ILVA

STABILIMENTO DI TARANTO

Ministero dell'Ambiente e della Tutela del Territorio e del Mare – D.G. Valutazioni e Autorizzazioni Ambientali

E.prot DVA – 2015 – 0017873 del 08/07/2015

Spett.le
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MINISTERO DELL'AMBIENTE E DELLA TUTELA DEL TERRITORIO E DEL MARE
RICEVUTO IL
07 LUG. 2015
DIREZIONE GENERALE PER LE VALUTAZIONI AMBIENTALI

Taranto: 07/07/2015
Ns. Rif.: DIR 233/15

Oggetto: DVA-DEC-2011-450 del 4/8/2011 di Autorizzazione Integrata Ambientale, come modificato dal Decreto di riesame DVA-DEC-2012-547 del 26/10/2012. Adempimenti previsti dal D.P.C.M. 14 marzo 2014 – prescrizione 16.g -60-62

In riferimento al D.P.C.M 14 marzo 2014 "Approvazione del piano delle misure e delle attività di tutela ambientale e sanitaria, a norma dell'articolo 1, commi 5 e 7, del decreto-legge 4 giugno 2013, n. 61, convertito, con modificazioni, dalla legge 3 agosto 2013, n. 89" e in particolare a quanto prescritto alla Parte II dell'Allegato " Attuazione del decreto di AIA del 26/10/2012 – prescrizioni 16.g -60-62", si trasmette con la presente la relazione sulla campagna di misura della polverosità diffusa del raffreddatore rotante:

STABILIMENTO DI TARANTO

"MEASUREMENT OF DUST EMISSIONS AT THE SINTER COOLERS D&E ILVA STELL PLANT IN TARANTO,ITALY"

redatta dalla società Kappa.
Dagli esiti della campagna di misurazione risulta evidente come le concentrazioni medie rilevate siano ampiamente al di sotto anche di un'eventuale prestazione di un sistema di abbattimento a tessuto. Normalmente per tali impianti si considerano prestazioni pari a 10 mg/Nm3 al camino.
Da quanto sopra non si ravvisa, quindi, la necessità di ulteriori interventi che reggano le condizioni di fattibilità tecnico-economica.

In considerazione dell'estensione del file, lo stesso sarà trasmesso comunque su supporto informatico.

Distinti saluti

ILVA S.p.A.
In Amministrazione Straordinaria
Stabilimento di Taranto

Il Direttore
Ing. Ruggero Cola

Pec Direzione

Da: direzione.taranto <direzione.taranto@ilvapec.com>
Inviato: martedì 7 luglio 2015 17:40
A: ministero ambiente
Oggetto: Nota ILVA S.p.A. in A. S. DIR 233/2015
Allegati: Dir 233.pdf; All. Dir 233_Relazione Kappa.pdf

Priorità: Alta

Si invia in allegato quanto indicato in oggetto.

Cordiali saluti

ILVA S.p.a. - In Amministrazione Straordinaria
Stabilimento di Taranto
Il Direttore
Ing. Ruggero Cola

Fa. ILVA S.p.A.
Dipartimento AIA
z.H. Mr. Angelo Cavallo

Via Appia km. 648 – 74100 Taranto (TA)
Italy

22. June 2015
Tel.: +39 99 4816682
E-Mail: angelo.cavallo@gruppoilva.com

Measurement report

project management Ing. Mag. Klaus Krüger

measurement: Mr. Dominik Aschauer / Mr. Helmut Huber / Mr. Martin Tscheliesnig

MEASUREMENT OF DUST EMISSIONS

AT THE SINTER COOLERS D & E

ILVA STEEL PLANT IN TARANTO, ITALY

document:	**measurement report**
client:	ILVA S.p.A.
measuring site:	Via Appia km. 648 – 74100 Taranto (TA)
Measurement period	Oct. 2014 – Feb. 2015
report generation:	Dominik Aschauer
Version:	6.0 including measurement campaign 09.13.02.2015

Table of content

1. INTRODUCTION

company

Fa. ILVA S.p.A.
Dipartimento AIA
Via Appia km. 648 – 74100 Taranto (TA) 24. October 2014
Italy

operator

Fa. ILVA S.p.A.
Dipartimento AIA
Via Appia km. 648 – 74100 Taranto (TA) 24. October 2014
Italy

Measuring site

Cooler plant D:
40°30'32.5"N 17°13'05.2"E
Cooler plant E:
40°30'30.0"N 17°13'07.5"E

type of production plant

Sinter cooler

measurement period

Oct. 2014 – February 2015

measured values

- temperature
- vertical flow velocity
- dust concentration
- particle size distribution

participating parties

ILVA S.p.A.

- Mr. Cavallo, Angelo
- Mr. Petronelli, Nicola
- Mr. Pulito, Piero
- Mr. Di Tursi, Gaetano
- Mr. Dimetri

Kapppa Filter Systems GmbH

- Mr. Aschauer, Dominik
- Mr. Huber, Helmut

- Mr. Tscheliesnig, Martin

Technical responsibility

- Mr. Aschauer, Dominik
- Mr. Huber, Helmut
- Mr. Tscheliesnig, Martin

2. DESCRIPTION OF THE PLANT

description of the production process and sources of emissions

After the sintering process the material is loaded onto a sinter cooler, to be cooled down to ambient temperatures. Pressurized air is being blown through the rotating bowl of the sinter cooler, leaving through a hood at the top of the sinter cooler.

Method for the reduction of dust emissions

On top of the sinter cooler a hood has been erected to reduce the emission of dust. On the upper side of the hood the cooling air leaves the sinter cooler through a number of defined openings.

Technical information to the sinter cooler

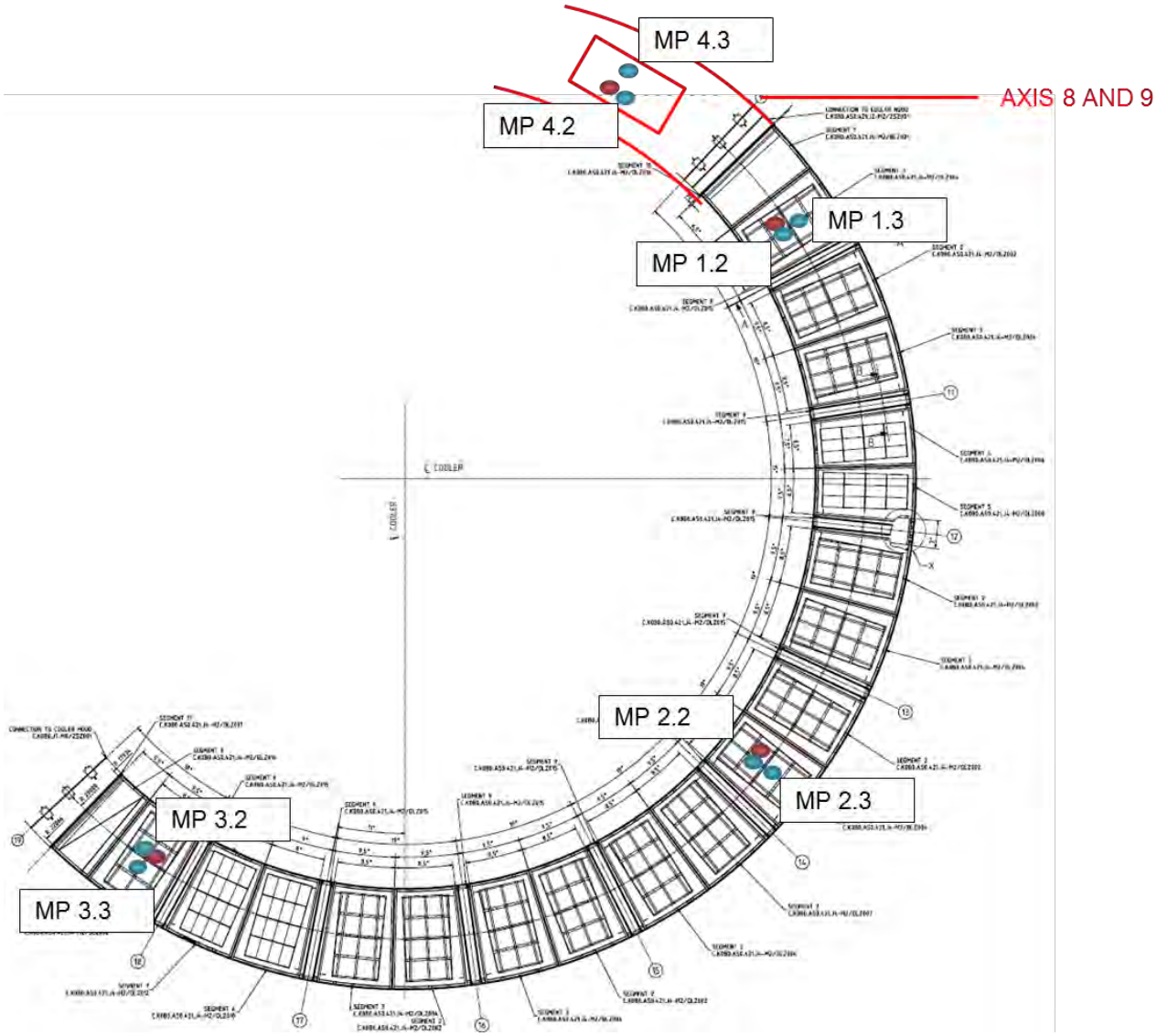
– diameter:	~ 40 m (to the center of the cooler)
– cooling surface	~ 426 m² (width of 4,12 m)
– bulk density of the material:	~ 1700 kg/m³
– top level of the enclosure:	~ 9,4 m
– usual material loading of the sinter cooler:	~ 800 – 1.000 t/h
– usual cooling duration:	90 min (0,7 U/h)
– cooling method:	air throughput by air fans, each 400.000 Bm³/h
– pressure of the fans:	1.200 Pa

operating conditions

In the measurement plan an evaluation of the worst case-scenario by operating the sinter coolers in full-load operation was suggested.
The actual operating conditions are collected by ILVA S.p.A. and will be included when received.

3. DESCRIPTION OF THE MEASUREMENTS

measurement points at the sinter cooler
(identical construction and identical measurement procedure of cooler D and E)



Legend:

Gravimetric measurements performed at the top of the cooler with gravimetric dust measurement device according to EN13284 to determine a representative total dust concentration:

Duration/measurement point: minimum 60min.

setup time/measurement point: ~ 30 min.

- MP x*4.2g approximately 0,75m aside of the central diameter of the sinter cooler in direction of the center of the cooler between axis 8 and 9
- MP x*1.2g approximately 0,75m aside of the central diameter of the sinter cooler in direction of the center of the cooler between axis 9 and 10
- MP x*2.2g approximately 0,75m aside of the central diameter of the sinter cooler in direction of the center of the cooler between axis 13 and 14
- MP x*3.2g approximately 0,75m aside of the central diameter of the sinter cooler in direction of the center of the cooler between axis 18 and 19

* x stands für “D” for cooler D respectively “E” for Cooler E

Further measurements with the aerosol spectrometer to determine the particle size distribution.

Additionally the following values will be measured simultaneously to the dust concentration measurements:

- gas temperature
- representative vertical flow velocity
- particle size distribution

Duration/measurement point: minimum 20min.

setup time/measurement point: ~ 10 min.

- MP x*4.2a approximately 0,75m aside of the central diameter of the sinter cooler in direction of the center of the cooler between axis 8 and 9
- MP x*4.3a approximately 0,75m aside of the central diameter of the sinter cooler in direction of the surroundings of the cooler between axis 8 and 9
- MP x*1.2a approximately 0,75m aside of the central diameter of the sinter cooler in direction of the center of the cooler between axis 9 and 10
- MP x*1.3a approximately 0,75m aside of the central diameter of the sinter cooler in direction of the surroundings of the cooler between axis 9 and 10
- MP x*2.2a approximately 0,75m aside of the central diameter of the sinter cooler in direction of the center of the cooler between axis 13 and 14
- MP x*2.3a approximately 0,75m aside of the central diameter of the sinter cooler in direction of the surroundings of the cooler between axis 13 and 14
- MP x*3.2a approximately 0,75m aside of the central diameter of the sinter cooler in direction of the center of the cooler between axis 18 and 19
- MP x*3.3a approximately 0,75m aside of the central diameter of the sinter cooler in direction of the surroundings of the cooler between axis 18 and 19

* x stands für “D” for cooler D respectively “E” for Cooler E

➢ measurements of air velocity

measurement method

For the evaluation of the flow rate of open systems no measurement guideline is applied. The measurement is carried out in accordance to a KAPPA standard.

Measurement equipment

manufacturer:	Testo GmbH
type:	Testo 417
Measurement range:	0,3...20m/s or 0...50°C
Accuracy:	1...12 m/s... 5% or 12...30 m/s...2%

- **air temperature measurements**

Measurement equipment

manufacturer:	Testo GmbH
type:	Immersion measurement tip Type K
Measurement range:	-200 to +1300 °C
Accuracy:	±(0.3 °C + 0.1% of m.v.)[1]

- **pressure measurements**

Measurement equipment

manufacturer:	Testo GmbH
type:	Testo 480 (internal digital manometer)
Measurement range:	0...+2000hPa or 0...+60°C
Accuracy:	±0,5% of m.v. or ±3°C

- **surface temperature measurements**

Measurement equipment

manufacturer:	Voltcraft
type:	IR 650-12D
Measurement range / Accuracy:	
- 50 bis 20 °C	± 2,5 °C ± 1,3 °C
20 bis 300 °C	± 1% of the measurement range ±1°C ± 0,5% of the measurement range or ± 0,5°C
300 bis 650 °C	± 1,5 % ± 0,5% of the measurement range or ± 0,5°C

- **Gravimetric measurements according to EN13284**

measurement method

According to BIA 3110 and EN13284 - Part 1 with the limitations listed below (modifications)

Measurement equipment

Filter supporting
Planar filter Munktell MG 160 ∅37mm
Gas meter Elster type BK-G4T
pump Paul Gothe GmbH type SB.6 TV
analytical scale Sartorius type Basic-Plus
flowmeter Kobold type KSK-1150-A-K20-00

[1] Stated is the measurement uncertainty of the measurement device. Due to the measurement uncertainty of the measurement method – therefore see page 18 – the total measurement uncertainty can be higher.

Measurement uncertainty: specified with the measurement results

➢ Measuring of the particle size distribution / aerosol spectrometer

measurement method

According to the 9080 BIA, BIA 2600, with the following restrictions:
The measurement of the light scattering photometer is used primarily to estimate the particle concentration - without a gravimetric measurement for comparison only relative results are delivered. To gain absolute values, a single comparison measurement must be performed at the same measurement point.

Measurement equipment

Manufacturer:	Grimm
Type:	Aerosol Spectrometer 1.108
Measurement range:	1 to 2.000.000 Particles/Liter
	0,1 to 100.000 µg/m³
Reproducibility:	+/- 3% across the measurement range

- EN13284-1 (as a guideline) 01.03.2002
  „ stationary source emissions – Determination of low range mass concentration of dust – Part 1: manual gravimetric method “
- VDI 4219 01.08.2009
  „Determination of the uncertainty of emission measurements by use of discontinuous measurement methods“
- BIA 9080 Stand: Oktober 1992
  „Streulichtphotometrie zur Feinstaubmessung“
- BIA 2600 Stand: Oktober 1993
  „Empfehlung zum Einsatz der Streulichtphotometrie im Rahmen der Arbeitsplatzüberwachung“
- BIA 3110 Stand: April 1994
  „Isokinetisches Probenahmesystem (IPS) zur Messung der Konzentrationen partikel- und dampfförmiger Stoffe in strömender Luft durch Teilstromentnahme“

4. MEASUREMENT REFERENCE

- several measurements on sinter coolers in the years 2011 and 2012 at different sinter plants operated by the Austrian Voestalpine in Linz, Austria and Donawitz, Austria.

5. NECESSARY MODIFICATIONS TO THE MEASUREMENT PLAN DATED 12.06.2014

1. It was not possible to access all three measuring points per measuring position. The measuring point at the inner diameter of the sinter cooler was not accessible. To reach the inner measurement point the lifting platform including the measurement setup would have been to be dismounted and re-erected after the positioning the lifting platform at the center of the sinter cooler. As the goal was to perform the measurements at one measurement point (e.g. MP 1.x) in close time interval, the measurement point at the inner diameter of the sinter cooler was sorted out and two measurement points were taken laterally from the central diameter of the sinter cooler.
2. To carry out isokinetic sampling during the 1st and 2nd measurement campaigns was not possible. Because of the difficult measurement conditions (long sampling pipe) the risk of loss of the dust sample during the manipulation of the lifter was rated too high. Therefore, the pipe was aligned approximately 60° upward.

6. STATISTICAL EVALUATION OF THE CORRELATION FACTOR

Evaluation of a mean density of the dust

For the calculation of a mean density of the measured dust, two different types of measurements have to be conducted at the same measurement point simultaneously (for the same measurement period):

1. Gravimetric measurement according to EN13284
2. Measuring of the particle size distribution with the aerosol spectrometer

With the gravimetric measurement device alone, no differentiation of the particle size fractions can be made. Only the total dust concentration is measured, which contains particles in different sizes.

A separation in the particle size fractions is possible with the application of an aerosol spectrometer. (although no dust concentration e.g. in mg/Nm³ can be determined, as the mean density of the measured dust is unknown)

From the comparative measurements, a correlation factor can be extracted, which refers to a mean density of the analysed dust sample. With the correlation factor, a dust concentration can be assigned to the information gained with the aerosol spectrometer. (e.g. in the unit mg/Nm³)

These comparative measurements have been conducted at following measurement points:

- MP1.2 sinter cooler D – 1st measurement campaign
- MP3.2 sinter cooler D – 1st measurement campaign
- MP3.2 sinter cooler D – 7th measurement campaign
  - 3 consecutive measurements have been performed during the 7th campaign at MP3.2
- MP2.2 sinter cooler D – 6th measurement campaign

From these measurement points a statistical evaluation of the correlation factors for the conversion of the aerosol spectrometer measurement results into a dust concentration has been made. A mean correlation factor has been identified from the comparative measurements. Therefore by application of the evaluated correlation factor, a dust concentration can be assigned to each measurement done with the aerosol spectrometer. For the conversion of the data collected with the aerosol spectrometer, always the evaluated mean correlation factor is used.

From a total of 6 comparative measurements a **mean correlation factor** of **2,727** has been evaluated. The measurements for the evaluation of a correlation factor were pre-selected taking the material density of Steel into consideration. Therefore comparative measurements which resulted in an unrealistically high or low material density have been excluded from any further evaluation. This was done in accordance to common evaluation standards, which require for a plausibility check to be conducted.

With a statistical confidence level of 85%, the evaluated correlation factor lies between **2,563** and **2,890**.

Evaluated correlation factor	*Confidence level 85%*	
	Lower limit of the confidence interval	Higher limit of the confidence interval
2,727	2,563	2,890

Due to the lack of normative regulations regarding the measurement procedure of diffuse emissions, the confidence level of 85% was chosen by Kappa in terms of reasonable discretion.

Influence of the mean density of the dust onto the aerosol spectrometer measurements

The conversion of the data collected with the aerosol spectrometer into a dust concentration in the unit mg/m³ has been carried out with the mean density of the dust evaluated in the previous chapter. (Evaluation of a mean density of the dust)

Therefore in consequence the results of single measurements the dust concentration measured with the gravimetric measurement device according to EN13284 and the dust concentration calculated with the data from the aerosol spectrometer can differ.

In doubt, the higher value applies!

7. MEASUREMENT RESULTS

general

measured values

All measured values (concentrations) in %, ppm or mg/m³ are understood as relative measurements and refer to 273K (0°C), 1.013 mbar and dry gas conditions.

Exception: measured values recorded with the aerosol spectrometer (dust monitor) in the paragraph “statistical information” are expressed as mass concentrations (mg/m³) and refer to the gas volume under operating conditions.

The measurement results are documented in the following chapter:

campaign 1

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
09.10.2014 10:39	09.10.2014 11:37	28	1016,4	~ 1,8m above the enclosure

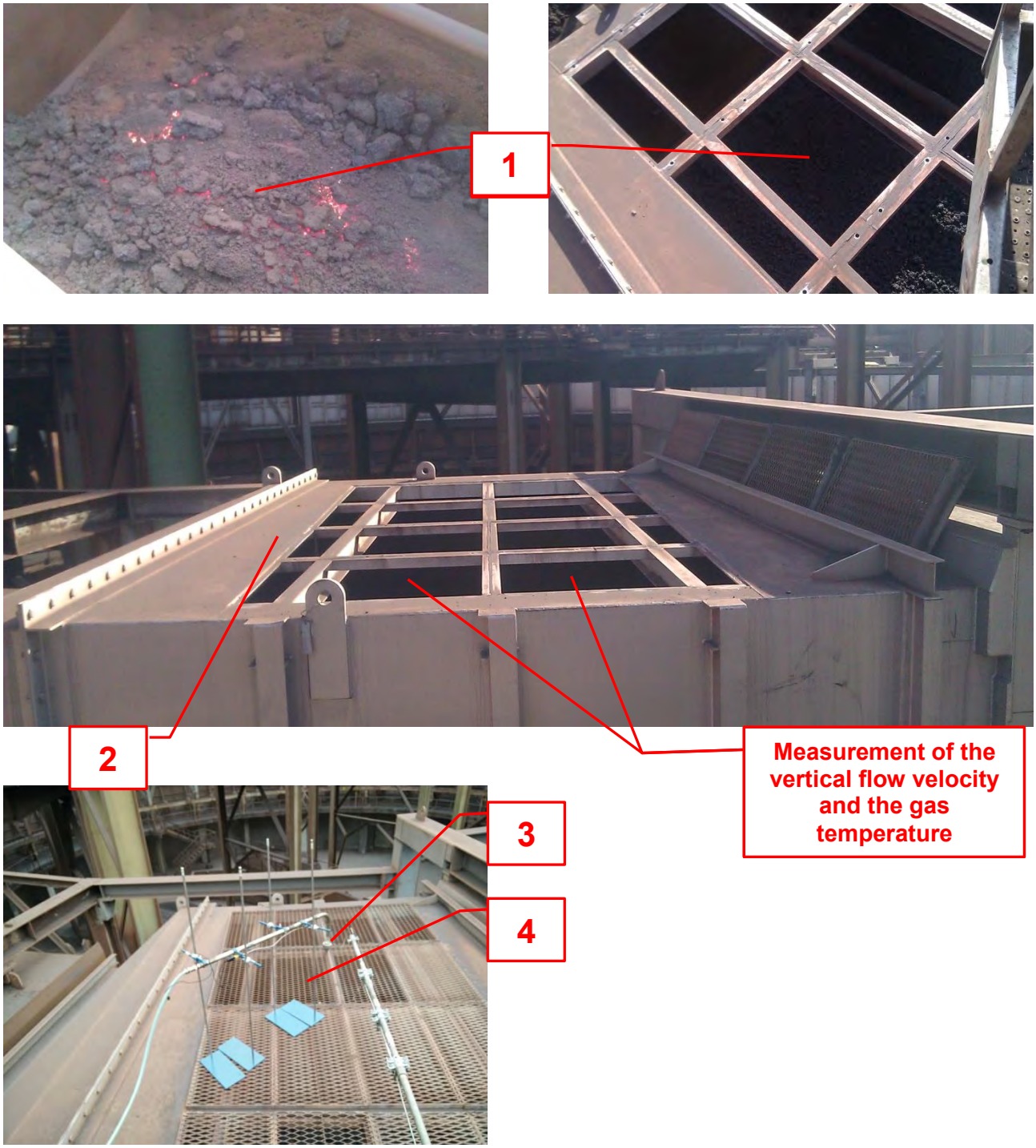
temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
(1)	**(2)**	**(3)**	**(4)**	
°C	**°C**	**°C**	**°C**	**m/s**
460	225	300	209	5,0

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
10:39	11:37	3,65	0,19	5,21

Comparison with the operational data collected by ILVA

During the measurement period the cooling time of the sinter material peaks at 100min. The calculated speed of the sinter cooler remains at about 1,26 m/min. The sinter temperature at the discharge point of the sinter machine peaks at about 390°C (11:10). The sinter production varies significantly due to sample taking.

Exemplary description of the measurement points



The illustration is exemplary and can be applied for each measurement point in the same fashion.

campaign 2

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
10.10.2014 16:55	10.10.2014 17:55	33	1016,4	~ 1,5m above the enclosure

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
420	230	>340	335	3,8

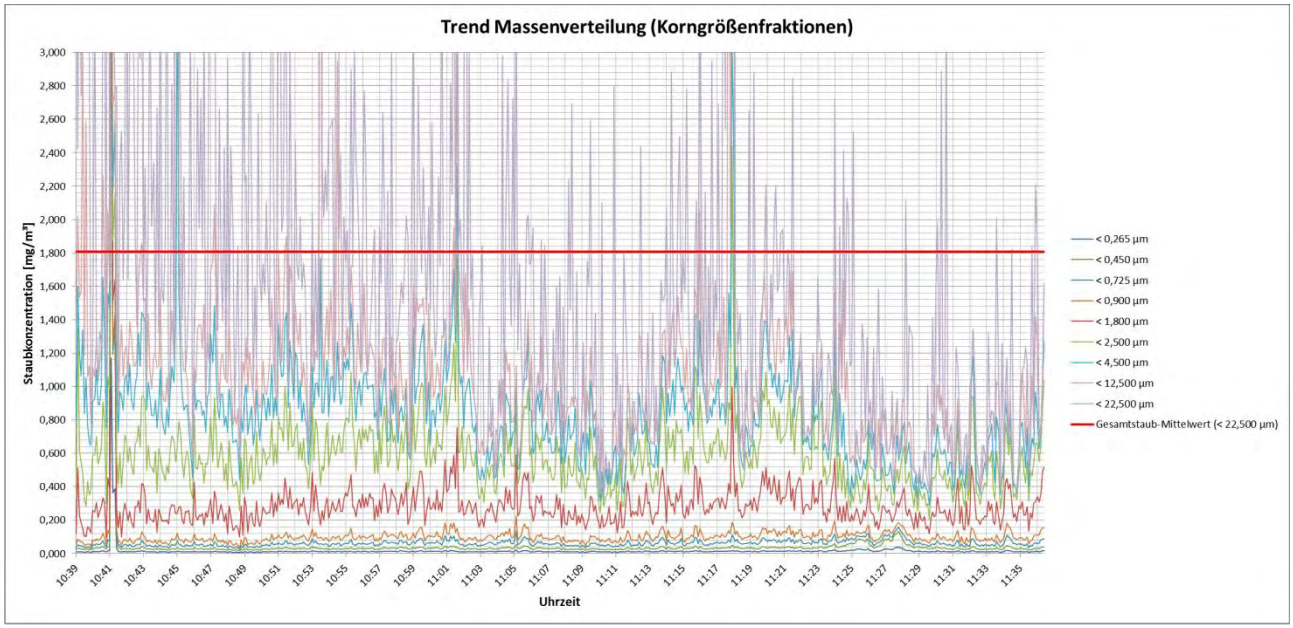
total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
16:55	17:55	0,93	0,13	13,98

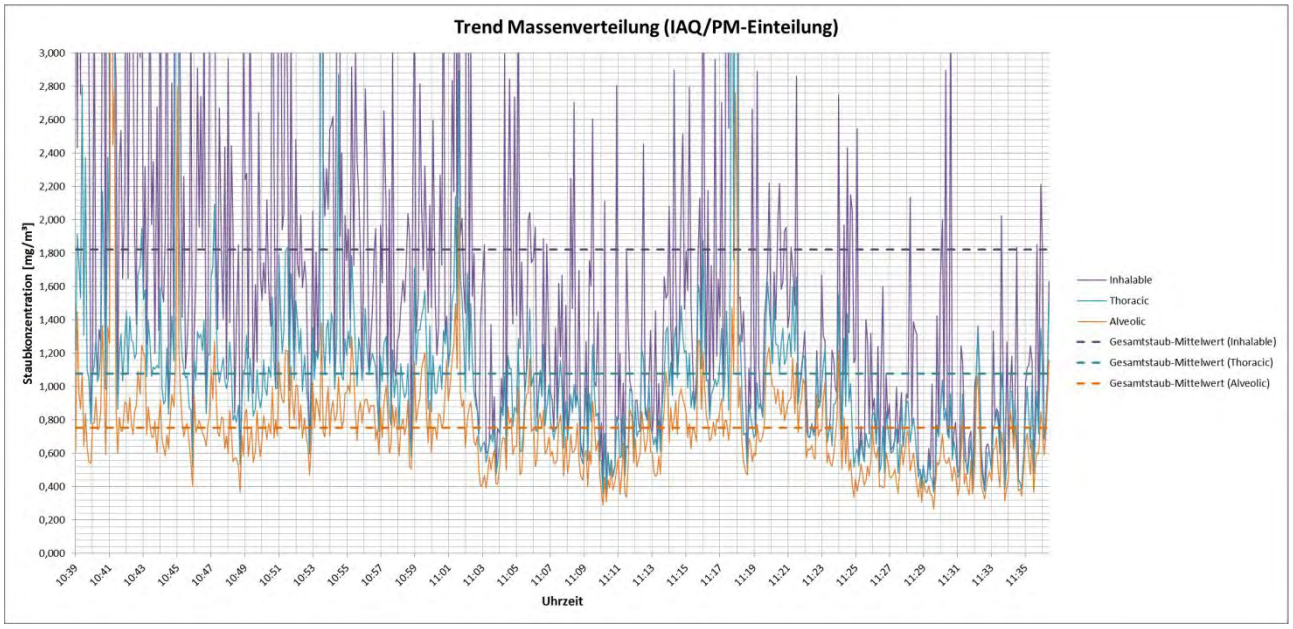
Comparison with the operational data collected by ILVA

The sinter cooler was operated very steady-going, though being out of operation between 17:30 and 17:36. The calculated speed of the sinter cooler remains at about 1,4 m/min. The sinter temperature at the discharge point of the sinter machine drops significantly when the cooler is taken out of operation.

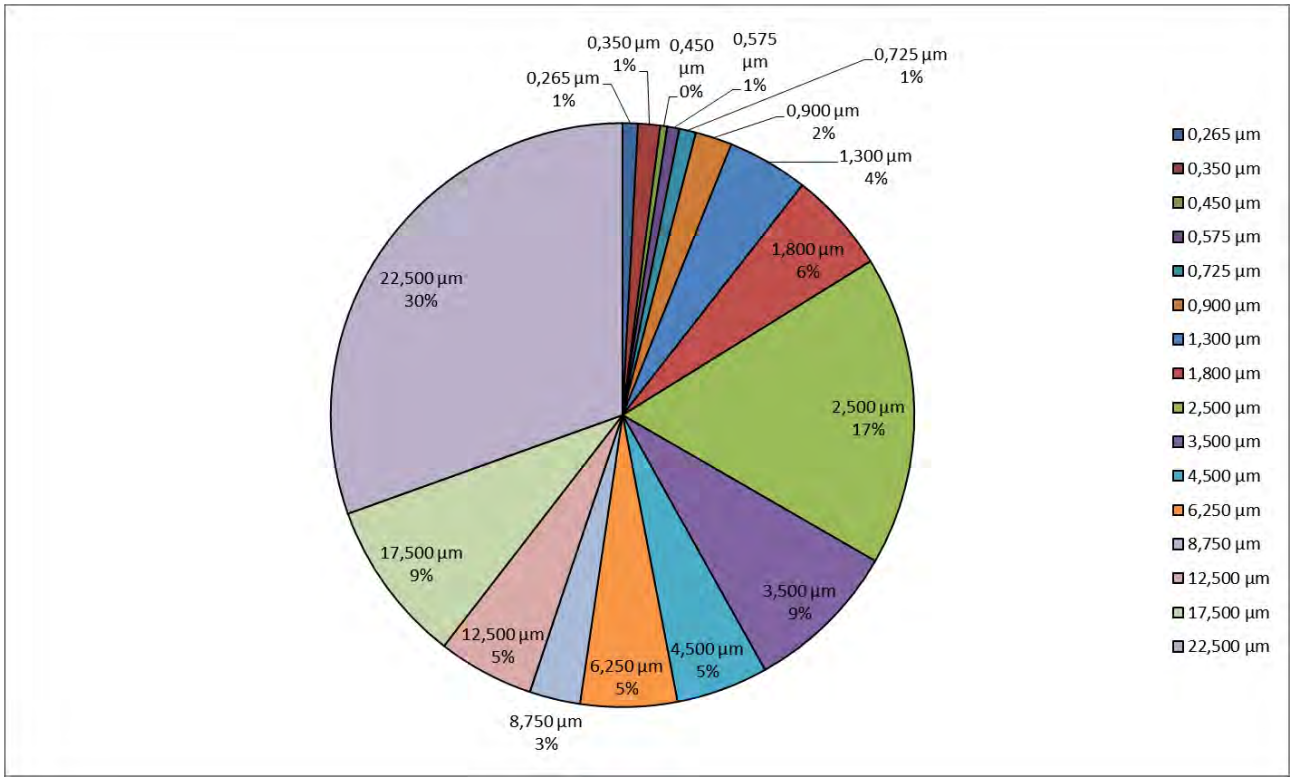
campaign 1

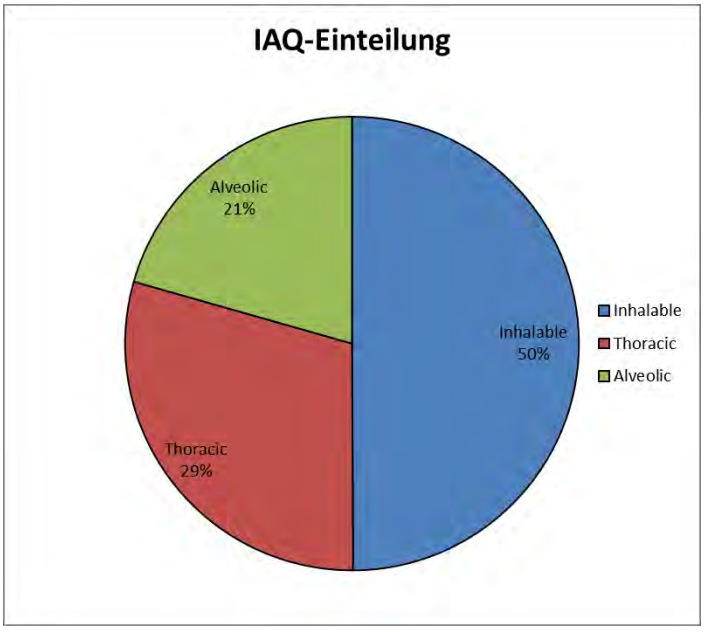
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,007	0,003	0,005	0,004	0,008	0,032	0,000	0,079	0,027	0,003	0,000	0,000	0,000	0,000	0,000
Maximum	1,168	2,477	0,418	0,039	0,048	0,099	0,199	0,612	1,444	1,400	1,498	2,710	2,188	2,972	6,565	26,679
Duchschnitt	0,015	0,022	0,007	0,012	0,017	0,037	0,081	0,101	0,310	0,155	0,092	0,097	0,051	0,096	0,163	0,551

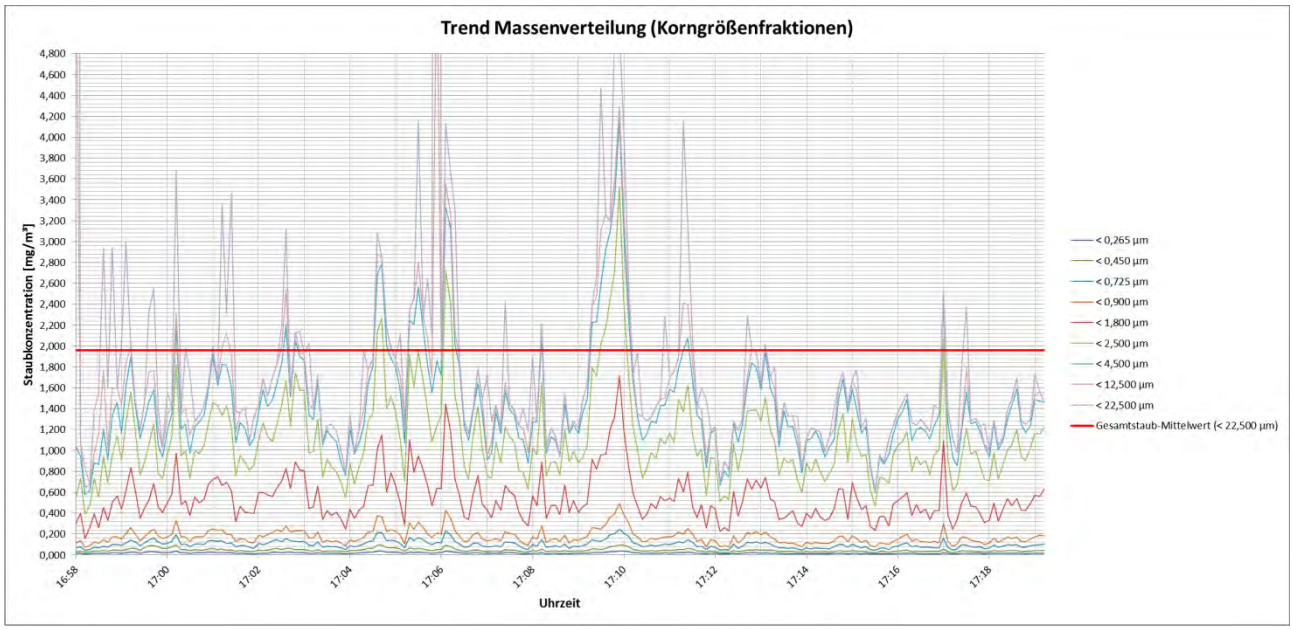
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,335	0,173	0,053	0,353	0,352	0,266
Maximum	8,196	5,972	5,445	39,903	9,272	6,406
Duchschnitt	0,978	0,468	0,152	1,824	1,077	0,752

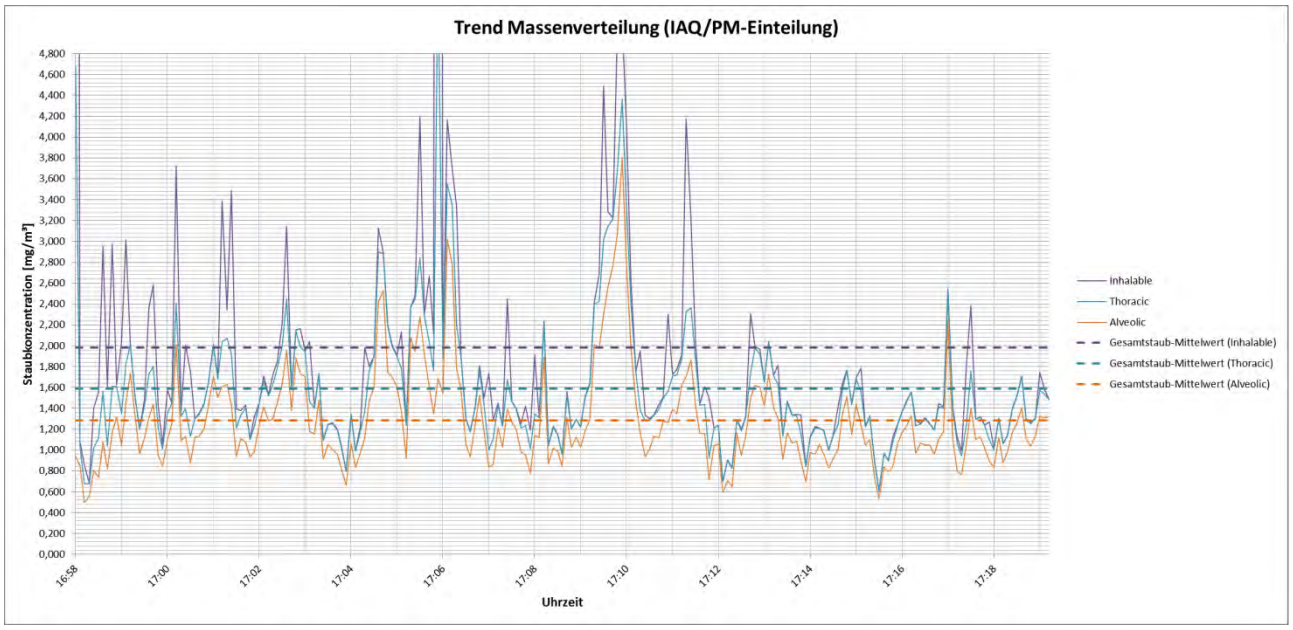
- **comments:**

no comments

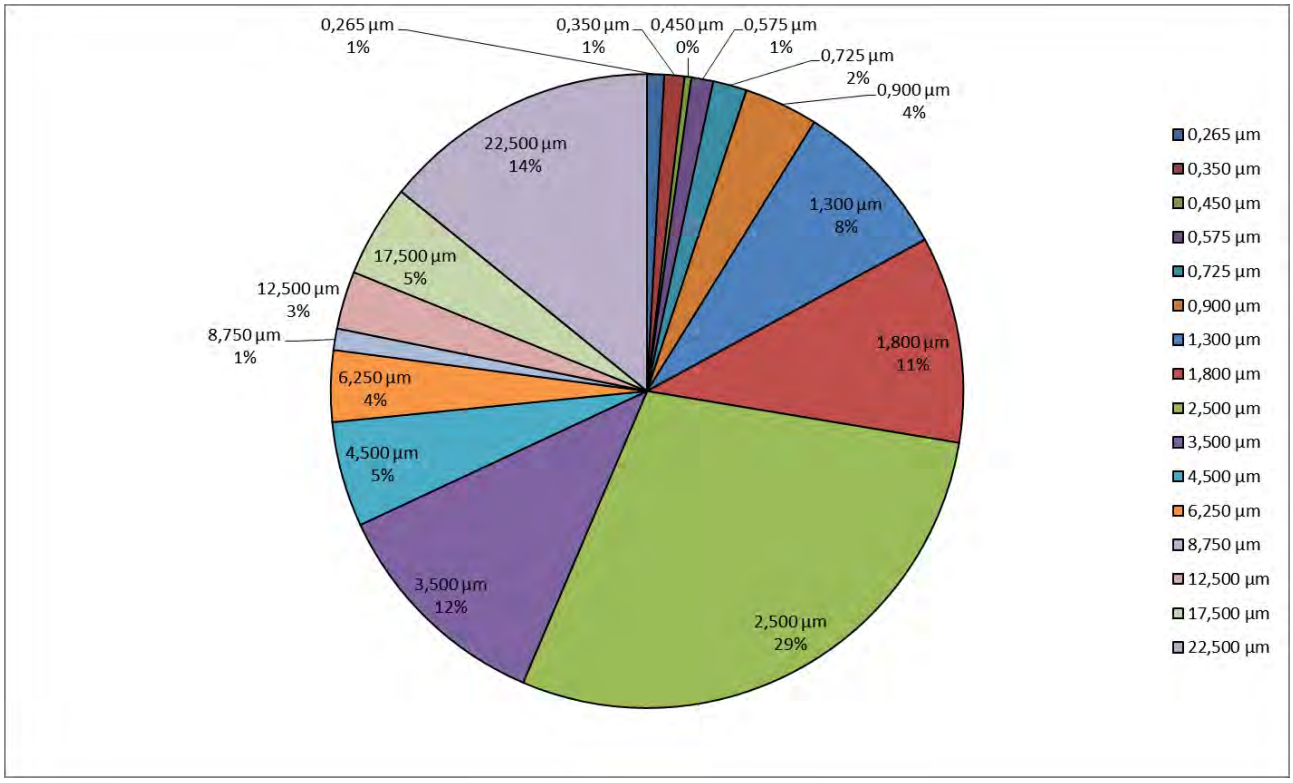
campaign 2

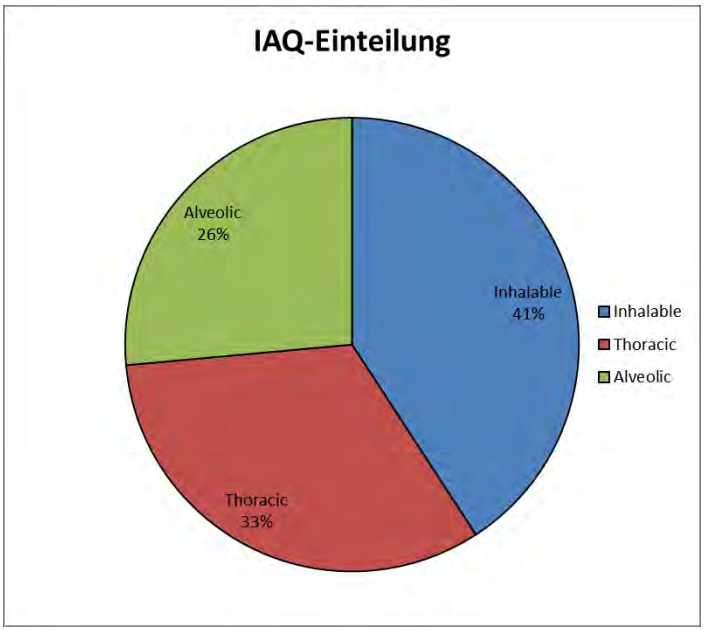
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,009	0,010	0,003	0,009	0,013	0,024	0,058	0,026	0,212	0,089	0,030	0,009	0,000	0,000	0,000	0,000
Maximum	0,037	0,046	0,015	0,056	0,100	0,246	0,544	0,678	1,812	0,567	0,264	0,544	0,696	3,697	6,167	19,719
Duchschnitt	0,017	0,020	0,007	0,022	0,034	0,074	0,161	0,207	0,565	0,228	0,105	0,071	0,021	0,058	0,092	0,278

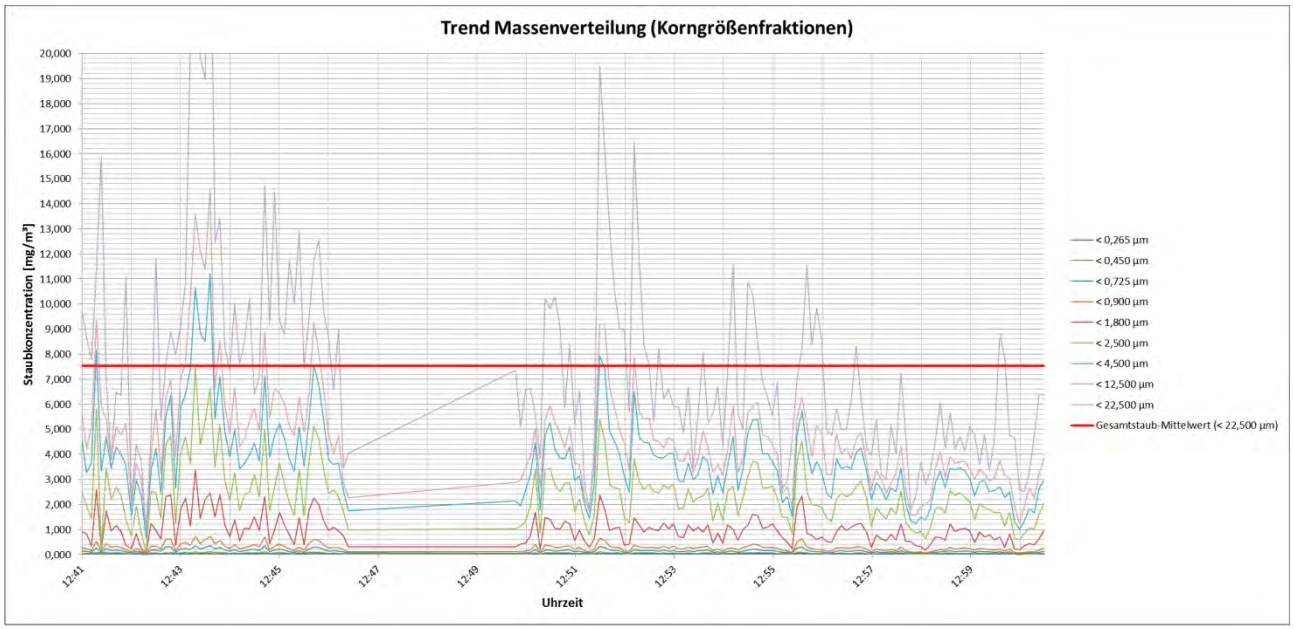
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,578	0,290	0,095	0,610	0,609	0,497
Maximum	4,097	2,646	0,701	31,785	5,637	3,808
Duchschnitt	1,481	0,844	0,242	1,979	1,588	1,283

