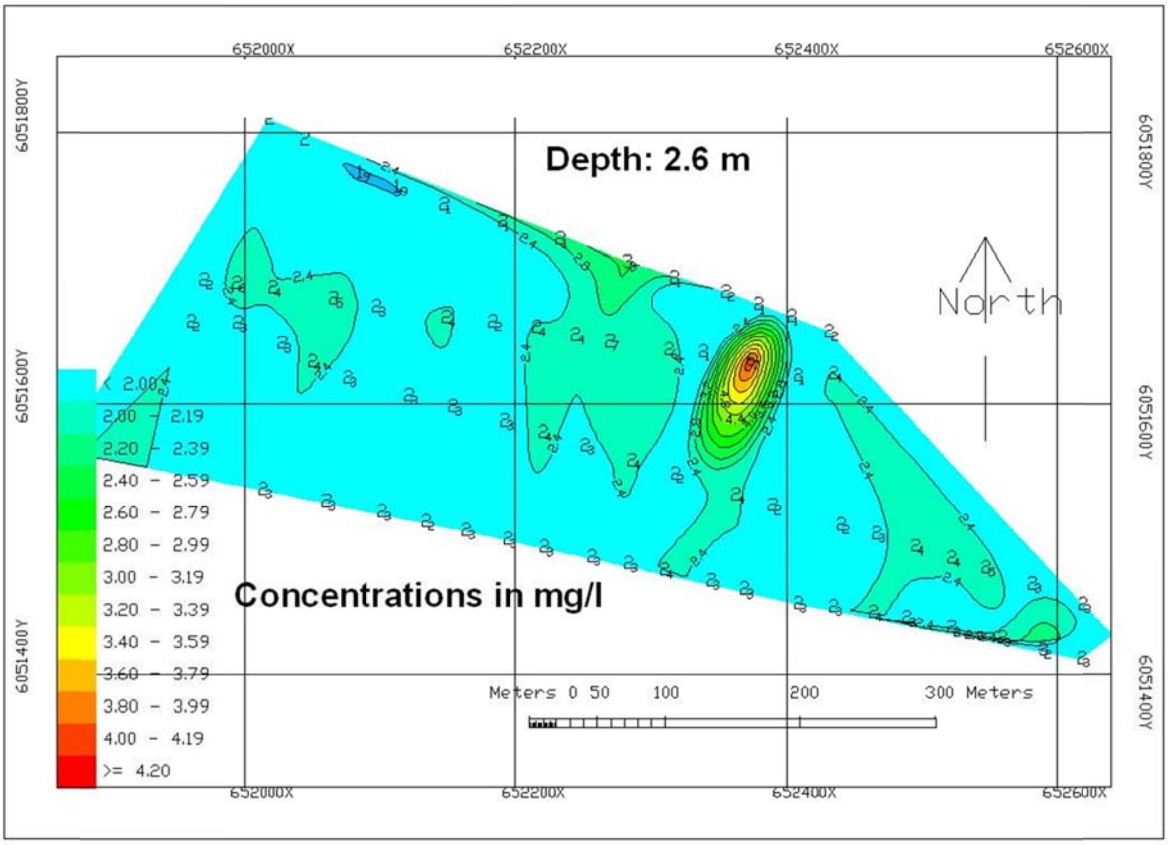


Figure 2-15 Results from Test 2 on 16 September 2009. Results in mg/l. Concentrations measured 2.6 m below the surface between 09:42 UTC and 10:07 UTC

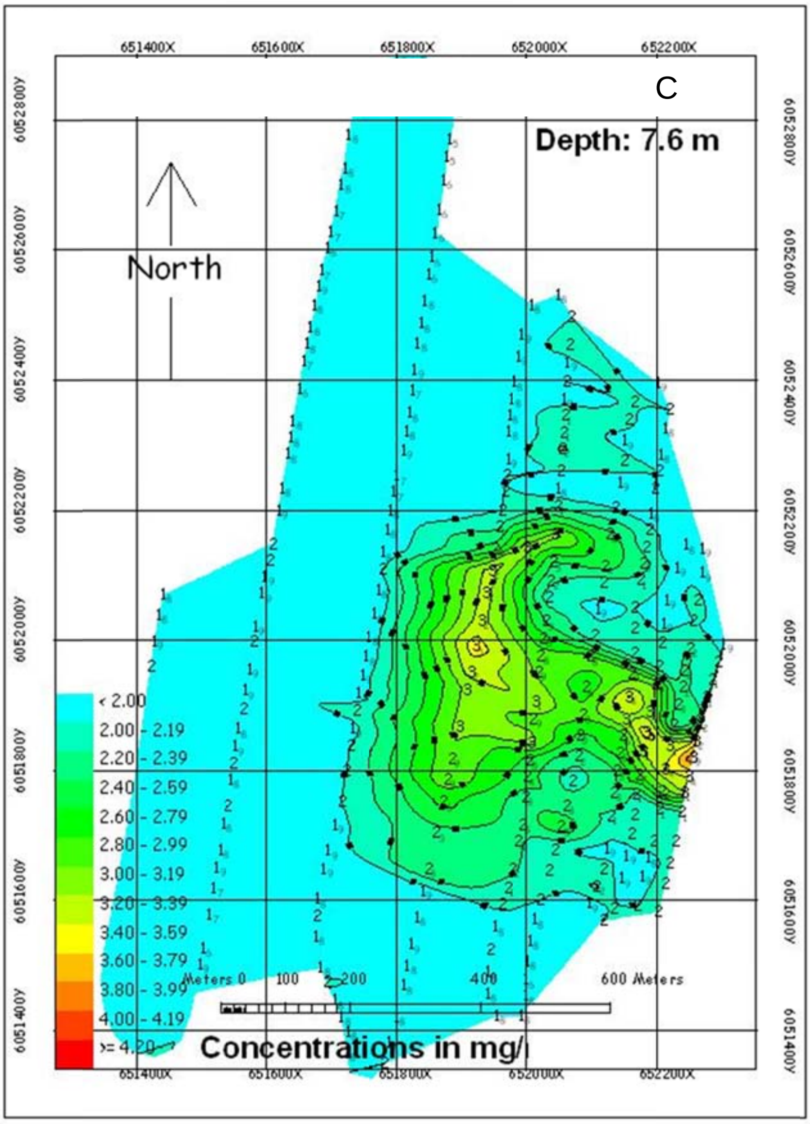


Figure 2-16 Results from Test 7 on 17 September 2009. Results in mg/l. Concentrations measured 7.6 m below the surface between 14:25 UTC and 15:39 UTC