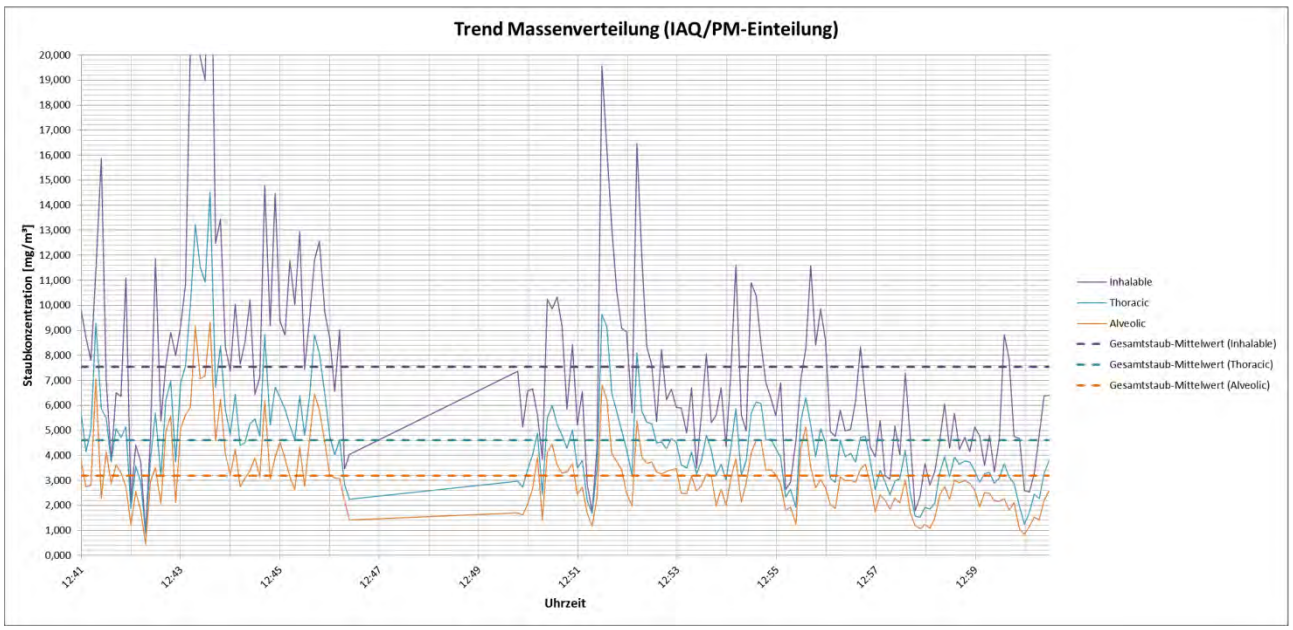
- **comments:**

no comments

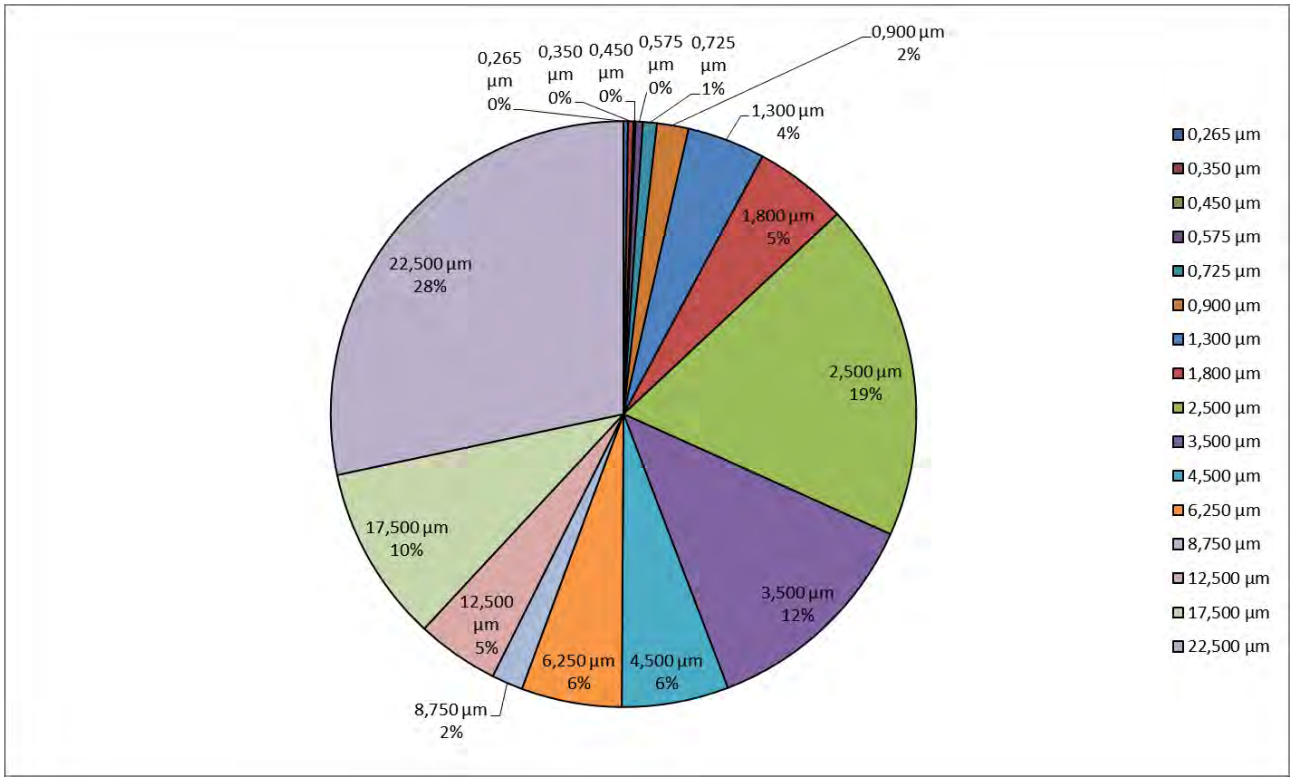
campaign 4

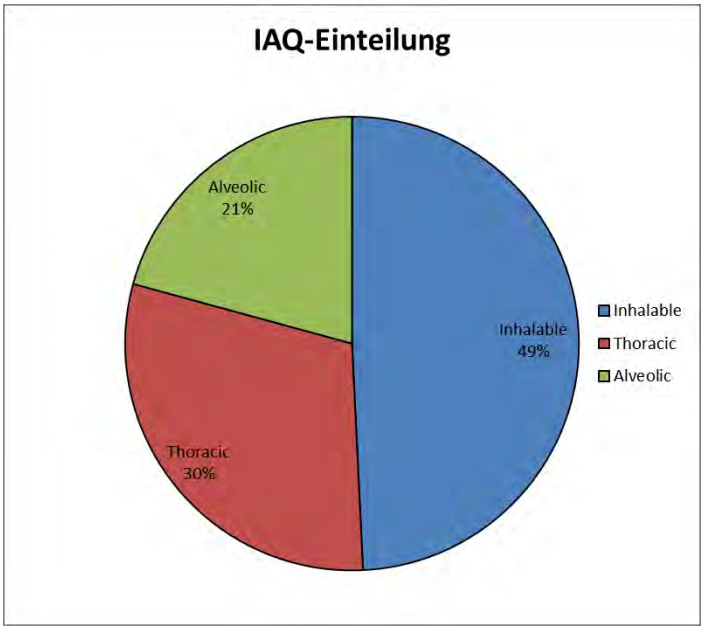
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,007	0,003	0,005	0,005	0,011	0,018	0,000	0,000	0,247	0,088	0,072	0,000	0,000	0,000	0,000
Maximum	0,035	0,045	0,024	0,086	0,163	0,380	0,910	1,739	4,211	3,035	1,532	1,631	0,572	1,450	3,382	10,440
Duchschnitt	0,019	0,023	0,008	0,030	0,058	0,131	0,324	0,388	1,406	0,939	0,444	0,417	0,130	0,342	0,733	2,131

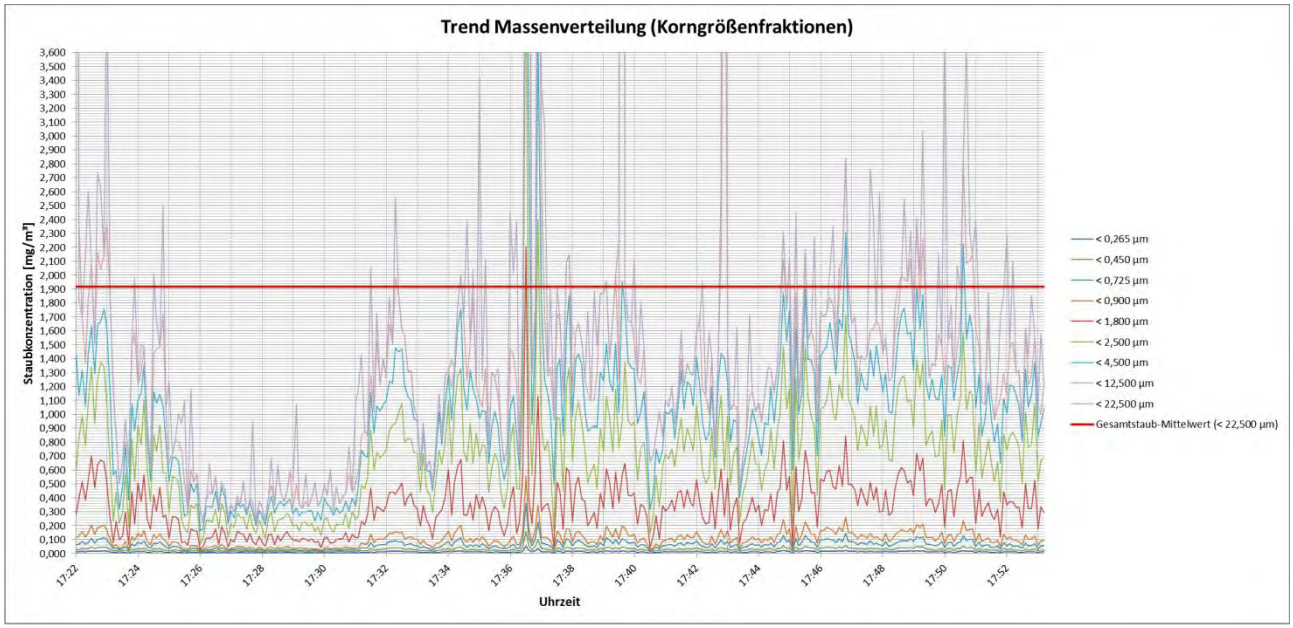
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,790	0,106	0,041	0,920	0,861	0,464
Maximum	12,893	5,478	1,156	28,441	14,534	9,331
Duchschnitt	4,159	1,748	0,410	7,544	4,598	3,182

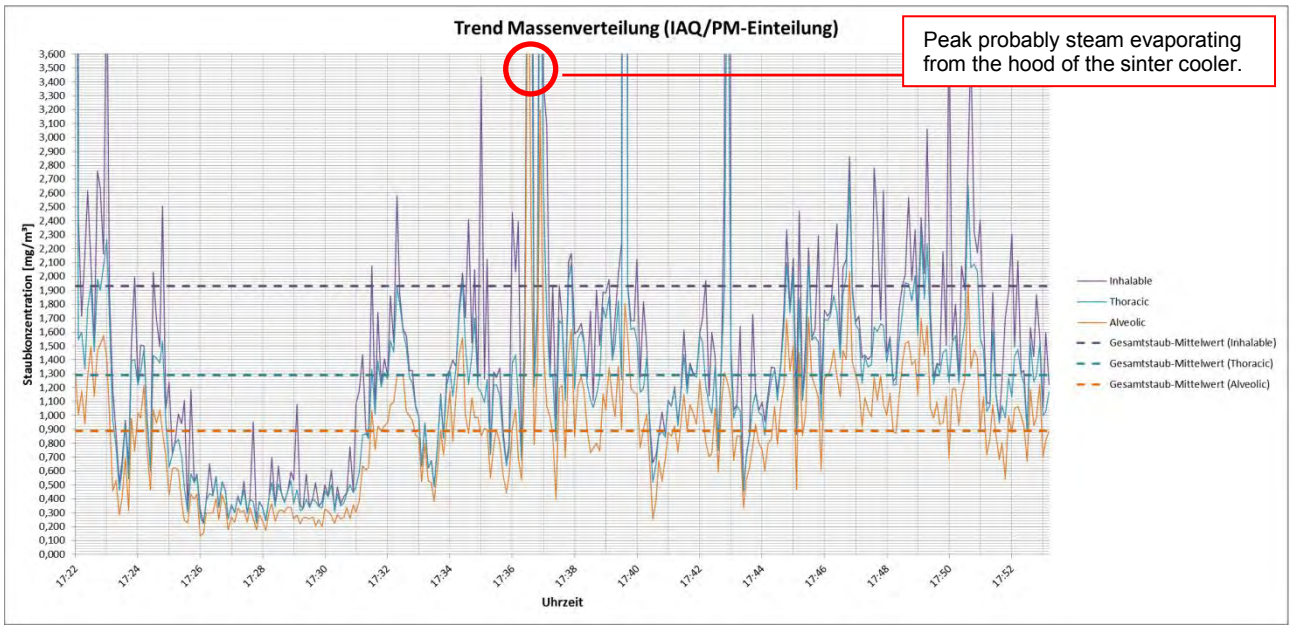
- **comments:**

Interruption of the measurement due to a connection problem.

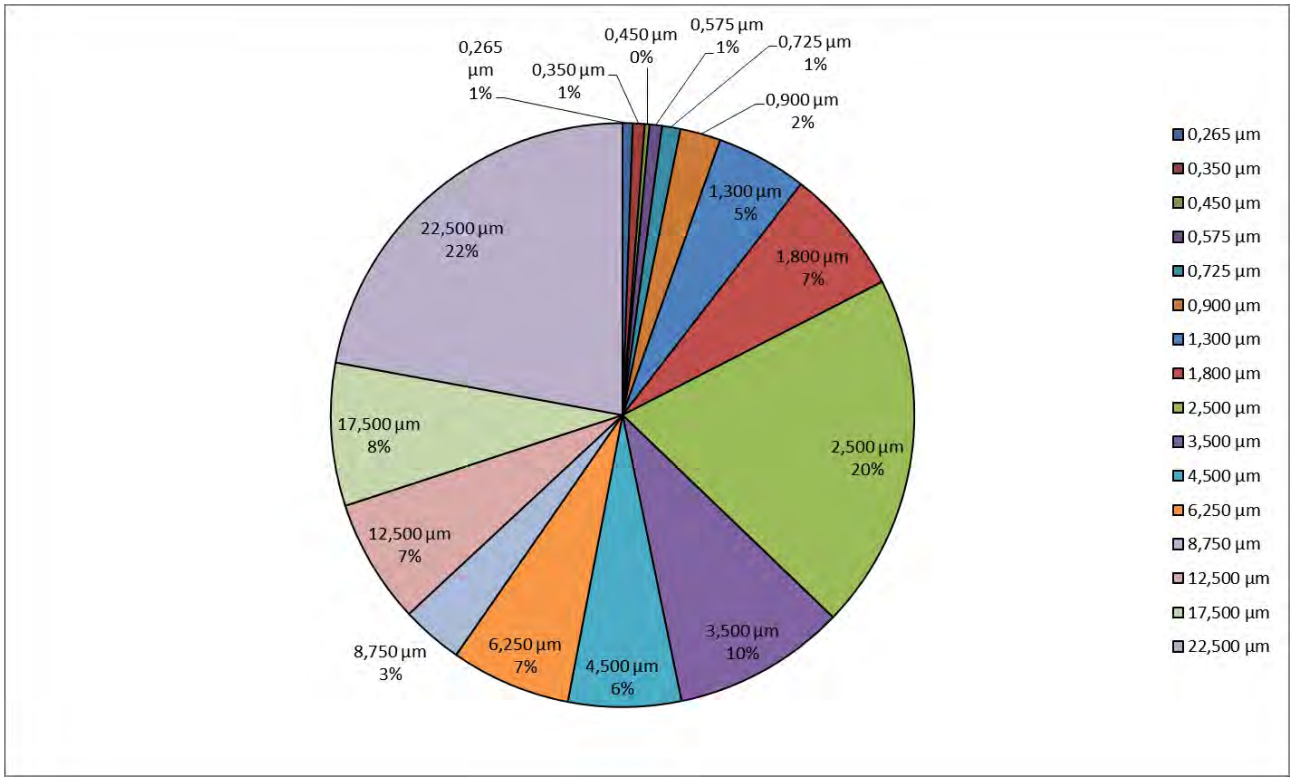
campaign 2

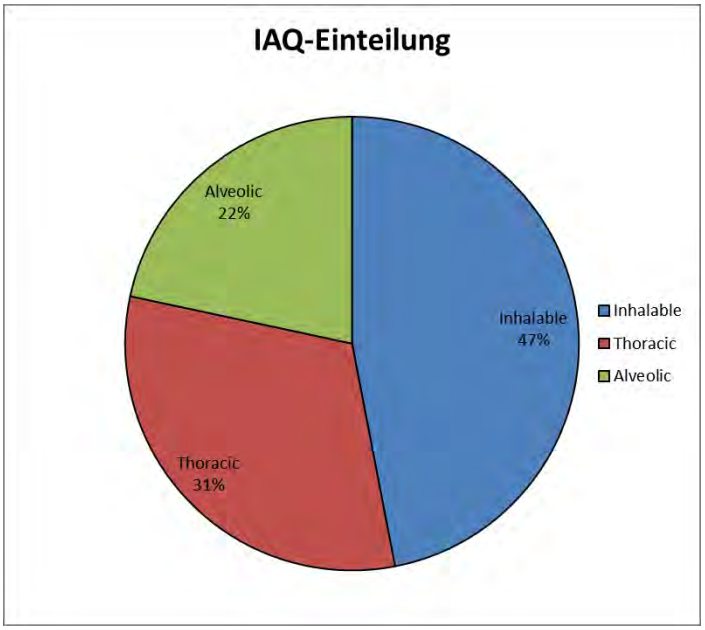
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,005	0,002	0,002	0,002	0,004	0,008	0,000	0,039	0,025	0,017	0,009	0,000	0,000	0,000	0,000
Maximum	0,053	0,063	0,042	0,092	0,109	0,194	0,444	1,206	2,213	0,982	0,906	1,115	2,213	12,542	21,684	52,198
Duchschnitt	0,011	0,013	0,005	0,013	0,020	0,043	0,097	0,134	0,378	0,184	0,120	0,128	0,066	0,132	0,152	0,424

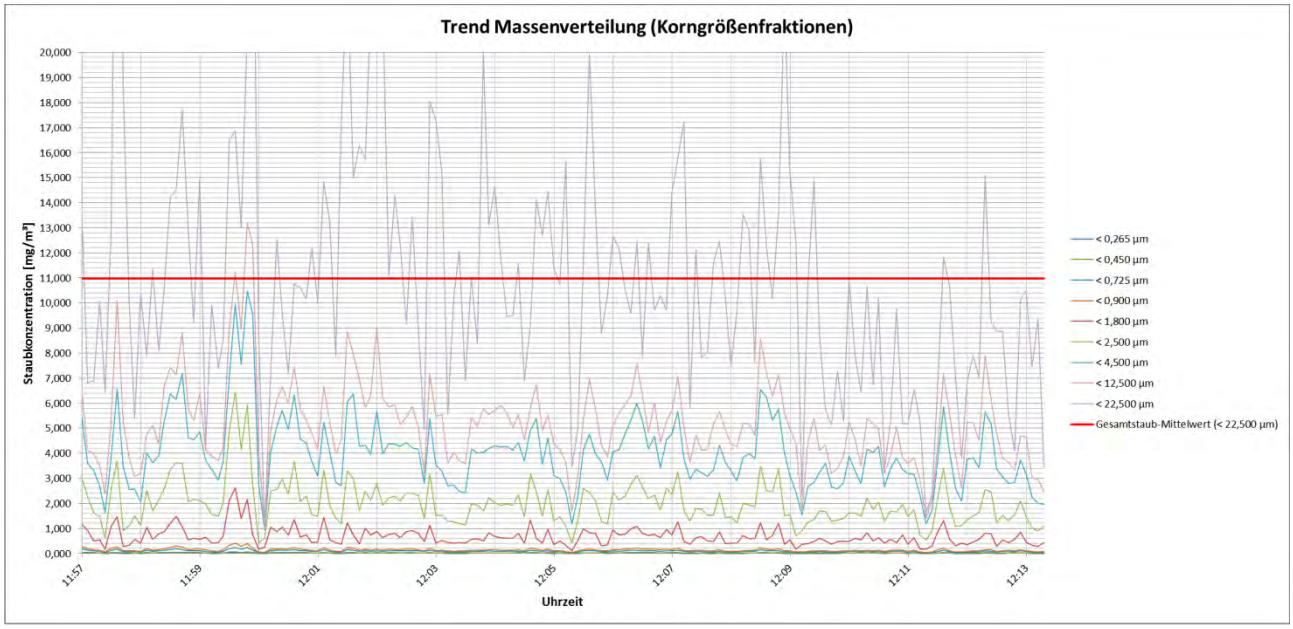
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,204	0,054	0,023	0,228	0,220	0,134
Maximum	10,304	3,320	0,831	91,704	14,994	4,812
Duchschnitt	1,178	0,540	0,149	1,931	1,290	0,890

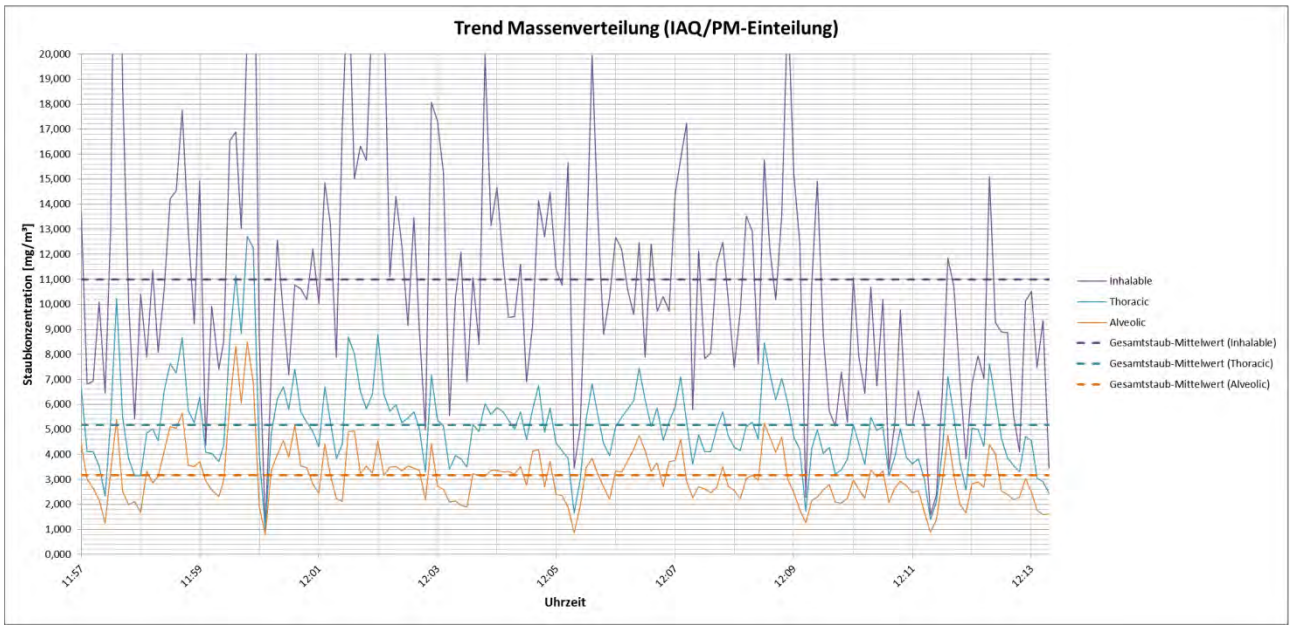
- **comments:**

Sinter cooler out of operation from 17:25 to 17:32. This can also be seen in the dust monitoring charts. Cool down of the surface temperature of the sinter material of about 40°C.

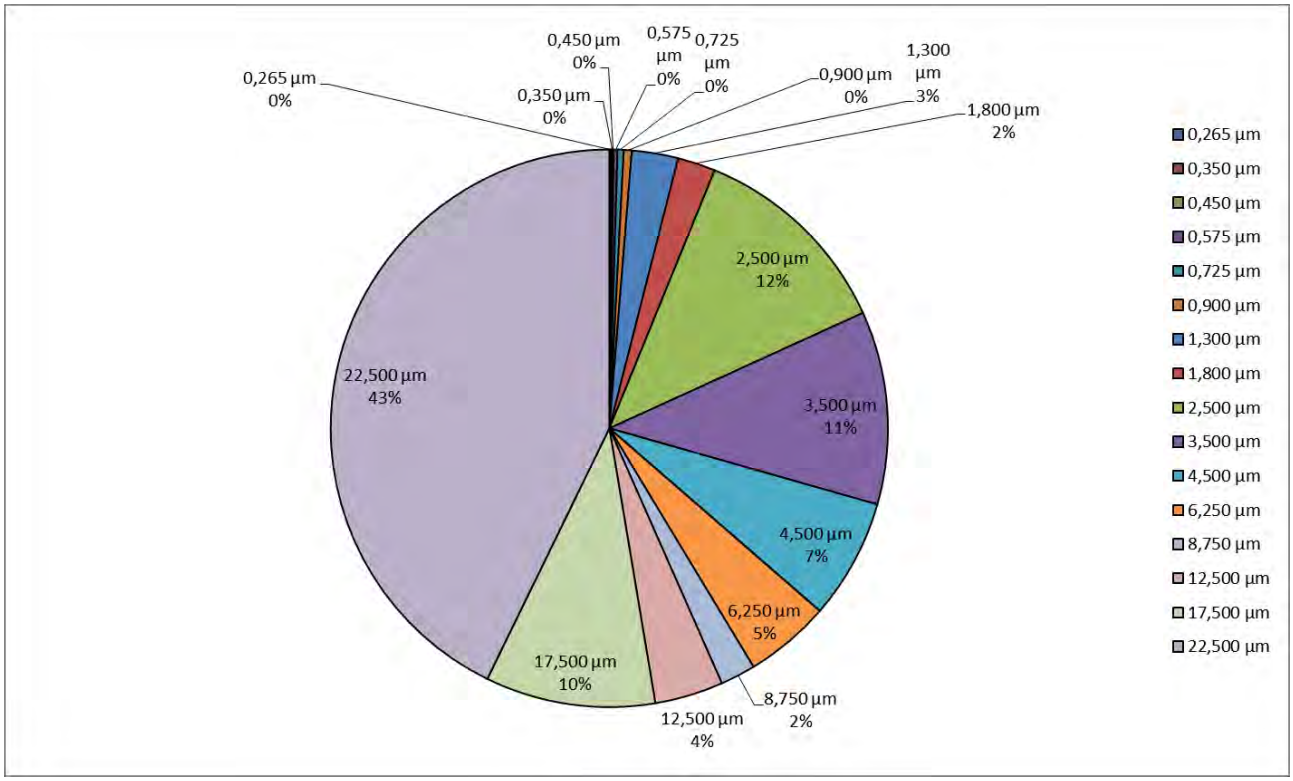
campaign 3

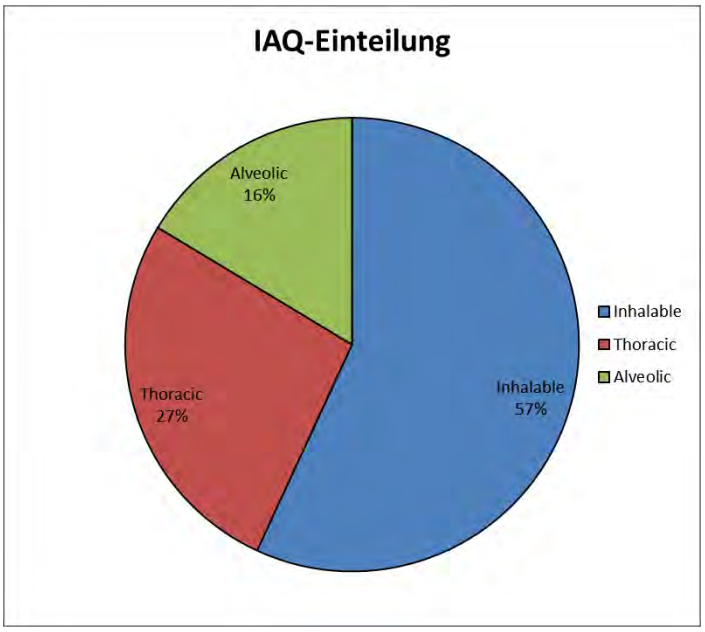
dust monitoring (Aerosol spectrometer)





particle size distribution





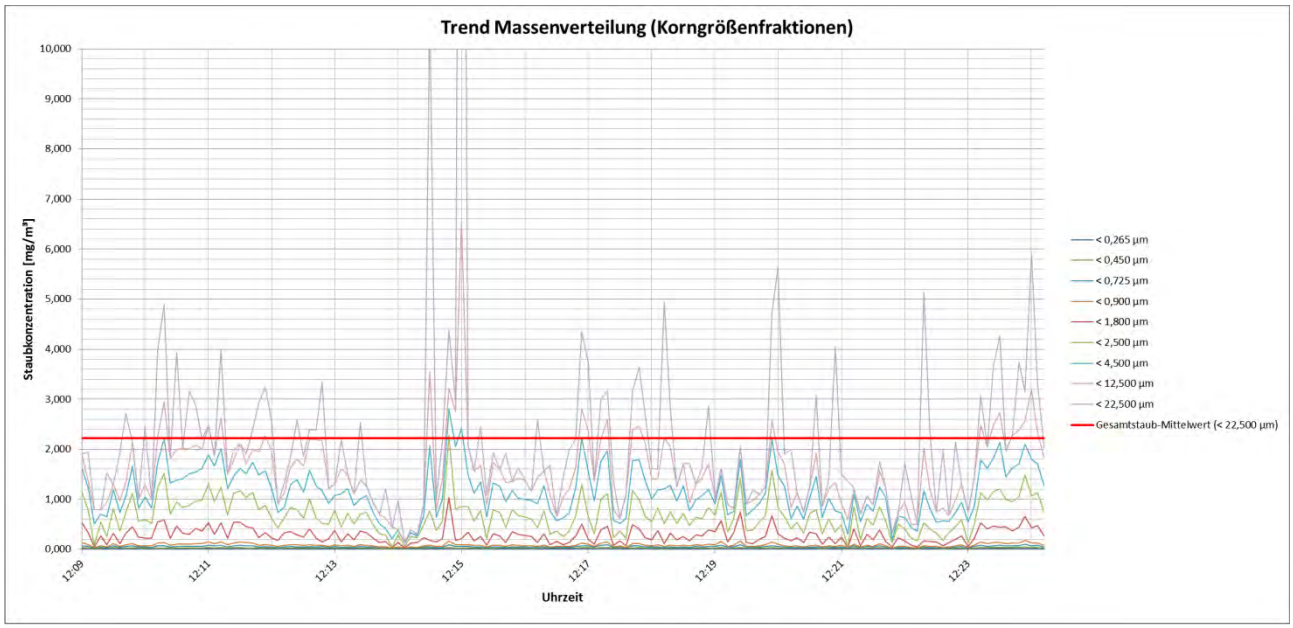
Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,005	0,003	0,007	0,009	0,011	0,058	0,000	0,271	0,213	0,105	0,082	0,000	0,000	0,000	0,000
Maximum	0,019	0,026	0,015	0,064	0,120	0,169	0,957	1,245	3,825	4,504	2,327	1,178	0,721	1,740	4,774	20,299
Duchschnitt	0,010	0,012	0,006	0,024	0,039	0,050	0,295	0,241	1,320	1,228	0,764	0,545	0,224	0,436	1,082	4,693

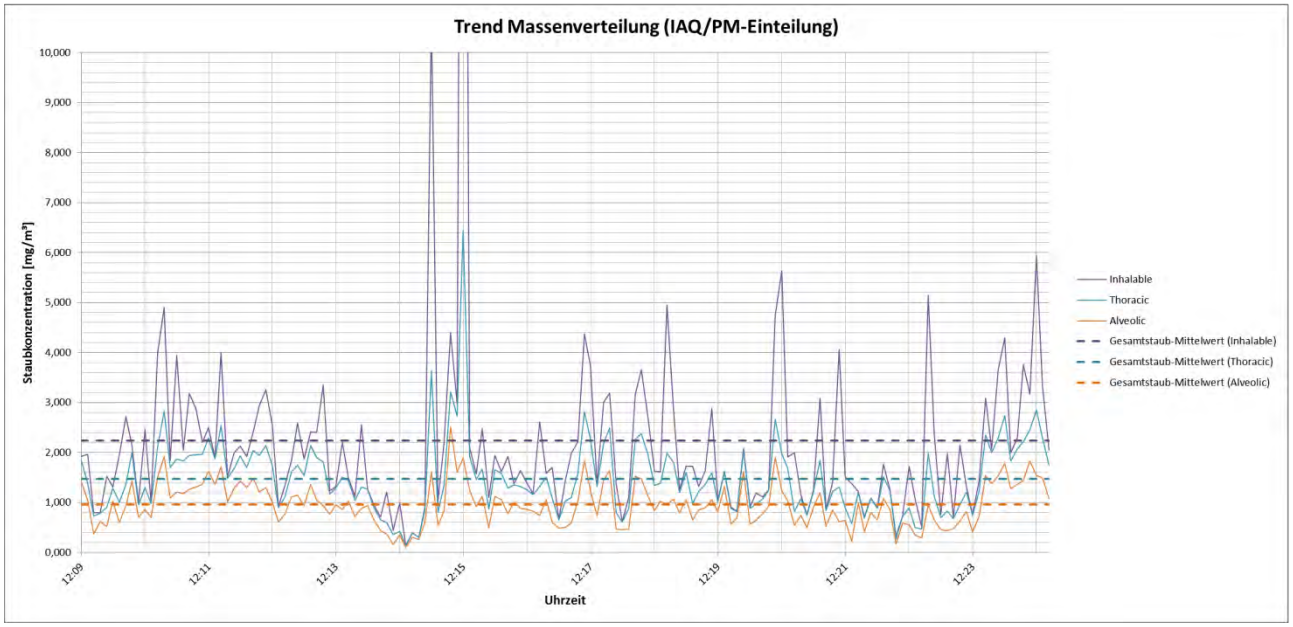
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,946	0,297	0,072	1,018	1,011	0,787
Maximum	11,501	4,633	0,884	35,189	12,720	8,498
Duchschnitt	4,552	1,427	0,283	10,980	5,166	3,159

- **comments:**

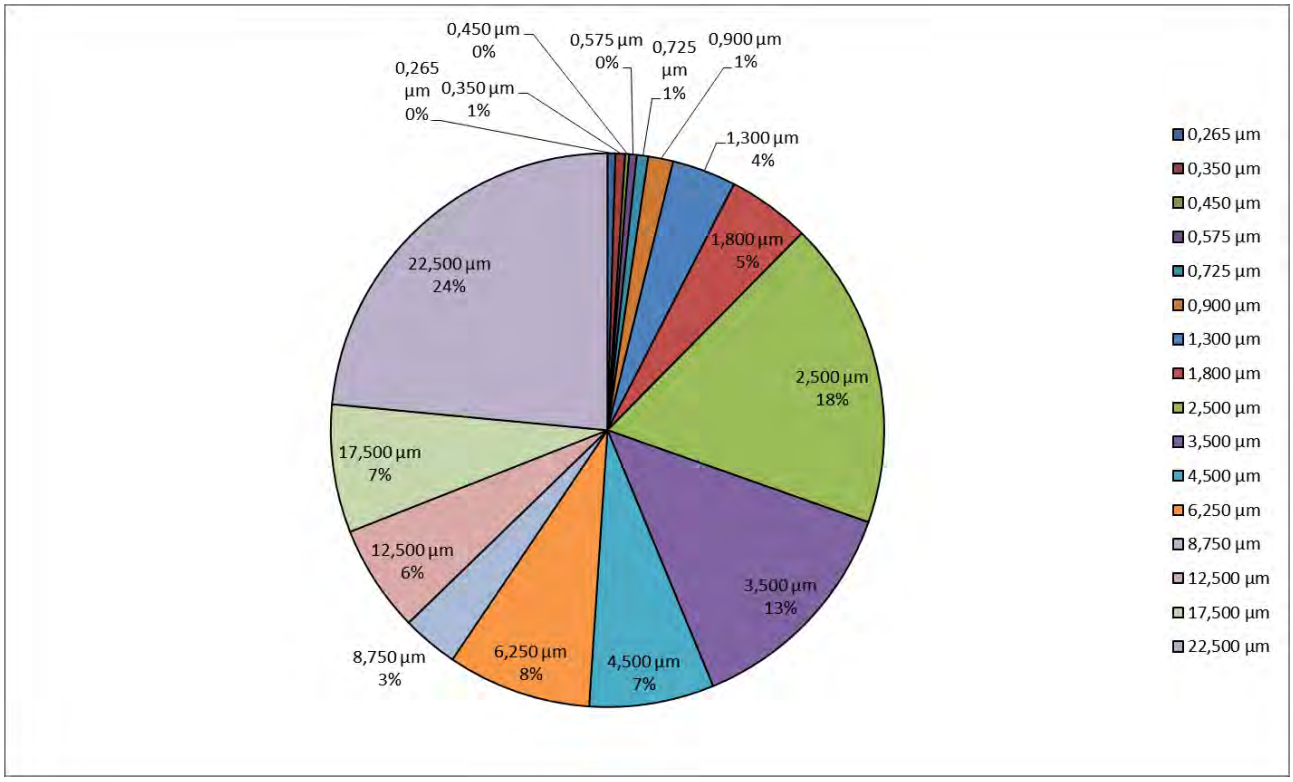
The gas temperature was measured with a thermocouple element

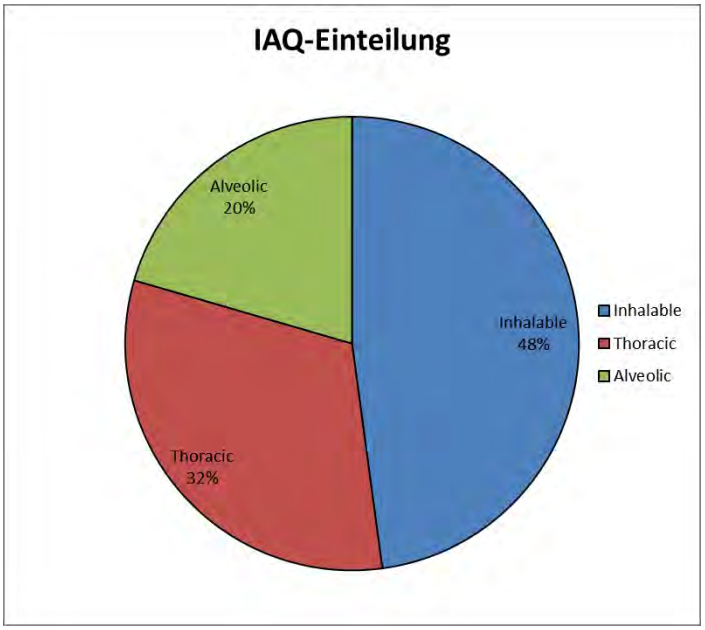
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,006	0,009	0,003	0,003	0,002	0,002	0,003	0,000	0,000	0,032	0,007	0,009	0,000	0,000	0,000	0,000
Maximum	0,022	0,026	0,007	0,019	0,033	0,081	0,222	0,639	1,248	0,920	0,633	0,716	0,821	2,610	7,162	16,819
Duchschnitt	0,010	0,013	0,005	0,010	0,015	0,032	0,083	0,108	0,400	0,298	0,162	0,187	0,073	0,139	0,166	0,523

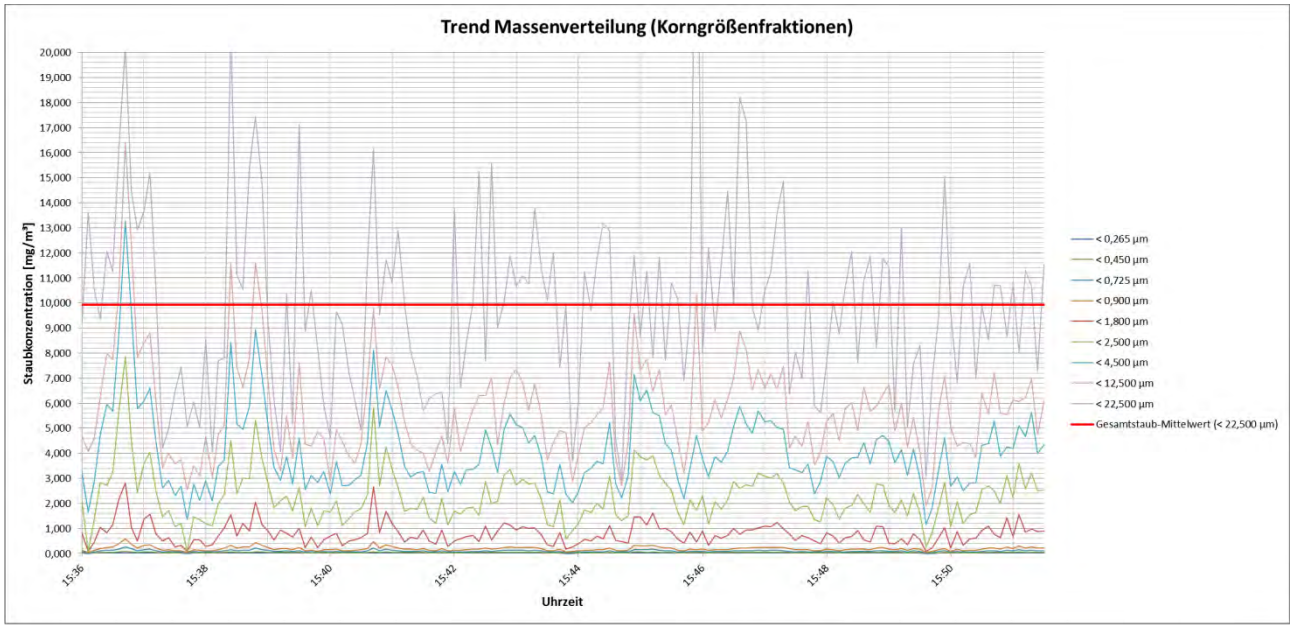
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,132	0,056	0,034	0,141	0,140	0,106
Maximum	4,781	1,652	0,326	30,553	6,449	2,526
Duchschnitt	1,343	0,503	0,130	2,237	1,478	0,958

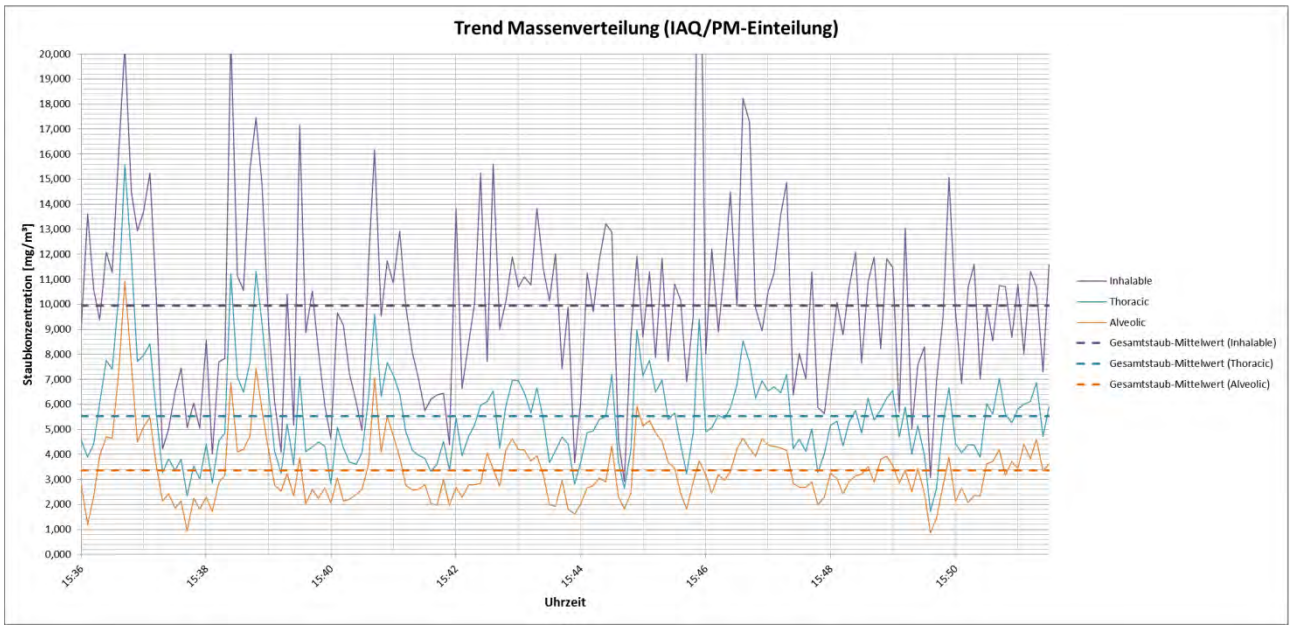
- **comments:**

no comments

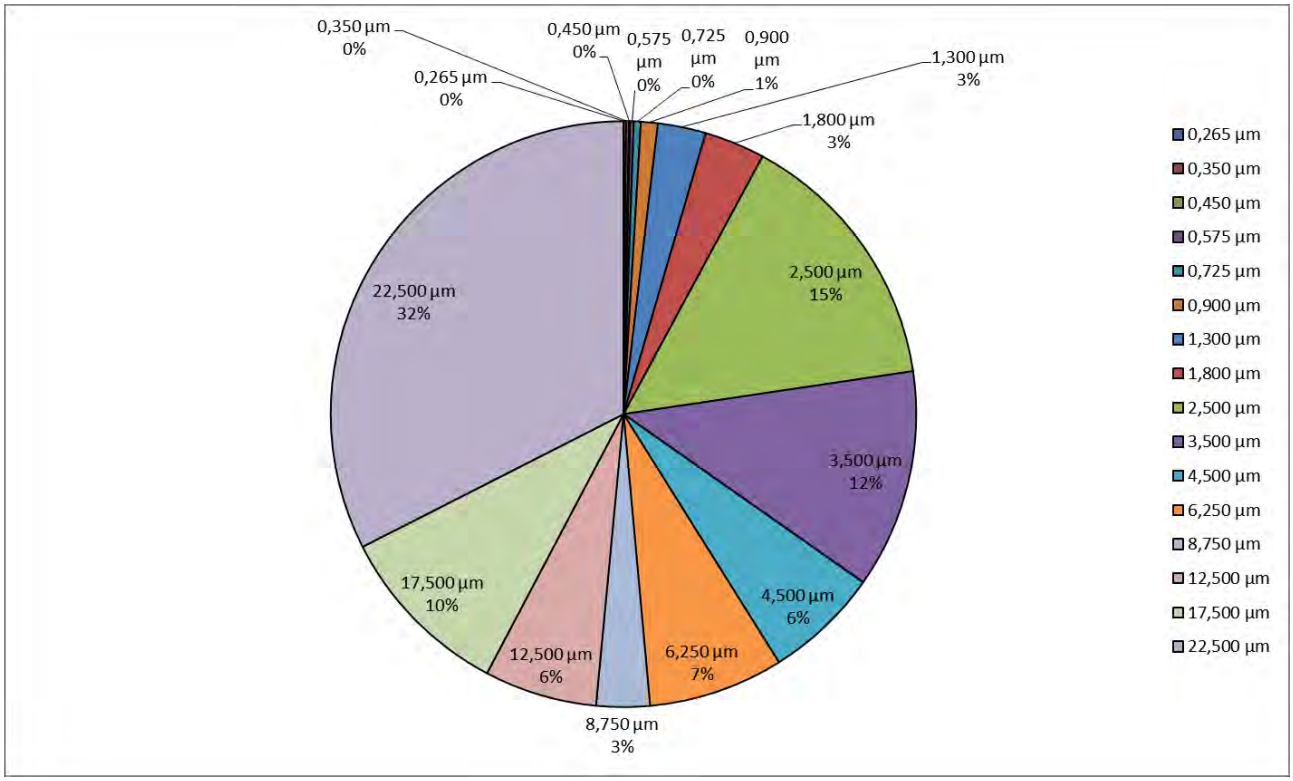
campaign 5

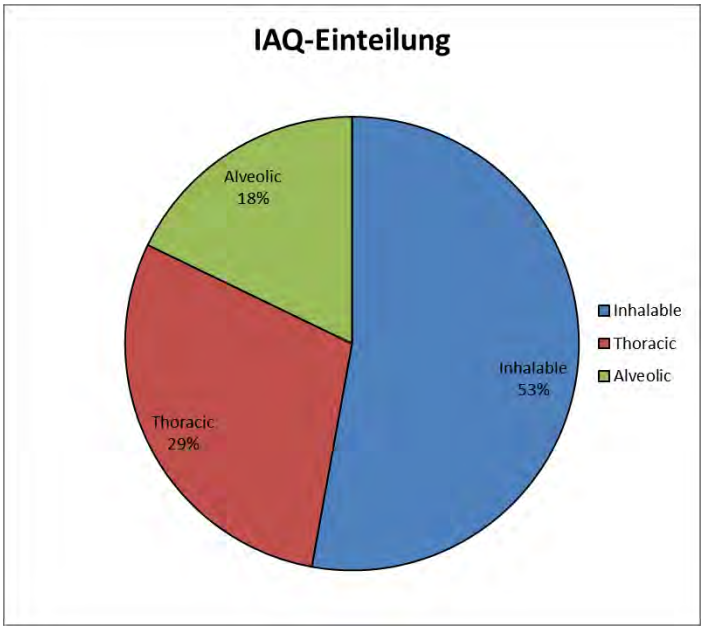
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,006	0,002	0,005	0,007	0,013	0,036	0,000	0,000	0,485	0,223	0,199	0,025	0,000	0,000	0,000
Maximum	0,025	0,033	0,018	0,062	0,124	0,323	0,885	1,426	5,050	3,713	1,691	1,885	0,970	2,755	3,581	16,239
Duchschnitt	0,014	0,017	0,006	0,020	0,038	0,093	0,264	0,332	1,468	1,200	0,631	0,741	0,293	0,618	0,973	3,227

Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	1,549	0,143	0,046	2,923	1,723	0,867
Maximum	14,371	5,553	1,042	30,146	15,579	10,922
Duchschnitt	4,926	1,602	0,323	9,950	5,519	3,360

- **comments:**

no comments

campaign 1

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
09.10.2014 12:04	09.10.2014 13:08	28	1016,4	~ 1,5m above the enclosure

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
310	160	300	295	4,9

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
12:04	13:08	0,53	0,09	16,98

Comparison with the operational data collected by ILVA[2]

During the measurement period the cooling time of the sinter material drops. The calculated speed of the sinter cooler remains at about 1,4 m/min. The sinter temperature at the discharge point of the sinter machine dips at about 300°C (12:20) and peaks at 370°C (12:50).

[2] The operational data collected by ILVA is displayed in the attachment.

campaign 2

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
10.10.2014	10.10.2014	33	1016,4	~ 1,7m above the enclosure
15:43	16:29			

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
430	210	>340	335	4,0

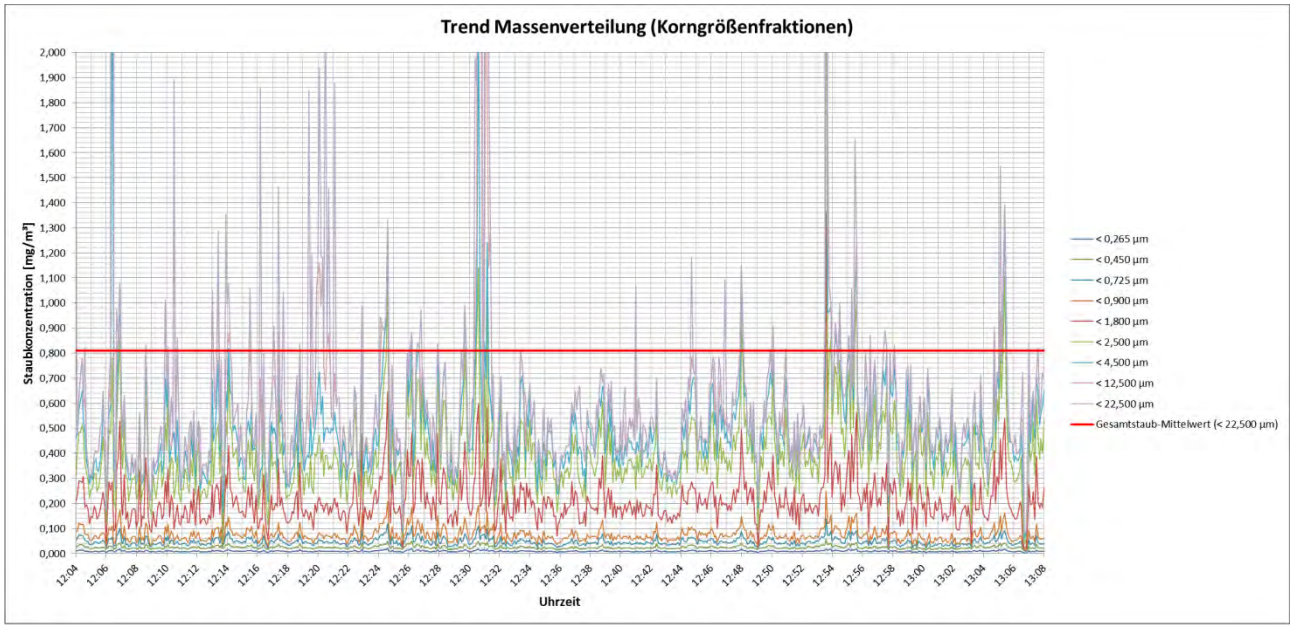
total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
15:43	16:29	0,96	0,19	19,79

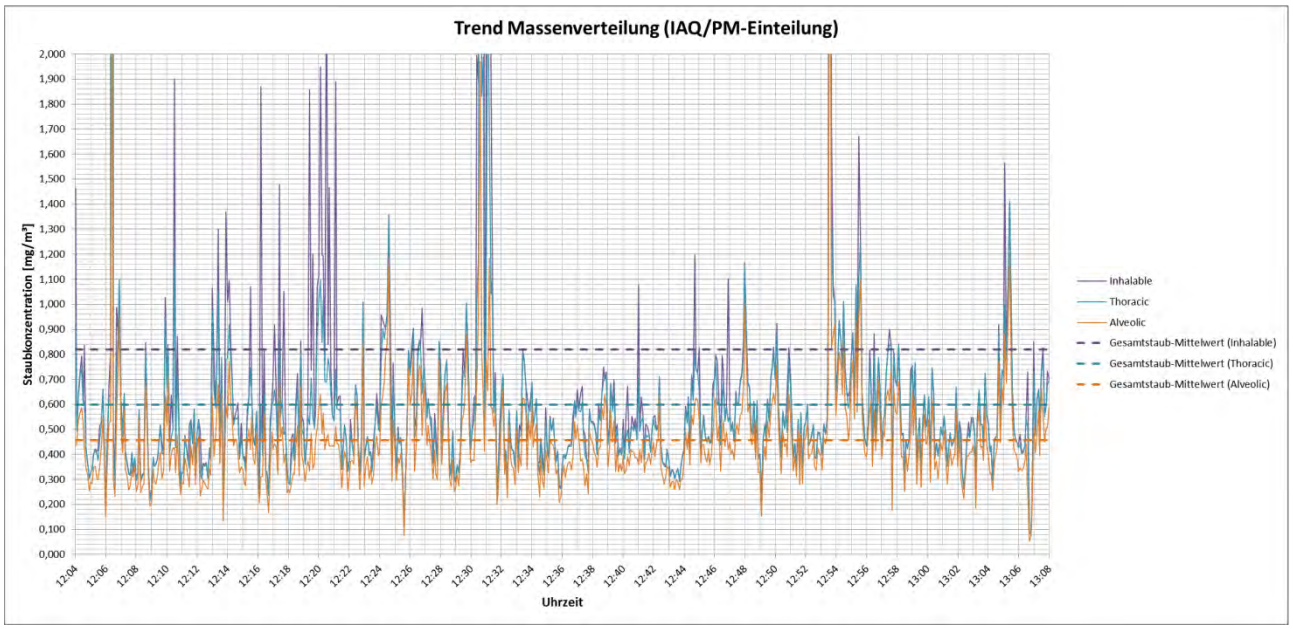
Comparison with the operational data collected by ILVA

The sinter cooler was operated very steady on the 10th of October. The calculated speed of the sinter cooler remains at about 1,4 m/min. The sinter temperature at the discharge point of the sinter machine drops slowly and dips at about 325°C. This differs from the material temperature measured by Kappa with a maximum value of 430°C.

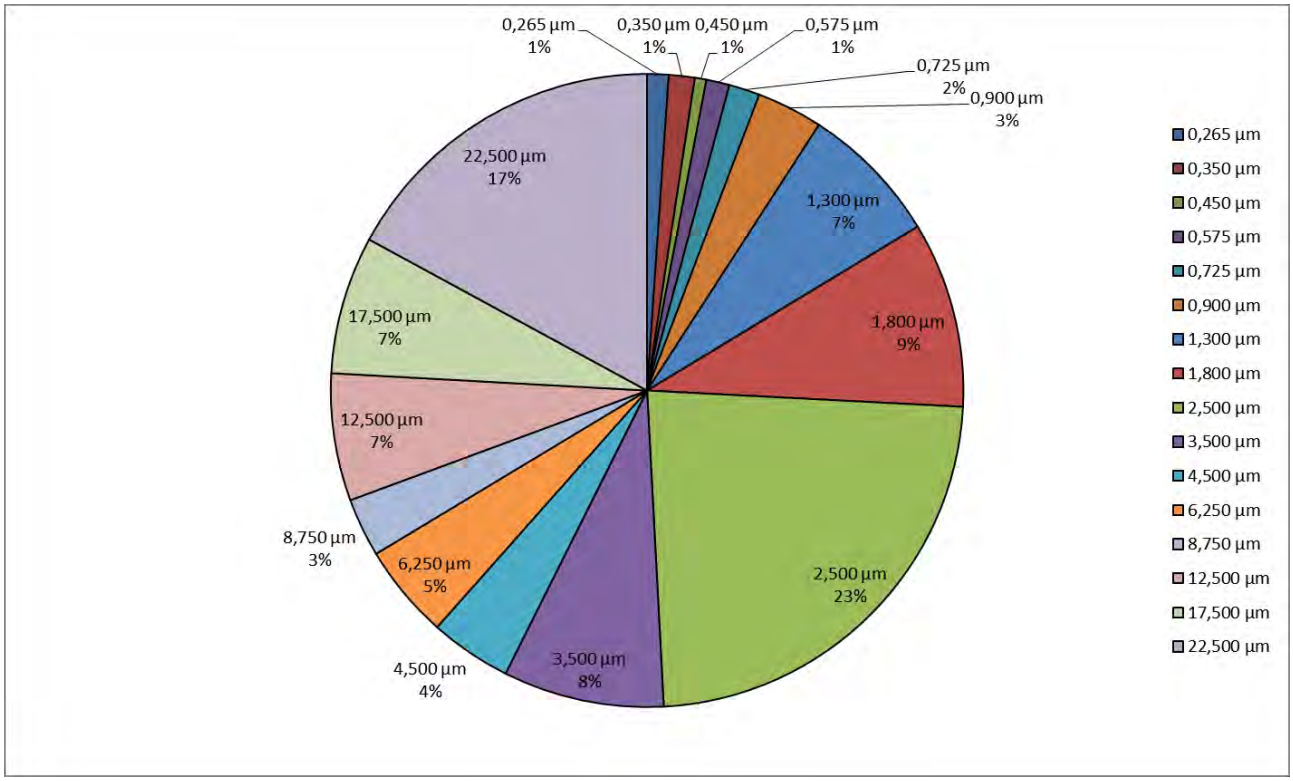
campaign 1

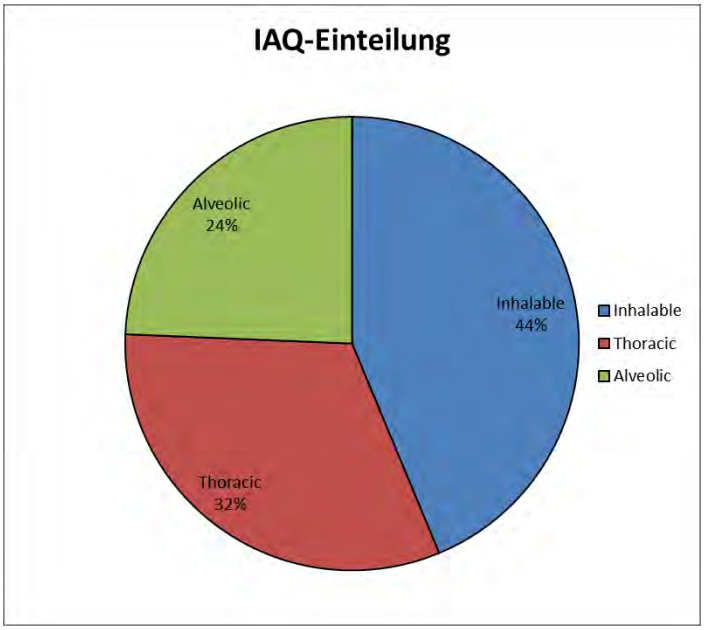
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,002	0,002	0,001	0,001	0,002	0,000	0,005	0,013	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,019	0,023	0,015	0,038	0,047	0,109	0,229	0,887	1,706	0,856	1,197	2,637	2,760	15,514	24,071	63,797
Duchschnitt	0,009	0,011	0,005	0,010	0,013	0,027	0,058	0,077	0,189	0,067	0,034	0,039	0,024	0,053	0,057	0,138

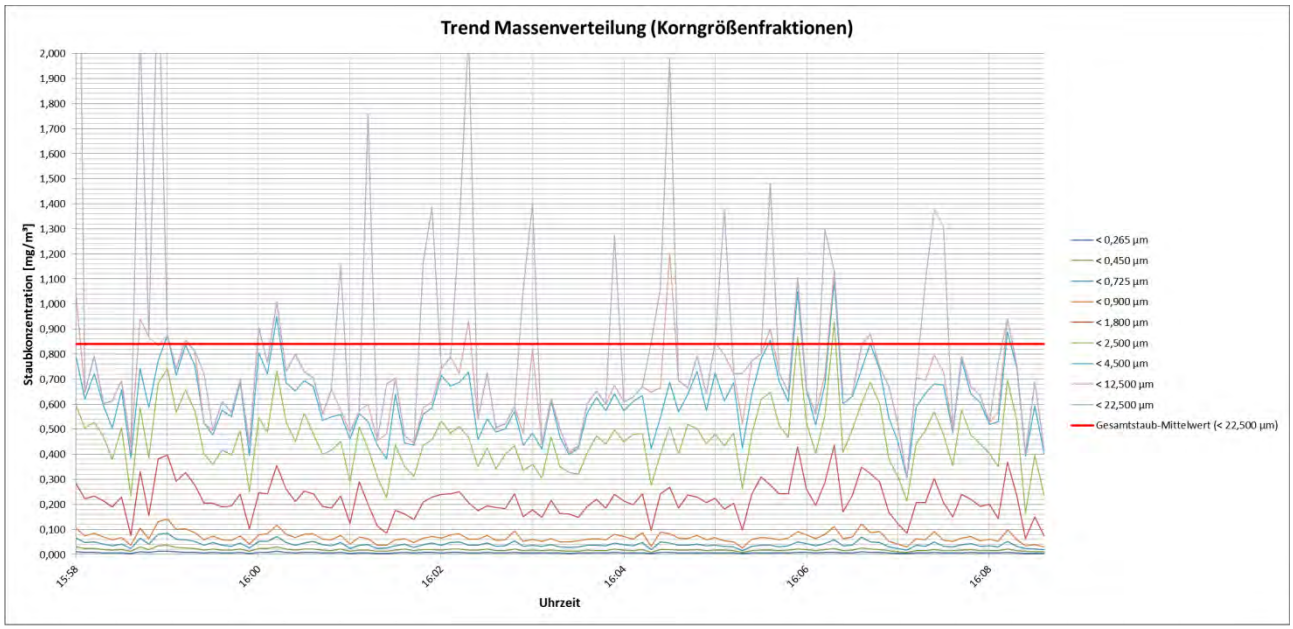
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,075	0,032	0,017	0,087	0,081	0,052
Maximum	14,018	2,190	0,432	111,625	19,711	3,268
Duchschnitt	0,555	0,313	0,101	0,820	0,599	0,457

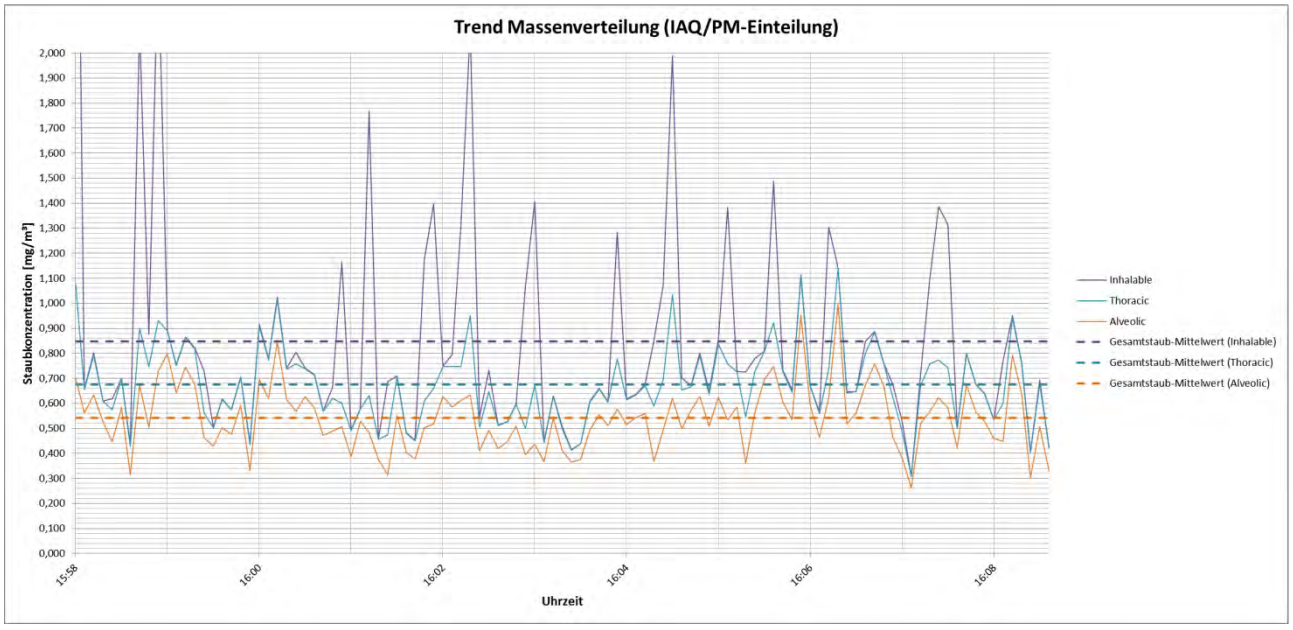
- **comments:**

no comments

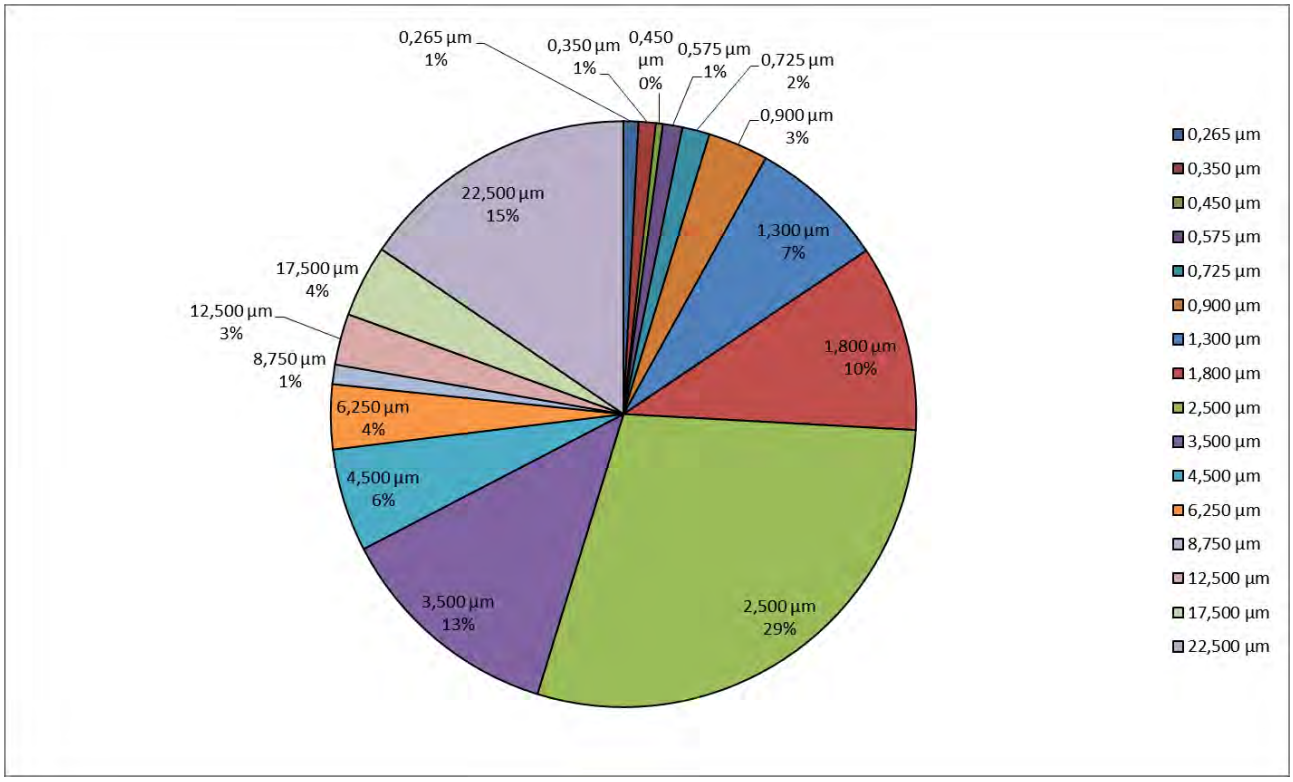
campaign 2

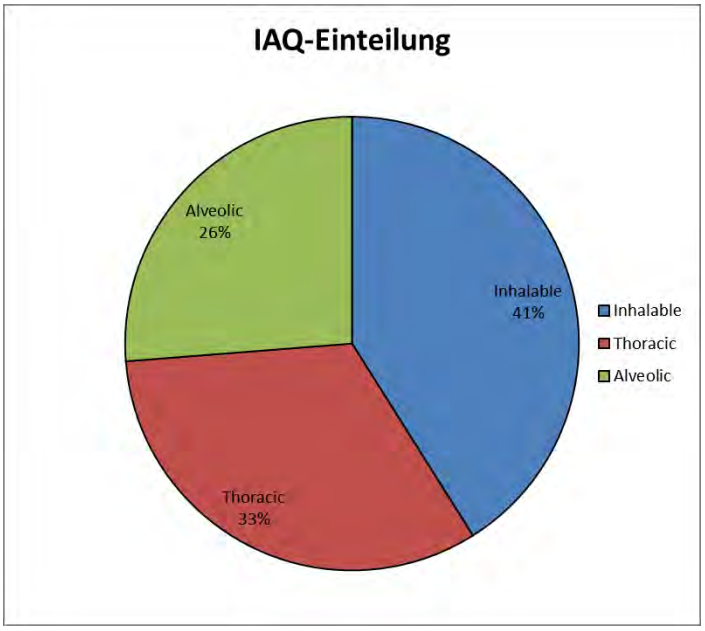
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,001	0,003	0,003	0,010	0,020	0,000	0,103	0,038	0,010	0,000	0,000	0,000	0,000	0,000
Maximum	0,013	0,015	0,007	0,020	0,029	0,056	0,126	0,224	0,492	0,173	0,105	0,154	0,075	0,362	0,597	2,320
Duchschnitt	0,007	0,008	0,003	0,009	0,013	0,028	0,063	0,087	0,243	0,106	0,048	0,030	0,009	0,024	0,033	0,130

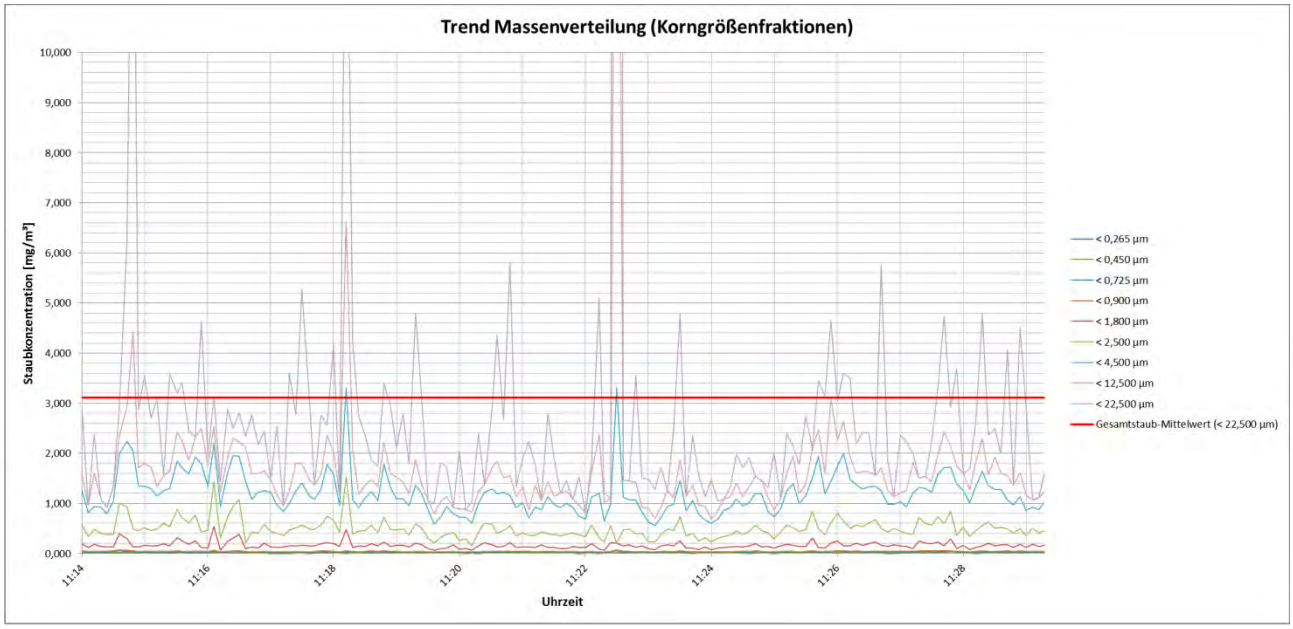
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,291	0,131	0,041	0,308	0,308	0,263
Maximum	1,078	0,687	0,182	3,760	1,139	0,998
Duchschnitt	0,629	0,348	0,097	0,848	0,675	0,542

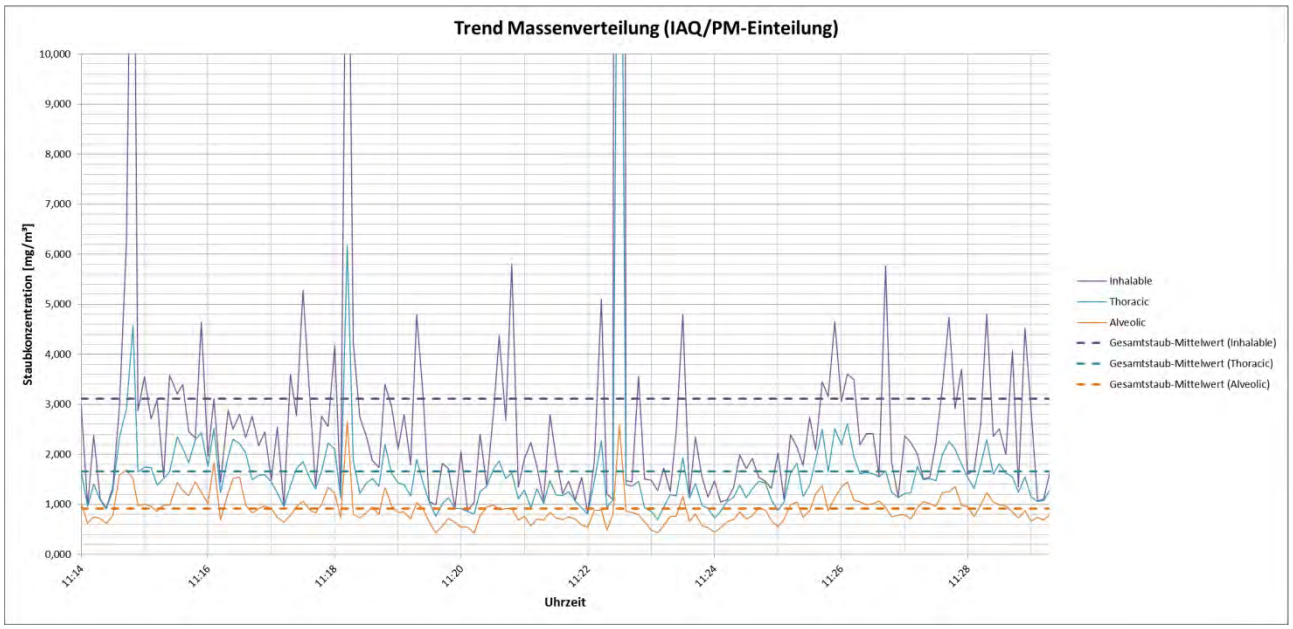
- **comments:**

no comments

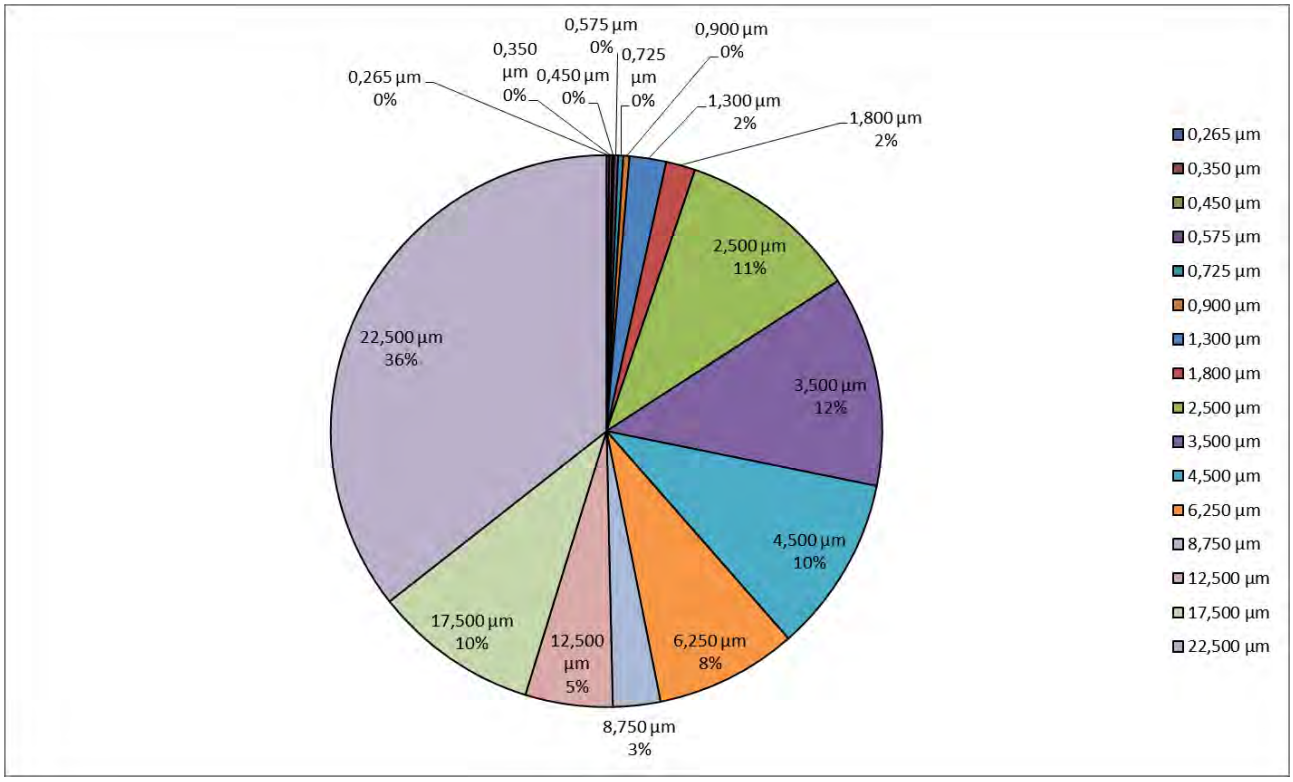
campaign 3

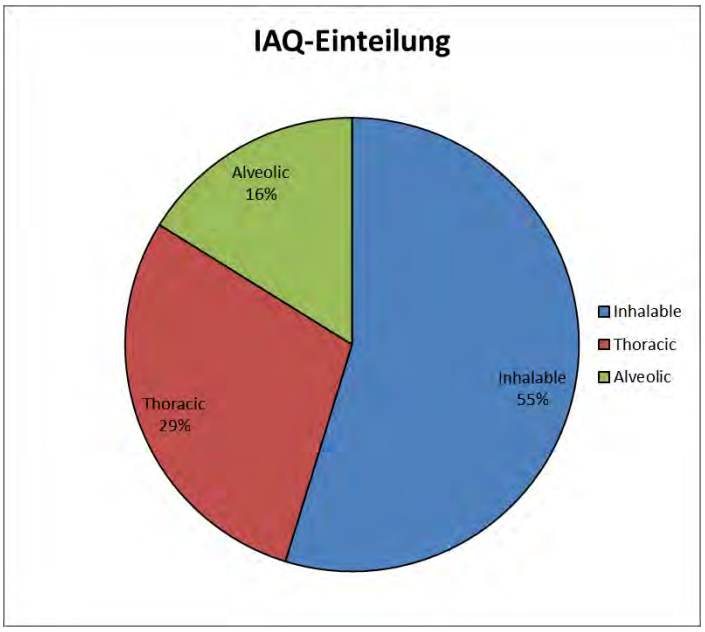
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,002	0,004	0,004	0,004	0,030	0,000	0,000	0,181	0,122	0,072	0,000	0,000	0,000	0,000
Maximum	0,007	0,009	0,006	0,016	0,019	0,023	0,131	0,339	1,047	0,823	2,493	3,779	4,376	11,744	16,710	48,718
Duchschnitt	0,005	0,006	0,003	0,007	0,009	0,011	0,067	0,053	0,331	0,384	0,322	0,259	0,086	0,159	0,300	1,107

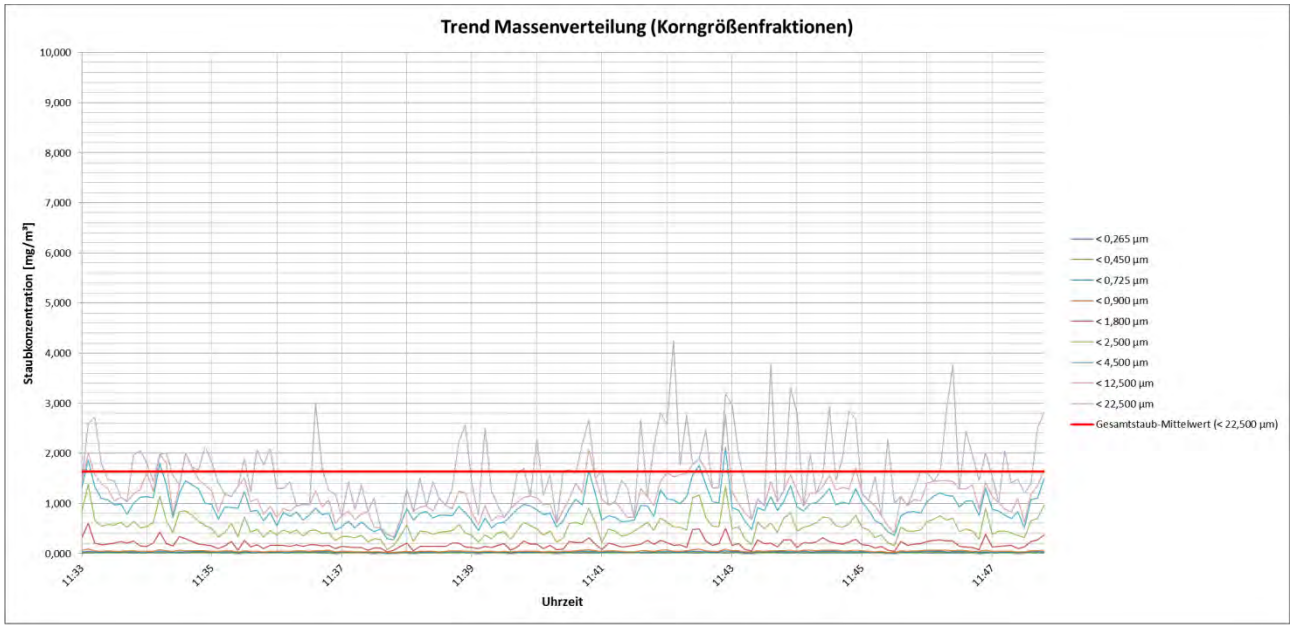
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,630	0,131	0,043	0,816	0,699	0,428
Maximum	14,531	1,045	0,165	88,638	19,244	2,664
Duchschnitt	1,466	0,360	0,077	3,116	1,656	0,919

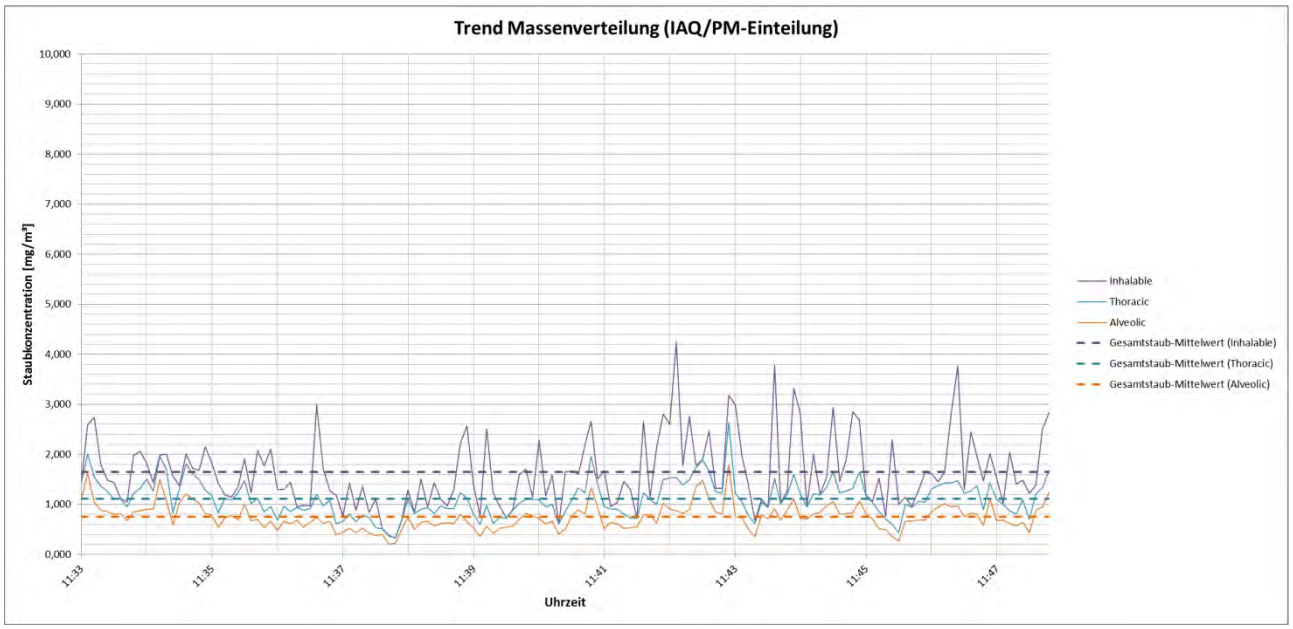
- **comments:**

The ventilator below the measurement point was not being operated during the measurements. The vertical airflow therefore was thermal-induced. The gas temperature was measured with a thermocouple element.

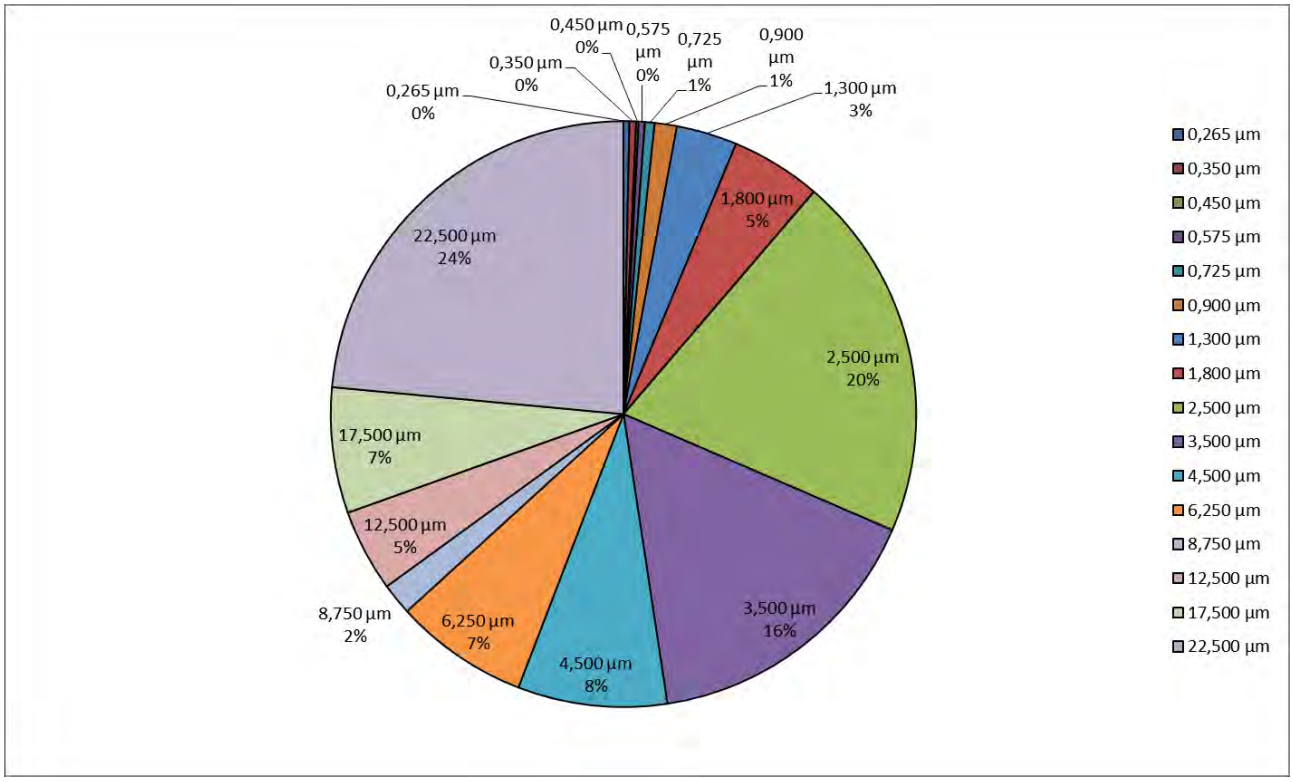
campaign 4

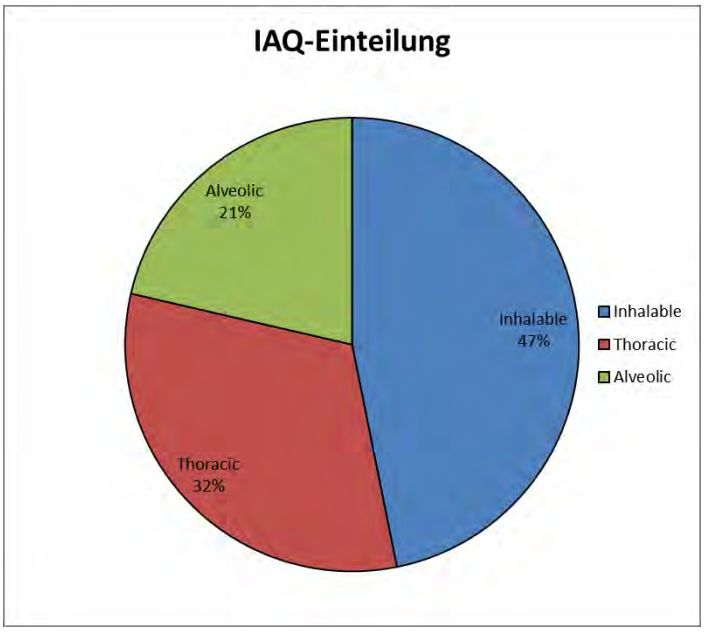
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,003	0,001	0,002	0,002	0,005	0,012	0,000	0,039	0,060	0,047	0,027	0,000	0,000	0,000	0,000
Maximum	0,009	0,011	0,004	0,010	0,017	0,045	0,144	0,368	0,845	0,528	0,260	0,317	0,124	0,362	0,796	2,320
Duchschnitt	0,005	0,006	0,002	0,006	0,009	0,020	0,055	0,082	0,331	0,264	0,135	0,121	0,029	0,074	0,113	0,385

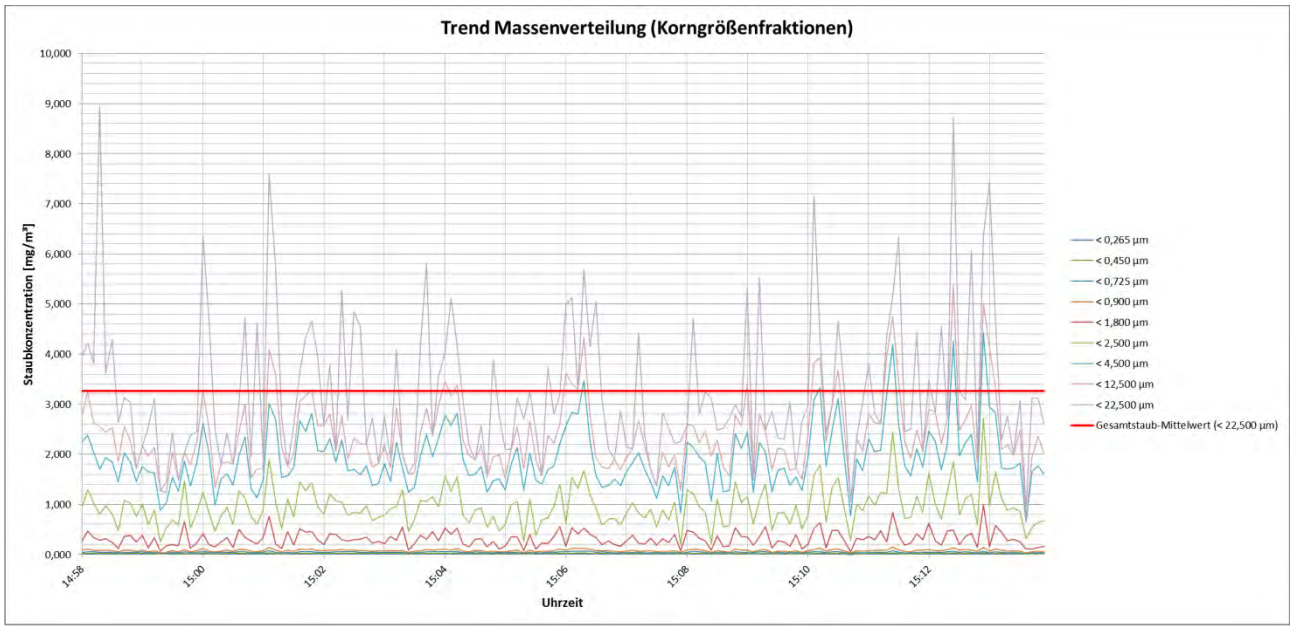
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,304	0,065	0,025	0,331	0,327	0,211
Maximum	2,423	0,995	0,186	4,253	2,647	1,795
Duchschnitt	1,015	0,371	0,080	1,644	1,115	0,751