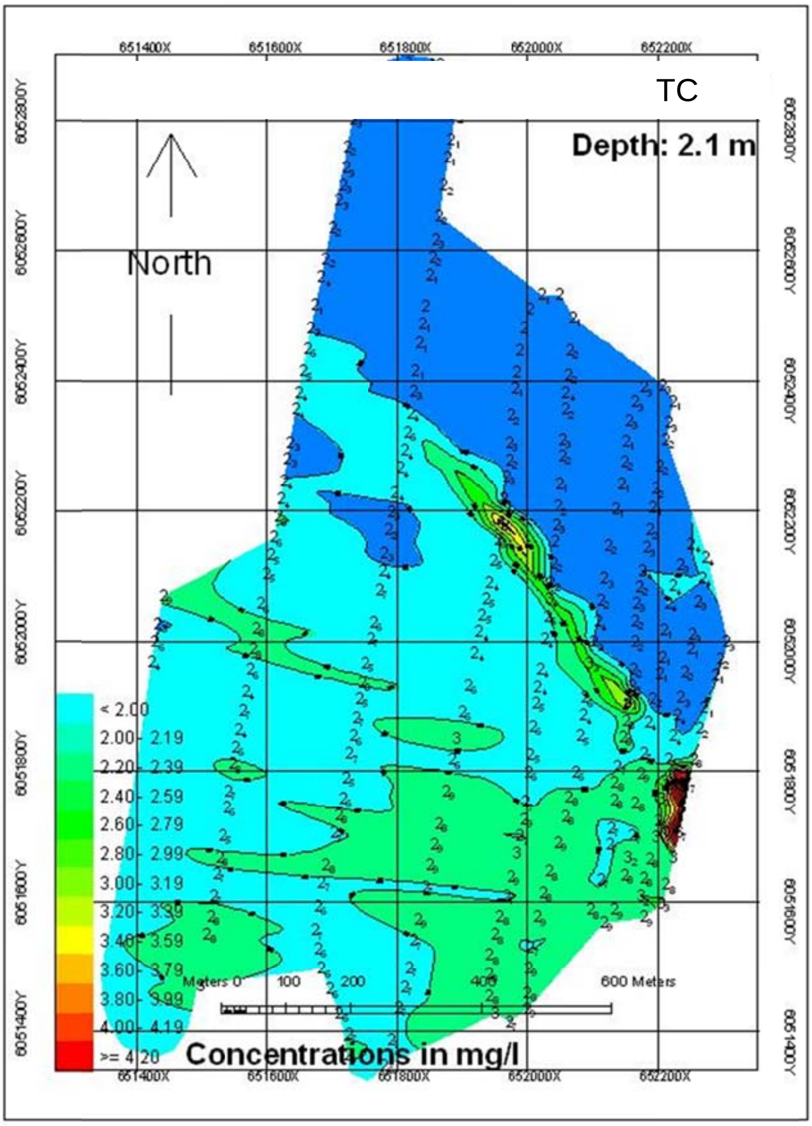


Figure 2-17 2D results from Test 7 on 17 September 2009. Results in mg/l. Concentrations measured 2.1 m below the surface between 14:25 UTC and 15:39 UTC

The observed plume extensions are shown to be in the order of magnitude of 400-600 m. For Tests 3, 4, 5 and 6 the plume extensions were even shorter and thus the mapping of these is not presented.

Low concentrations in the plume are also seen. The spill leaves the dredger at concentrations between 200 mg/l and 1000 mg/l. However, due to the low currents most of the sediment settles out long before it travels away from the dredger. An example of this is shown in Figure 2-18 for Test 7.

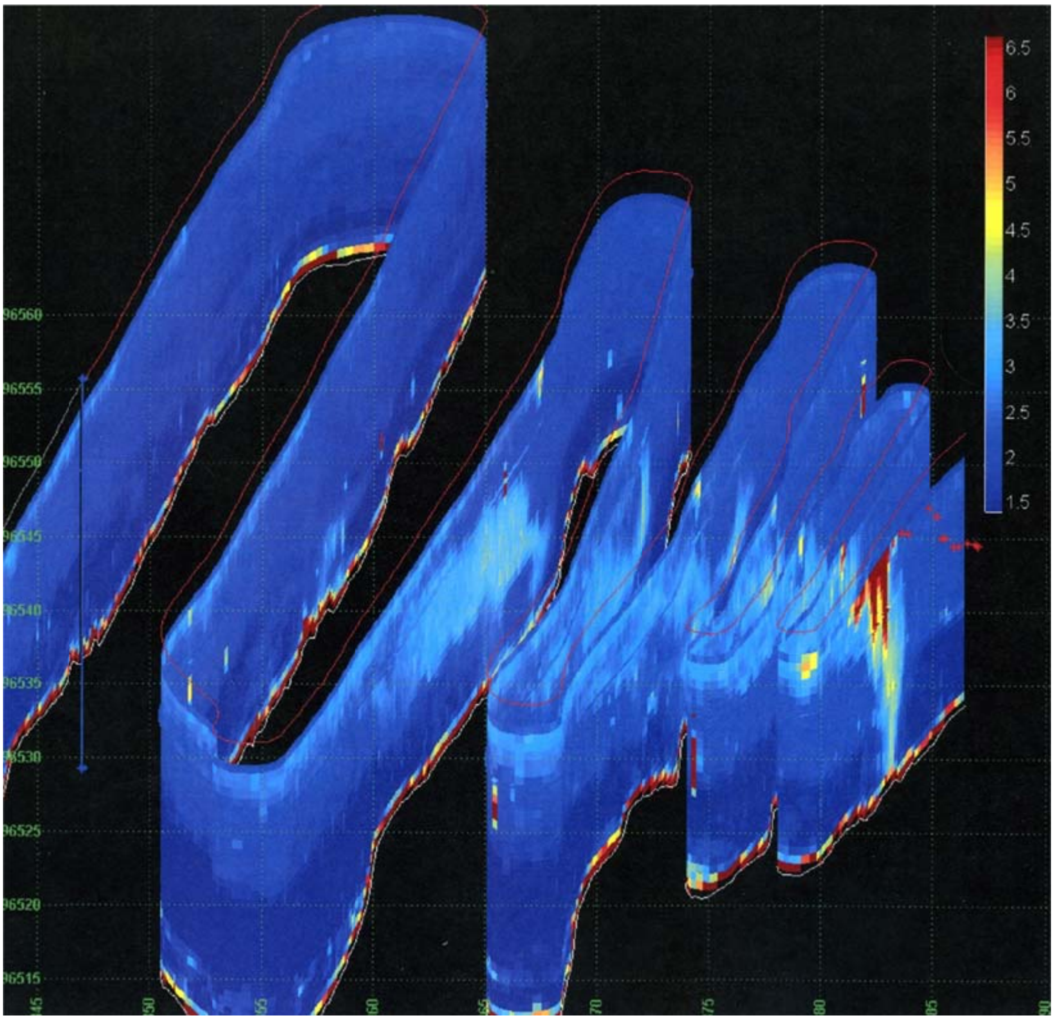


Figure 2-18 Results from Test 7 on 17 September 2009. Result in mg/l

Here it is seen that there is a lot of sediment over the entire water column very close to the dredger (right side of the plot) whereas the plume strength is quickly decreasing away from the dredger. The plume hits the bed before the last sweep at the left side of the picture. This implies that the plume is fully mapped. Due to the small velocities the sediment will settle out at a short distance from the dredger.