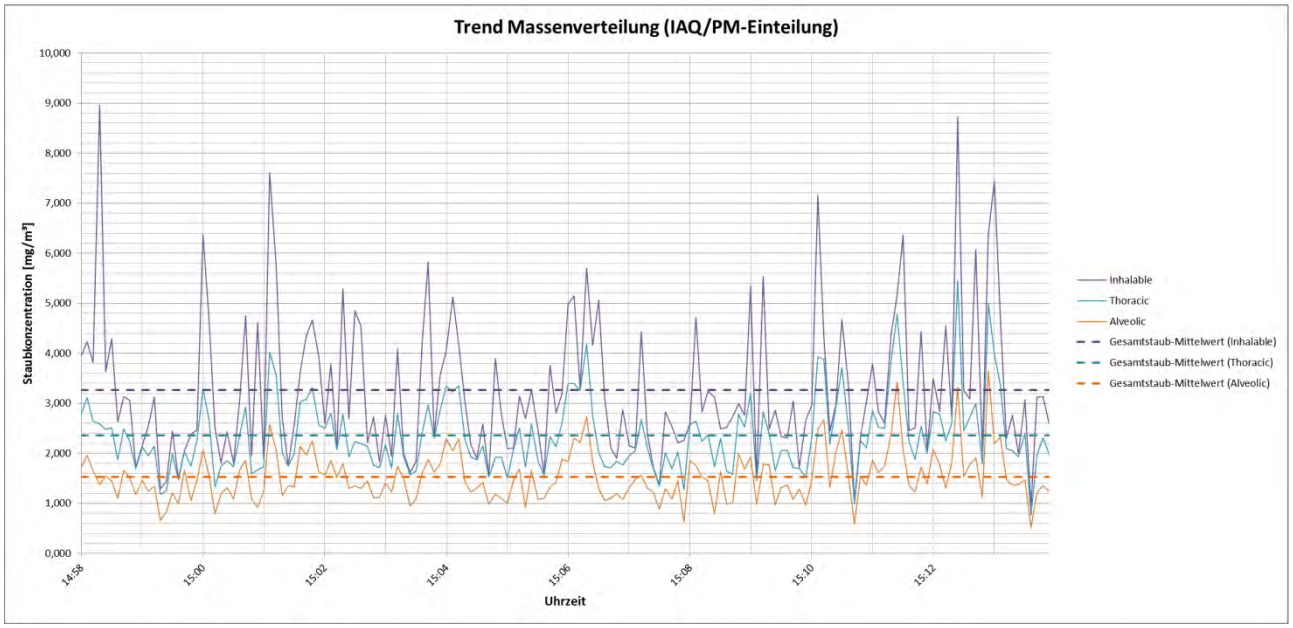
- **comments:**

no comments

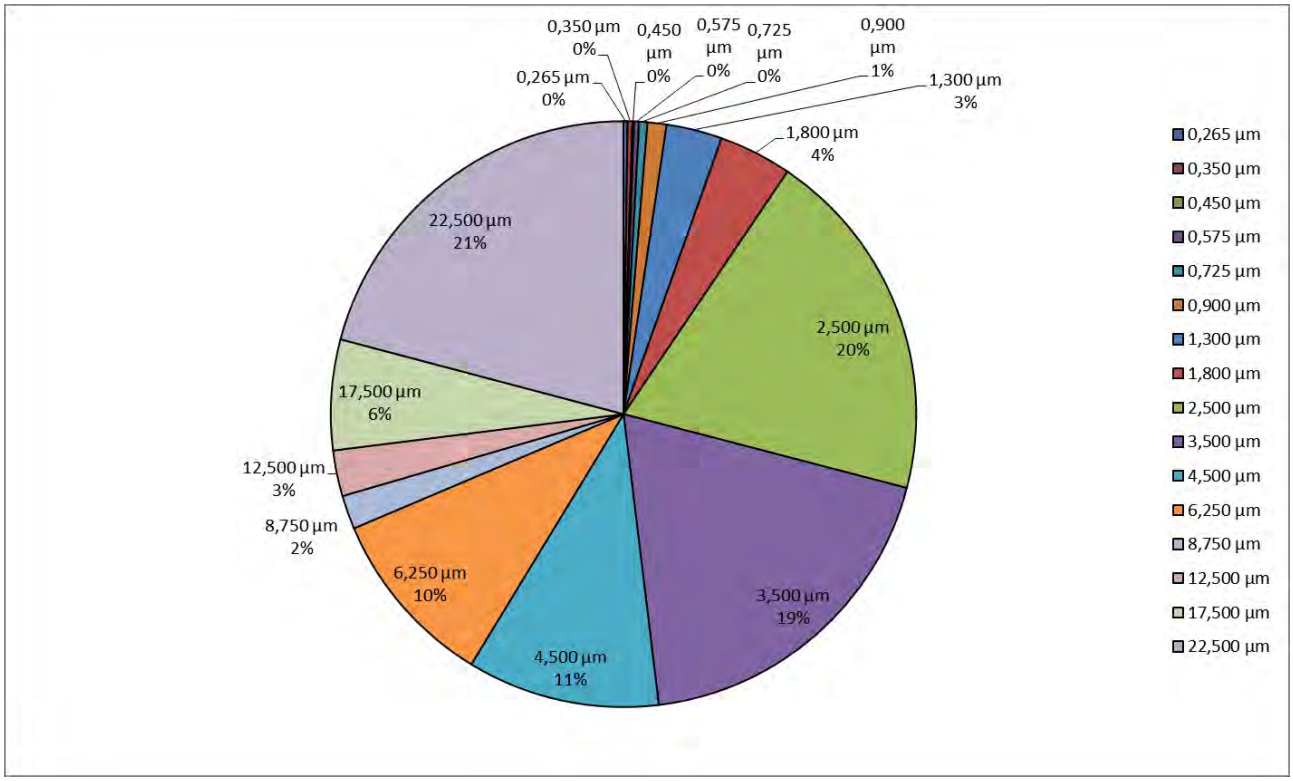
campaign 5

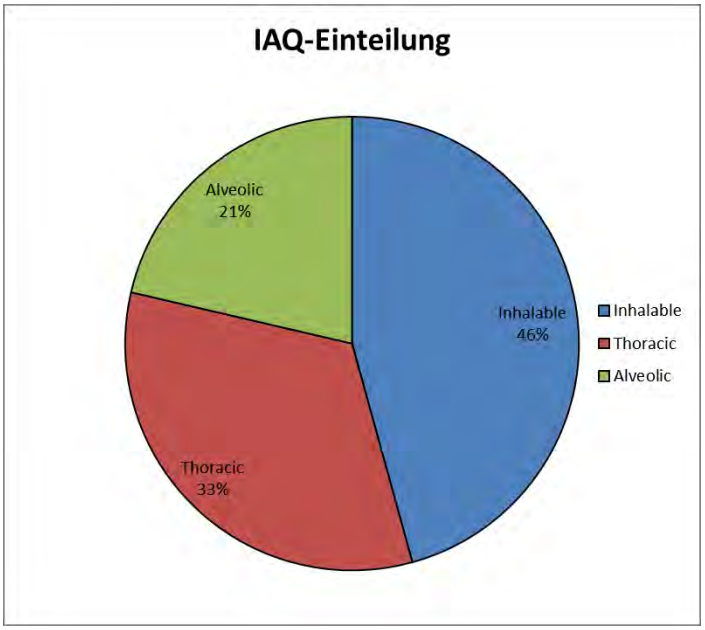
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,004	0,002	0,004	0,005	0,012	0,024	0,000	0,118	0,201	0,118	0,082	0,000	0,000	0,000	0,000
Maximum	0,012	0,014	0,005	0,015	0,029	0,079	0,251	0,605	1,727	1,563	0,852	0,797	0,274	0,435	0,995	5,800
Duchschnitt	0,007	0,009	0,003	0,009	0,015	0,034	0,101	0,131	0,639	0,621	0,347	0,324	0,061	0,082	0,199	0,681

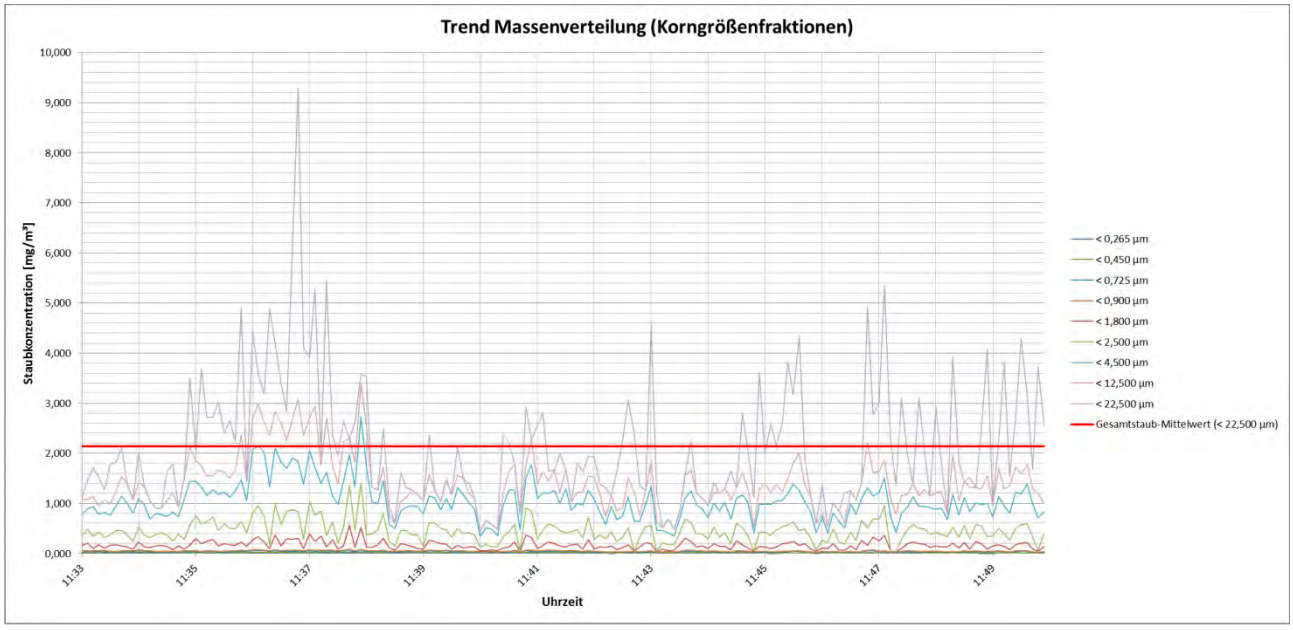
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,690	0,170	0,045	0,938	0,763	0,510
Maximum	4,870	1,909	0,316	8,953	5,451	3,649
Duchschnitt	2,142	0,677	0,135	3,271	2,355	1,529

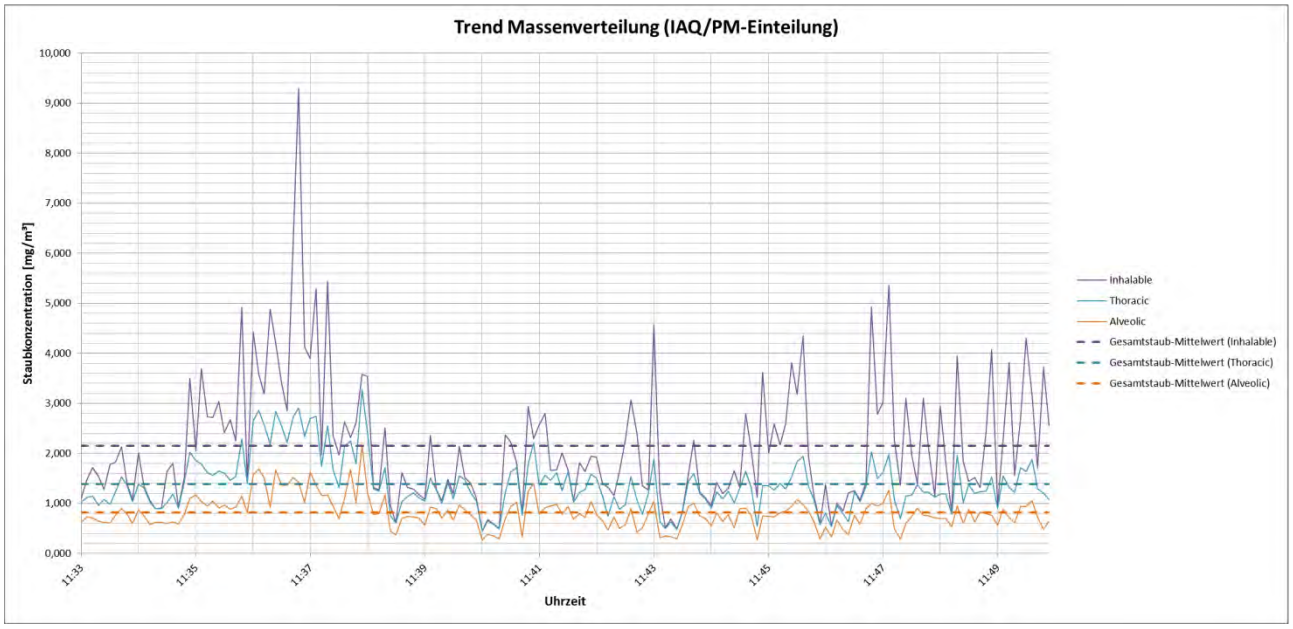
- **comments:**

no comments

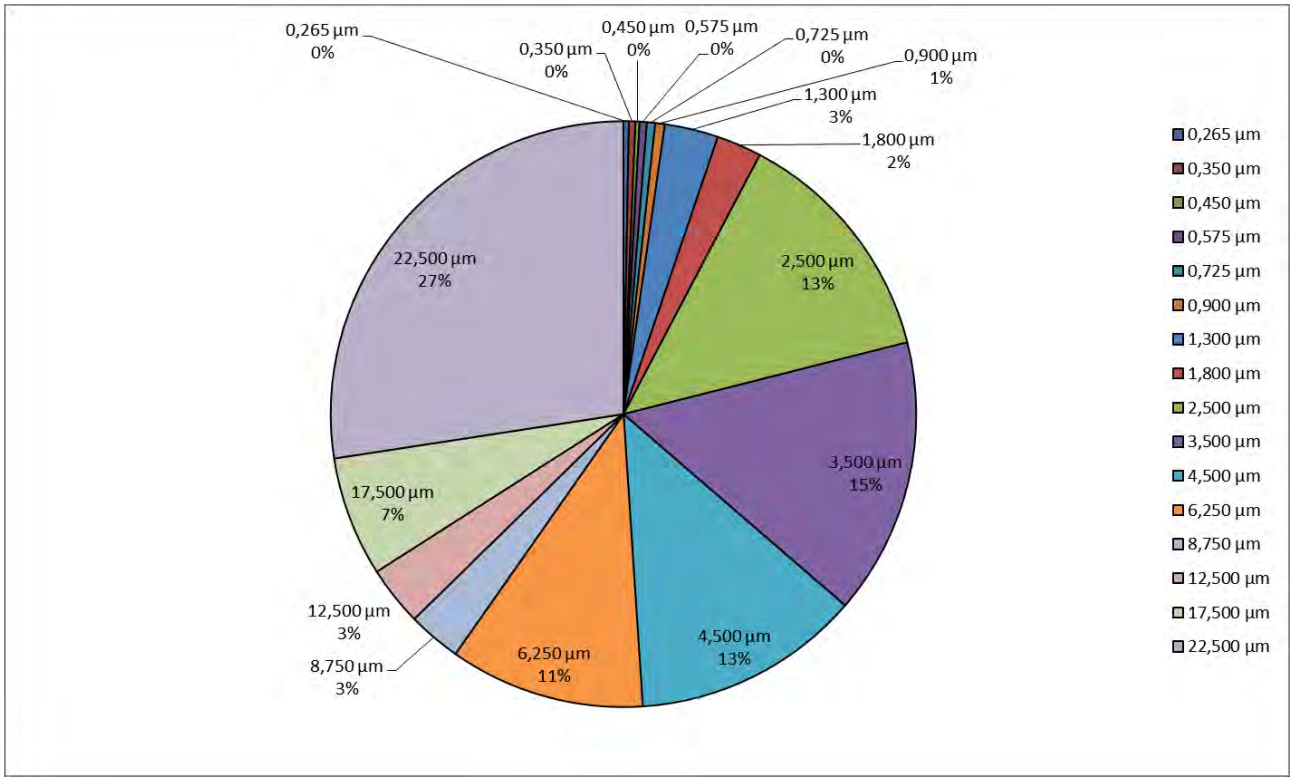
campaign 3

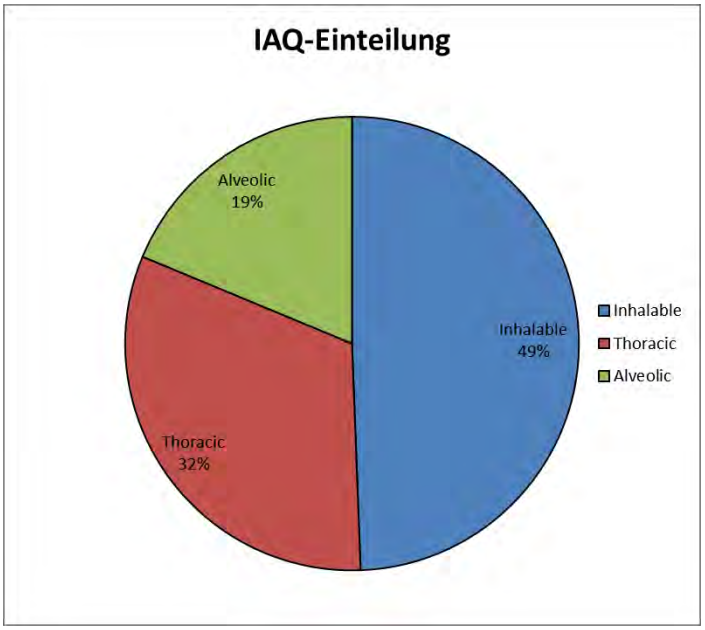
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,005	0,003	0,003	0,003	0,001	0,008	0,000	0,000	0,091	0,078	0,027	0,000	0,000	0,000	0,000
Maximum	0,012	0,014	0,011	0,016	0,020	0,030	0,176	0,323	0,893	0,772	0,622	0,589	0,323	0,725	0,995	5,220
Duchschnitt	0,006	0,008	0,005	0,009	0,010	0,011	0,063	0,053	0,286	0,327	0,270	0,231	0,063	0,070	0,142	0,587

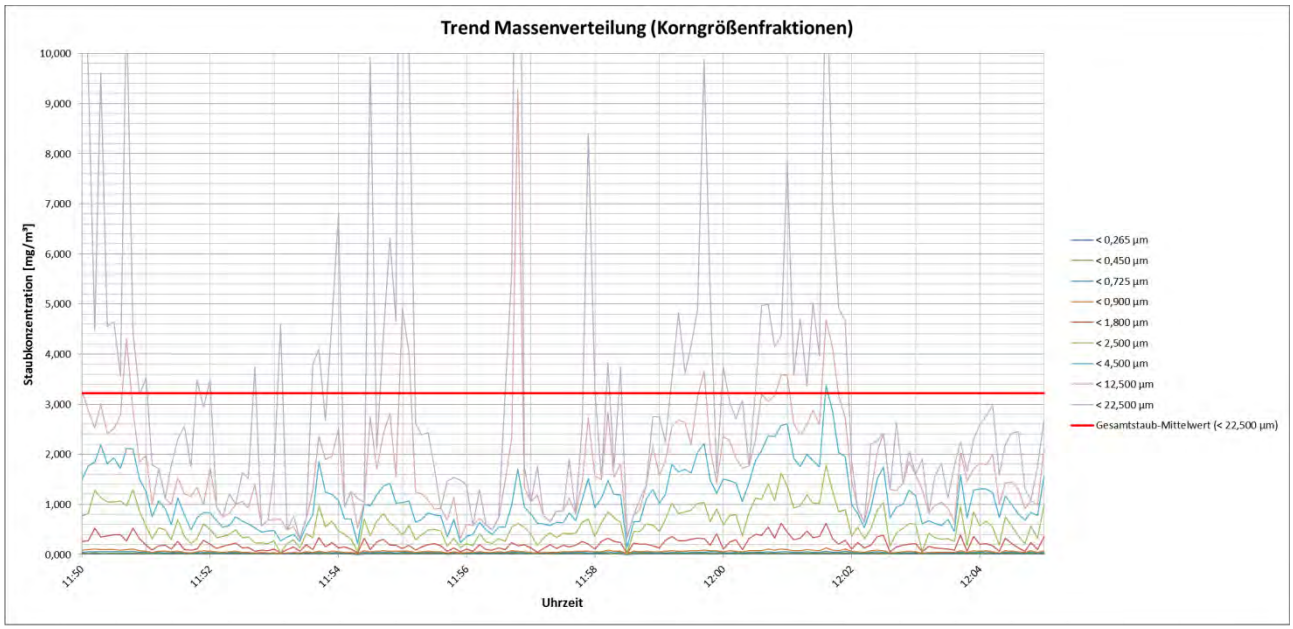
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,407	0,050	0,029	0,448	0,441	0,270
Maximum	3,016	1,006	0,189	9,294	3,280	2,159
Duchschnitt	1,247	0,337	0,082	2,147	1,385	0,814

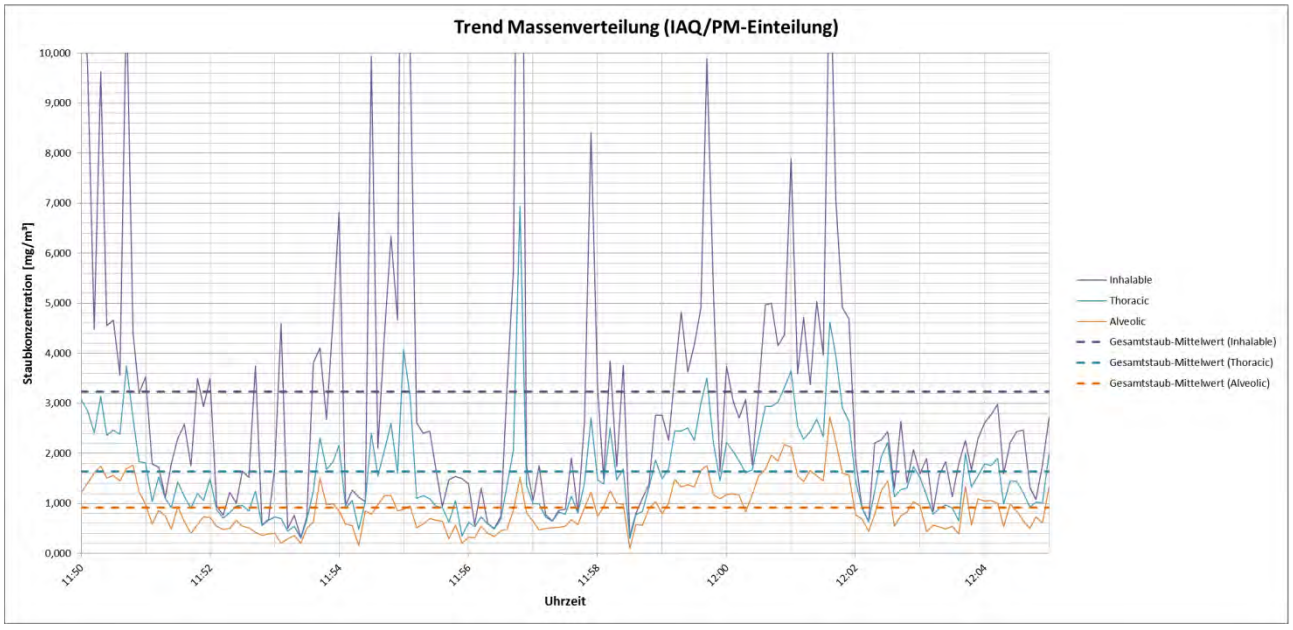
- **comments:**

no comments

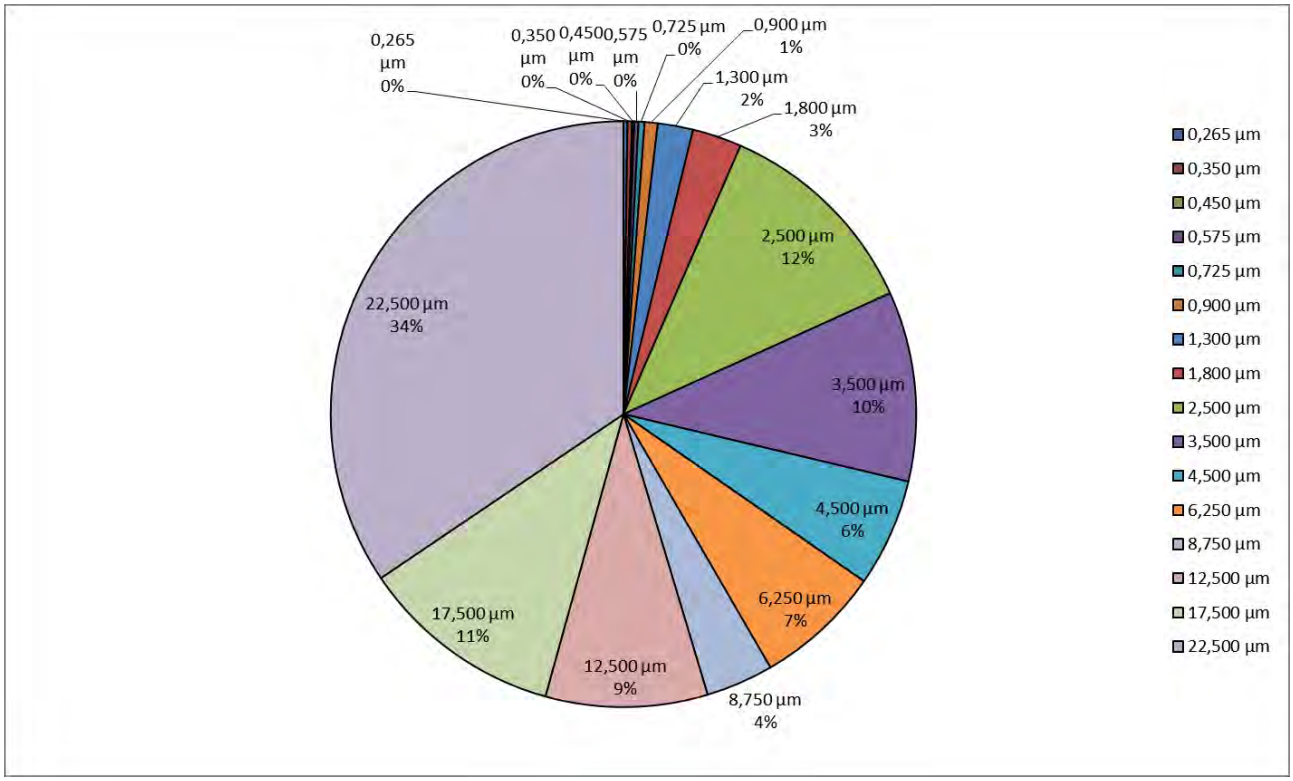
campaign 4

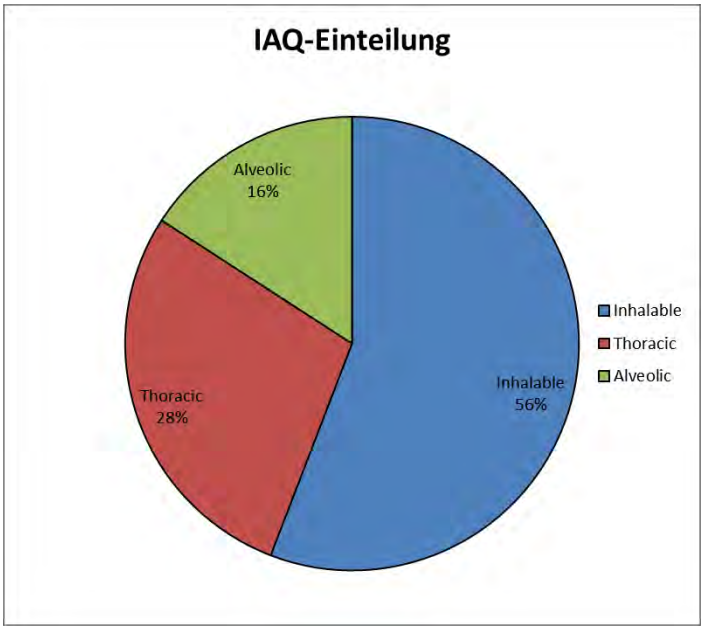
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,005	0,002	0,002	0,002	0,002	0,005	0,000	0,000	0,022	0,020	0,018	0,000	0,000	0,000	0,000
Maximum	0,011	0,014	0,007	0,017	0,025	0,060	0,188	0,362	1,156	1,038	0,609	1,368	1,567	4,640	3,382	13,919
Duchschnitt	0,007	0,008	0,004	0,007	0,011	0,023	0,063	0,088	0,376	0,337	0,192	0,225	0,120	0,288	0,362	1,110

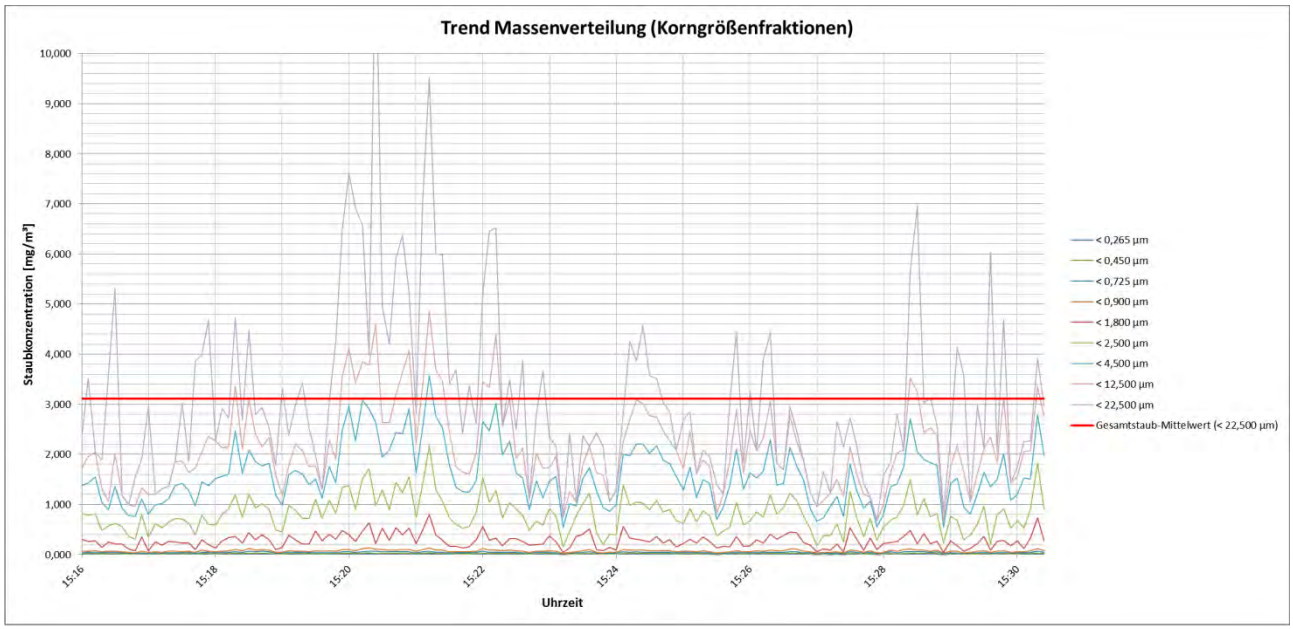
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,263	0,028	0,020	0,317	0,291	0,101
Maximum	5,766	1,274	0,242	21,826	6,940	2,727
Duchschnitt	1,447	0,427	0,097	3,229	1,637	0,917

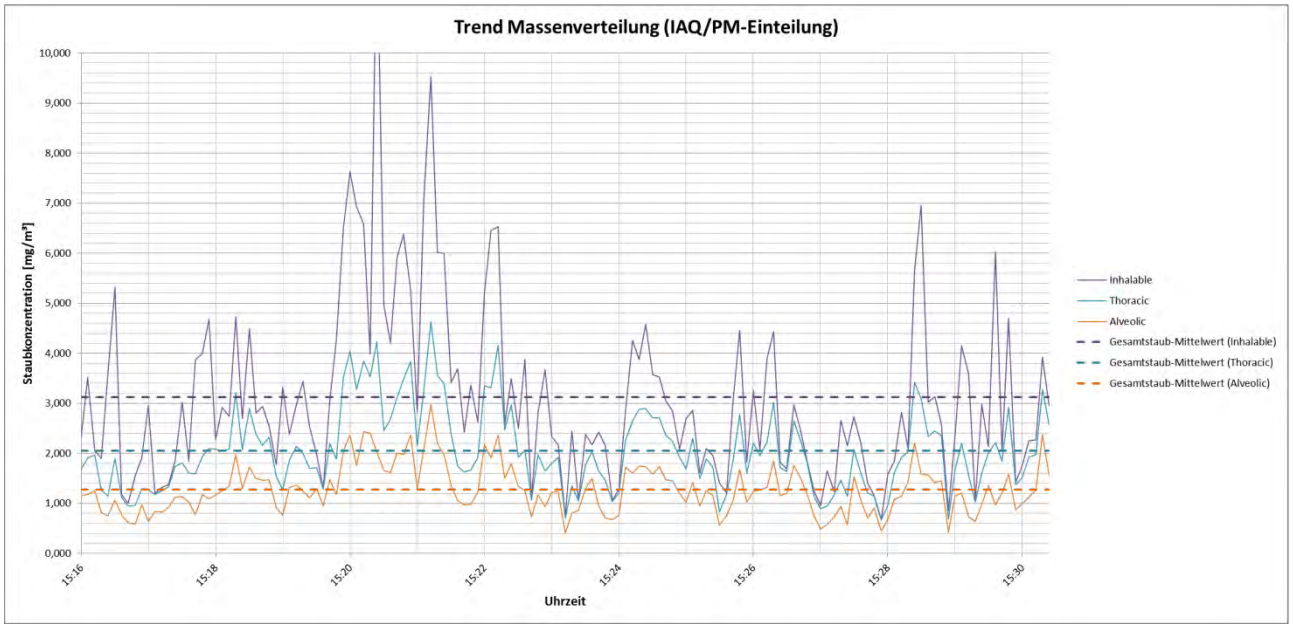
- **comments:**

no comments

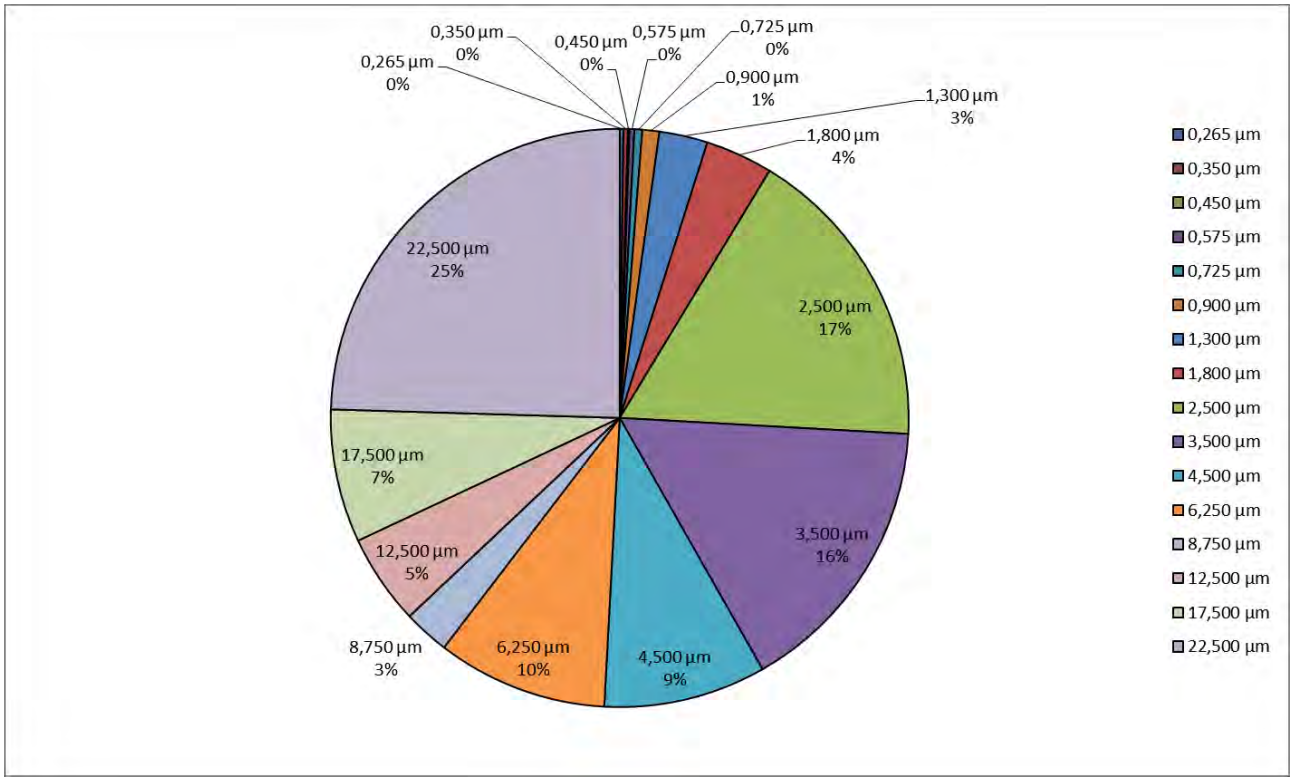
campaign 5

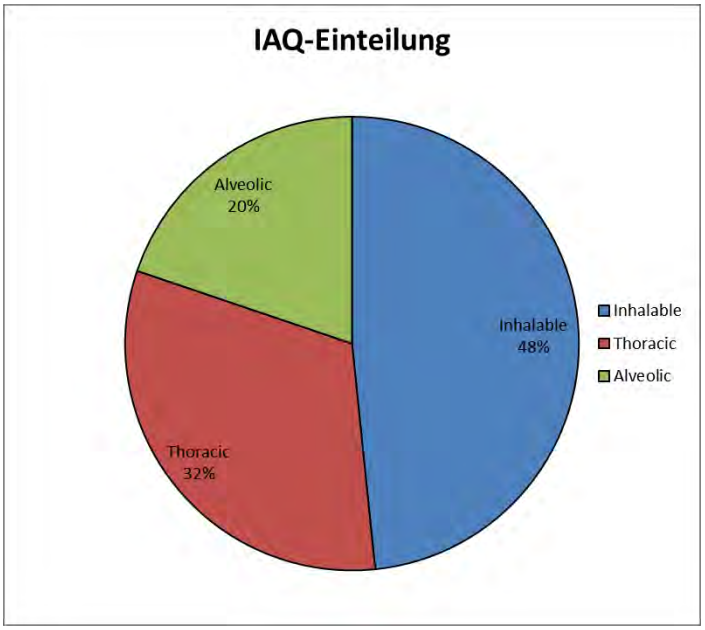
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,001	0,004	0,004	0,008	0,019	0,000	0,110	0,127	0,071	0,082	0,000	0,000	0,000	0,000
Maximum	0,011	0,013	0,005	0,015	0,027	0,069	0,207	0,453	1,377	1,104	0,639	0,725	0,249	1,015	1,194	7,540
Duchschnitt	0,007	0,008	0,003	0,008	0,014	0,030	0,084	0,118	0,536	0,495	0,283	0,297	0,080	0,157	0,232	0,764

Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,614	0,125	0,034	0,672	0,663	0,404
Maximum	4,136	1,532	0,272	12,740	4,635	2,966
Duchschnitt	1,855	0,576	0,117	3,122	2,053	1,278

- **comments:**

no comments

campaign 1

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
09.10.2014	09.10.2014	27	1016,4	~ 1,8m above the enclosure
15:55	16:47			

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
460	215	250	234	2,2

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
15:55	16:47	1,43	0,20	13,98

Comparison with the operational data collected by ILVA

During the measurement period the cooling time of the sinter material drops. The calculated speed of the sinter cooler remains at about 1,4 m/min. The sinter temperature at the discharge point of the sinter machine drops continuously and dips at about 340°C (16:40). The sinter production varies significantly in the first half of the measurement period.

campaign 2

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
10.10.2014	10.10.2014	27	1016,4	~ 1,8m above the enclosure
09:33	10:20			

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
440	170	280	277	1,35

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
09:33	10:20	0,41	0,16	39,02

Comparison with the operational data collected by ILVA

The sinter cooler was not operated at the beginning of the measurements. When operated, the sinter cooler was operated steady-going. The calculated speed of the sinter cooler remains at about 1,4 m/min. The sinter temperature at the discharge point of the sinter machine increases with the beginning of the measurements.

campaign 6

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
11.02.2015	11.02.2015	40	1018,1	~ 0,3m above the enclosure
14:18	15:03			

temperature and flow velocity measurements			
material temperature	**temperature of the enclosure**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**m/s**
290	115	102	2,9

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
14:18	15:03	0,86	0,27	31,40

campaign 7

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
12.02.2015	12.02.2015	15,7	1018,1	~ 0,15m above the enclosure
12:06	13:18			

temperature and flow velocity measurements			
material temperature	**temperature of the enclosure**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**m/s**
190 310 (13:00)	80	41	2,9

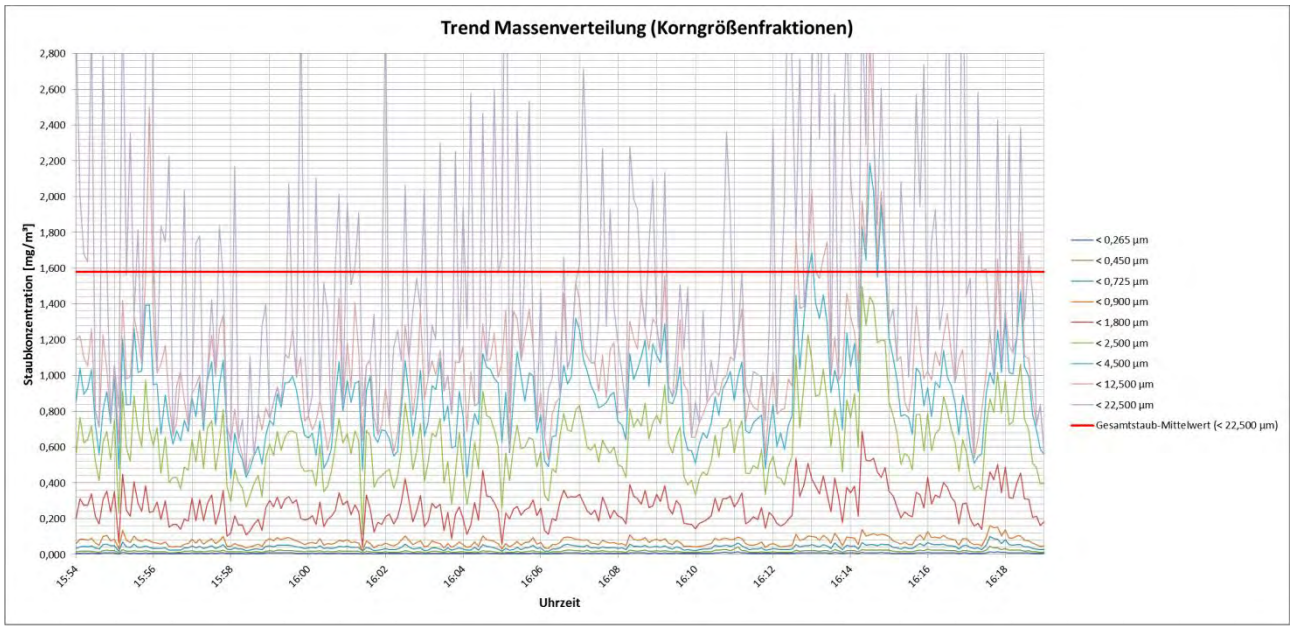
total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
12:06	13:18	3,54	0,19	5,37

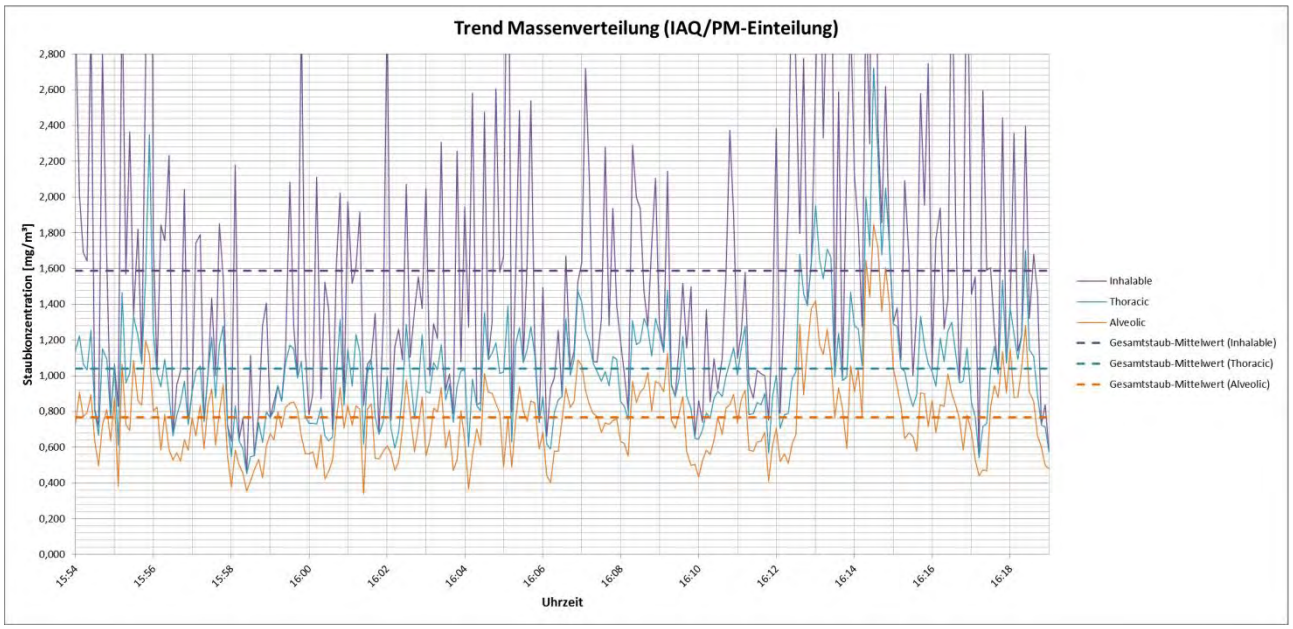
- **comments:**

interruption of the measurement due to a malfunction of the aerosol spectrometer

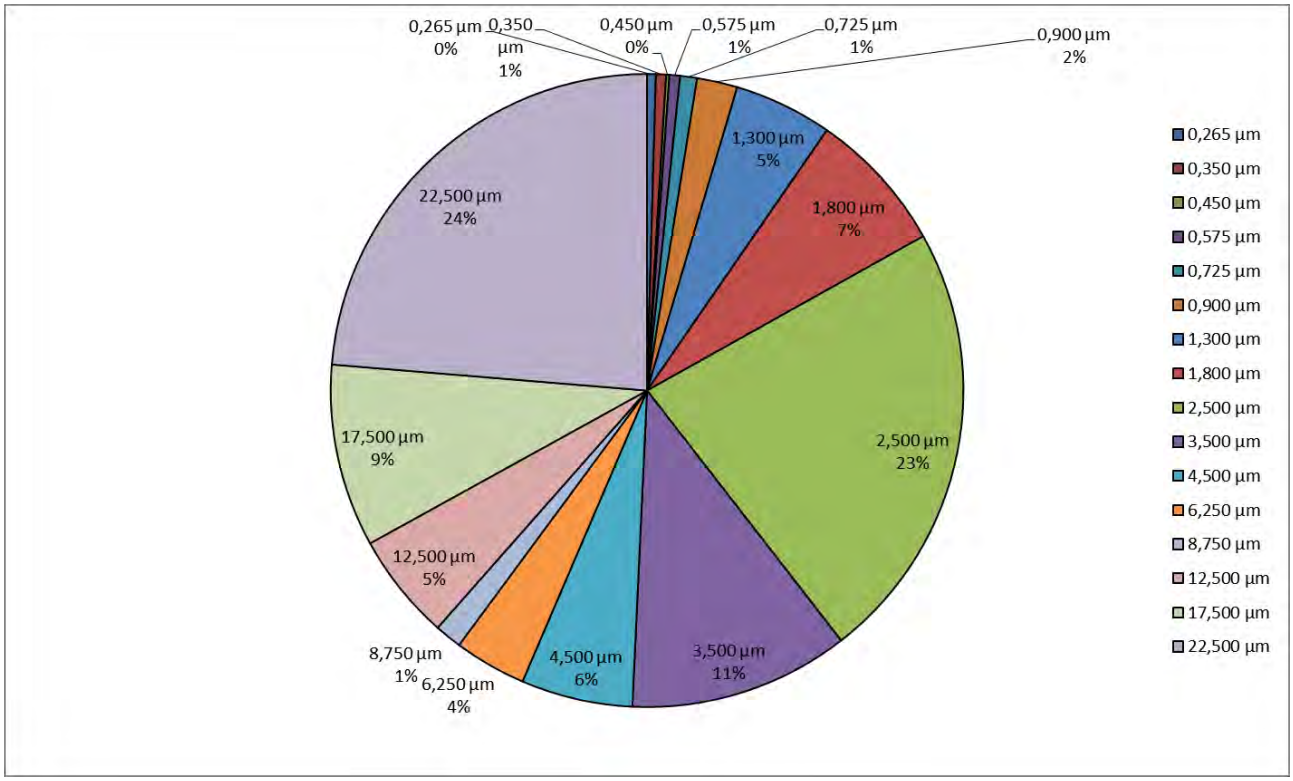
campaign 1

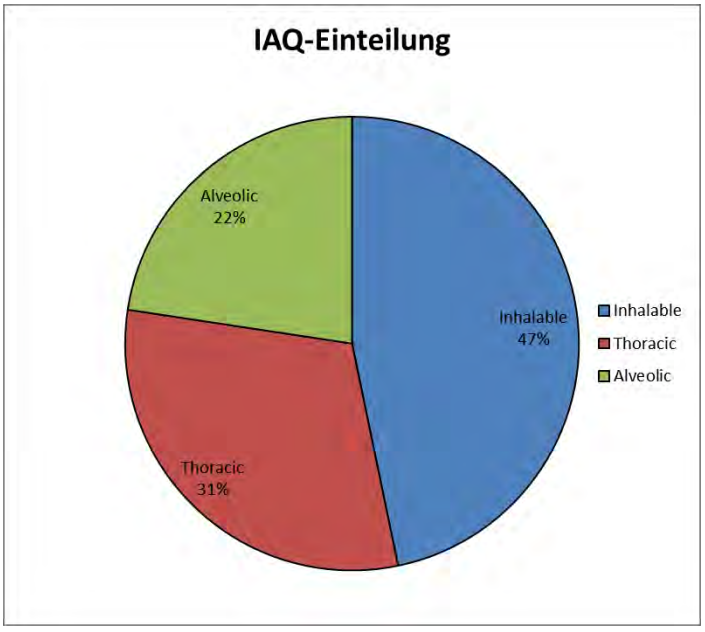
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,001	0,002	0,004	0,005	0,020	0,000	0,071	0,075	0,034	0,000	0,000	0,000	0,000	0,000
Maximum	0,016	0,023	0,010	0,025	0,032	0,073	0,175	0,374	0,919	0,519	0,247	0,208	0,149	0,797	1,393	4,060
Duchschnitt	0,007	0,008	0,003	0,009	0,014	0,033	0,079	0,115	0,357	0,178	0,090	0,058	0,022	0,086	0,147	0,374

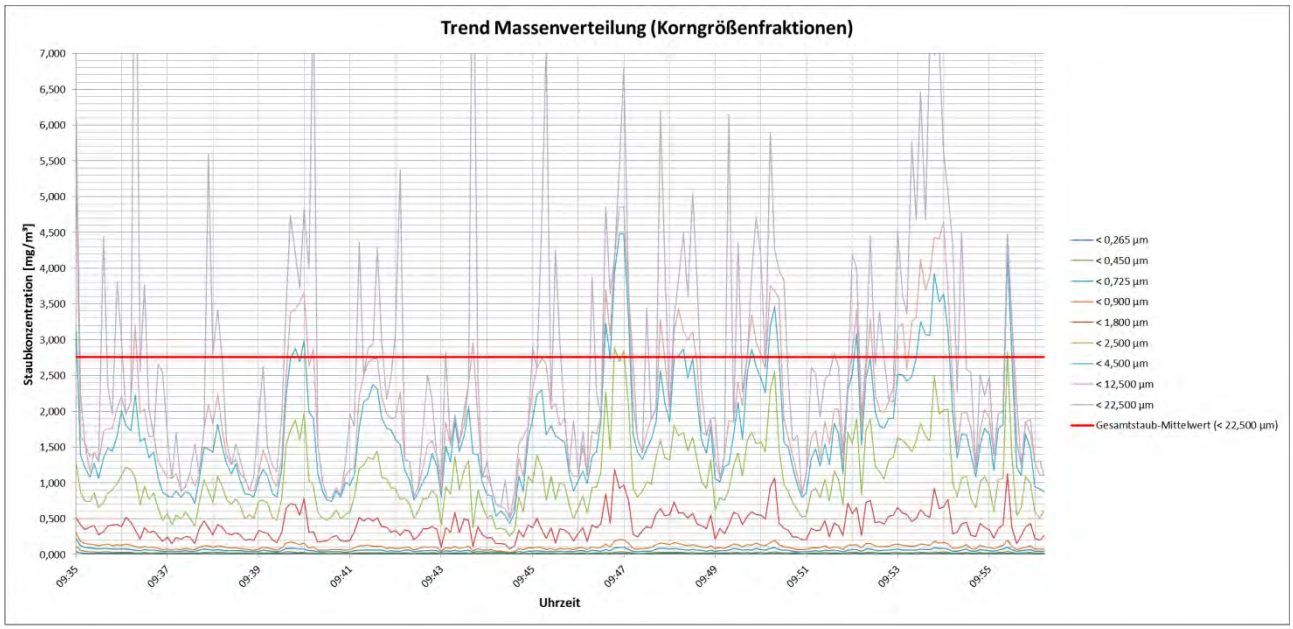
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,424	0,099	0,031	0,455	0,452	0,338
Maximum	2,441	1,095	0,237	7,959	2,724	1,843
Duchschnitt	0,951	0,459	0,112	1,588	1,041	0,768

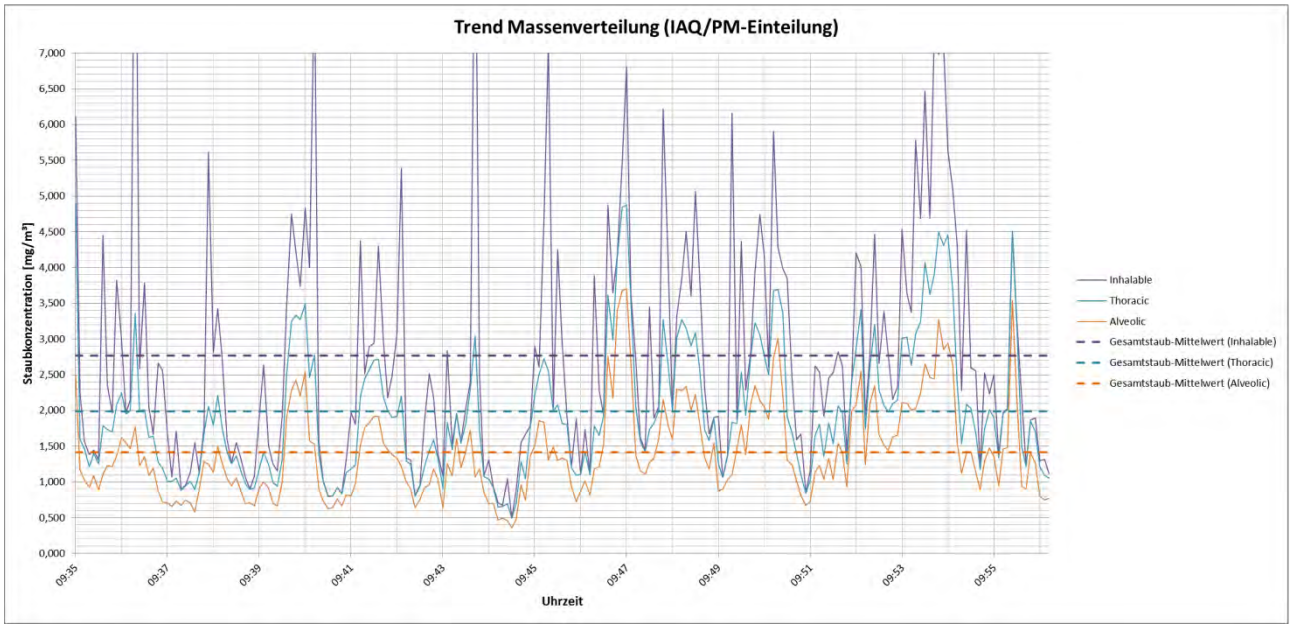
- **comments:**

no comments

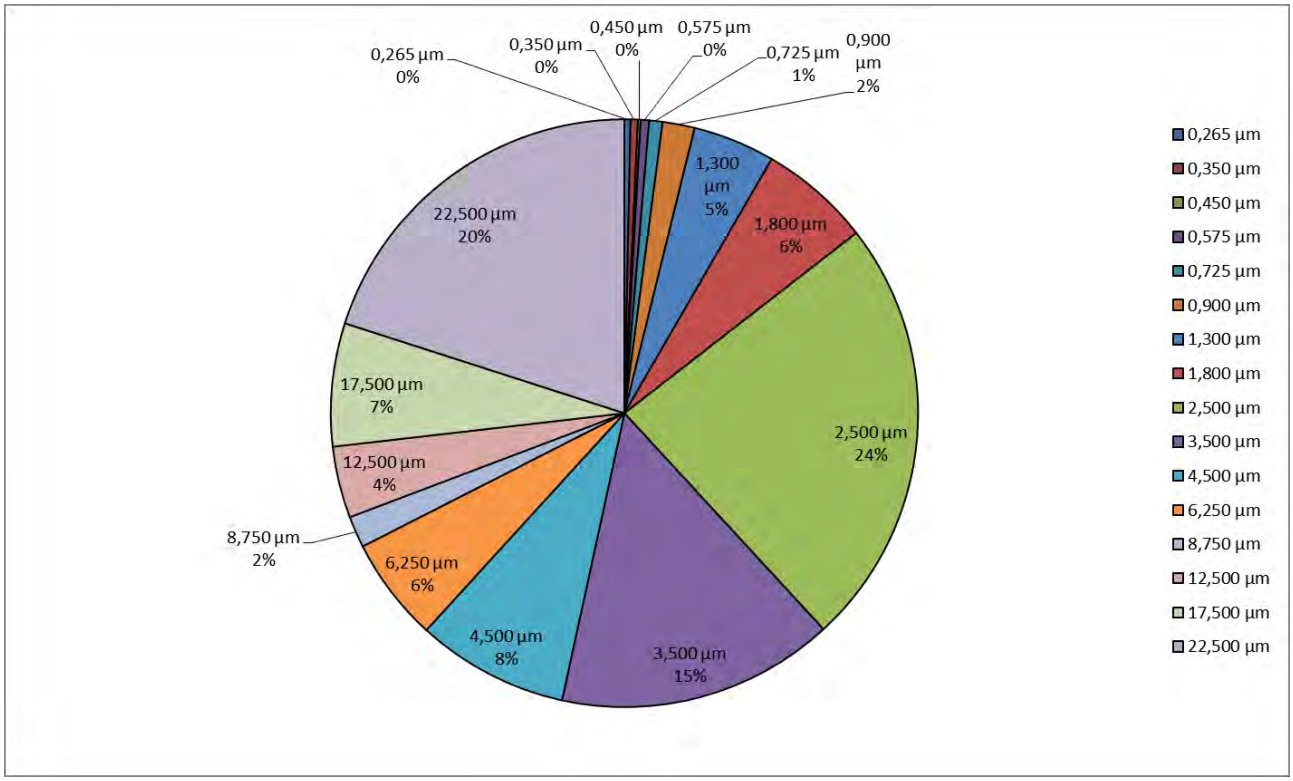
campaign 2

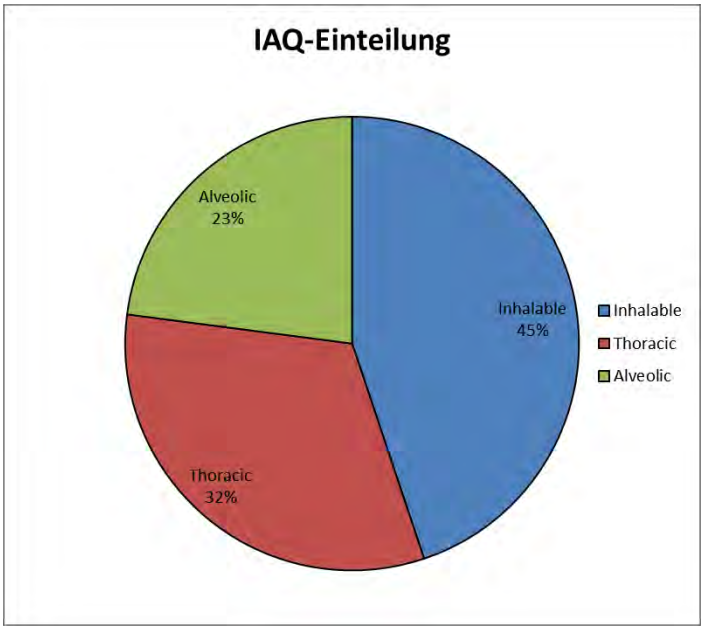
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,005	0,002	0,004	0,004	0,014	0,023	0,000	0,179	0,121	0,044	0,009	0,000	0,000	0,000	0,000
Maximum	0,034	0,039	0,038	0,062	0,043	0,109	0,324	0,677	1,872	1,225	0,829	0,988	0,597	0,725	3,183	5,800
Duchschnitt	0,009	0,011	0,004	0,013	0,020	0,049	0,125	0,169	0,652	0,421	0,231	0,158	0,048	0,109	0,187	0,553

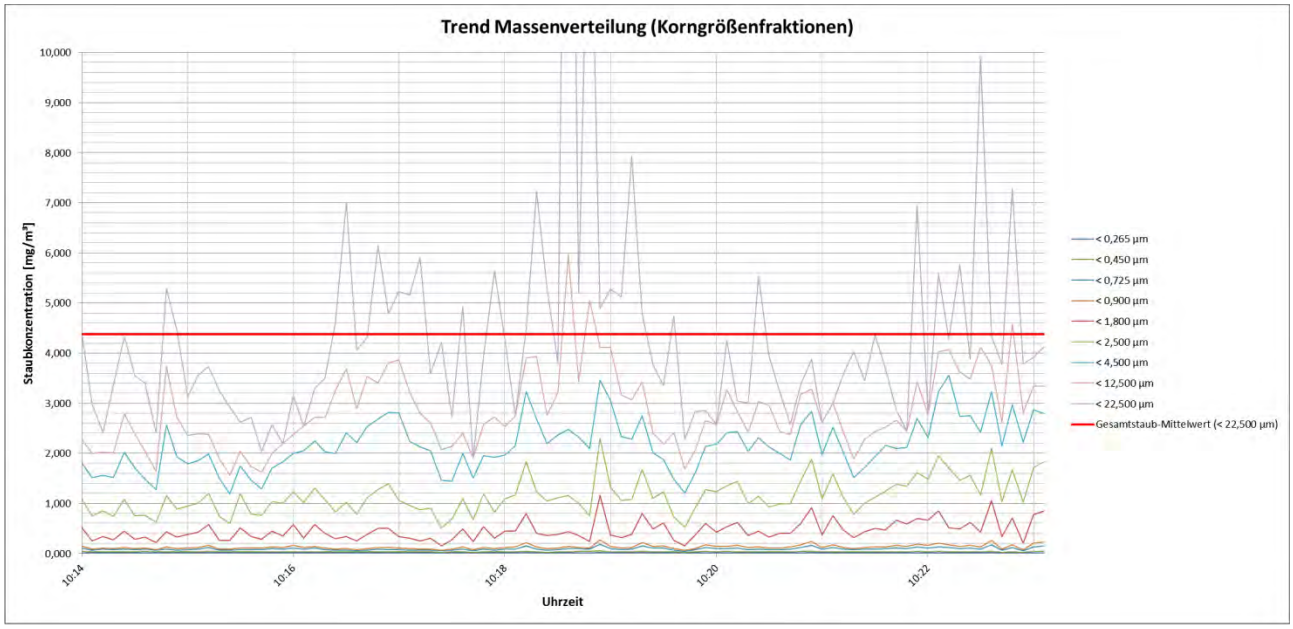
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,459	0,178	0,046	0,497	0,493	0,362
Maximum	4,504	2,062	0,386	10,610	4,894	3,701
Duchschnitt	1,820	0,757	0,170	2,768	1,987	1,416

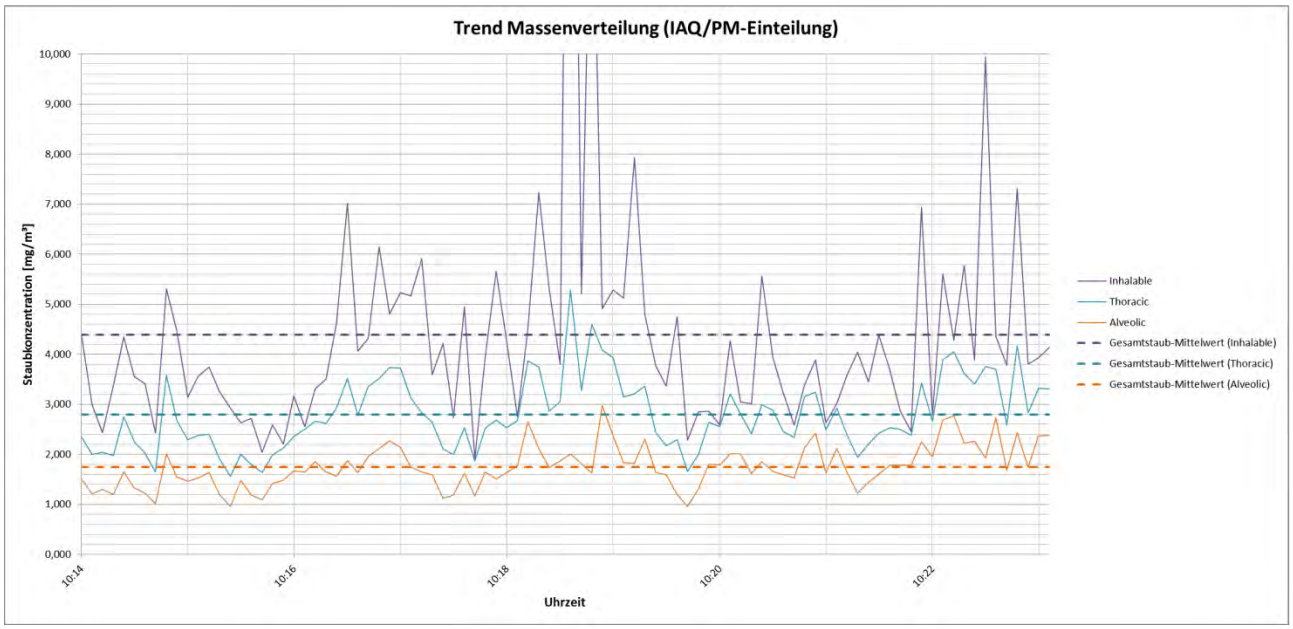
- **comments:**

no comments

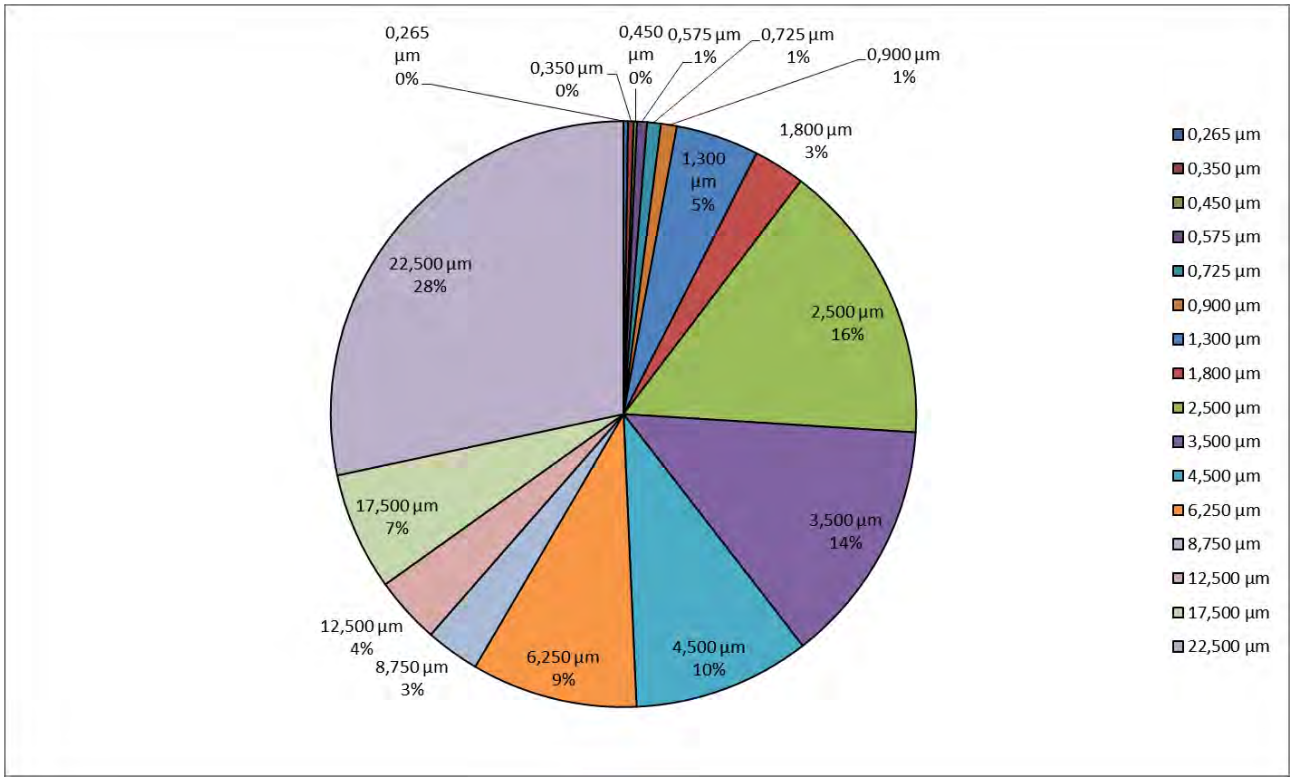
campaign 3

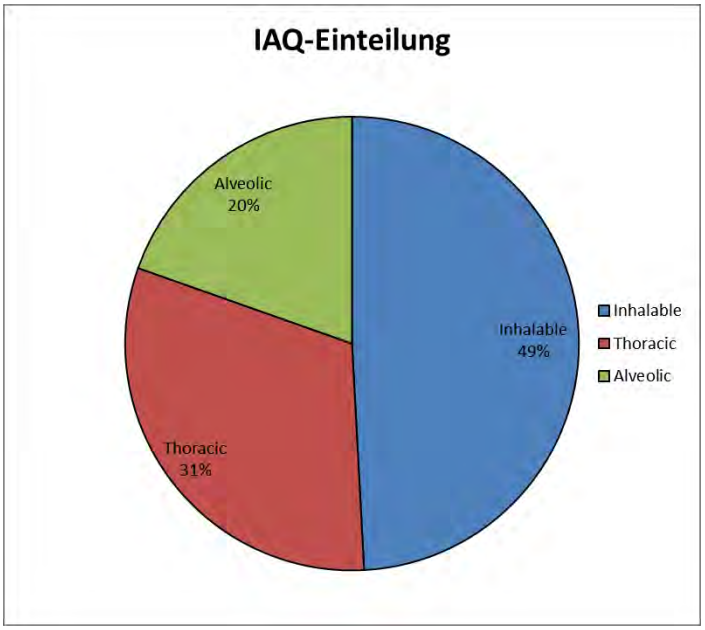
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,007	0,008	0,005	0,011	0,015	0,014	0,082	0,000	0,343	0,317	0,179	0,172	0,000	0,000	0,000	0,000
Maximum	0,018	0,023	0,014	0,052	0,079	0,092	0,435	0,458	1,183	1,174	0,748	0,725	0,647	2,247	2,785	15,659
Duchschnitt	0,011	0,014	0,008	0,024	0,033	0,038	0,201	0,125	0,685	0,592	0,428	0,401	0,131	0,162	0,285	1,242

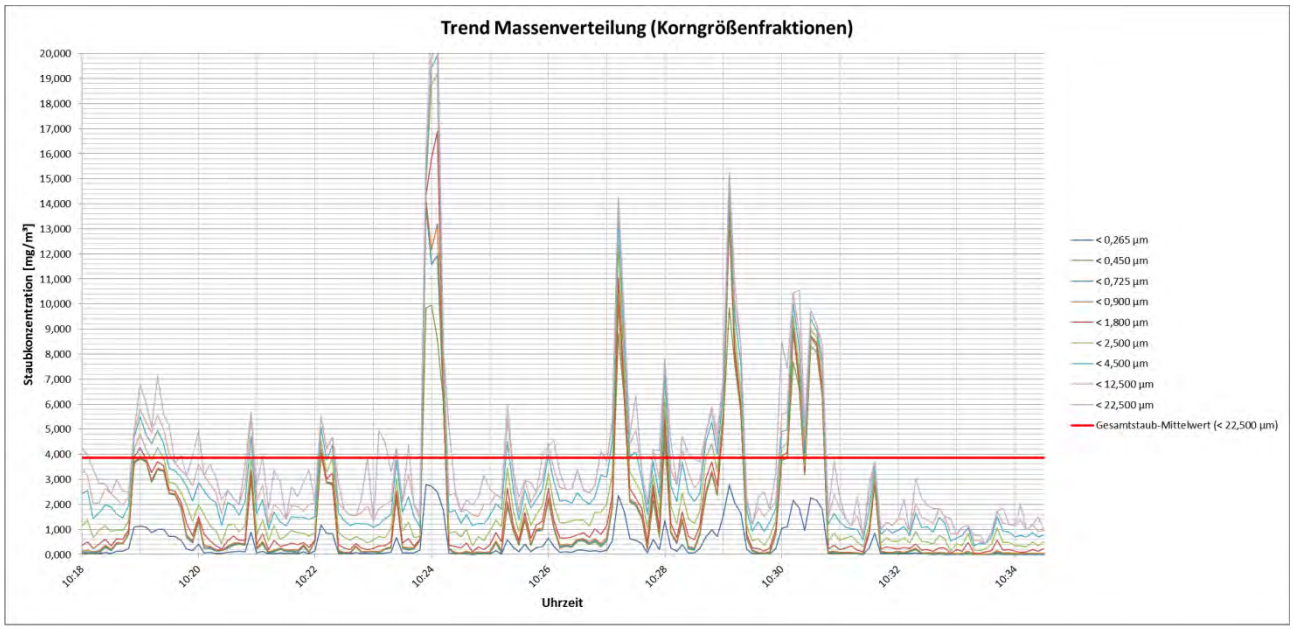
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	1,398	0,375	0,098	1,914	1,565	0,963
Maximum	4,249	1,767	0,448	23,632	5,283	2,966
Duchschnitt	2,523	0,846	0,212	4,392	2,792	1,751

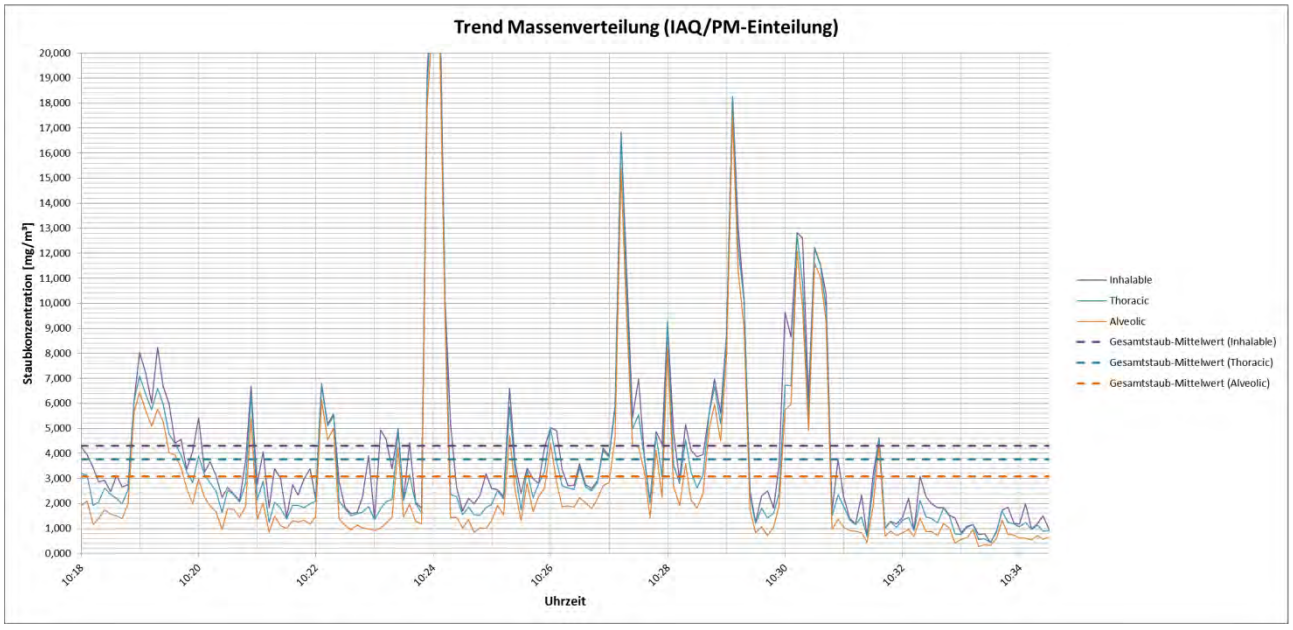
- **comments:**

no comments

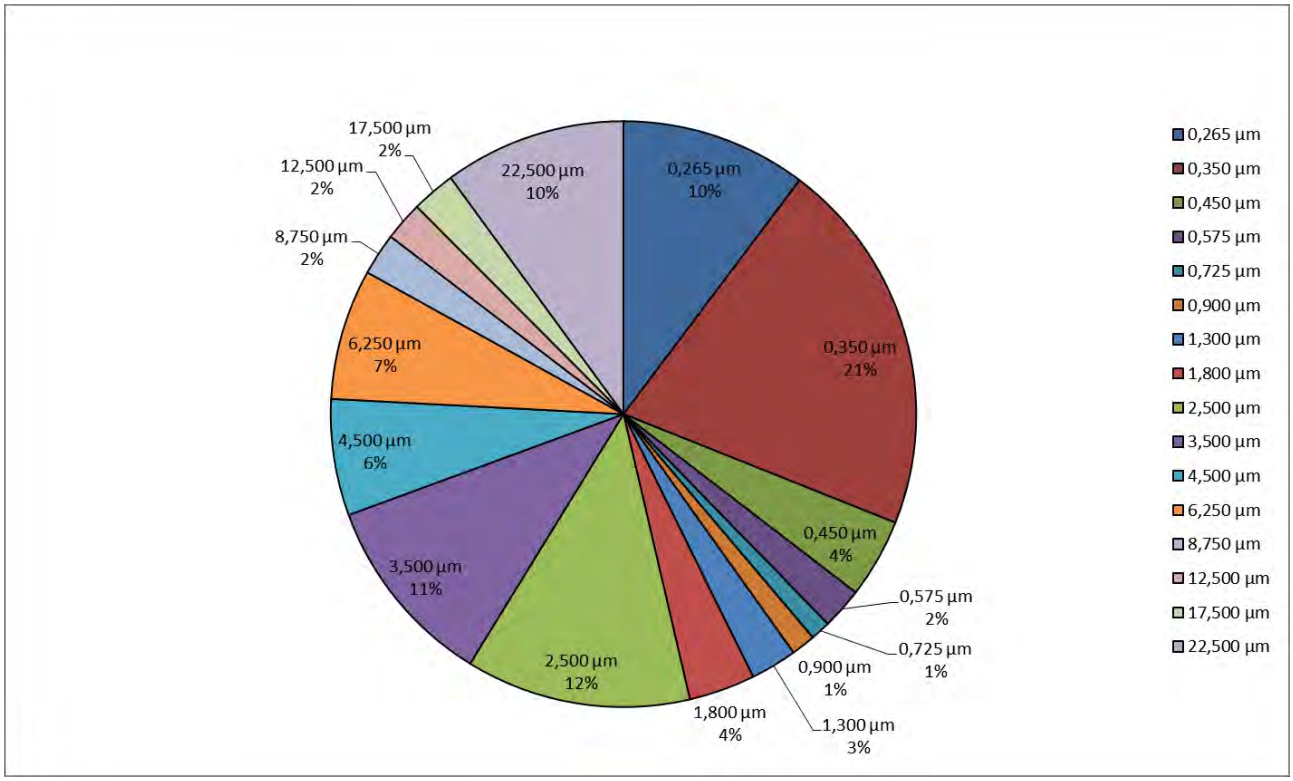
campaign 4

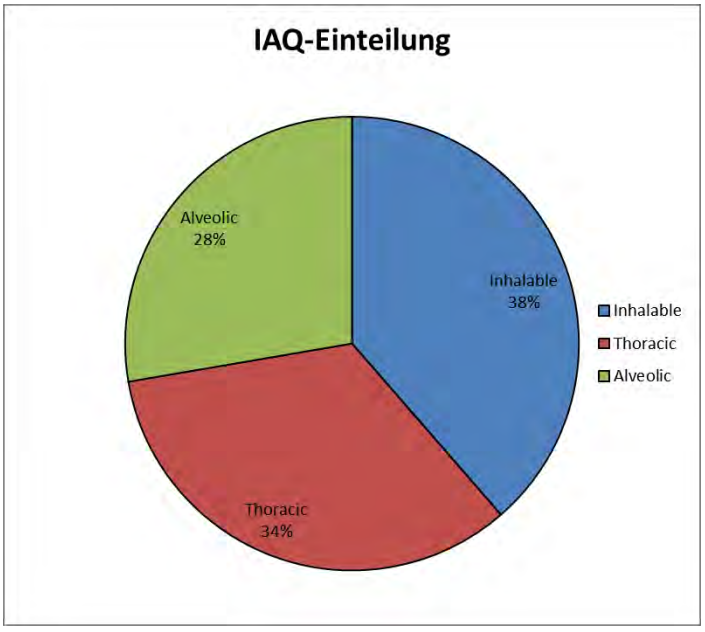
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,002	0,003	0,001	0,002	0,003	0,006	0,013	0,000	0,070	0,088	0,078	0,018	0,000	0,000	0,000	0,000
Maximum	2,800	4,694	2,679	3,011	1,160	1,262	0,743	2,986	2,922	0,878	0,595	0,752	0,298	0,435	0,597	2,900
Duchschnitt	0,396	0,801	0,169	0,088	0,042	0,051	0,099	0,141	0,479	0,410	0,248	0,278	0,090	0,083	0,093	0,388

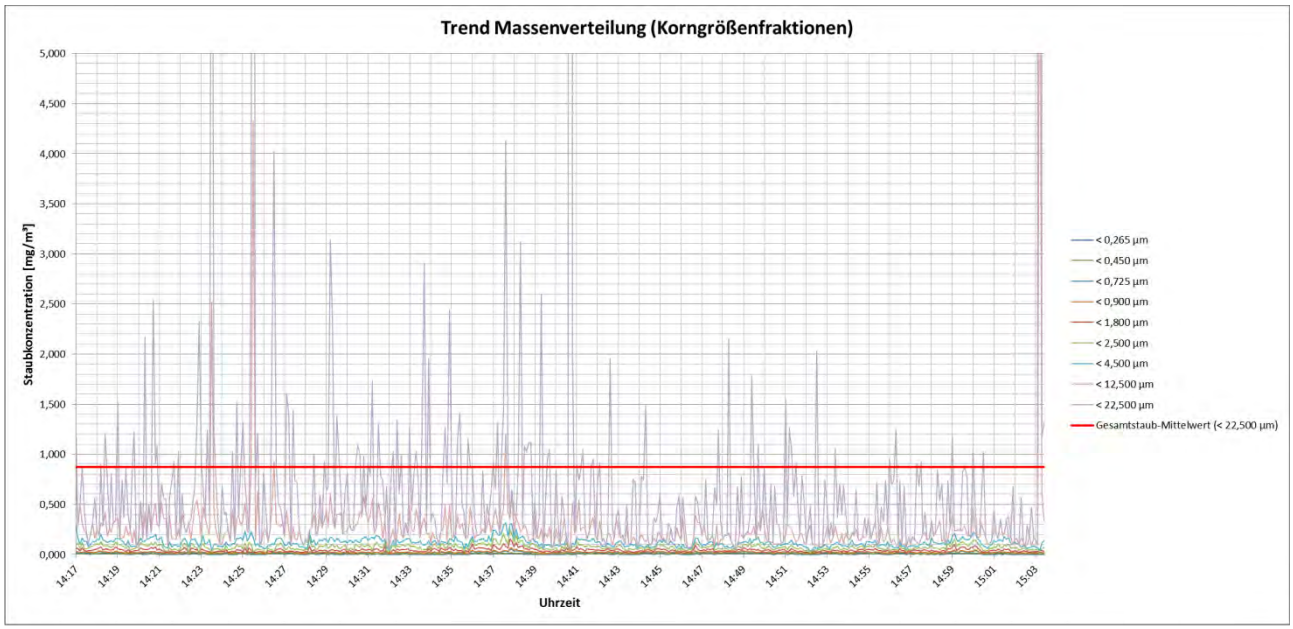
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,407	0,113	0,029	0,437	0,435	0,288
Maximum	22,626	20,580	16,226	24,543	23,106	21,916
Duchschnitt	3,592	2,487	1,986	4,294	3,750	3,080

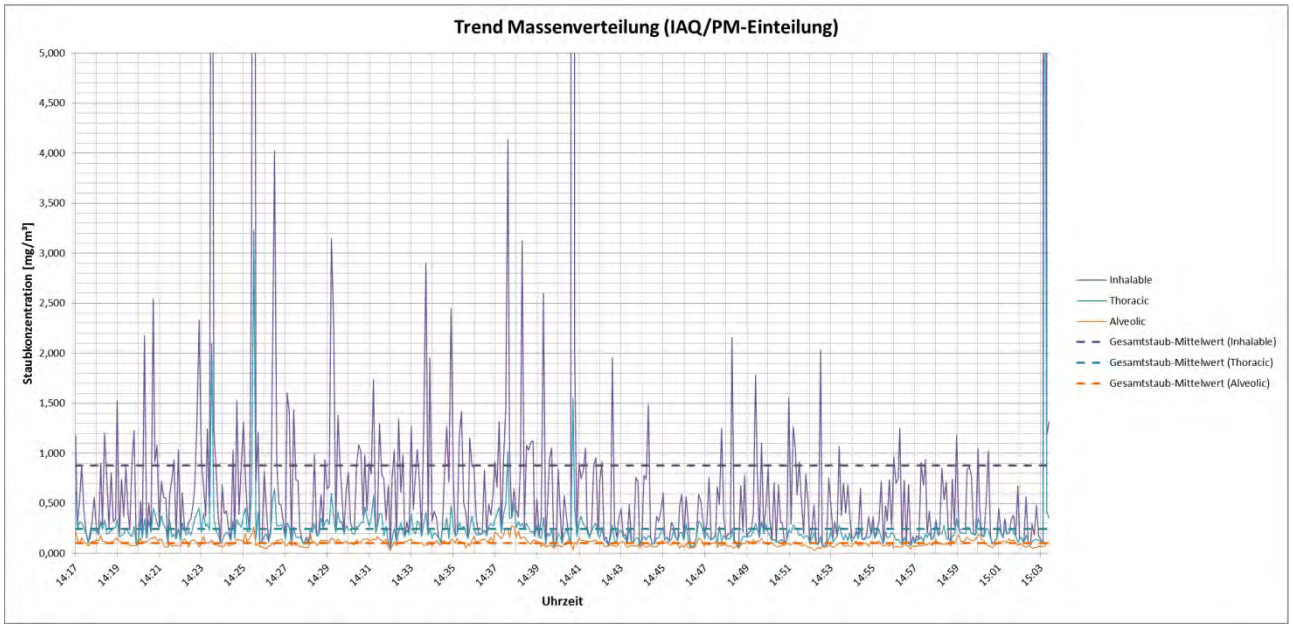
- **comments:**

no comments

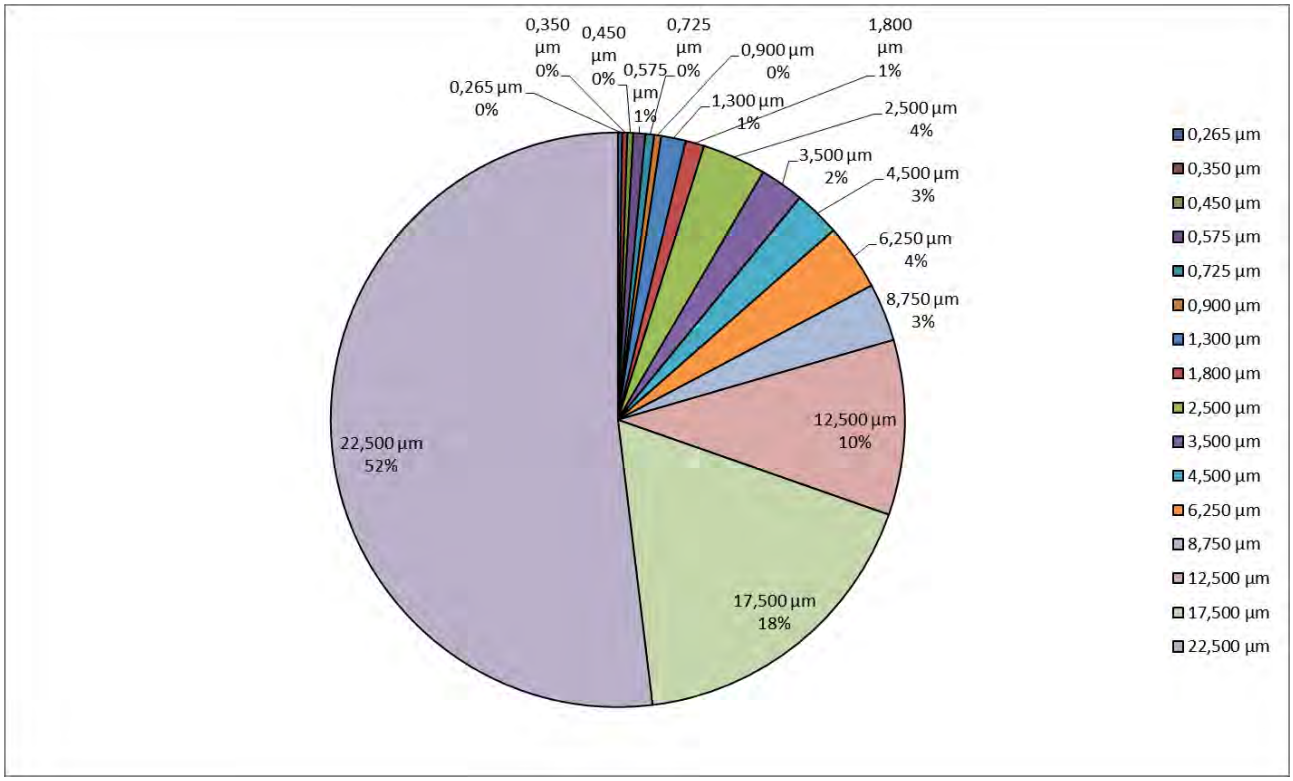
campaign 6

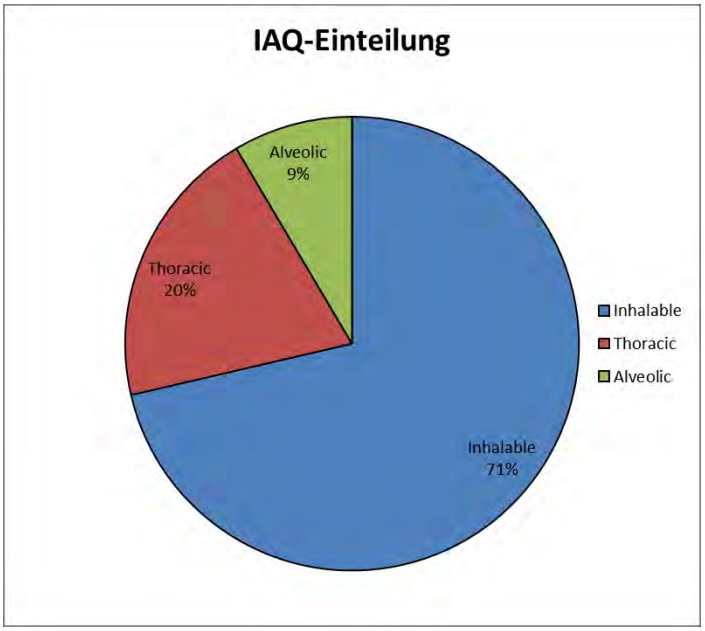
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,001	0,001	0,001	0,001	0,001	0,001	0,002	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,004	0,008	0,008	0,020	0,018	0,013	0,043	0,045	0,094	0,064	0,139	0,725	0,970	7,685	22,479	52,198
Duchschnitt	0,002	0,003	0,003	0,006	0,004	0,003	0,012	0,009	0,031	0,022	0,023	0,033	0,028	0,086	0,155	0,454

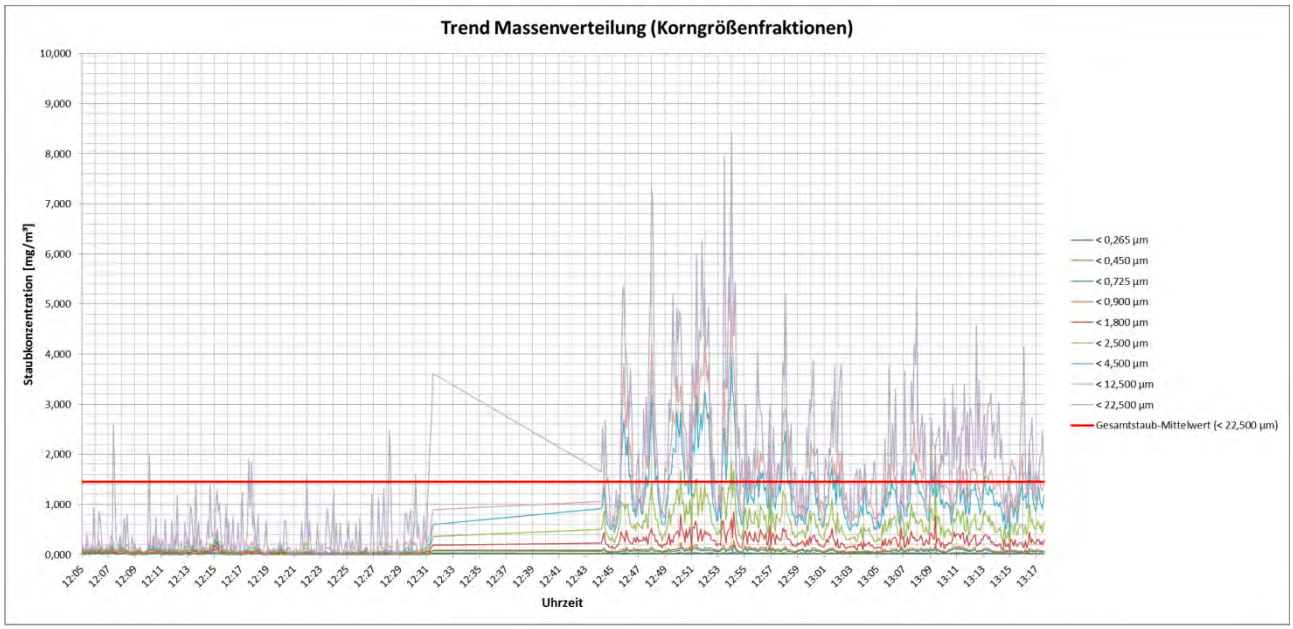
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,035	0,011	0,006	0,054	0,053	0,029
Maximum	4,239	0,201	0,076	62,684	7,826	0,281
Duchschnitt	0,202	0,062	0,026	0,877	0,247	0,105

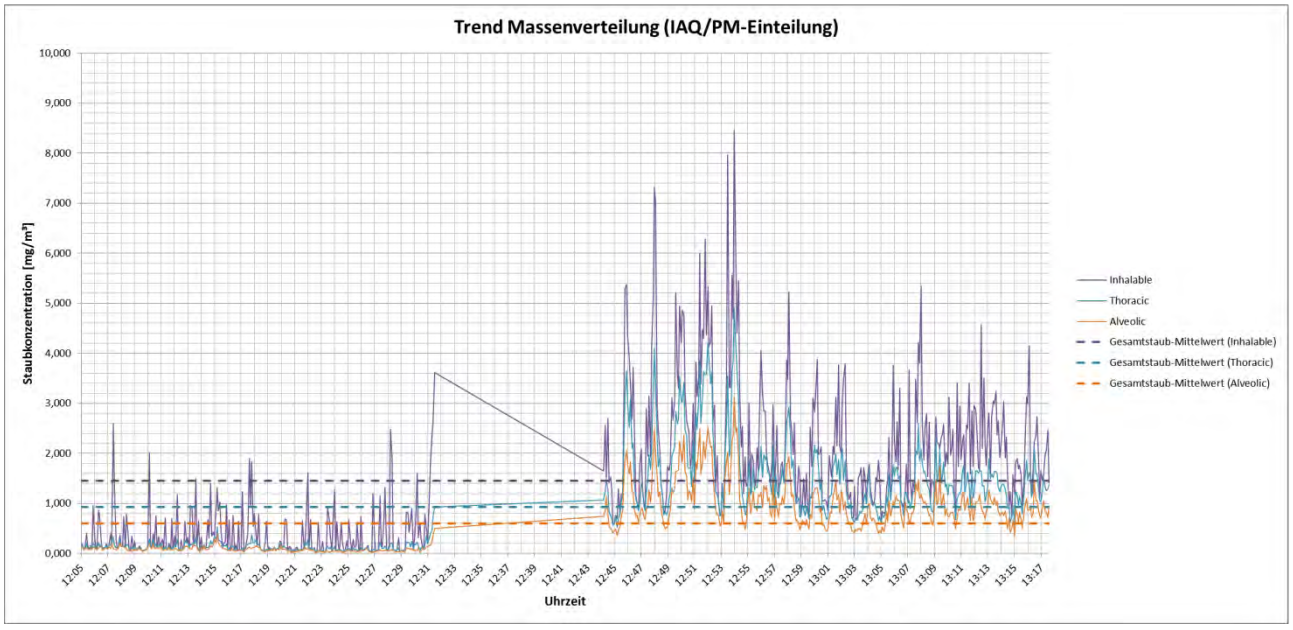
- **comments:**

no comments

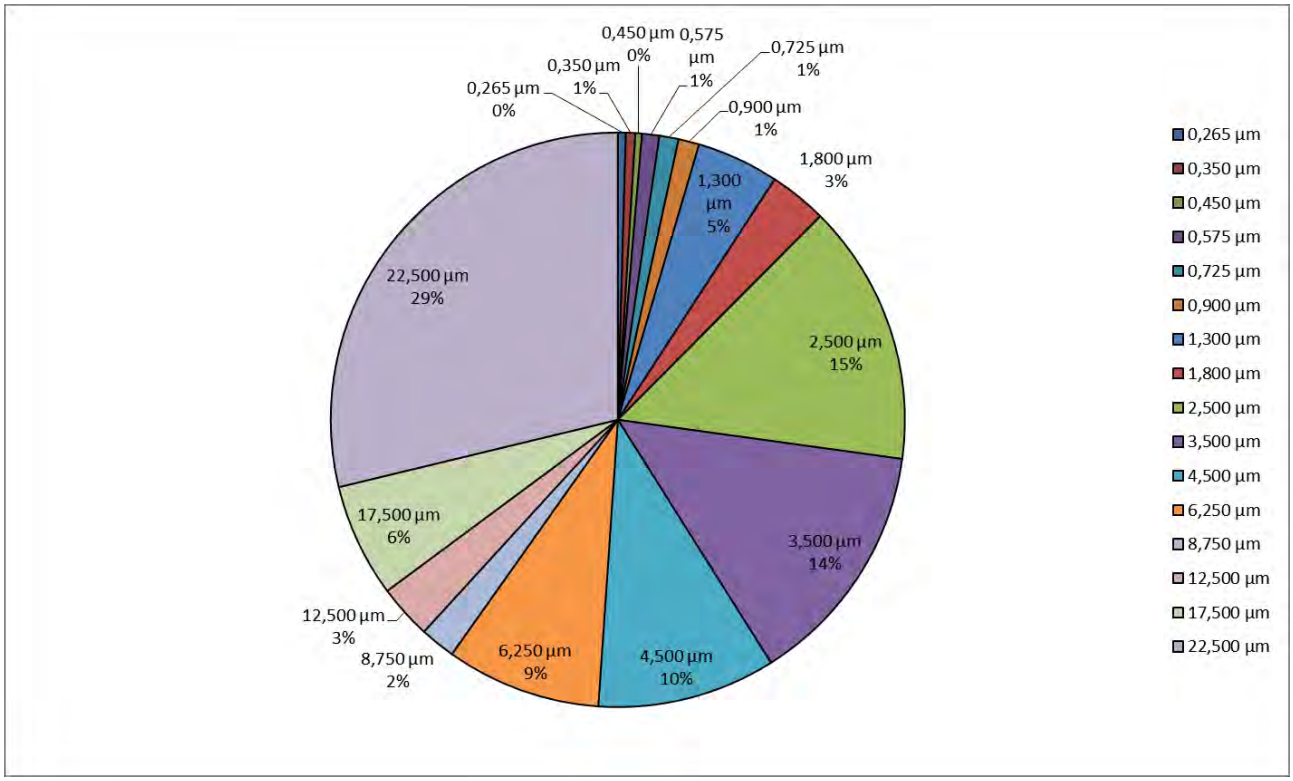
campaign 7

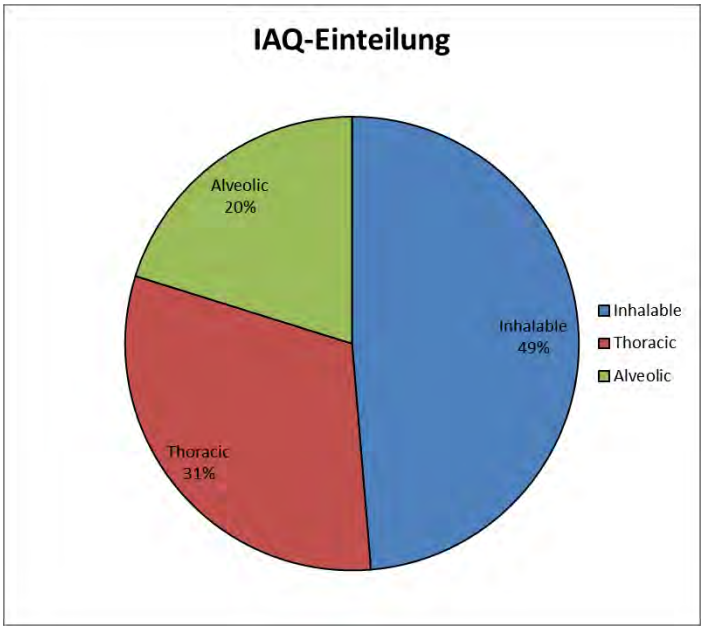
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,001	0,002	0,001	0,002	0,001	0,001	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,019	0,023	0,022	0,056	0,076	0,090	0,334	0,300	1,163	1,205	0,934	0,879	0,199	0,362	0,995	4,060
Duchschnitt	0,006	0,008	0,005	0,014	0,016	0,017	0,067	0,047	0,213	0,201	0,145	0,126	0,029	0,044	0,092	0,416