3 ADDITIONAL PLUME MEASUREMENTS, OCTOBER 2010

3.1 General

Additional measurements were carried out on 7 October 2010. On this date dredging took place at the geotechnical test pit in the Fehmarnbelt. The test pit is located near Geotechnical station A002. The coordinates are given in Table 3-1. When fully dredged the test pit will be 30m -70m wide and 10m deep.

Table 3-1 Coordinates of test location (UTM-32)

Station name	Easting [m]	Northing [m]
A002	645703	6042513

The dredging was carried out using the stationary backhoe dredger "Maricavor". This is depicted in Figure 3-1. This dredger type is expected to be very similar to most of the dredgers used during the actual construction of the fixed link.

Figure 3-1 "Maricavor"

Maricavor was assisted by 2-3 split-barges and the operation was almost continuous.

3.2 Equipment

The research vessel DHIVA was used for the measuring campaign. The ship is shown in Figure 3-2.

Figure 3-2 Research vessel DHIVA

A 2L Ruttner manual water sampler, a LISST 100 optical backscatter device and standard Owen tubes /6/ were used for this campaign.

3.3 Survey Procedures

DHIVA manoeuvred to the downstream side of the operation where the barges were located. From this side DHIVA sailed as close to the dredging operation as possible. The plume was very visible and therefore easily located. DHIVA manoeuvred until the boat was centred in the plume. The measurements were quickly carried out as there was a risk of the boat drifting out of the plume because the plumes were often narrow and limited. An example of a typical distance to the barge is shown in Figure 3-3.

Settling velocity tests using Owen tubes were conducted on the rear deck of DHIVA following the standard procedures for Owen tube tests, Ref /6/. Generally, the samples were taken near the surface because this was the only place where the plume was visible. Measuring further down in the water column would be under the risk of measuring outside the plume.

Figure 3-3 Typical distance to the barge

The water samples were taken using a 2L Ruttner manual water sampler, see Figure 3-4. The samples were stored in 2L plastic containers for later analysis. The samples were taken at every LISST or Owen tube position and at a number of additional positions. The water samples were later analysed for sediment concentration and primary sediment distribution. The latter was done by Malvern analysis at the University of Copenhagen.

Figure 3-4 Water sampling (Maricavor in the background)

At the positions where the LISST 100 was applied the LISST was tied to the boom of the ship and lowered down 1m at a time hereby logging the grain-size distributions over the depth. The LISST 100 was kept long enough at each depth to get several samplings. The procedure was stopped well above the seabed because the echo-sounder showed large rocks on the bed. The same procedure was applied on the way up again.

Samples with either Owen tubes or LISST measurements were made at different distances from the dredging operations in the plume downstream from the dredging operation. In this way the plume properties could be mapped.

DHI gained access to the Maricavor and retrieved a small sample of soil from the grab of the dredger. The sample was retrieved by hand and stored in a certified plastic bag. The sample was later analysed for primary grain-size distribution.

3.4 Hydrodynamic Conditions

The surface currents measured by DHI's fixed station at MS02 are shown in Figure 3-5.

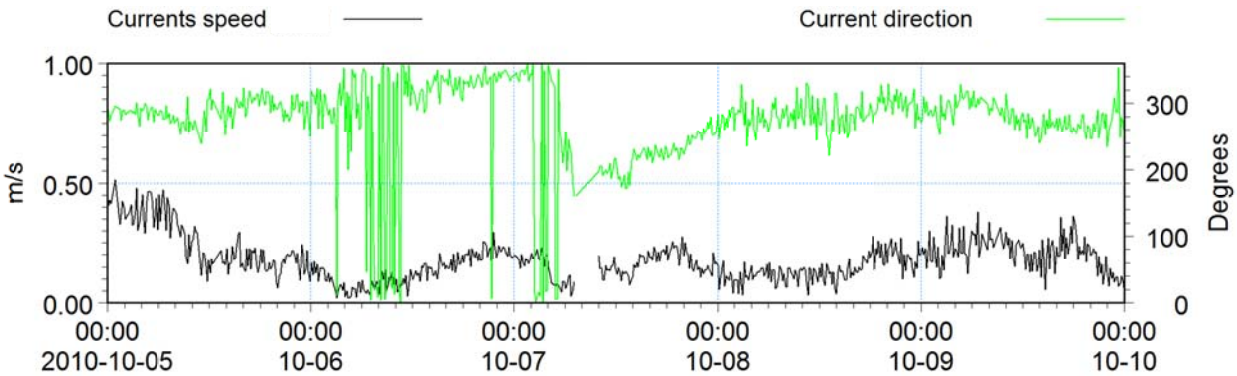


Figure 3-5 Currents as MS02

In the morning some swell waves were recorded. Generally there were easterly currents at the dredging position, small waves, low wind and slightly misty.

3.5 Analysis of Dredged Material

The soil was light brown/grey and consisted of very hard lumps, which could hardly be broken up by hand. No smell was recorded indicating low levels of organic content. A photo of the material in the barge is shown in Figure 3-6.

DHI retrieved a small sample of the dredged material from the barge. The material was taken directly from the grab.

Figure 3-6 Soil in the barge at Maricavor

The sub sample was sent to the University of Copenhagen to determine the primary grain size distribution by laser analysis. The result is shown in Figure 3-7.

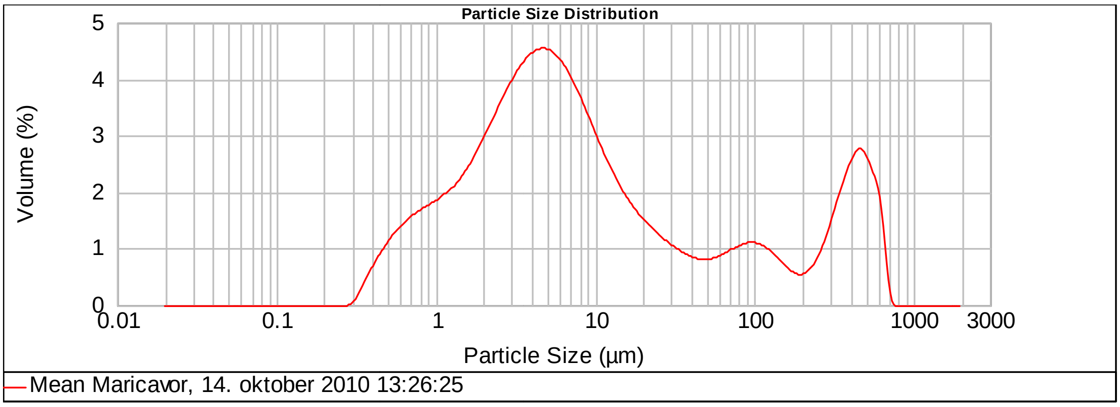


Figure 3-7 Primary particle frequency distribution in µm. Full documentation can be found in Appendix A

The results show that the dredged material consists of a large amount of particles less than 10 µm. A significant part of these particles have diameters less than 1 µm. It also shows that the sample holds a significant amount of sand that must be expected to settle fast when spilled.

3.6 Analysis of Water Samples

A series of water samples were collected during the campaign. These were taken partly for calibration purposes and partly for analysis of concentration and primary grain size distributions at different distances from the dredging operation. In Table 3-2 an overview of the gathered water samples is presented.

Table 3-2 Overview of water samples

Name	Time (UTC)	Depth below surface (m)	Distance to dredger (m)	Concentration (mg/l)
S1	10:05	5	118	3.0
S2	10:22	1	3	23.6
S3	11:35	2	350	5.4
S4	11:43	2	300	1.2
S5	12:01	2	263	2.2
S6	12:08	2	92	4.2
S7	12:14	2	50	2.1
S8	12:21	2	100	3.8
S9	13:04	2	30	10.4
S10	13:04	2	30	3.3
S11	13:11	4	40	8.1
S12	13:58	2	100	11.6
S13	14:44	3	470	2.2
S14	15:37	2	At MS02	1.3

In Figure 3-8 the primary grain size distributions are presented. Note that S14 is considered a Clearwater test without influence from the plume.

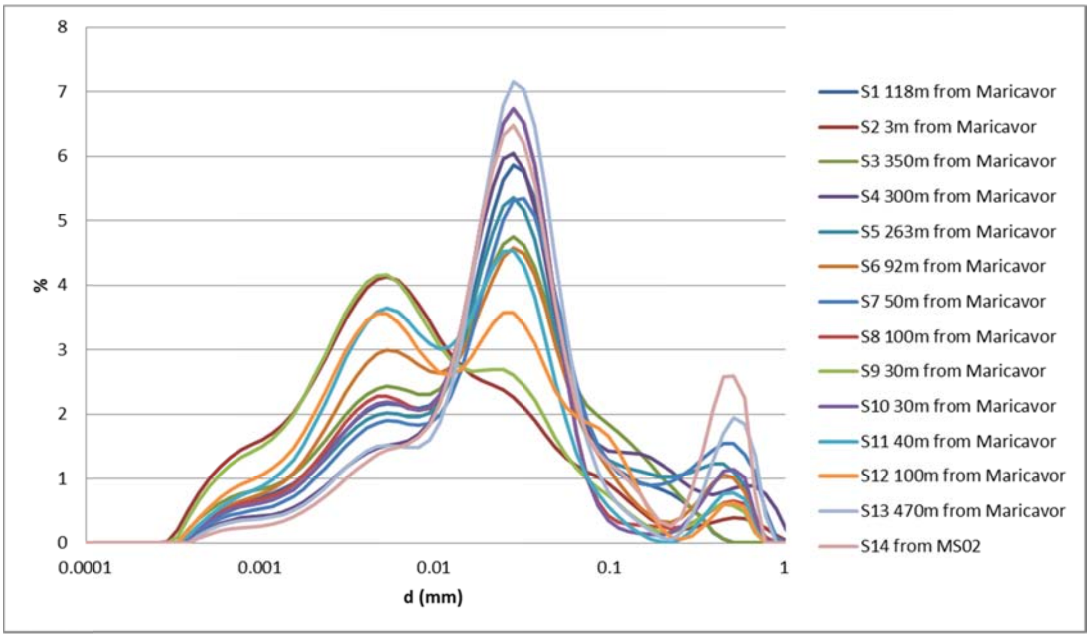


Figure 3-8 Primary particle frequency distributions measured near the Maricavor

The primary grain size distributions found in the plumes are either bimodal or monomodal. The bimodal distribution has very clear peaks at around 8μm and 80μm. The monomodal distribution has its peak at around 8μm. In some cases very different measurements are taken only a few metres from each other at almost the same time. The reason is that the measurements are made in plumes with different properties. Visual observations from the campaign indicated very local plumes with clear water in between. The bimodal plume may originate from a different geological layer than the monomodal plume. Alternatively one of the distributions originates from the dredging operation and the other from the overflow water. Some measurements show both types of characteristics indicating that the two plume types have been mixed.

Another interesting observation is that the Clearwater sample gathered from MS02 shows the same grain size distribution properties as the dredged material. This indicates that the material in suspension on this date originates from the local seabed.

3.7 LISST Measurements

Nine LISST profiles were measured. The locations were chosen in different distances from the dredger in order to monitor the plume characteristics. The LISST 100 is an optical instrument measuring grain size distributions and concentrations. The LISST measures grain size distributions between 2.5μm and 450μm. In Table 3-3 an overview of the LISST profiles is given.

Table 3-3 Overview of list profiles

Test no	Start time (UTC)	Distance from Maricavor [m]
1	13:05	30
2	13:11	40
3	12:08	92
4	12:22	100
5	12:02	263
6	11:44	300
7	11:36	350
8	14.46	470
9	15.37	At MS02 (Clearwater)

The spilled material cannot be expected to behave as primary particles when spilled. This is partly due to the material breaking up in particles larger than the primary particles and partly due to flocculation after the spill occurred. The LISST measurements of the actual grain size distributions in the plume are shown in Figure 3-9 and Figure 3-10.