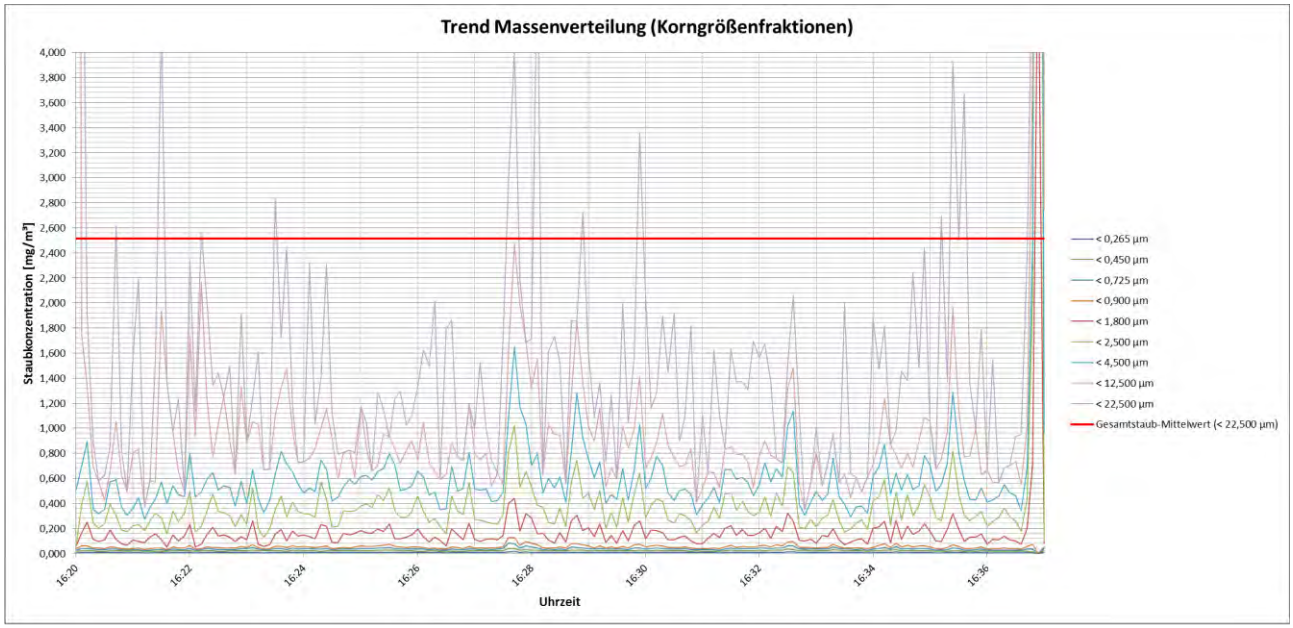
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,020	0,015	0,009	0,020	0,020	0,020
Maximum	4,442	1,384	0,391	8,452	4,909	3,110
Duchschnitt	0,843	0,306	0,093	1,453	0,930	0,603

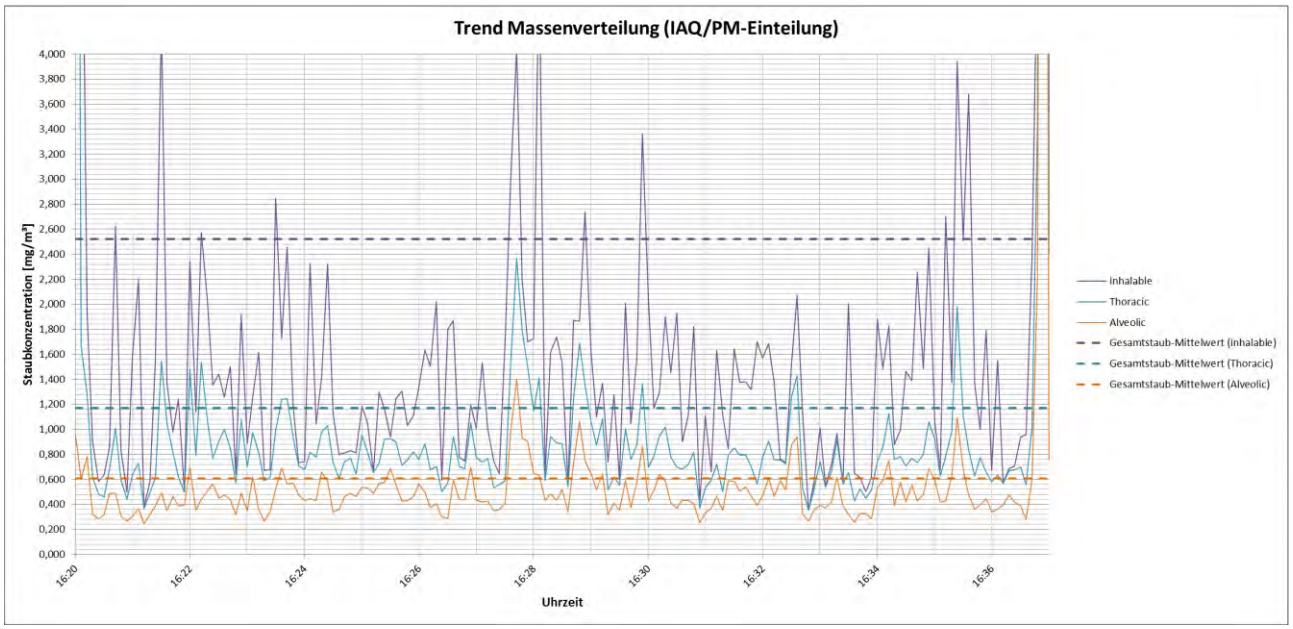
- **comments:**

no comments

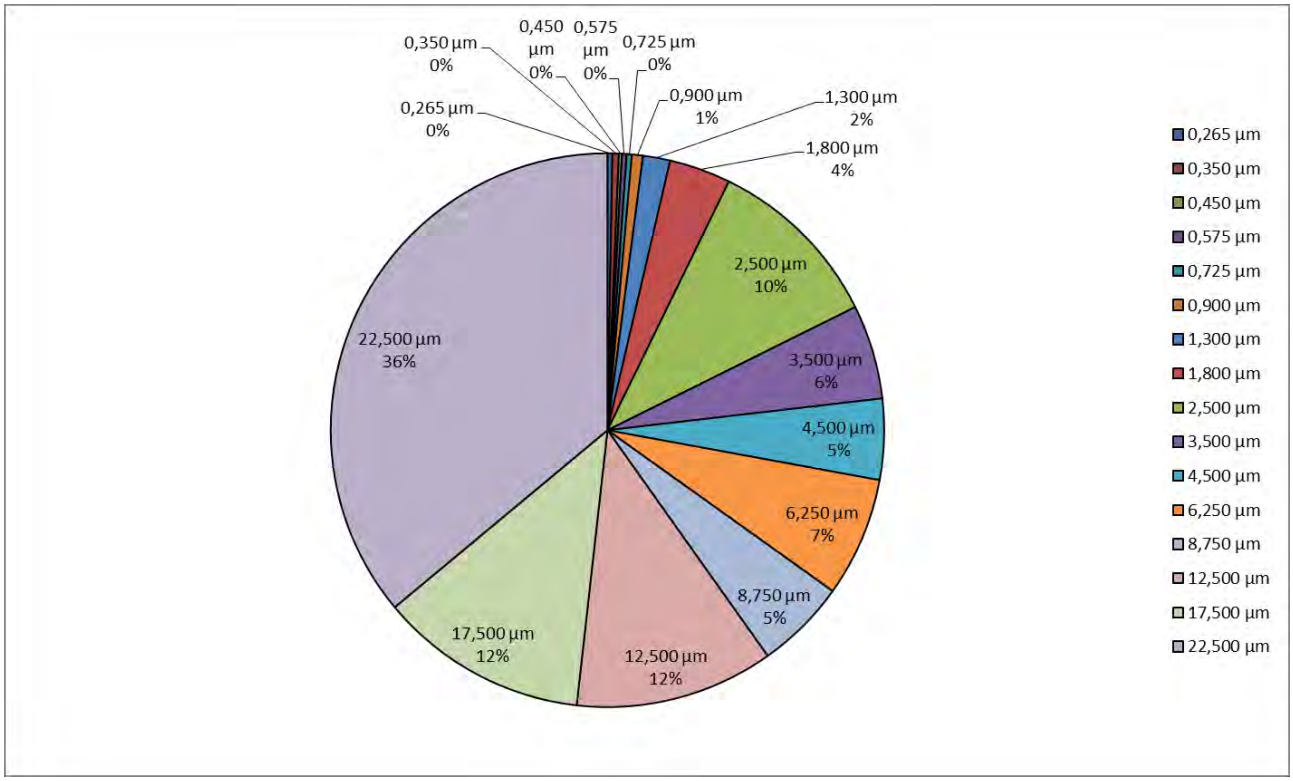
campaign 1

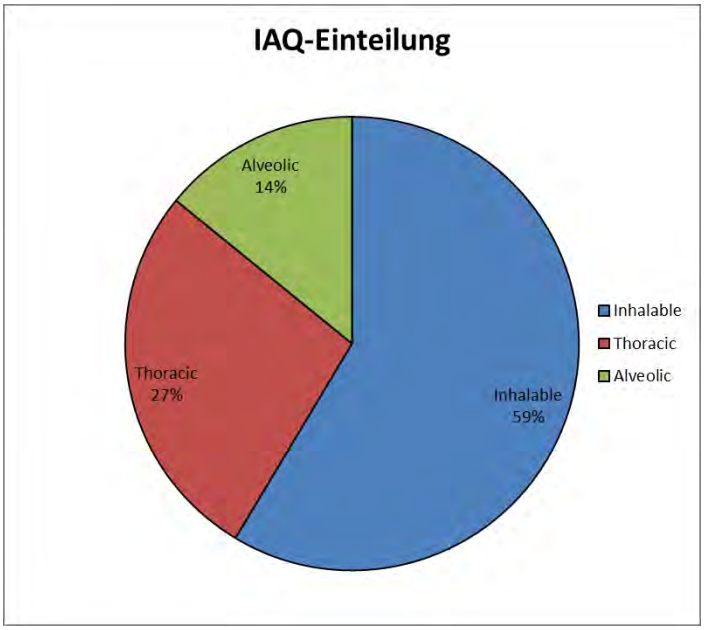
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,000	0,000	0,000	0,000	0,000	0,000	0,012	0,000	0,000	0,000	0,027	0,018	0,000	0,000	0,000	0,000
Maximum	0,015	0,017	0,009	0,019	0,023	0,049	0,423	4,602	10,437	1,701	2,567	6,570	6,664	16,457	13,527	50,458
Duchschnitt	0,007	0,009	0,004	0,007	0,008	0,016	0,040	0,090	0,262	0,138	0,119	0,175	0,133	0,292	0,306	0,906

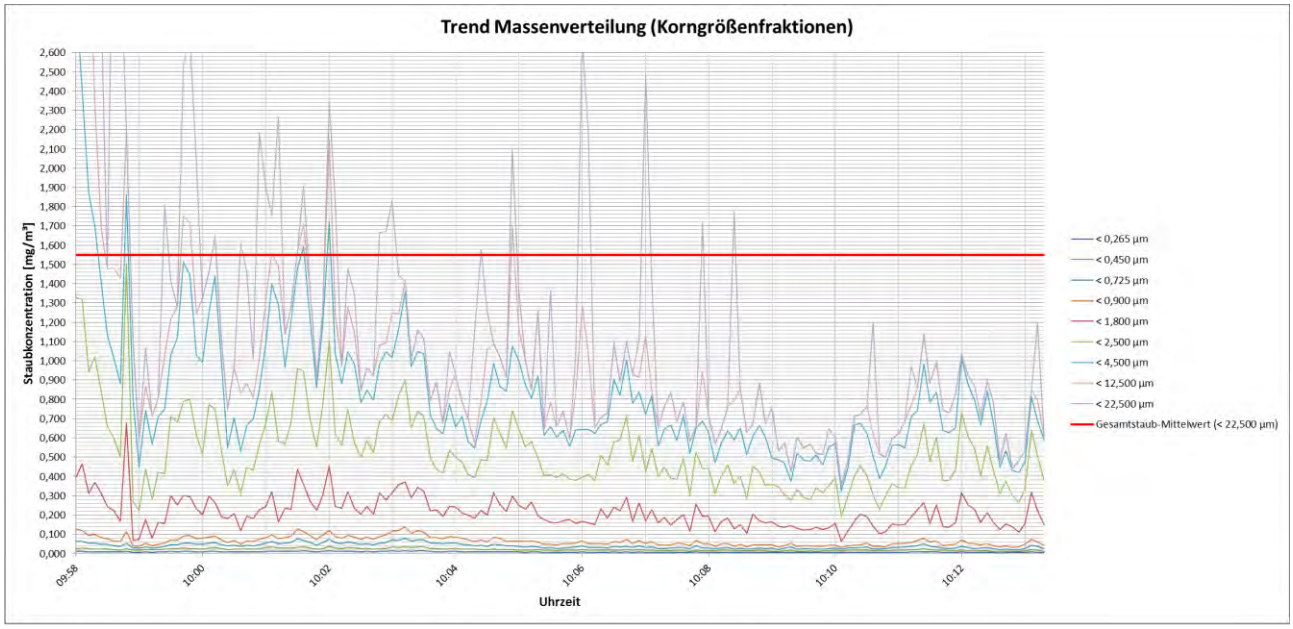
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,333	0,068	0,041	0,359	0,355	0,245
Maximum	35,507	10,071	1,004	113,207	41,560	18,130
Duchschnitt	1,028	0,325	0,081	2,520	1,173	0,608

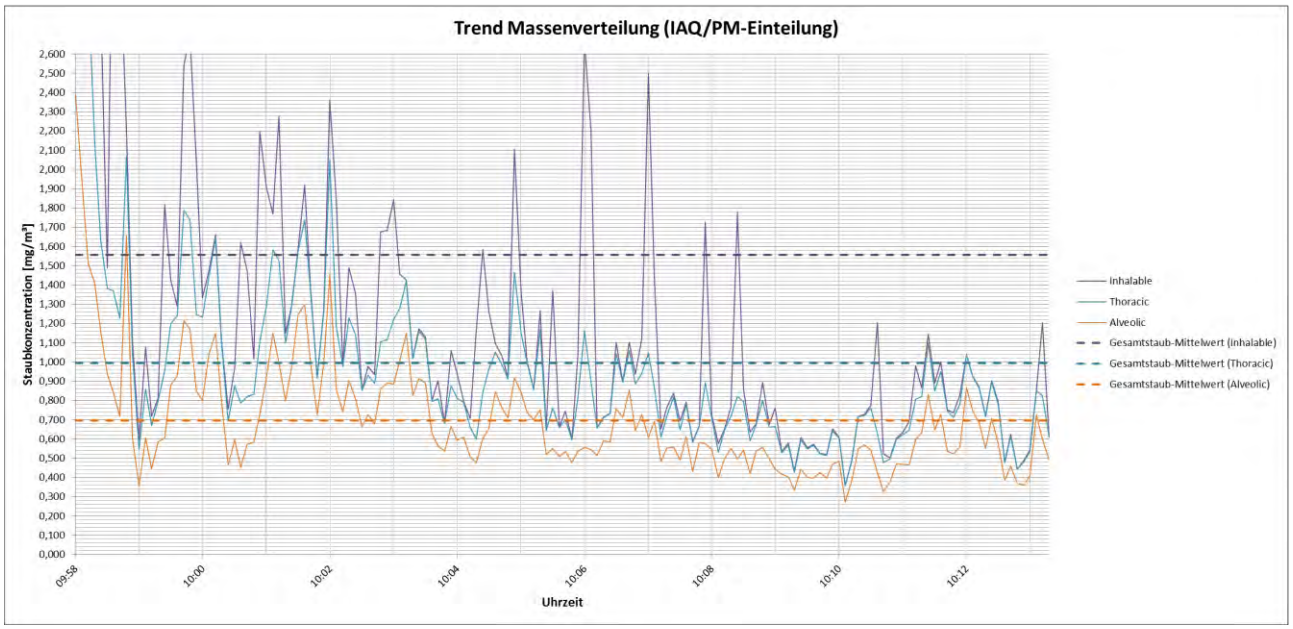
- **comments:**

no comments

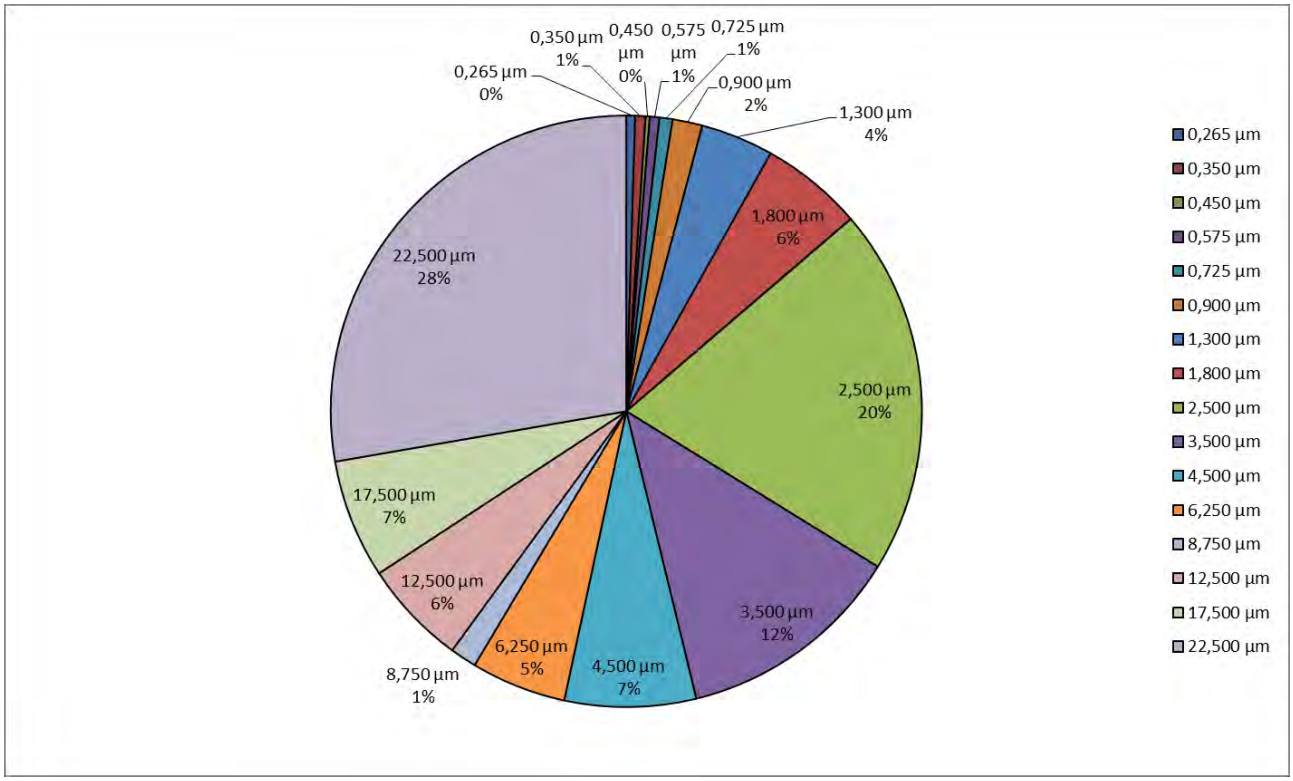
campaign 2

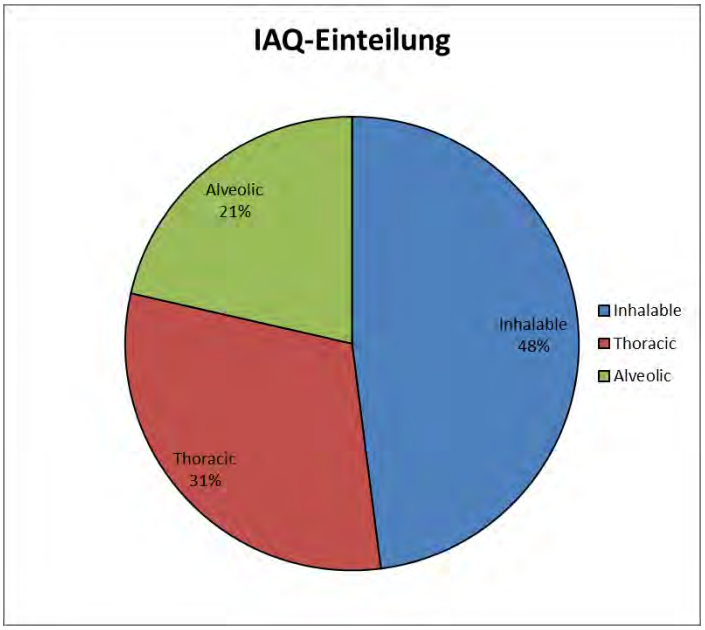
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,004	0,001	0,003	0,004	0,008	0,015	0,000	0,127	0,064	0,034	0,009	0,000	0,000	0,000	0,000
Maximum	0,014	0,016	0,006	0,019	0,026	0,064	0,162	0,414	0,933	0,907	0,660	1,078	0,821	3,117	5,371	36,538
Duchschnitt	0,007	0,009	0,004	0,008	0,011	0,025	0,062	0,087	0,311	0,192	0,111	0,081	0,022	0,089	0,101	0,429

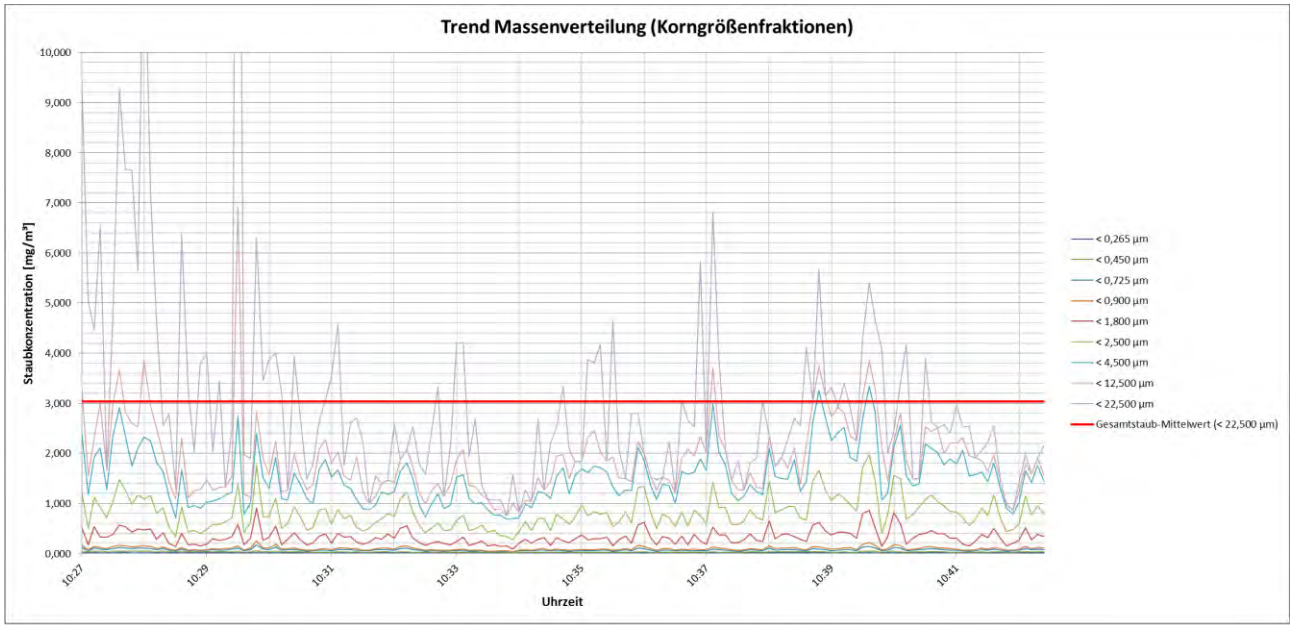
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,334	0,138	0,041	0,359	0,357	0,273
Maximum	5,646	1,088	0,213	49,832	7,778	2,390
Duchschnitt	0,905	0,385	0,098	1,557	0,993	0,696

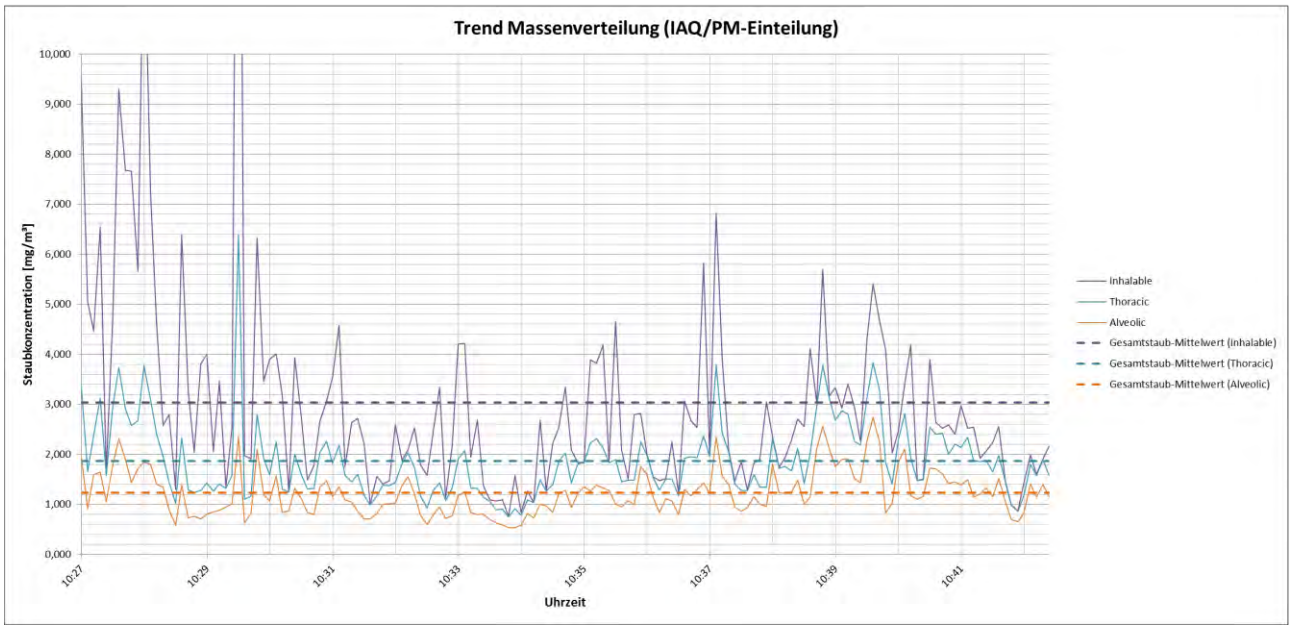
- **comments:**

no comments

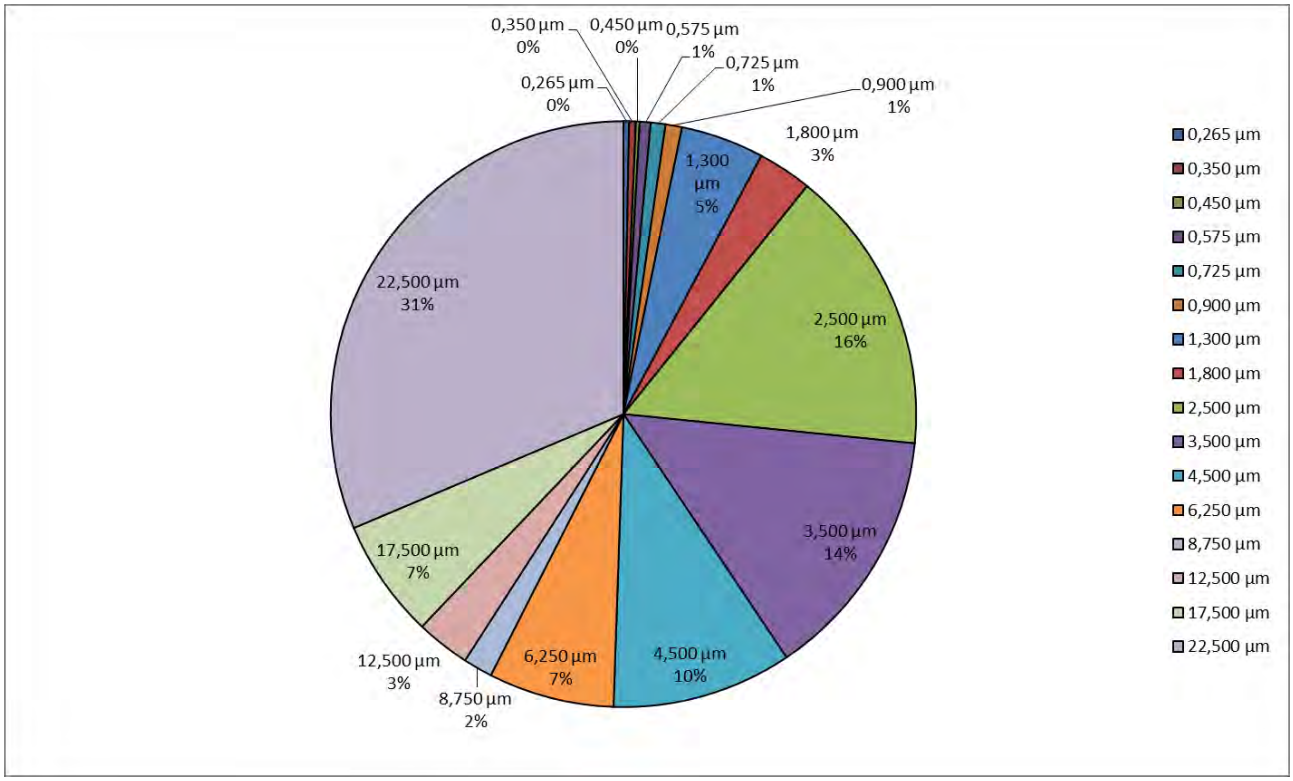
campaign 3

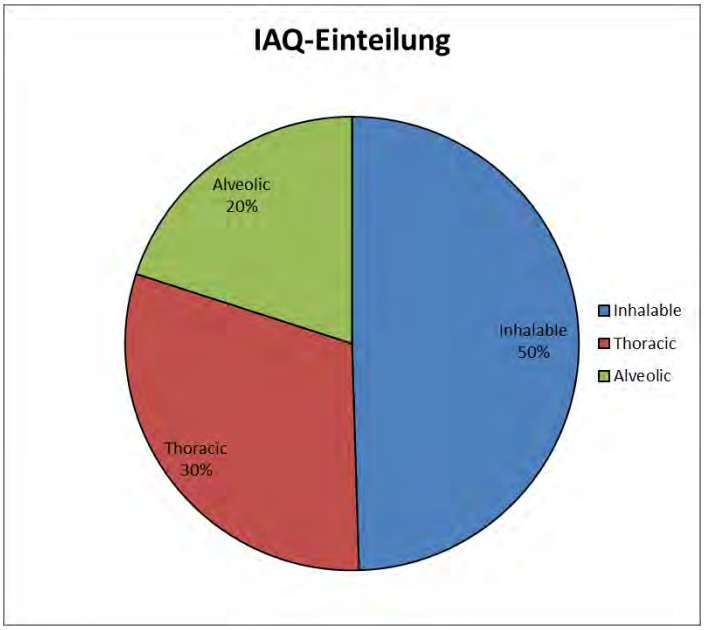
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,005	0,003	0,006	0,008	0,008	0,044	0,000	0,187	0,188	0,088	0,018	0,000	0,000	0,000	0,000
Maximum	0,016	0,021	0,014	0,051	0,071	0,072	0,370	0,356	1,115	0,915	0,720	1,423	0,845	1,885	3,183	12,179
Duchschnitt	0,009	0,011	0,006	0,018	0,025	0,027	0,139	0,091	0,479	0,425	0,301	0,210	0,049	0,090	0,199	0,950

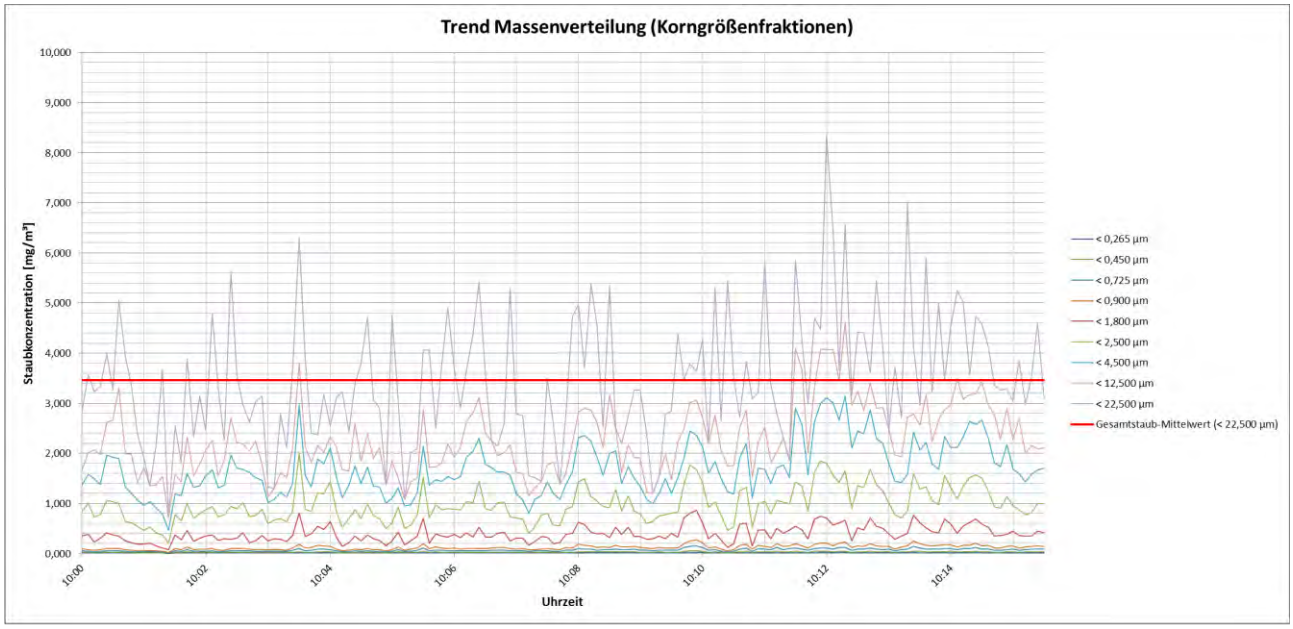
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,699	0,207	0,056	0,761	0,751	0,533
Maximum	5,213	1,474	0,375	22,279	6,396	2,742
Duchschnitt	1,693	0,604	0,157	3,042	1,871	1,231

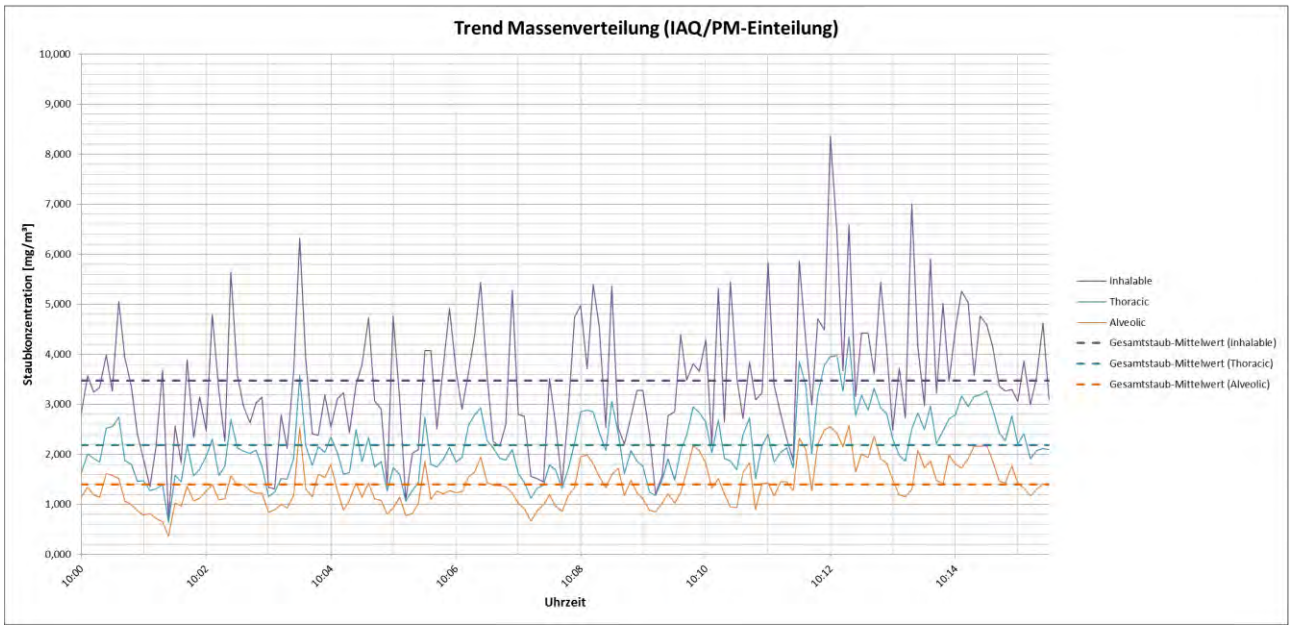
- **comments:**

no comments

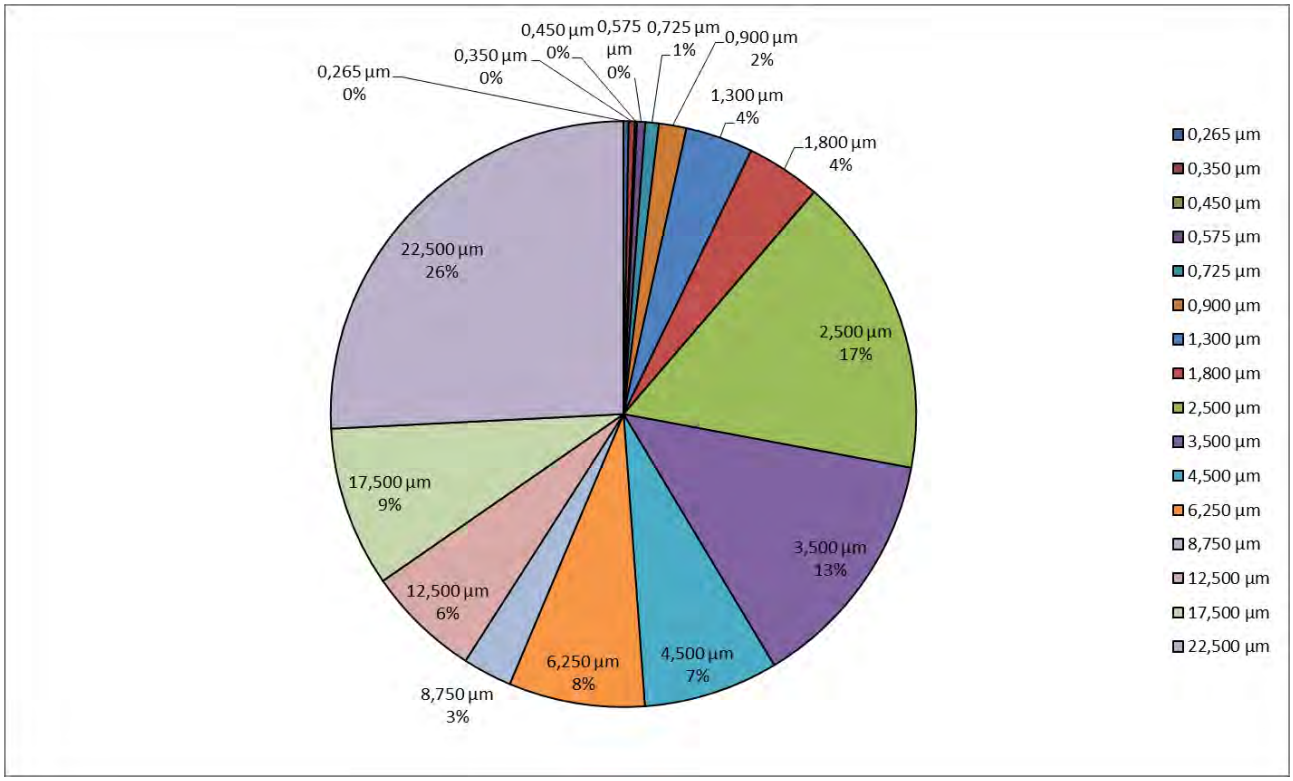
campaign 4

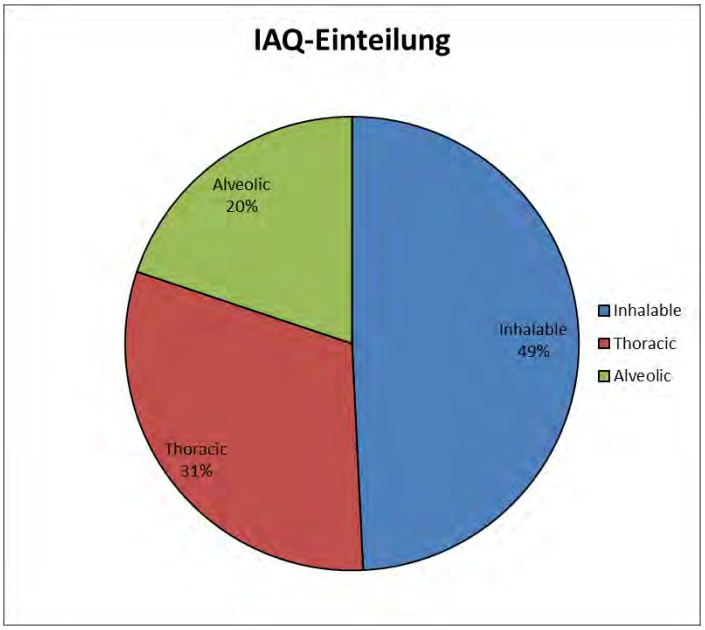
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,001	0,002	0,004	0,010	0,021	0,000	0,129	0,181	0,074	0,082	0,000	0,000	0,000	0,000
Maximum	0,020	0,024	0,009	0,039	0,061	0,119	0,281	0,395	1,199	0,969	0,551	0,589	0,298	1,015	1,591	3,480
Duchschnitt	0,010	0,012	0,004	0,016	0,026	0,052	0,129	0,142	0,576	0,465	0,258	0,260	0,094	0,217	0,306	0,892

Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,590	0,153	0,037	0,708	0,641	0,369
Maximum	3,911	1,445	0,372	8,358	4,344	2,581
Duchschnitt	1,970	0,716	0,176	3,470	2,180	1,401

- **comments:**

no comments

campaign 1

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
08.10.2014 16:48	08.10.2014 17:50	28	1016,4	~ 1,5m above the enclosure

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
n. m.	30	n.m.	n.m.	2,58

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
16:48	17:50	2,66	0,08	3,00

Comparison with the operational data collected by ILVA

During the measurement period the cooling time of the sinter material stays at 100 min. The calculated speed of the sinter cooler remains at about 1,26 m/min. The sinter temperature at the discharge point of the sinter machine varies between 140°C and 240°C.