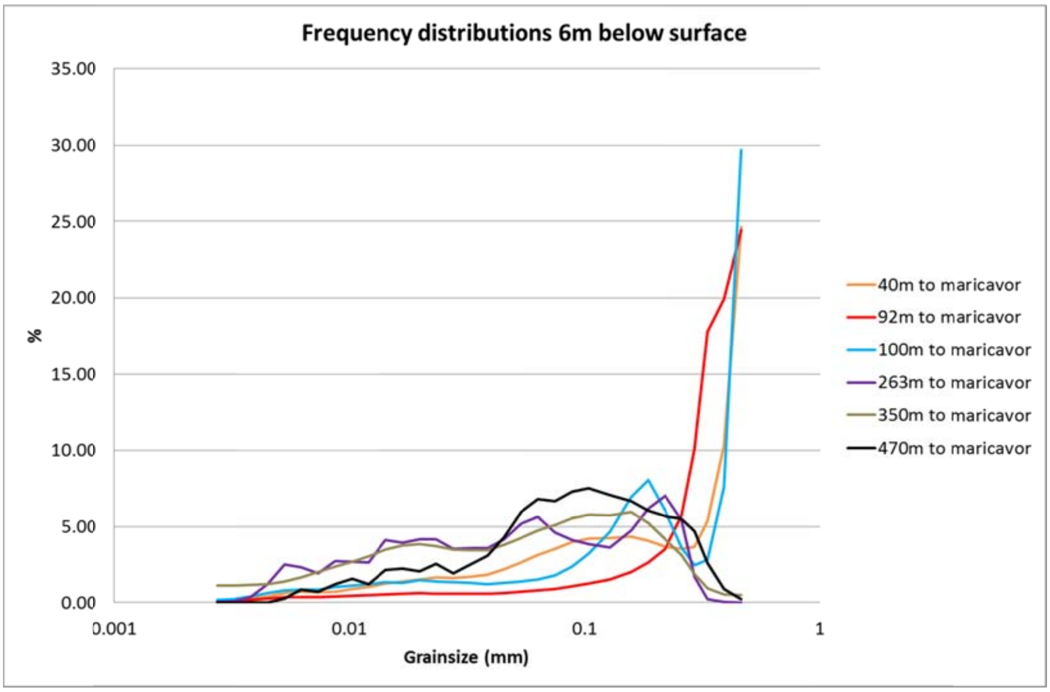


Figure 3-9 Frequency distribution approximately 6m below surface measured with LISST

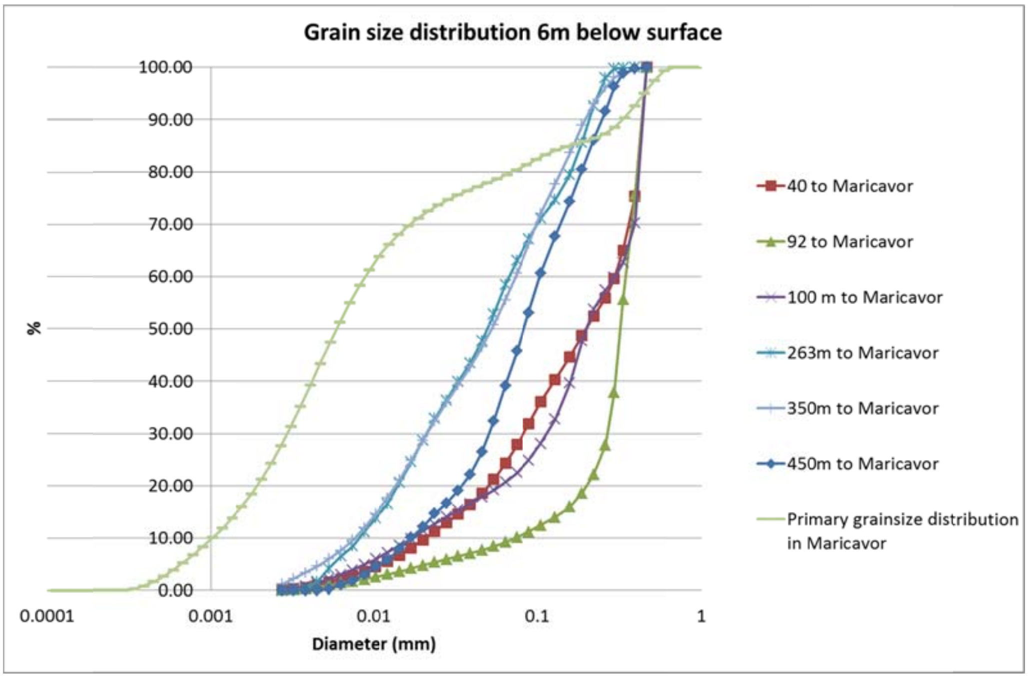


Figure 3-10 Grain size distributions approximately 6m below surface

The results show that the plume properties change when moving away from the Maricavor. Initially the plume contains particles up to 0.5mm in diameter; however, as the distance to the Maricavor increases the plume properties change. At 263m and above the plume is dominated by grain sizes less than 0.1mm. All other particles have settled. The results also show that at these distances 10-15 % of the material is less than 10μm. The change in the median grain size is given in Figure 3-11.

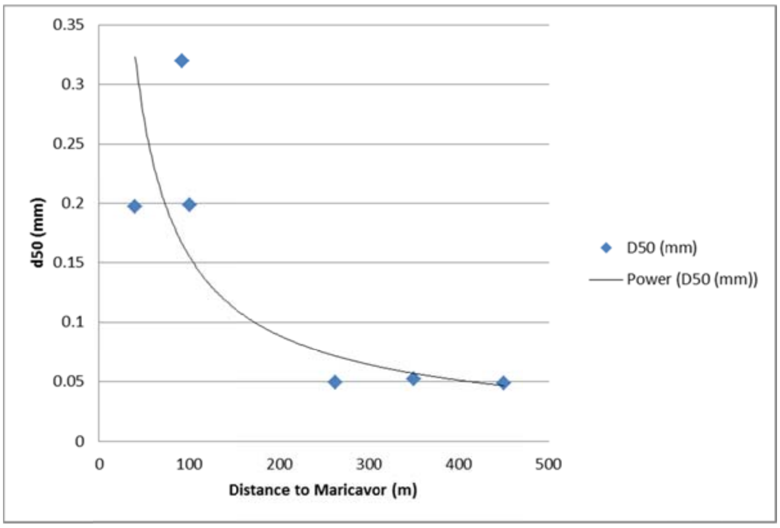


Figure 3-11 d_{50} as function of distance from Maricavor

Note that these curves are a function of the given hydrodynamic conditions and that other hydrodynamic conditions will allow the coarse material to travel further before settling.

3.8 Evaluation of Breakup Mode and Flocculation

In Figure 3-12 a comparison between the primary grain size frequencies and the measured in situ grain size frequencies is given.

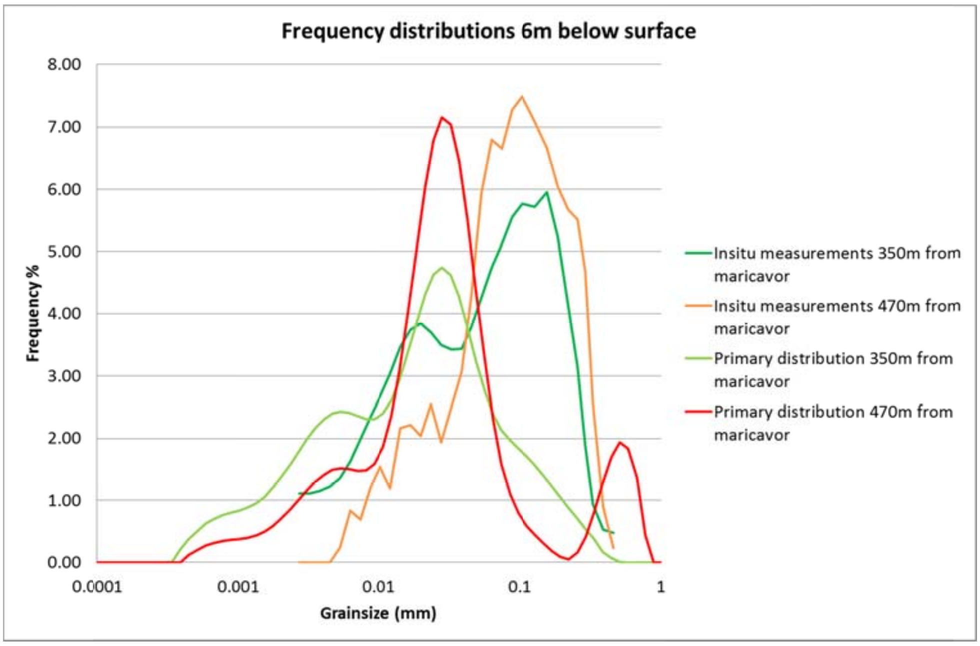


Figure 3-12 Comparison between measured in situ grain size frequencies and primary particle frequencies

In this plot two distinct peaks are seen in all measurements. By comparing the peaks from the in situ frequency distribution with the peaks from the primary frequency distribution a ratio between the flocs found in the plume and the primary distribution at the same location can be estimated. The accumulated grain size distributions are compared in Figure 3-13 and Figure 3-14.

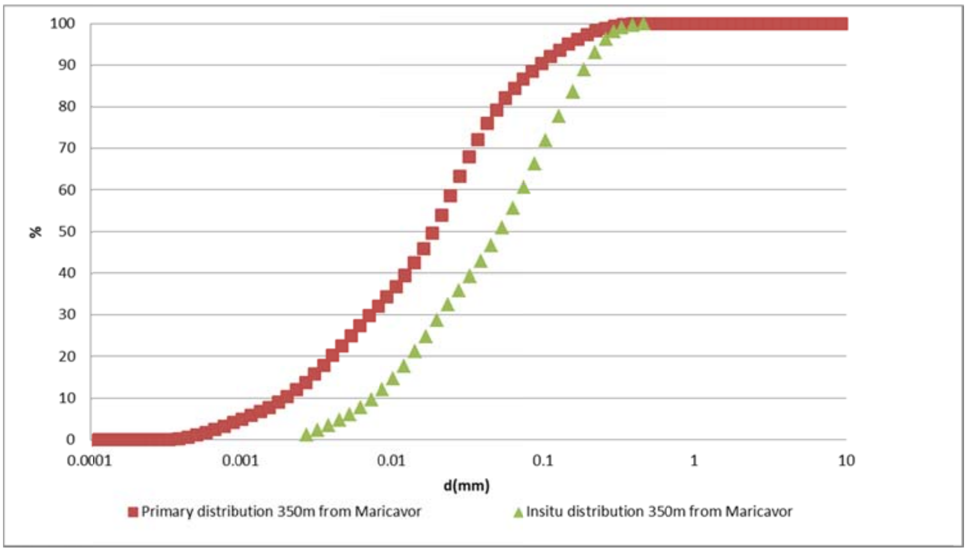


Figure 3-13 Primary grain size distribution compared to in situ grain size distribution 350m from Maricavor

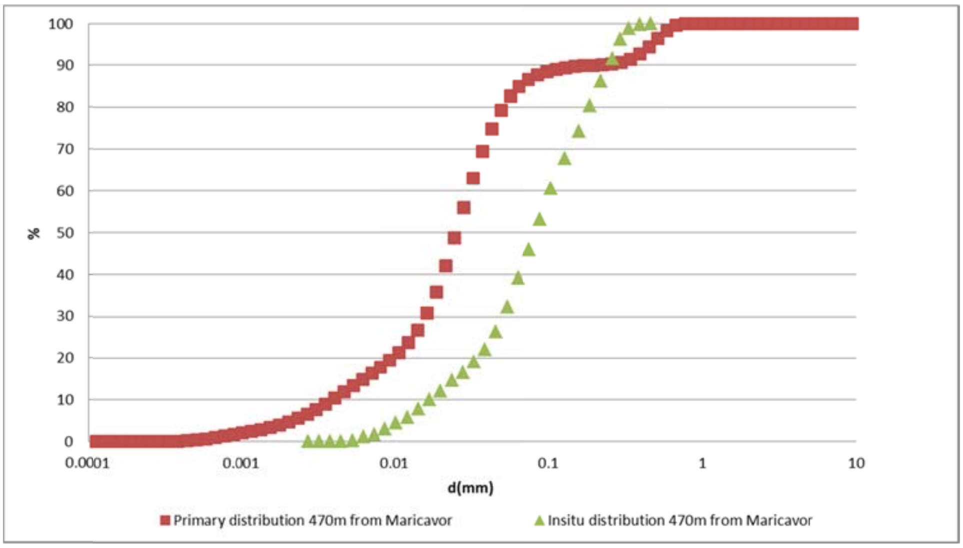


Figure 3-14 Primary grain size distribution compared to in situ grain size distribution 470m from Maricavor

Table 3-4 presents the factors between grain sizes for various exceedence frequencies for LISST measurements and primary grain size distributions.

Table 3-4 Factors between spilled floc sizes and primary grain sizes

	d_{10} (mm)	d_{20} (mm)	d_{30} (mm)	d_{40} (mm)	d_{50} (mm)	d_{60} (mm)	d_{70} (mm)	d_{80} (mm)	d_{90} (mm)	Average factor
Primary grain size distribution 350m from Maricavor	0.002	0.004	0.007	0.013	0.019	0.026	0.035	0.051	0.095	-
In situ grain size distribution 350m from Maricavor	0.008	0.014	0.021	0.034	0.052	0.073	0.099	0.139	0.195	-
Factor ($d_{insitu}/d_{primary}$)	3.8	3.4	2.9	2.7	2.8	2.9	2.8	2.7	2.0	2.9
Primary grain size distribution 470m from Maricavor	0.004	0.010	0.016	0.020	0.025	0.031	0.038	0.051	0.201	-
In situ grain size distribution 470m from Maricavor	0.017	0.034	0.037	0.048	0.082	0.103	0.138	0.184	0.247	-
Factor ($d_{insitu}/d_{primary}$)	4.3	3.5	2.3	2.3	3.3	3.4	3.7	3.6	1.2	3.1

The ratio between the primary particles and the actual floc sizes measured using LISST is approximately 3.

This ratio means that original soil has broken up or flocculated into flocs that are 3 times larger than their basic components. This can be due to the destruction mode of the original soil and it can be due to flocculation or both. However, the spill test showed that flocculation was a slow process and literature /5/ shows that at the present concentrations flocculation should not be significant. Therefore the ratio given is most likely the ratio between the breakup mode and the primary particle distribution.

Measurements conducted in a plume close to the dredger show characteristics similar to the ones found in the sample from Maricavor. A comparison between the primary particle distributions in the Maricavor and in the plume 30m away is shown in Figure 3-15.