Since the sinter cooler was not operated between 13:10 and 16:05 the material was already cooled down when reaching the measurement point. This is shown in the measured temperature of the enclosure.

campaign 2

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
10.10.2014	10.10.2014	30	1016,4	~ 1,0m above the enclosure
12:32	13:25			

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
300	115	100	97	2,75

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
12:32	13:25	0,49	0,06	12,24

Comparison with the operational data collected by ILVA

The sinter cooler was operated very steady-going. The calculated speed of the sinter cooler remains at about 1,4 m/min. The sinter temperature at the discharge point of the sinter machine increases slowly.

campaign 6

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
10.02.2015	10.02.2015	15,5	1014,3	~ 0,6m above the enclosure
15:59	16:44			

temperature and flow velocity measurements			
material temperature	**temperature of the enclosure**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**m/s**
145	60	32	2,69

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
15:59	16:44	2,49	0,21	8,43

Comparison with the operational data collected by ILVA

The sinter cooler was out of operation from 16:02 to 16:10.

campaign 7

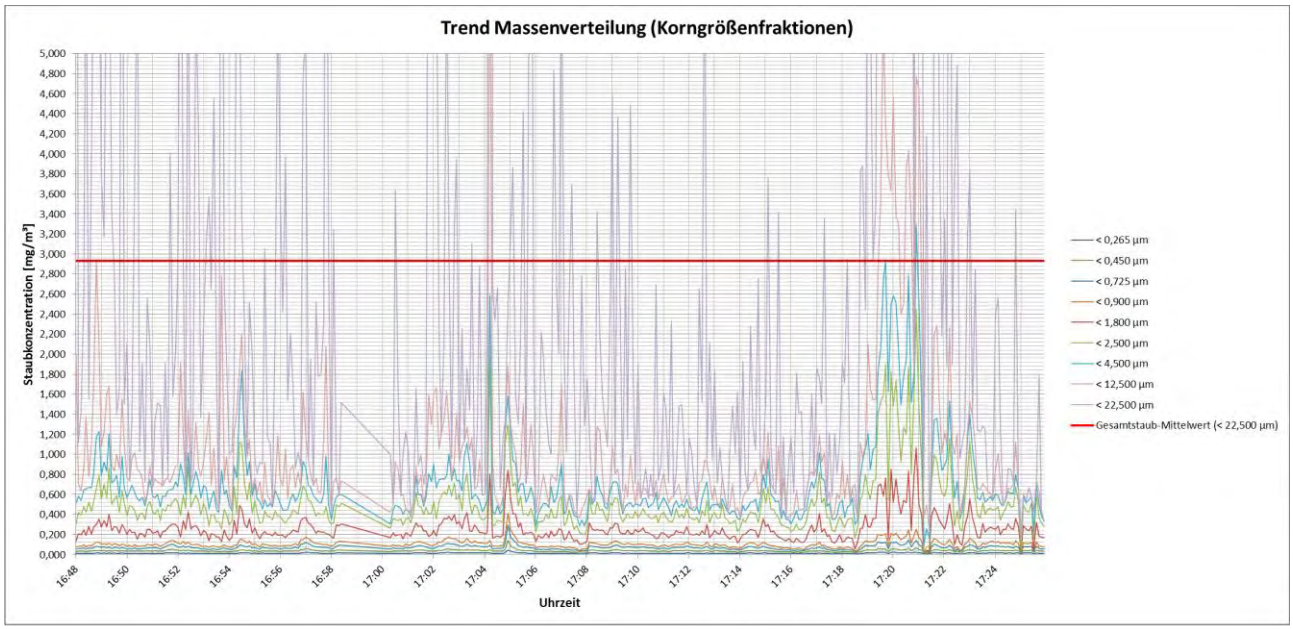
environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
11.02.2015	11.02.2015	12,3	1016,4	0,0m above the enclosure The mesh has been removed.
09:40	10:30			

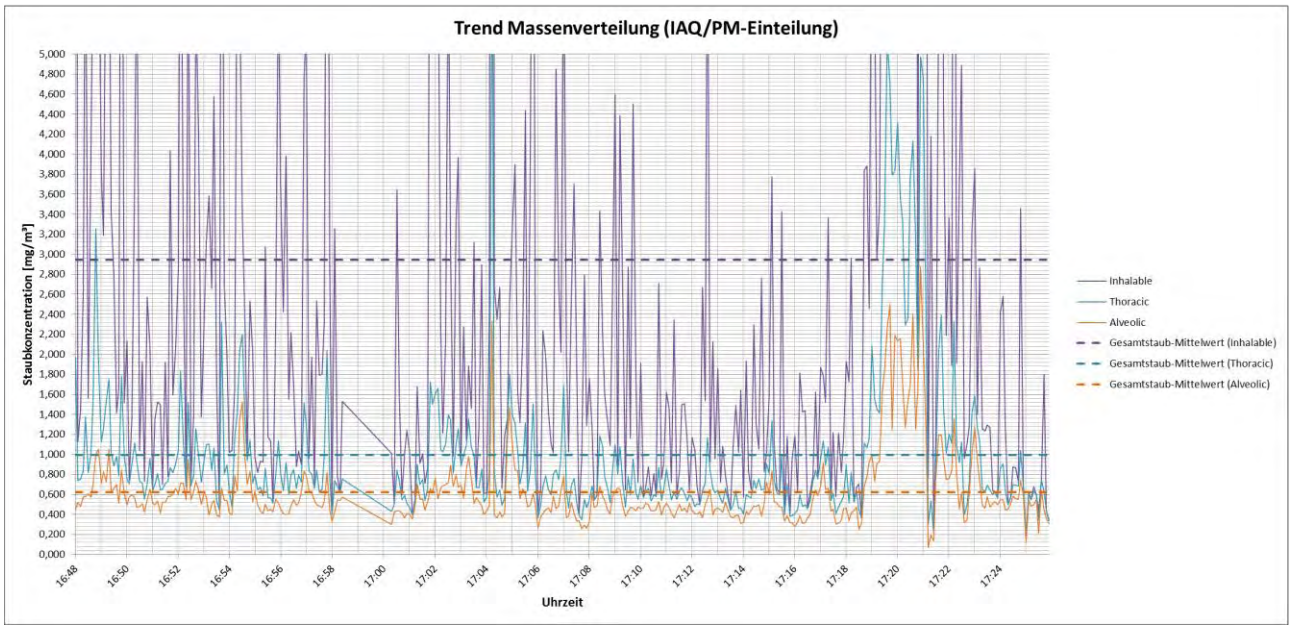
temperature and flow velocity measurements			
material temperature	**temperature of the enclosure**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**m/s**
96	20	21,5	3,01

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
09:40	10:30	0,97	0,16	14,49

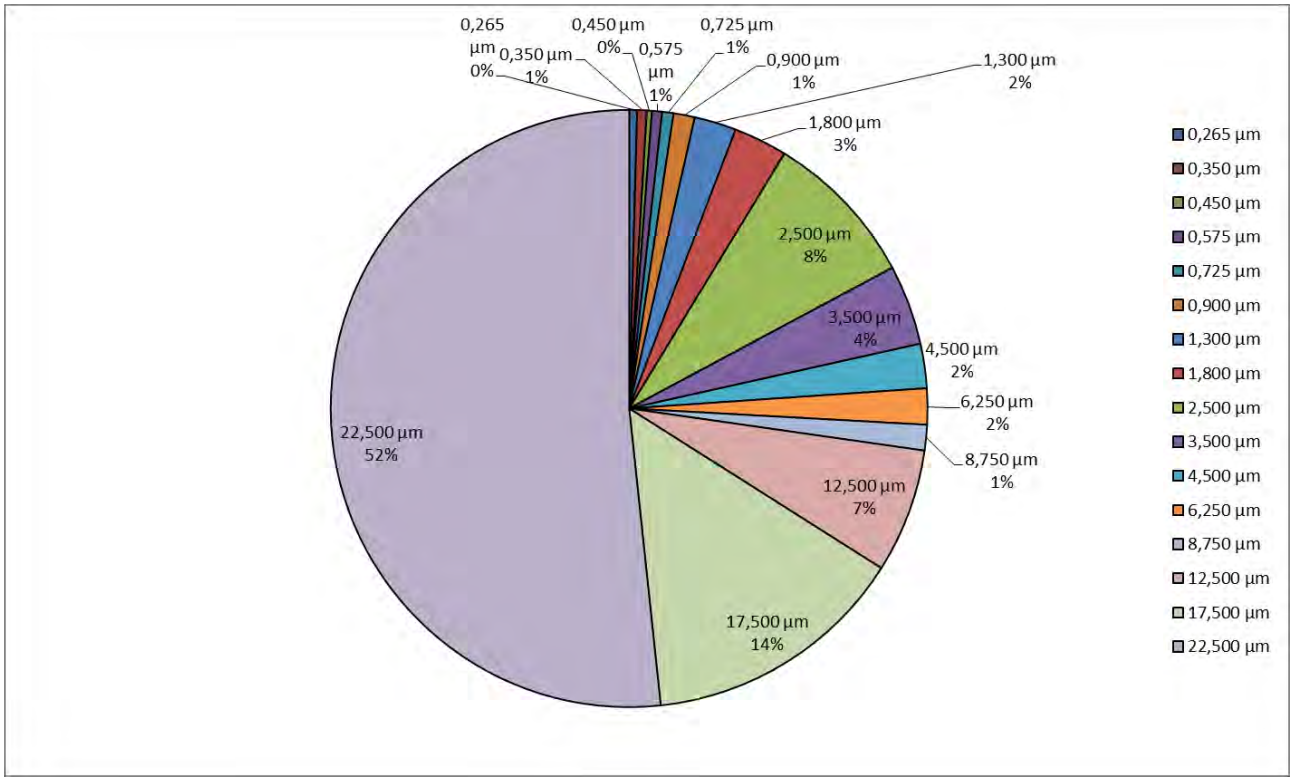
campaign 1

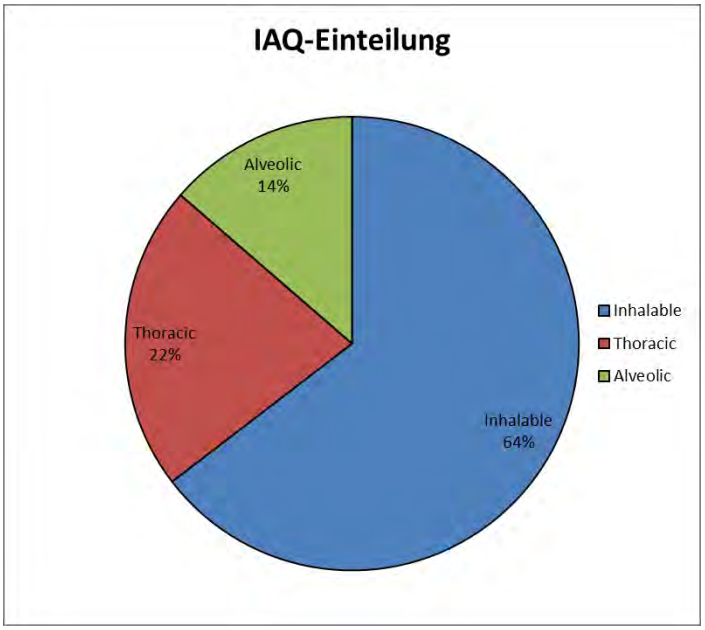
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,008	0,004	0,003	0,002	0,001	0,003	0,000	0,000	0,003	0,003	0,000	0,000	0,000	0,000	0,000
Maximum	0,046	0,052	0,042	0,079	0,075	0,119	0,251	0,562	1,387	0,727	0,423	0,589	0,771	2,465	6,366	19,139
Duchschnitt	0,013	0,015	0,008	0,016	0,018	0,034	0,067	0,085	0,248	0,127	0,070	0,057	0,041	0,197	0,420	1,514

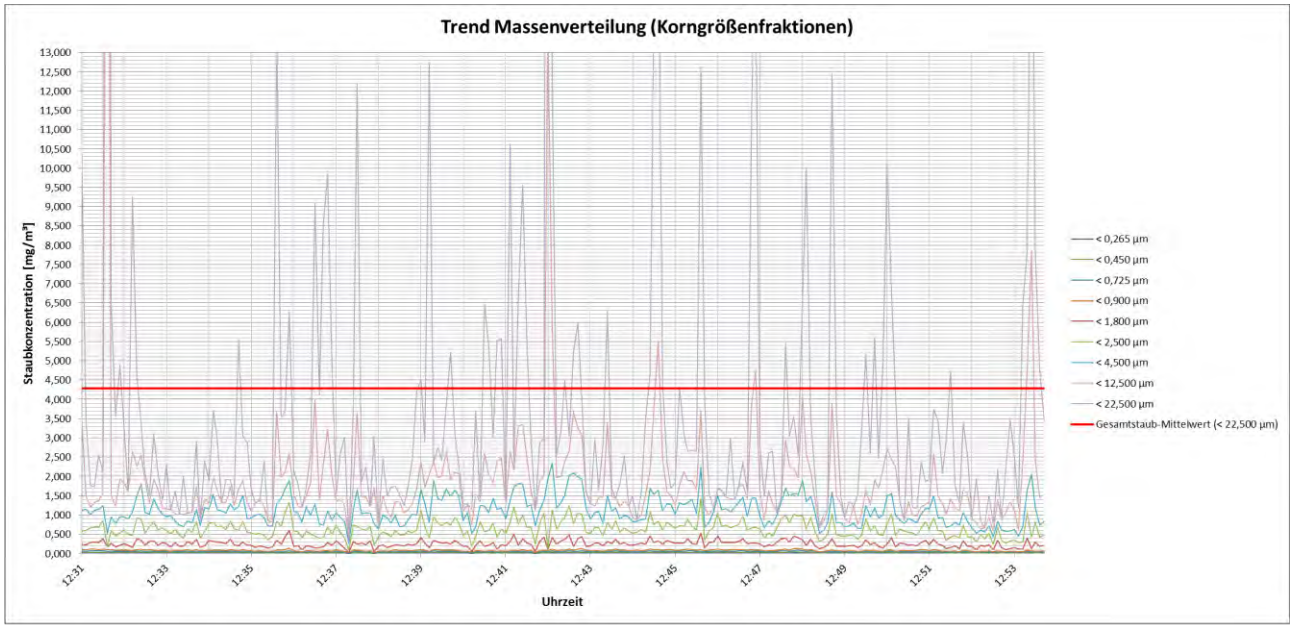
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,153	0,032	0,027	0,164	0,163	0,068
Maximum	4,735	1,782	0,485	31,925	6,346	2,881
Duchschnitt	0,850	0,397	0,135	2,943	0,993	0,621

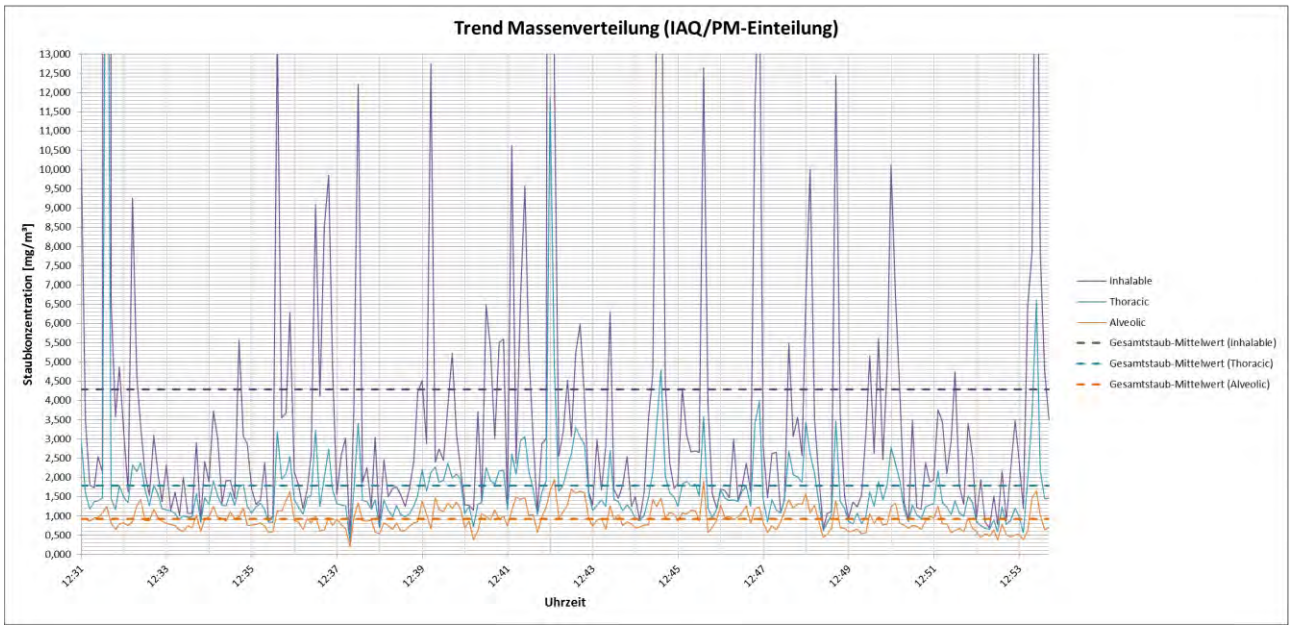
- **comments:**

Due to an interruption of the measurement performed with the dust monitor, only the first part of the measurement period is displayed.

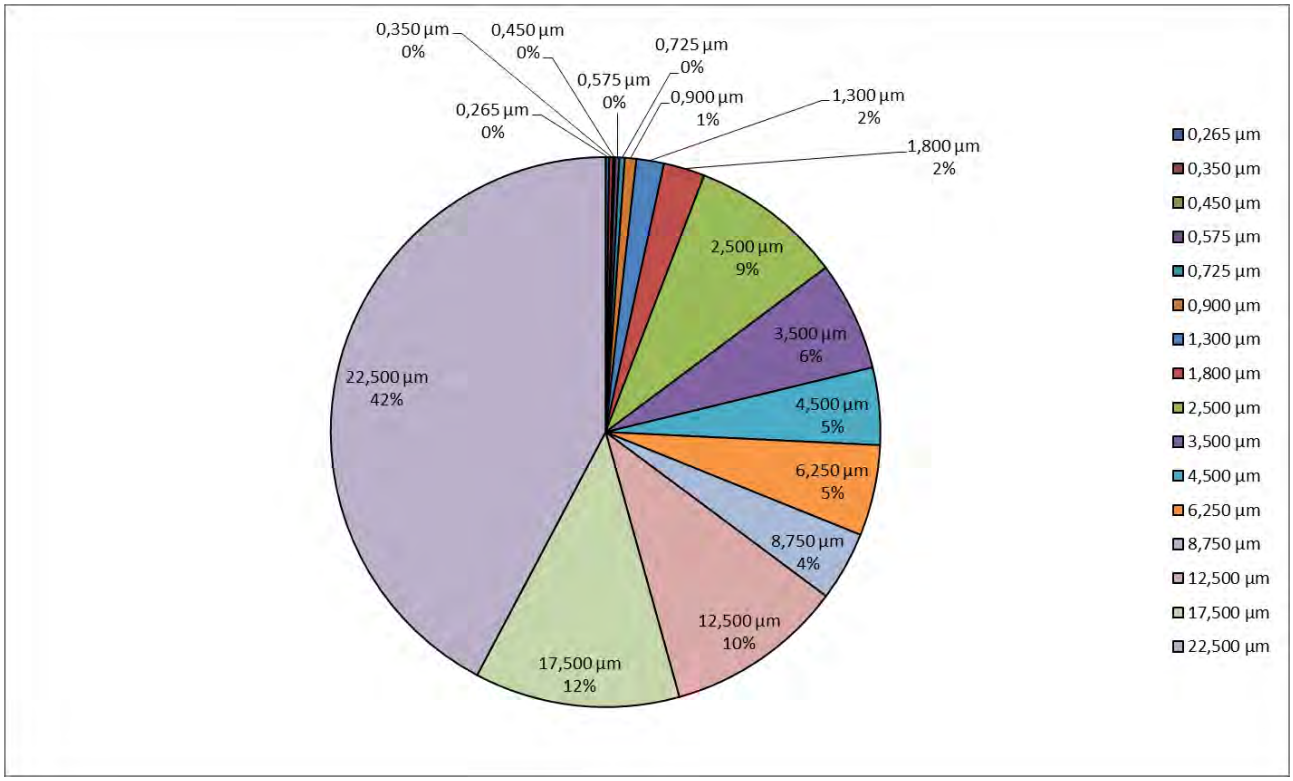
campaign 2

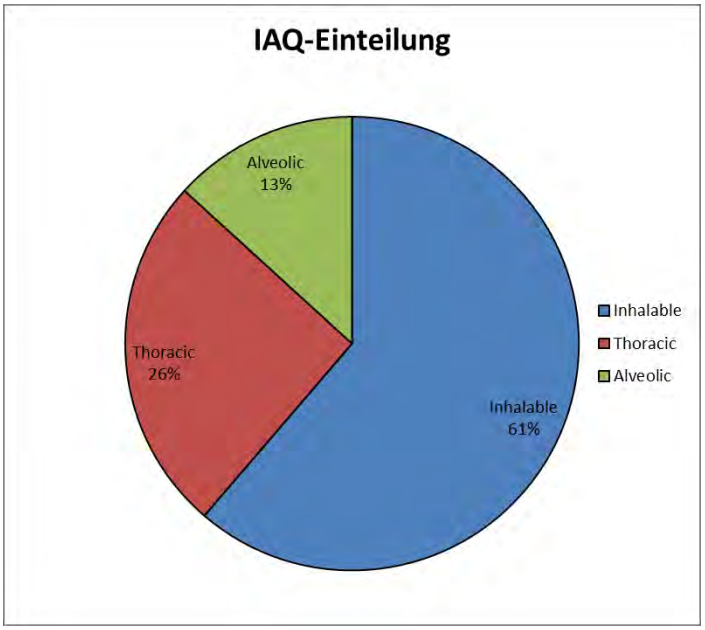
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,005	0,002	0,003	0,002	0,003	0,012	0,000	0,000	0,000	0,047	0,027	0,000	0,000	0,000	0,000
Maximum	0,013	0,015	0,007	0,019	0,023	0,066	0,172	0,311	0,904	0,788	1,001	3,380	6,366	21,894	24,270	70,757
Duchschnitt	0,009	0,010	0,005	0,011	0,013	0,029	0,069	0,104	0,383	0,275	0,194	0,228	0,175	0,449	0,517	1,809

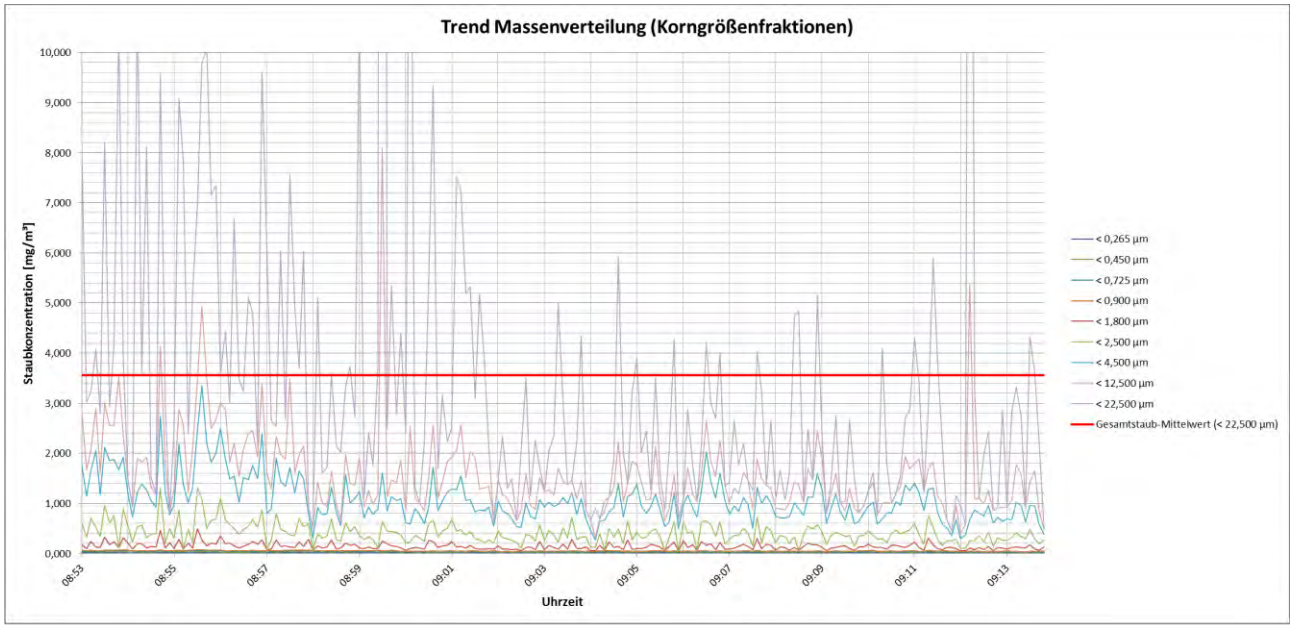
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,317	0,073	0,027	0,360	0,345	0,197
Maximum	17,440	1,008	0,224	127,201	23,821	1,939
Duchschnitt	1,549	0,466	0,116	4,290	1,784	0,926

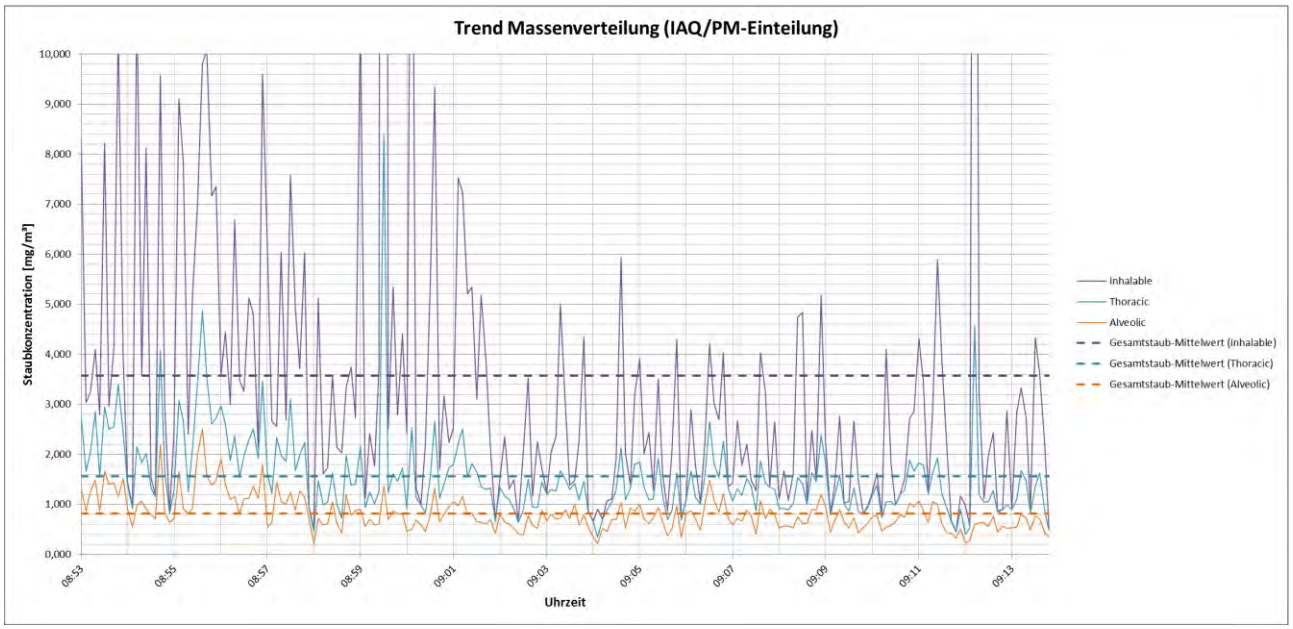
- **comments:**

sinter cooler out of operation from ~ 13:15 to 13:30

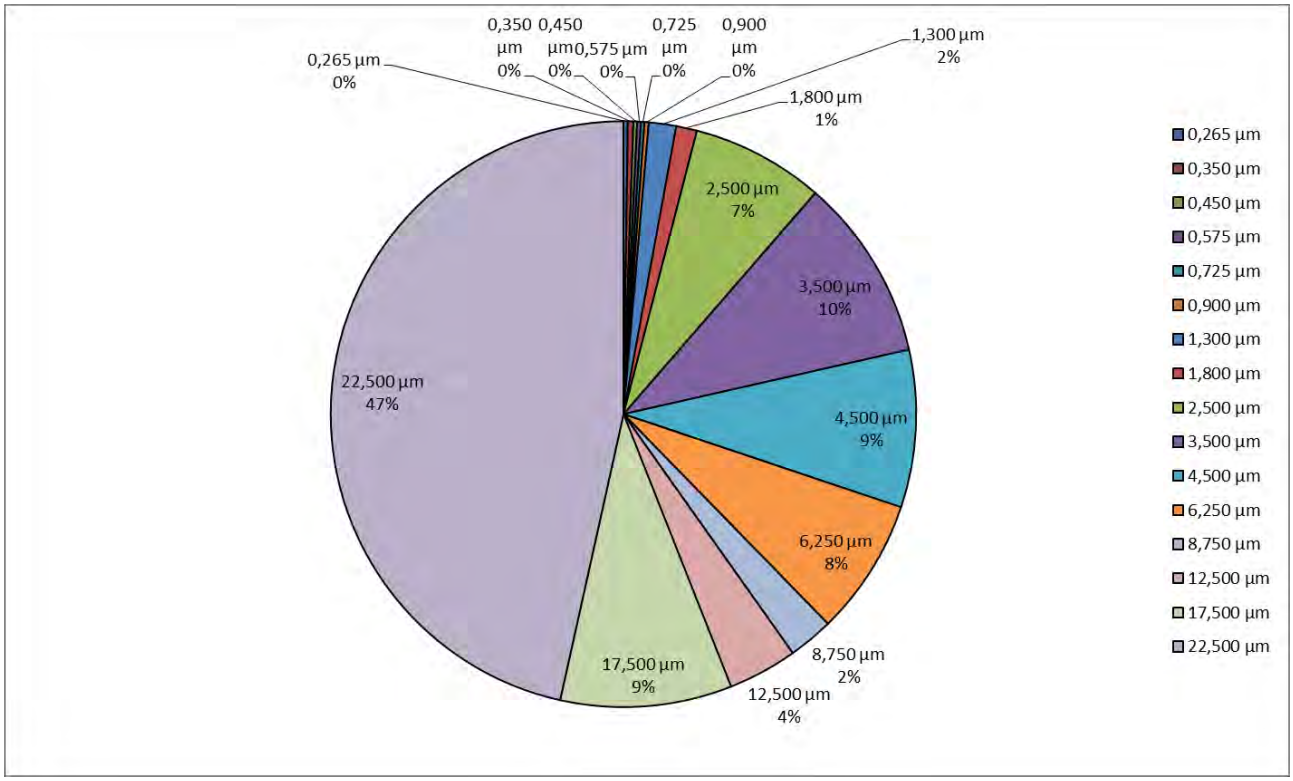
campaign 3

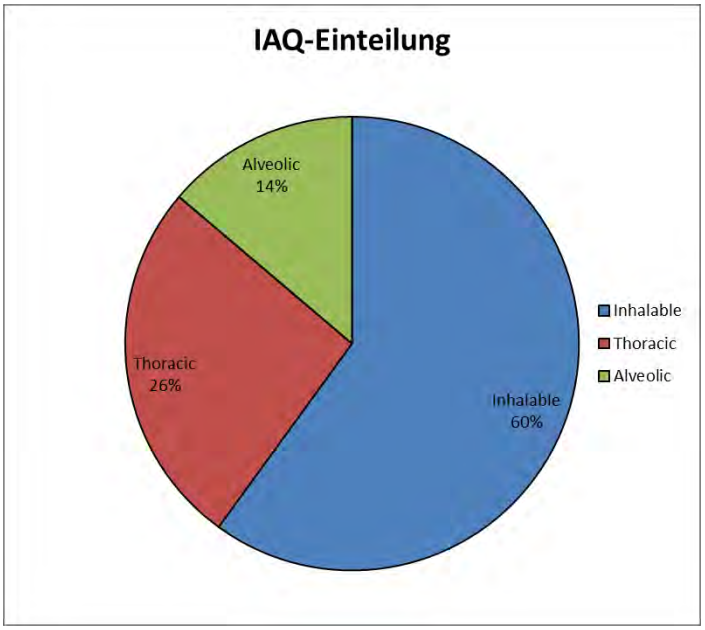
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,007	0,004	0,005	0,002	0,001	0,007	0,000	0,000	0,065	0,041	0,036	0,000	0,000	0,000	0,000
Maximum	0,012	0,018	0,015	0,012	0,017	0,023	0,155	0,271	0,844	1,272	0,988	0,952	1,492	4,132	10,941	45,818
Duchschnitt	0,009	0,011	0,007	0,007	0,007	0,008	0,054	0,041	0,261	0,359	0,309	0,269	0,089	0,136	0,337	1,657

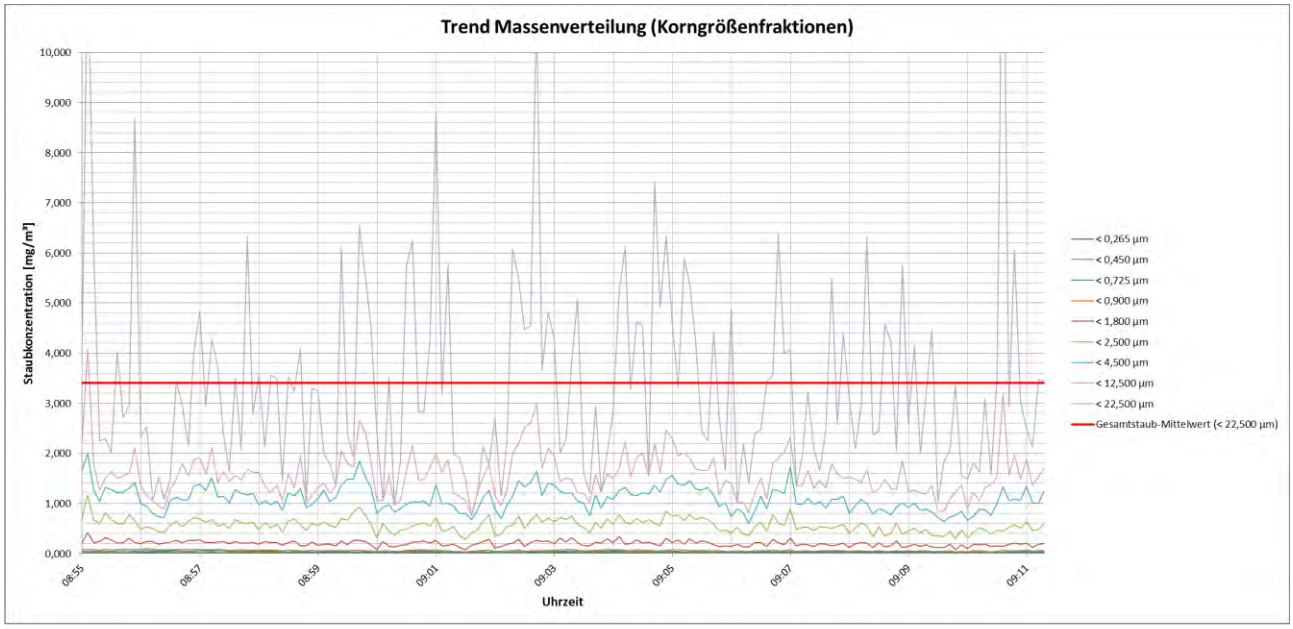
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,304	0,083	0,048	0,457	0,344	0,217
Maximum	5,390	0,943	0,177	64,864	8,380	2,507
Duchschnitt	1,355	0,310	0,082	3,570	1,558	0,821

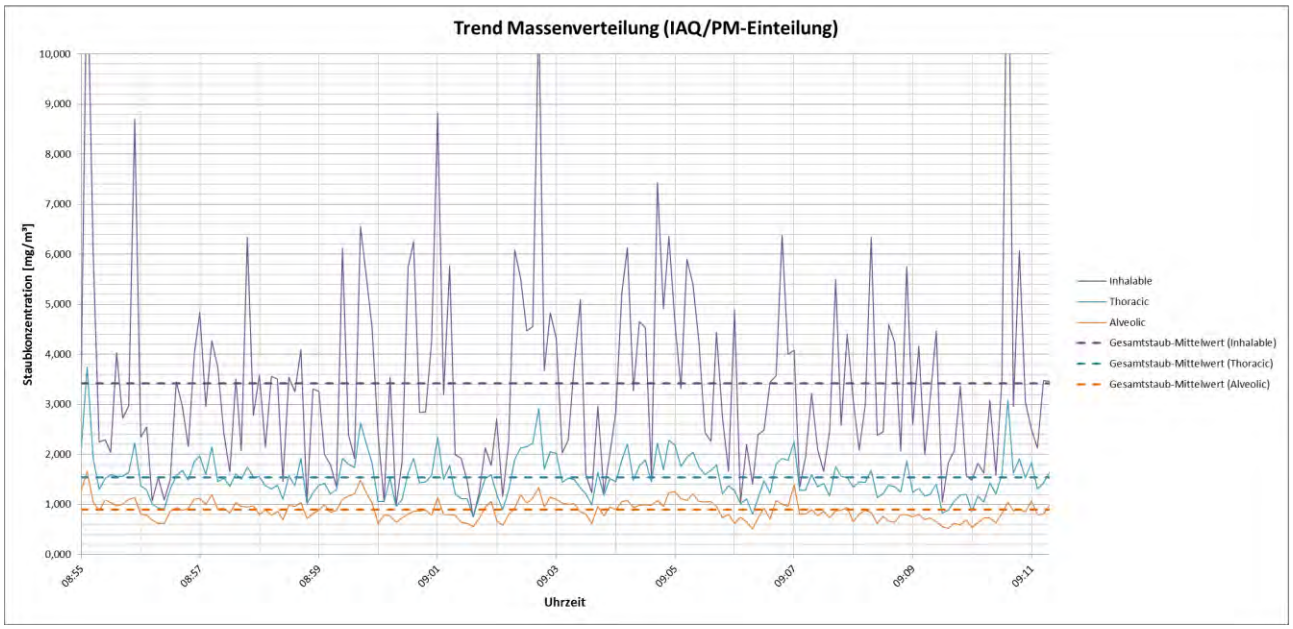
- **comments:**

no comments

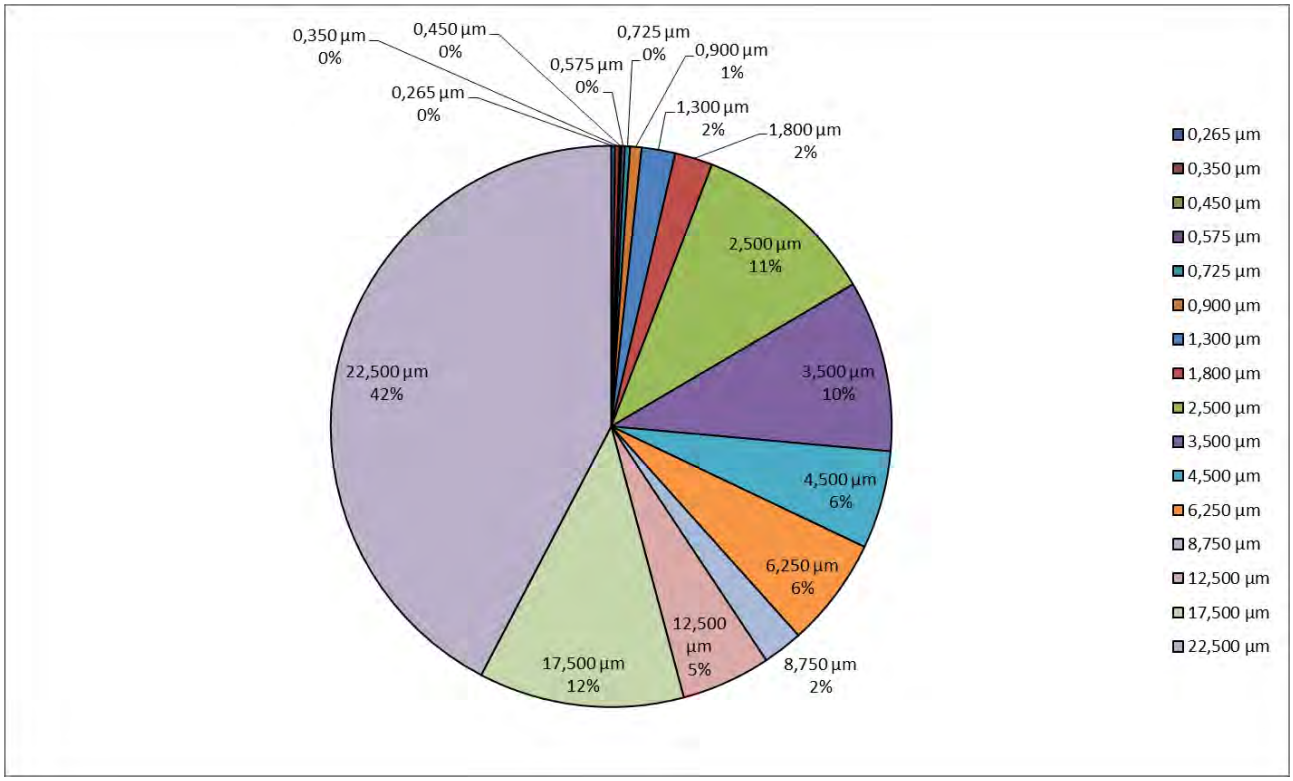
campaign 4

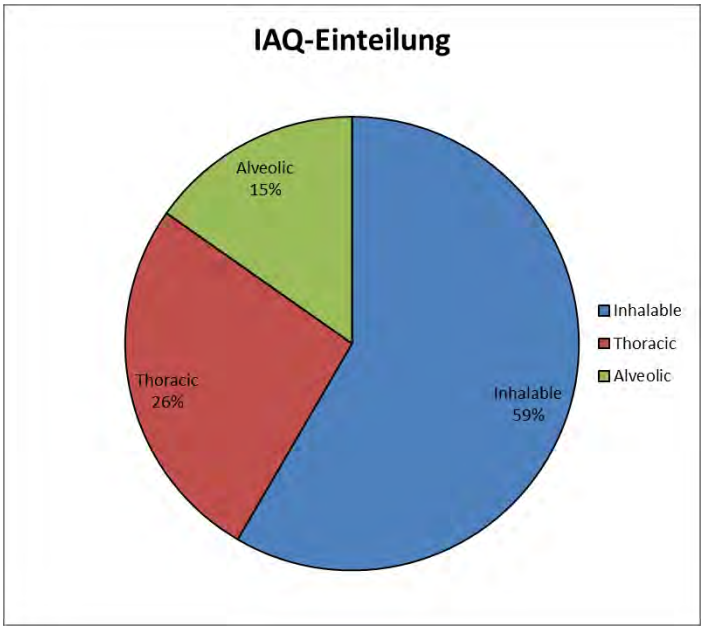
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,005	0,002	0,003	0,005	0,011	0,028	0,000	0,209	0,158	0,068	0,054	0,000	0,000	0,000	0,000
Maximum	0,012	0,017	0,008	0,015	0,018	0,038	0,111	0,212	0,742	0,665	0,406	0,562	0,323	1,450	2,785	8,700
Duchschnitt	0,008	0,009	0,004	0,007	0,010	0,023	0,066	0,075	0,364	0,336	0,193	0,215	0,079	0,175	0,404	1,443

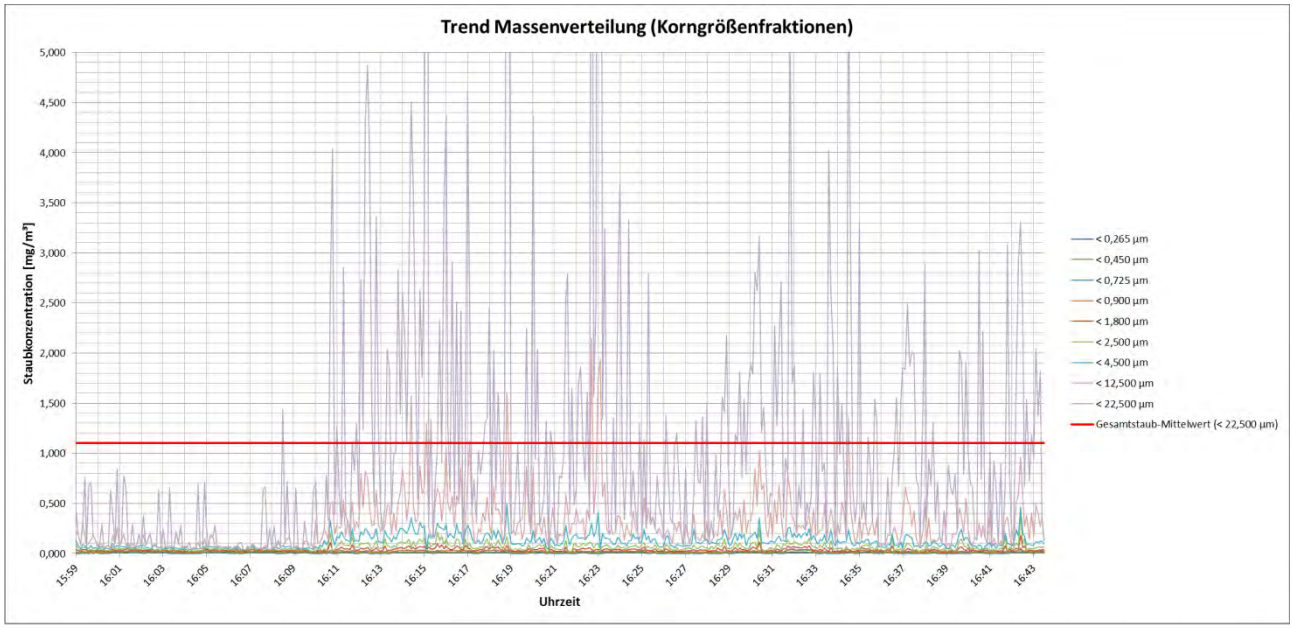
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,699	0,212	0,051	0,756	0,750	0,514
Maximum	3,057	0,821	0,164	14,078	3,745	1,658
Duchschnitt	1,347	0,411	0,096	3,418	1,541	0,892

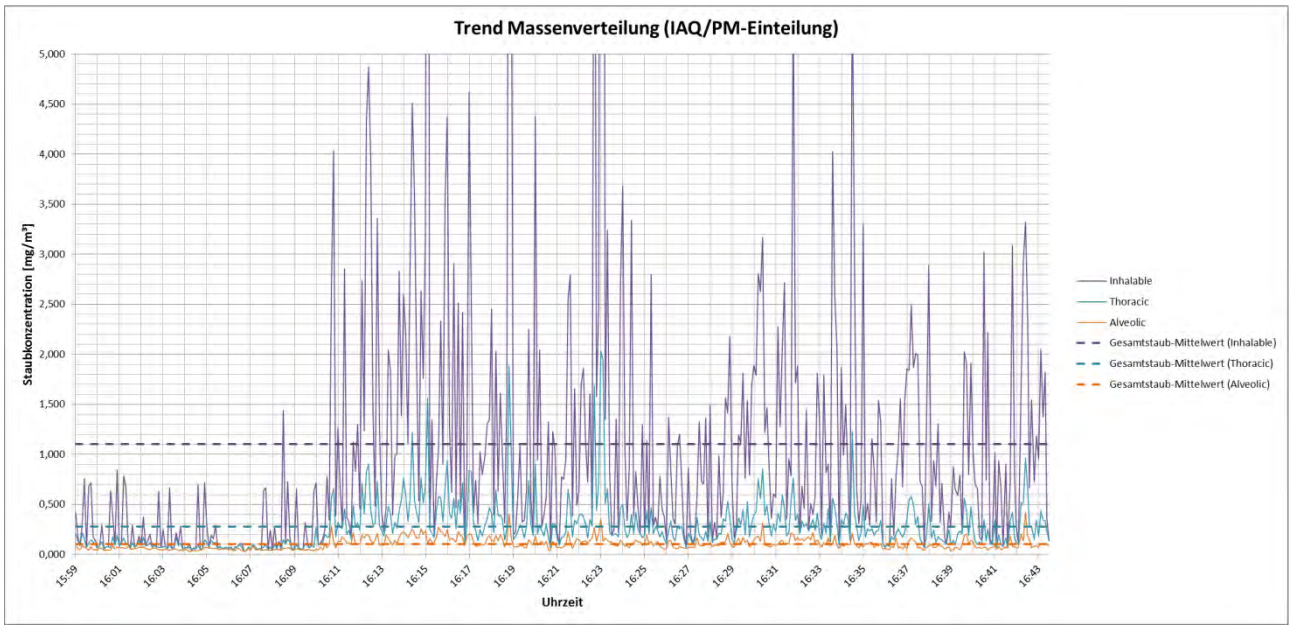
- **comments:**

no comments

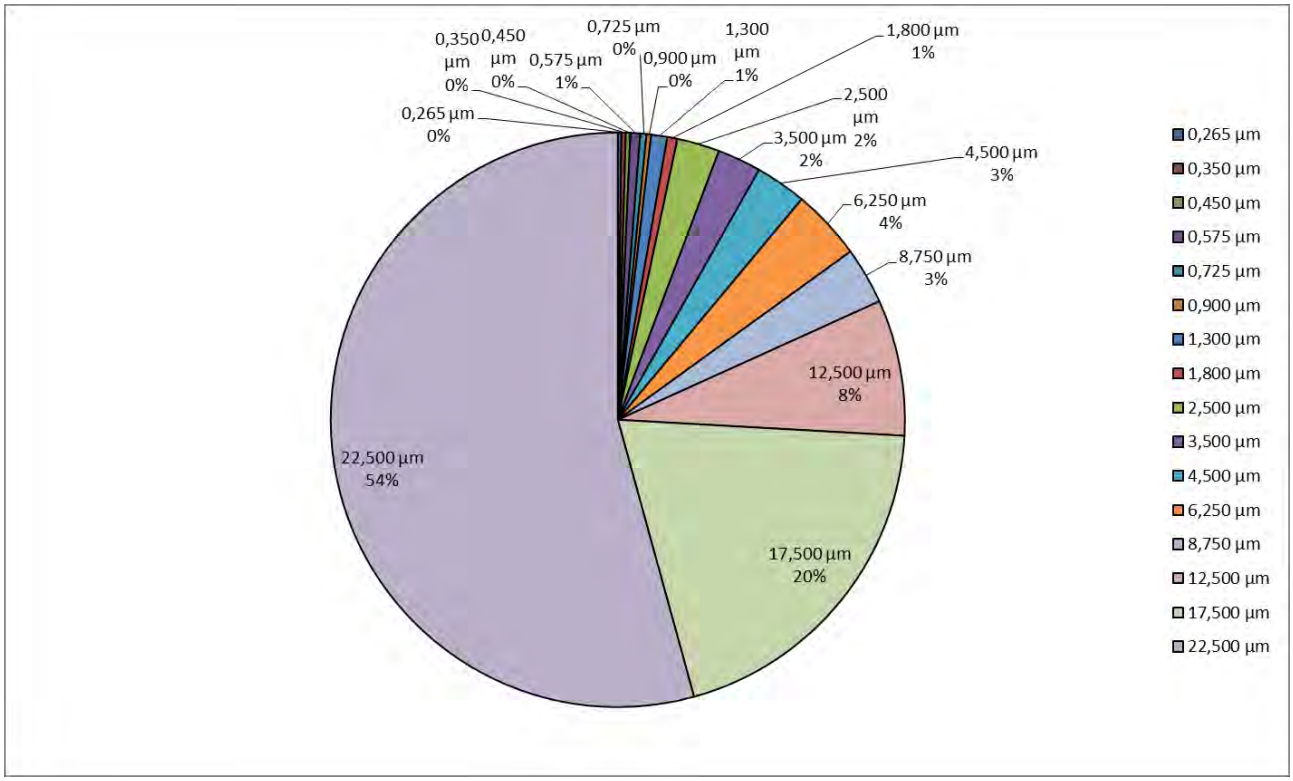
campaign 6

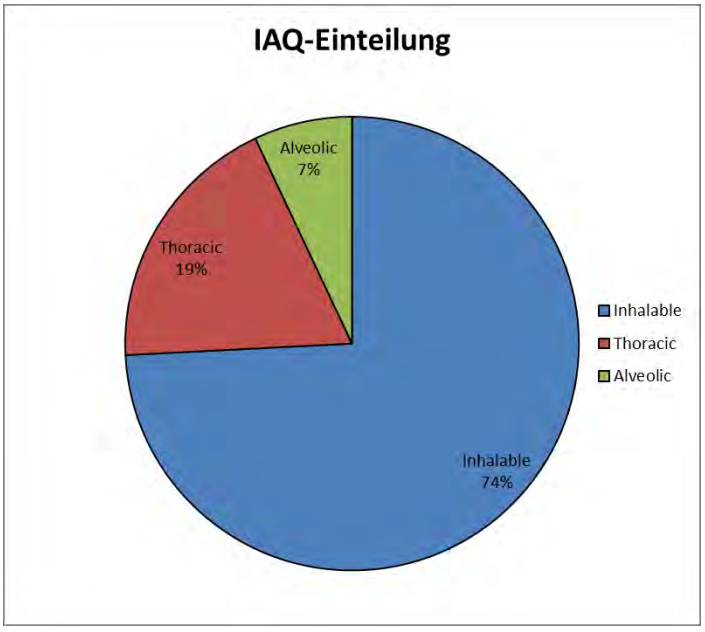
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,001	0,001	0,001	0,002	0,000	0,000	0,002	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,006	0,007	0,006	0,014	0,011	0,009	0,039	0,087	0,196	0,132	0,196	0,444	0,522	1,377	2,984	11,599
Duchschnitt	0,002	0,003	0,003	0,006	0,004	0,003	0,010	0,006	0,026	0,027	0,032	0,044	0,035	0,084	0,218	0,597