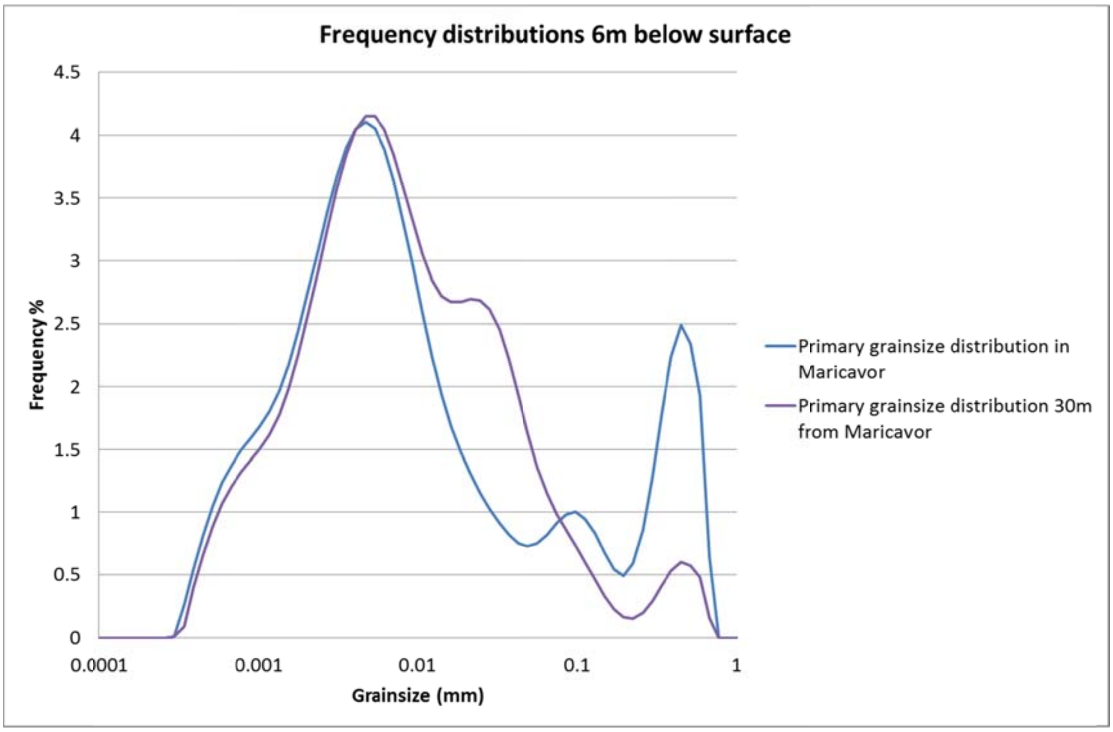


Figure 3-15 Comparison between primary grain size distribution in the Maricavor and the primary grain size distribution 30m away

The coarsest fractions have settled within 30m from the dredger. Finer grain sizes from the original soil remain in suspension when travelling away from the dredger.

3.9 Owen Tube Tests

A total of six Owen tube tests were carried out. However, most of the results were corrupted due to unsteady conditions on the research vessel. These results were therefore discarded. One test succeeded. The result is given in Figure 3-16.

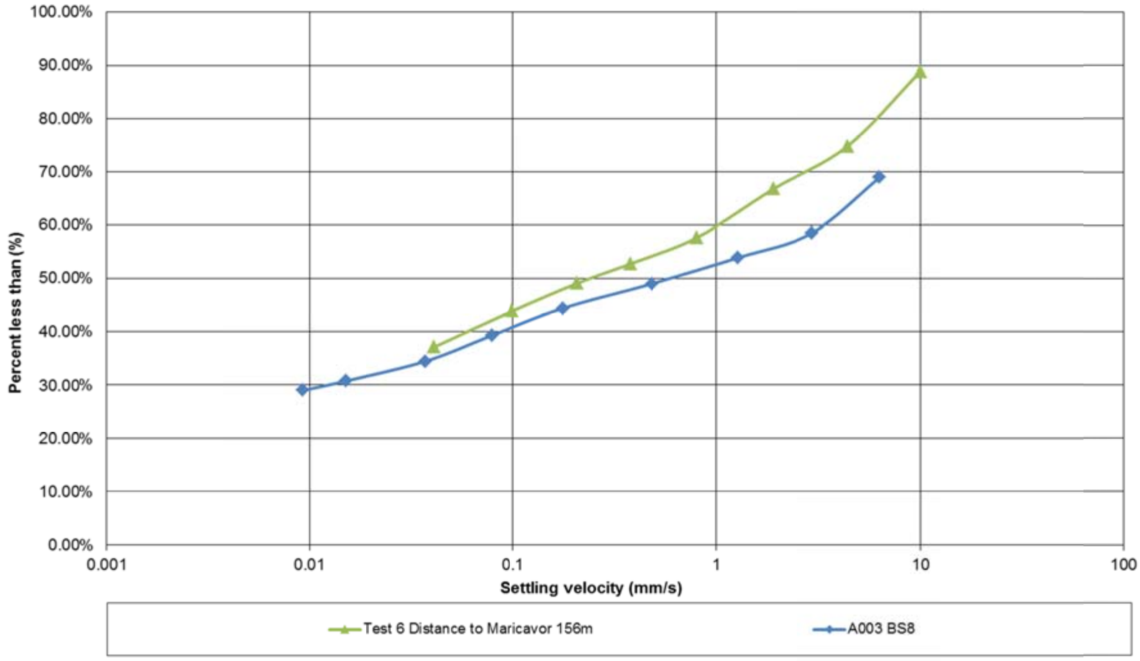


Figure 3-16 In situ owen tube test 156m from the dredger compared to laboratory Owen tube test for a similar nearby soil type (A003 BS8)

Figure 3-16 shows that at this location there is a similarity between the Owen tube tests carried out in the field and the Owen tube tests carried out in the laboratory. Both tests show that there is approximately 30% of material with a settling velocity below the lower limit for this measuring technique. The two tests show similar behaviour and the difference is less than 10%. This indicates that the breakup mode used in the laboratory is very similar to the one actually seen in the field. Note that this conclusion is based on one test only. It would require a series of tests to conclude that the breakup mode in the field and in the laboratory is the same at all locations under all conditions.

4 CONCLUSIONS

4.1 Spill Experiment September 2009, Danish Side

The present tests were performed at low current speeds which did not allow a plume to form which is sufficiently long and wide for model calibration. The current speeds and turbulence levels were so low that, in periods, most of the sediment settled very close to the release points. This has the consequence that concentrations in the plume were low and the detectable plume was short.

The results show plume extensions up to 400-600 m.

The average current speed at MS01 is around 0.3 m/s with maximum velocities above 1 m/s. The current speeds registered during the spill test periods were very low, less than 0.2 m/s. The tested conditions are therefore not representative for normal conditions in the Fehmarnbelt.

Some results for settling velocities and grain sizes are obtained from the performed spill tests, which may be used for the modelling work. However, these settling velocities represent only a few test cases with very low concentrations. The settling velocity depends on the flocculation and thus the concentration in the plume and the turbulence level. Therefore optimally more results should be collected under more representative current conditions in order to strengthen the data basis; however, the data suggests slow flocculation over time. Grain sizes will increase by a factor 2-4 and the settling velocities are measured to be between 0.05 mm/s and up to 3.66 mm/s. A significant number of tests showed median settling velocities below 0.05 mm/s. However, these tests were not long enough to determine the actual median settling velocity.

4.2 Spill Measurements October 2010, Test Pit, German Side

Additional tests performed in October 2010 showed that the mean grain size is a decreasing function of the distance to the dredger. d_{50} decreases by a factor of 7 within the first 300m from the dredger as the coarser fractions settle.

Additional tests also show that flocs travelling more than 300m away from the dredger are approximately 3 times larger than the primary particles they consist of. Physical reasons are breakup mode or flocculation.

Comparison of primary grain size distributions taken during Clearwater tests and primary distributions taken in the plumes indicate that the material in suspension away from the plume has the same grain size distribution as the sediment in the plume. This indicates that the point of origin for the background sediment is local.

The spill from the dredging operation holds at least two very different plume properties. Most likely this is due to different properties at different levels in the bed.

Comparison of an Owen tube test conducted in the field with an Owen tube test conducted in the laboratory for the same material indicates that the breakup mode in the laboratory is similar to the breakup mode found in the field.

5 REFERENCES

/1/ www.femern.dk

/2/ Rambøll's Geotechnical Investigations

/3/ RAT 542-023 0 Preliminary Spillage Assessment. Rambøl Arup Tec 24/09 2009

/4/ 11802650-11 FEHY Sediment Spill, Impact Area. Preliminary Assessment (E1-5). Report, DHI January 2009

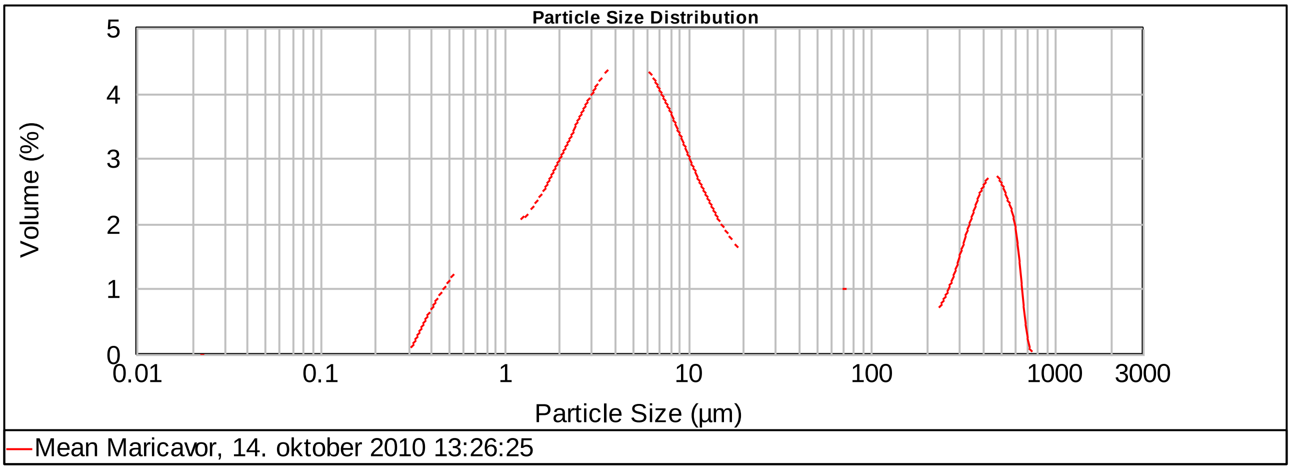
/5/ Mikkelsen, O.A. and Pejrup, M. (2001). The use of a LISST-100 laser particle sizer for in situ estimates of floc size, density and settling velocity. Geo Marine letters, 20(4), p. 187-195

/6/ Determination of the settling velocities of cohesive muds. M.W.Owen. HR Wallingford, 1988.

APPENDIX A

Grain Size Distributions from Maricavor

Grain Size Distributions from Maricavor



Size (μm)	Volume In %
0.010	0.00
0.011	0.00
0.013	0.00
0.015	0.00
0.017	0.00
0.020	0.00
0.023	0.00
0.026	0.00
0.030	0.00
0.035	0.00
0.040	0.00
0.046	0.00
0.052	0.00
0.060	0.00
0.069	0.00
0.079	0.00
0.091	0.00
0.105	

Size (μm)	Volume In %
0.105	0.00
0.120	0.00
0.138	0.00
0.158	0.00
0.182	0.00
0.209	0.00
0.240	0.00
0.275	0.01
0.316	0.26
0.363	0.55
0.417	0.82
0.479	1.04
0.550	1.24
0.631	1.38
0.724	1.50
0.832	1.59
0.955	1.68
1.096	

Size (μm)	Volume In %
1.096	1.80
1.259	1.96
1.445	2.18
1.660	2.45
1.905	2.75
2.188	3.07
2.512	3.39
2.884	3.67
3.311	3.90
3.802	4.05
4.365	4.11
5.012	4.05
5.754	3.89
6.607	3.64
7.586	3.31
8.710	2.95
10.000	2.58
11.482	

Size (μm)	Volume In %
11.482	2.24
13.183	1.94
15.136	1.68
17.378	1.47
19.953	1.30
22.909	1.16
26.303	1.03
30.200	0.91
34.674	0.82
39.811	0.75
45.709	0.73
52.481	0.75
60.256	0.82
69.183	0.91
79.433	0.98
91.201	1.00
104.713	0.95
120.226	

Size (μm)	Volume In %
120.226	0.83
138.038	0.68
158.489	0.54
181.970	0.49
208.930	0.59
239.883	0.86
275.423	1.28
316.228	1.79
363.078	2.23
416.869	2.49
478.630	2.34
549.541	1.93
630.957	0.64
724.436	0.00
831.764	0.00
954.993	0.00
1096.478	0.00
1258.925	

Size (μm)	Volume In %
1258.925	0.00
1445.440	0.00
1659.587	0.00
1905.461	0.00
2187.762	0.00
2511.886	0.00
2884.032	0.00
3311.311	0.00
3801.894	0.00
4365.158	0.00
5011.872	0.00
5754.399	0.00
6606.934	0.00
7585.776	0.00
8709.636	0.00
10000.000	

Average of 3 measurements from DHI 1 prøve Klavs Bundgaard 12-10-10.mea