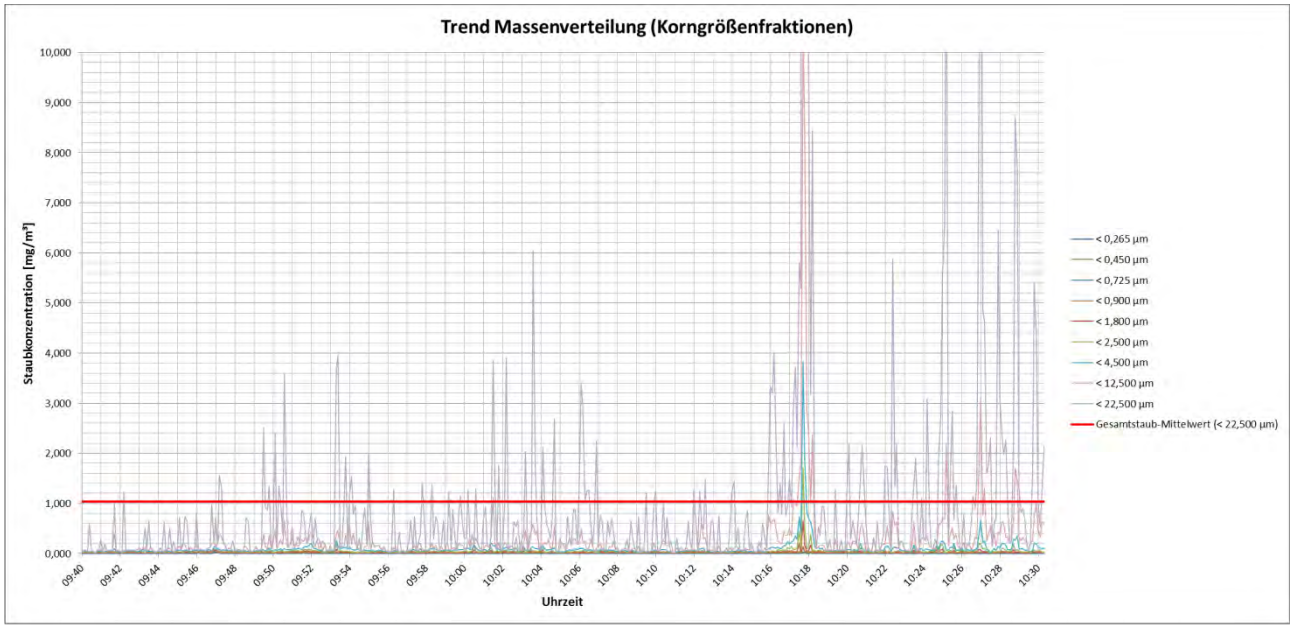
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,037	0,016	0,009	0,039	0,038	0,028
Maximum	1,322	0,279	0,078	15,542	2,033	0,423
Duchschnitt	0,220	0,054	0,024	1,102	0,279	0,104

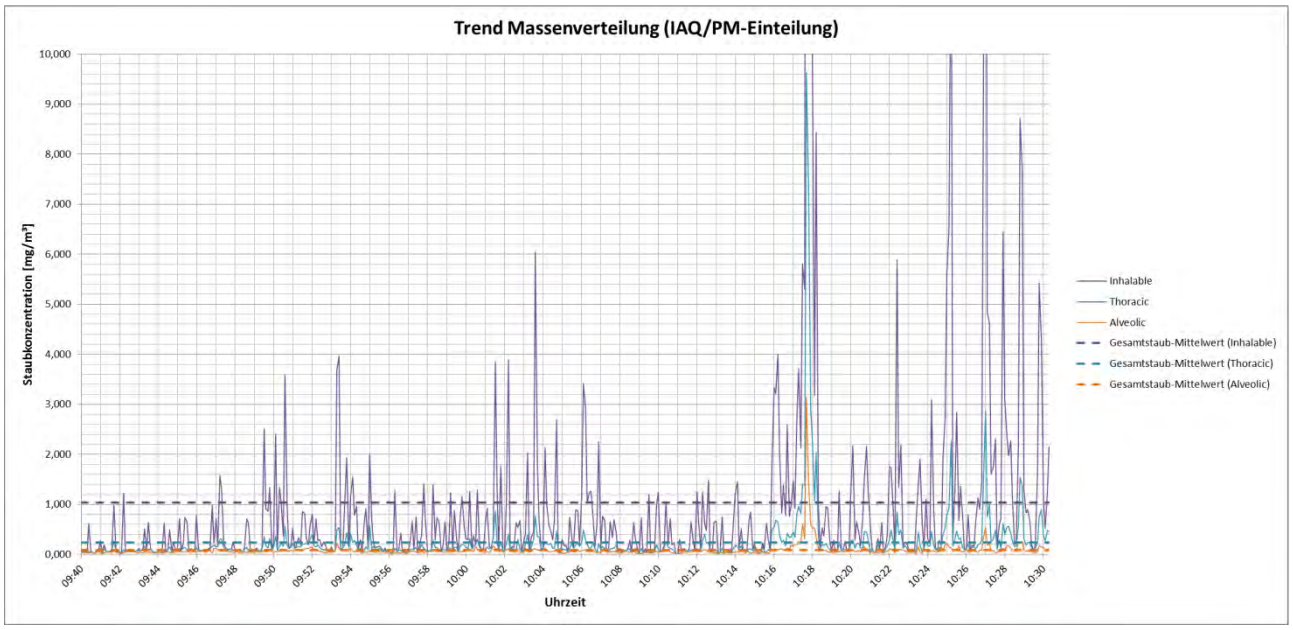
- **comments:**

no comments

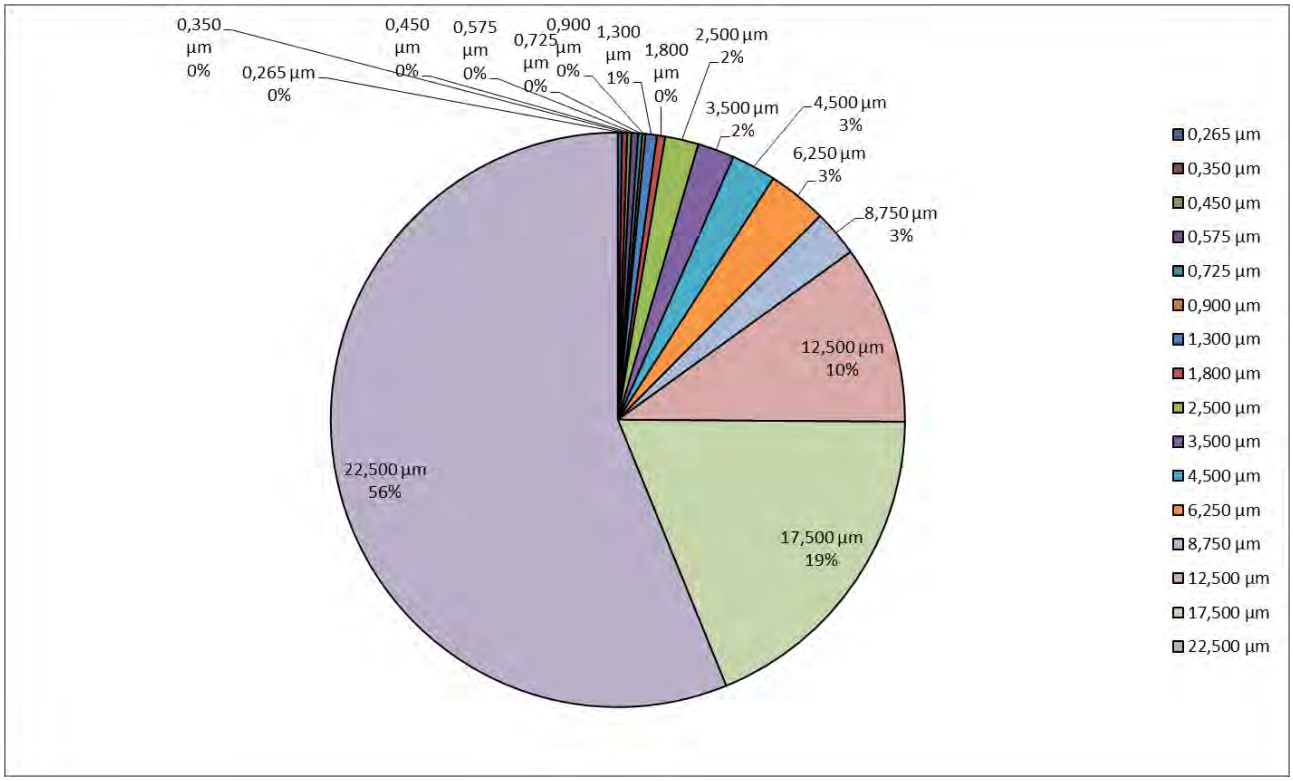
campaign 7

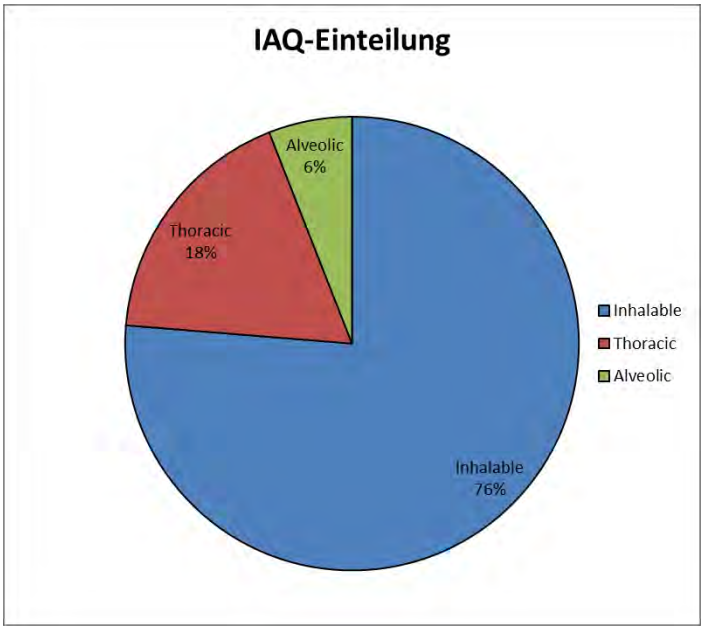
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,001	0,002	0,001	0,002	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,009	0,011	0,013	0,035	0,036	0,037	0,186	0,325	1,057	0,920	1,201	1,794	0,920	4,495	7,559	23,199
Duchschnitt	0,002	0,003	0,002	0,004	0,002	0,002	0,007	0,005	0,020	0,021	0,026	0,035	0,027	0,104	0,194	0,581

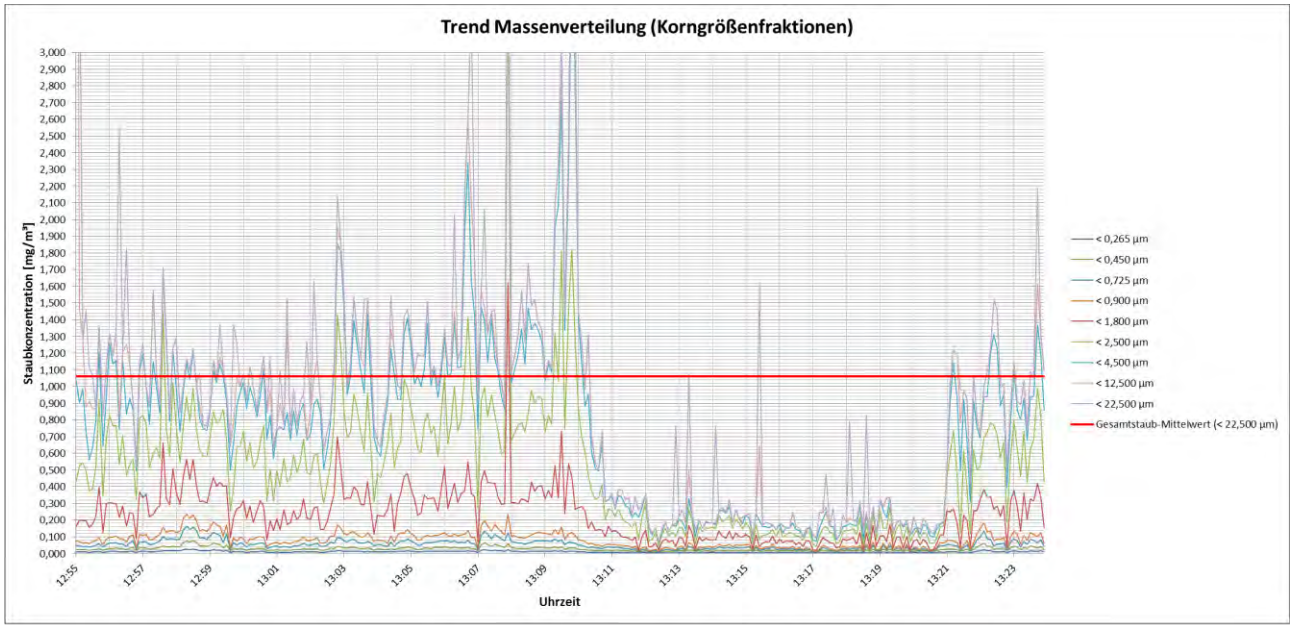
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,016	0,015	0,010	0,016	0,016	0,016
Maximum	7,545	1,244	0,250	40,430	9,626	3,129
Duchschnitt	0,189	0,041	0,020	1,037	0,242	0,081

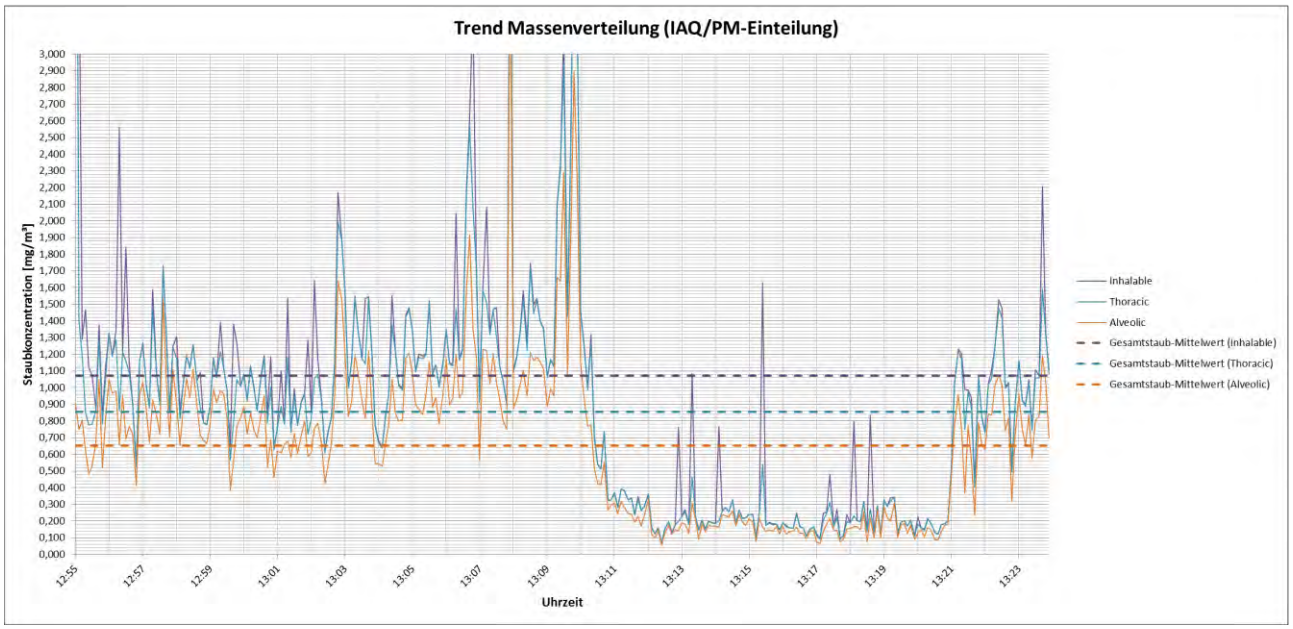
- **comments:**

no comments

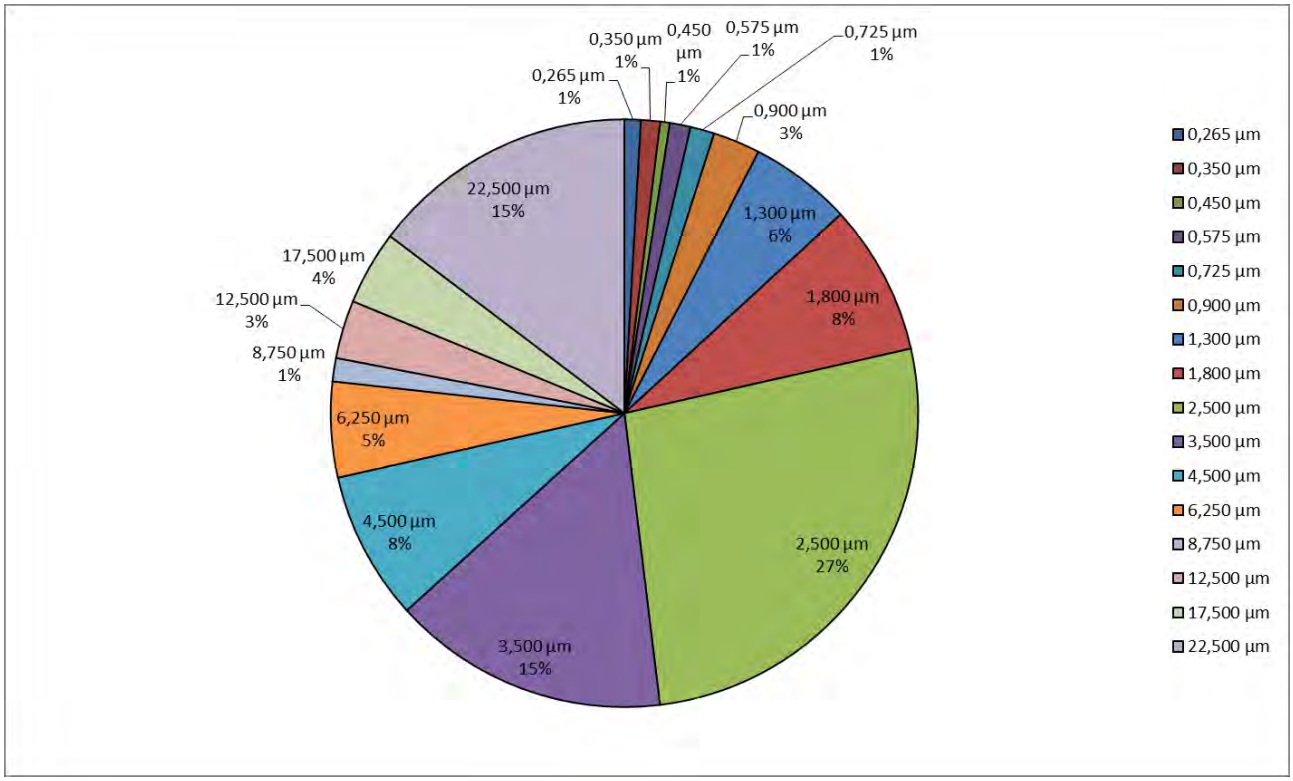
campaign 2

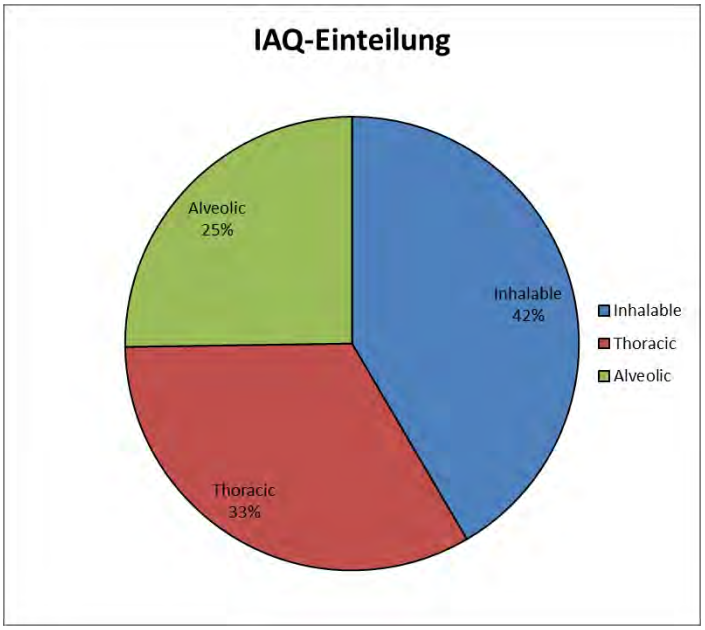
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,002	0,004	0,002	0,001	0,001	0,001	0,002	0,000	0,021	0,006	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,027	0,030	0,019	0,043	0,046	0,110	0,330	1,059	1,985	1,245	0,622	0,507	0,647	5,075	7,758	33,059
Duchschnitt	0,010	0,011	0,006	0,012	0,014	0,028	0,060	0,088	0,282	0,161	0,087	0,056	0,014	0,034	0,043	0,156

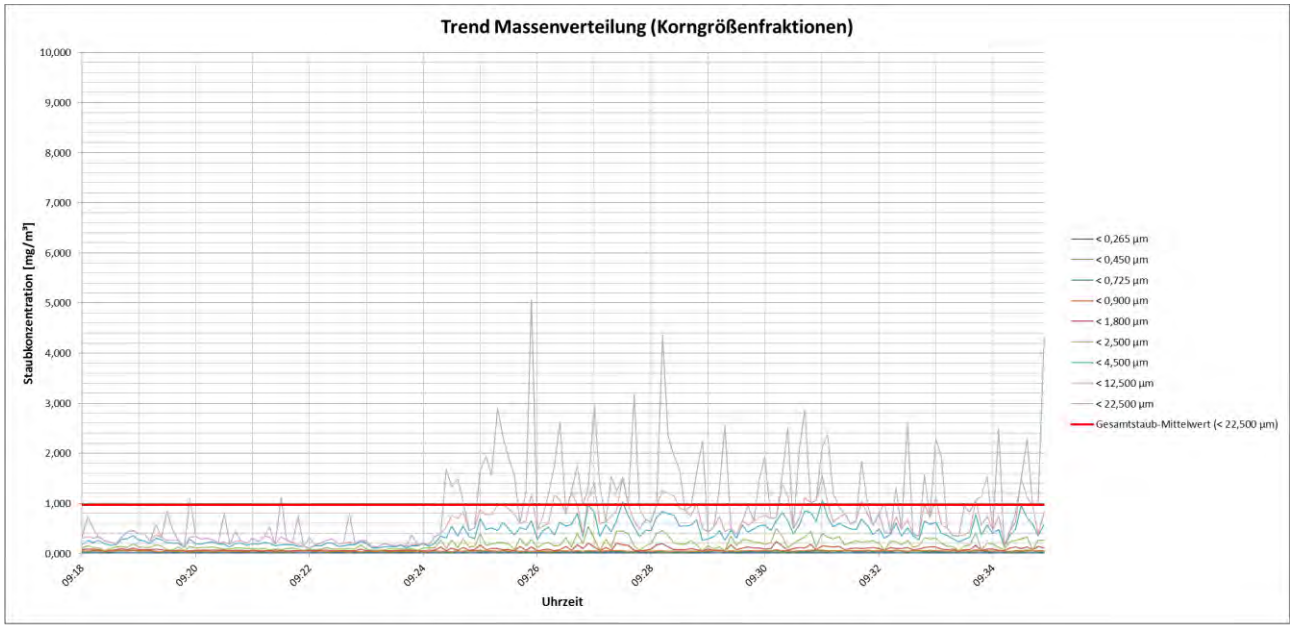
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,063	0,035	0,016	0,066	0,066	0,056
Maximum	4,236	2,589	0,484	48,093	6,373	3,712
Duchschnitt	0,795	0,385	0,112	1,071	0,856	0,650

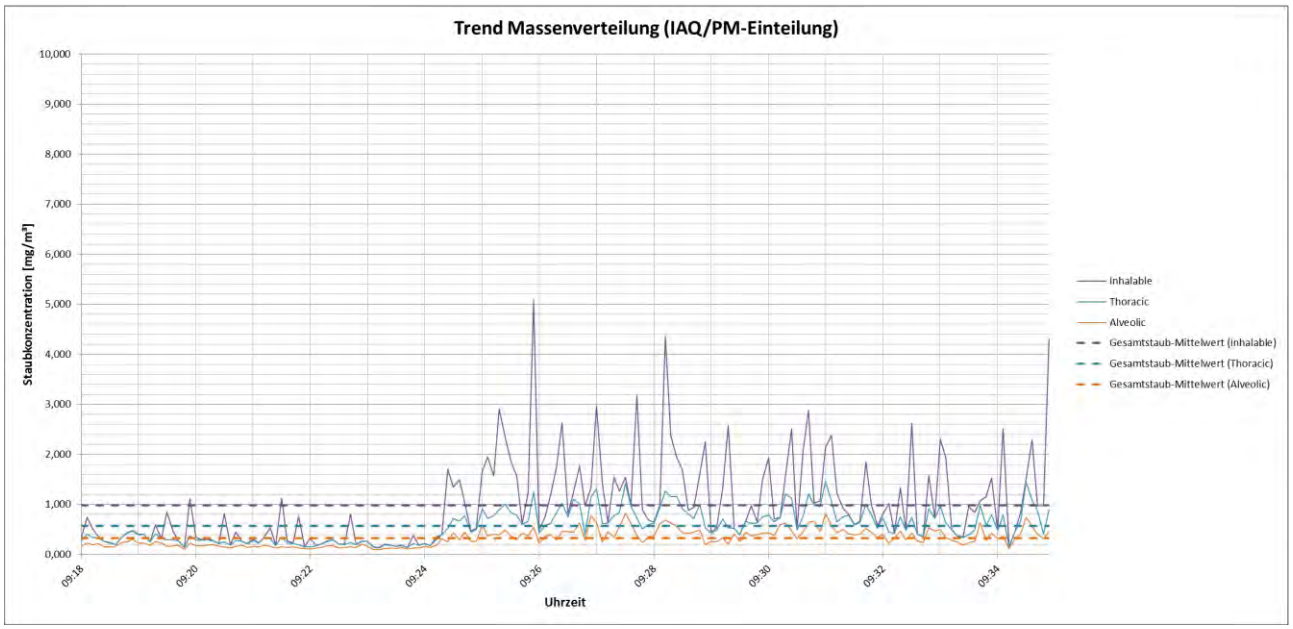
- **comments:**

Drop of the dust concentration most probably because the sinter cooler was out of operation from 13:15.

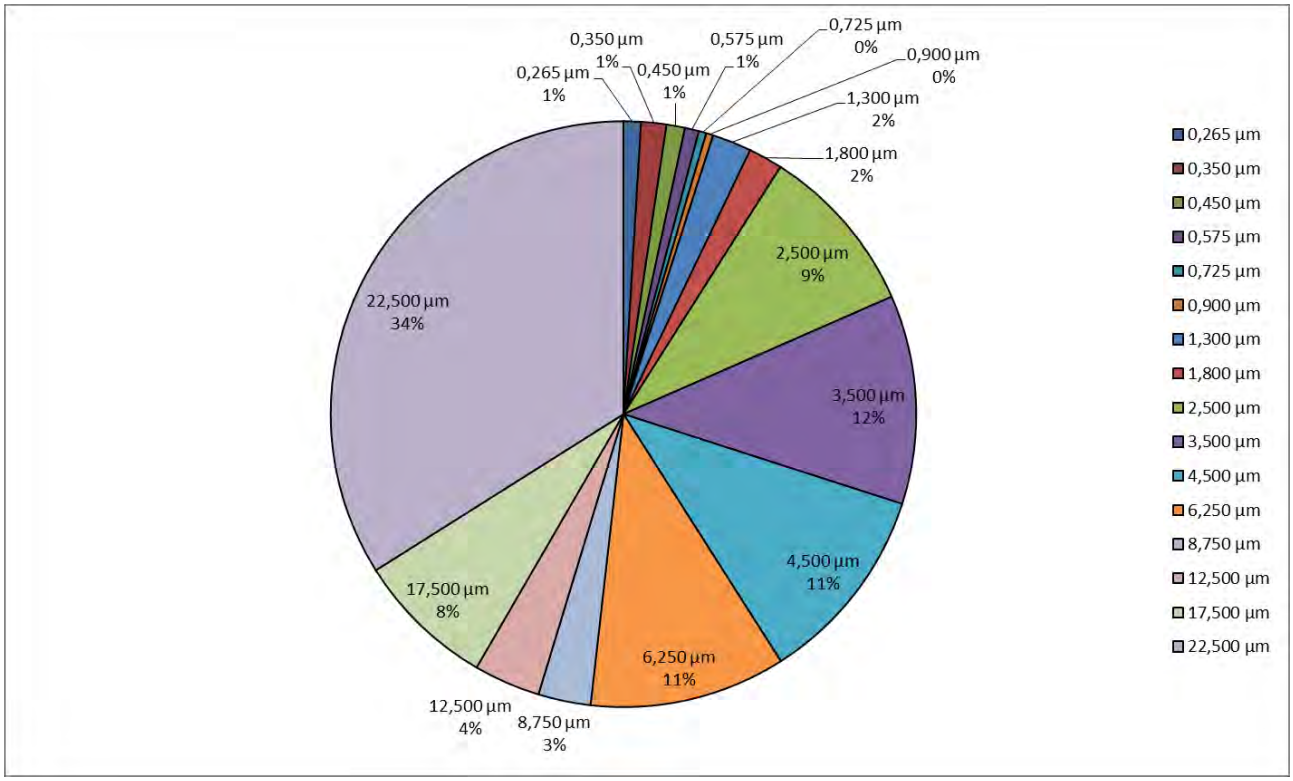
campaign 3

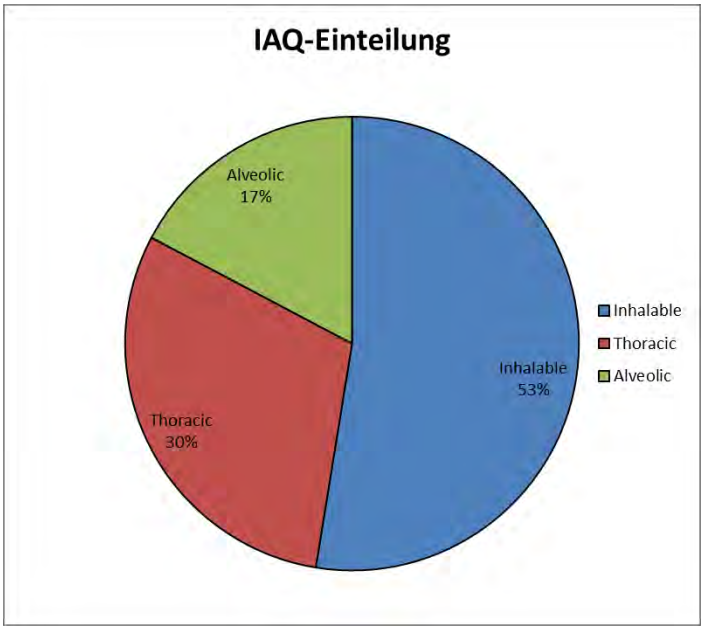
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,007	0,005	0,004	0,001	0,001	0,003	0,000	0,000	0,014	0,007	0,000	0,000	0,000	0,000	0,000
Maximum	0,013	0,020	0,015	0,012	0,009	0,013	0,064	0,123	0,322	0,350	0,328	0,480	0,224	0,507	0,597	3,480
Duchschnitt	0,009	0,014	0,010	0,008	0,004	0,004	0,021	0,018	0,092	0,112	0,107	0,106	0,028	0,036	0,075	0,331

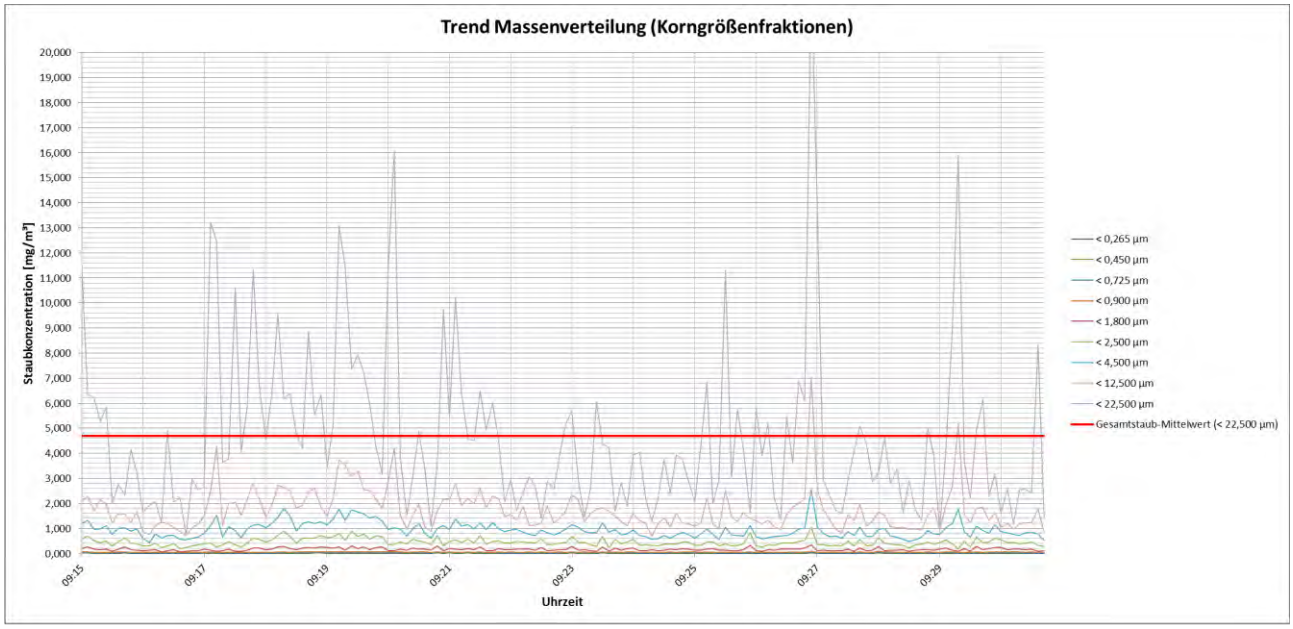
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,128	0,065	0,042	0,136	0,134	0,100
Maximum	1,330	0,392	0,115	5,076	1,464	0,817
Duchschnitt	0,507	0,152	0,066	0,985	0,566	0,324

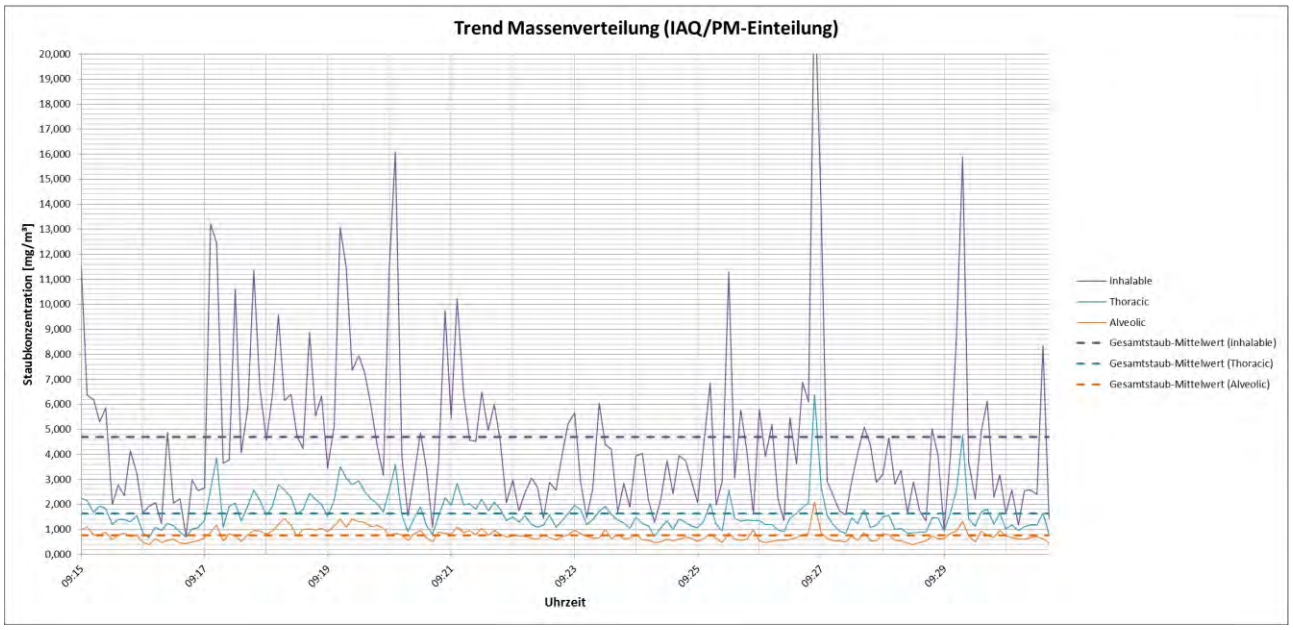
- **comments:**

The sinter cooler was out of operation between 09:20 and 09:25.

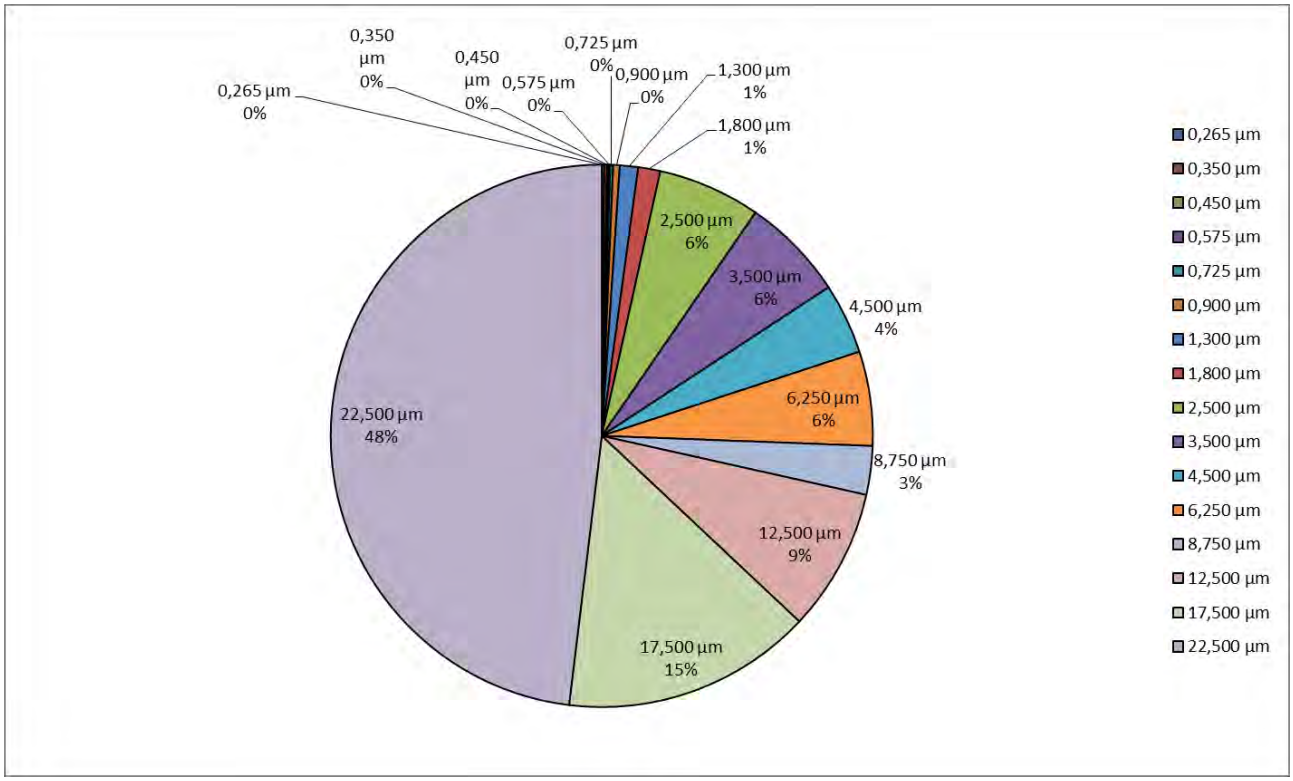
campaign 4

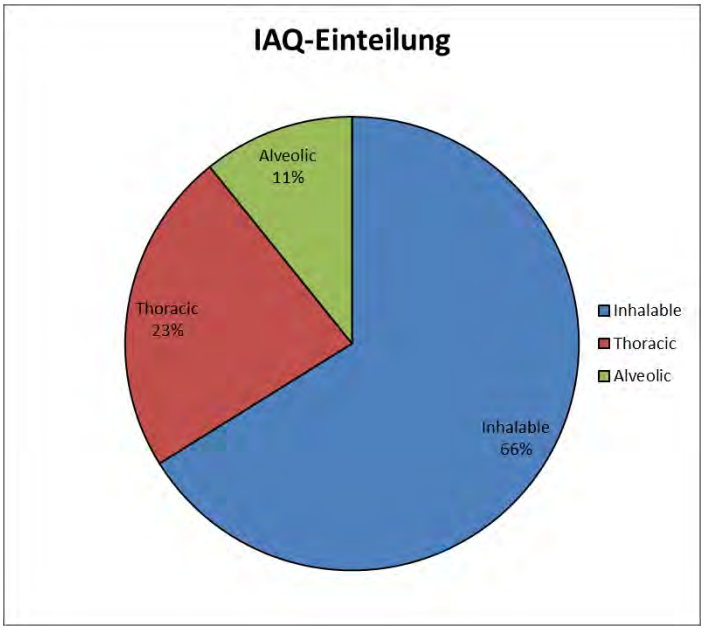
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,006	0,002	0,003	0,003	0,007	0,017	0,000	0,068	0,103	0,041	0,045	0,000	0,000	0,000	0,000
Maximum	0,009	0,011	0,005	0,009	0,016	0,034	0,102	0,210	0,705	0,840	0,758	1,287	0,920	2,392	4,376	11,599
Duchschnitt	0,007	0,008	0,003	0,005	0,008	0,018	0,051	0,062	0,287	0,289	0,197	0,263	0,136	0,398	0,699	2,250

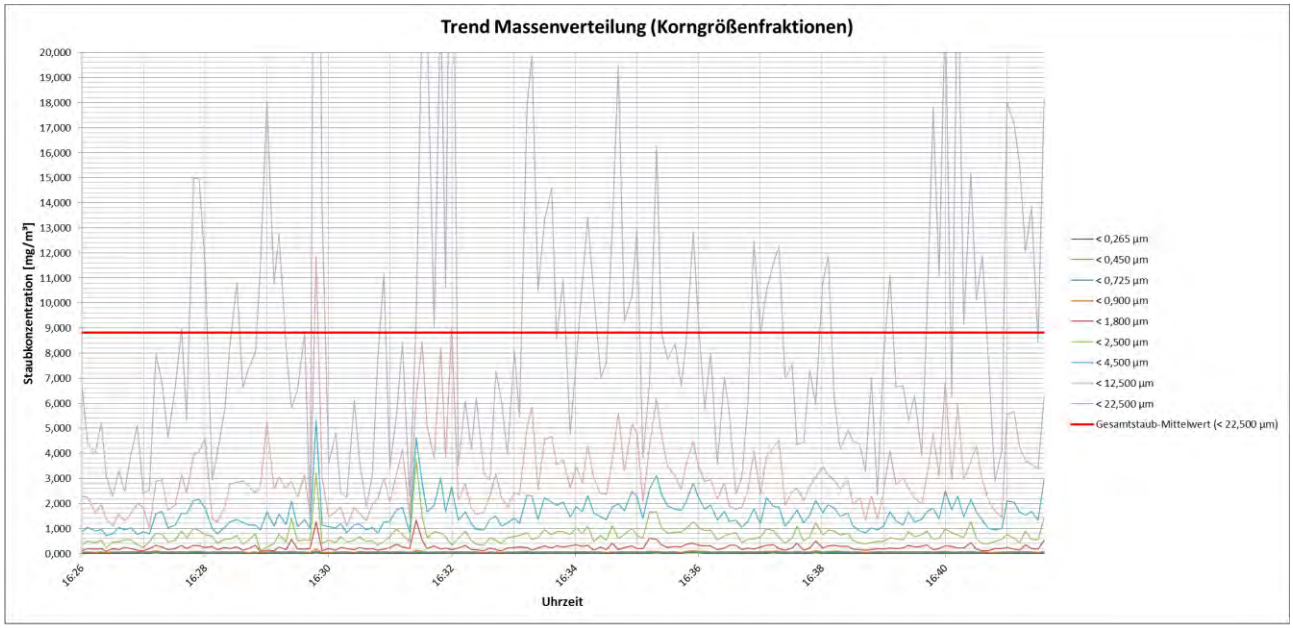
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,594	0,159	0,048	0,722	0,673	0,382
Maximum	5,105	0,761	0,143	23,003	6,387	2,088
Duchschnitt	1,378	0,332	0,079	4,688	1,636	0,765

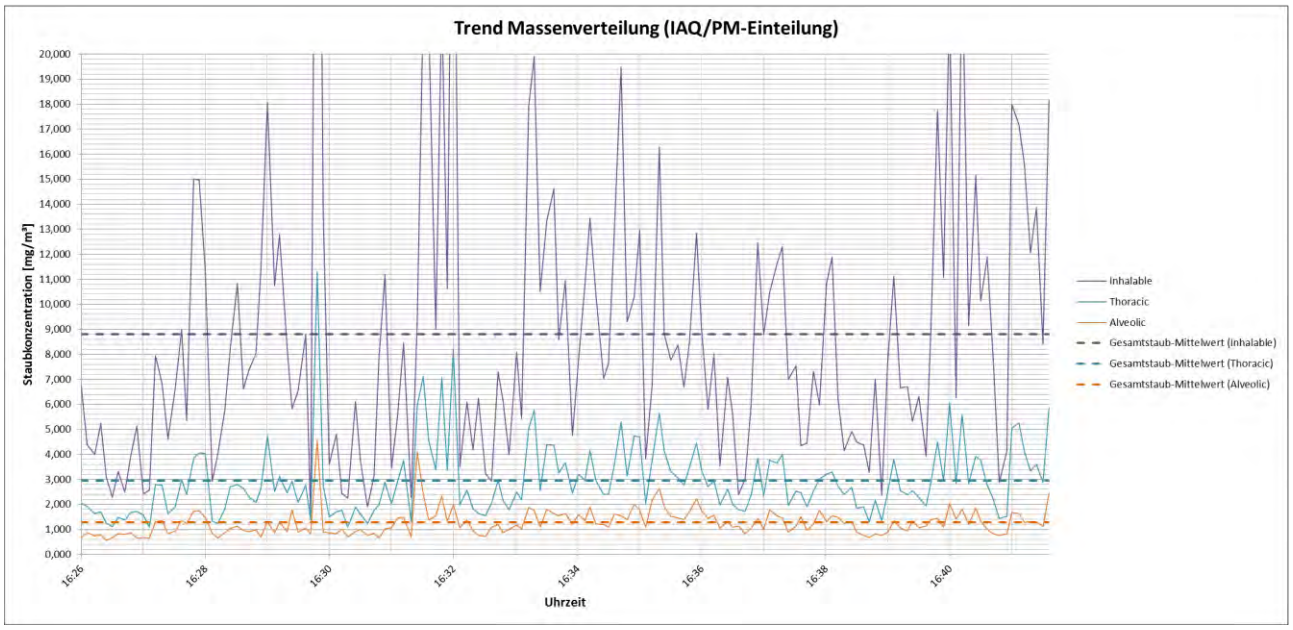
- **comments:**

no comments

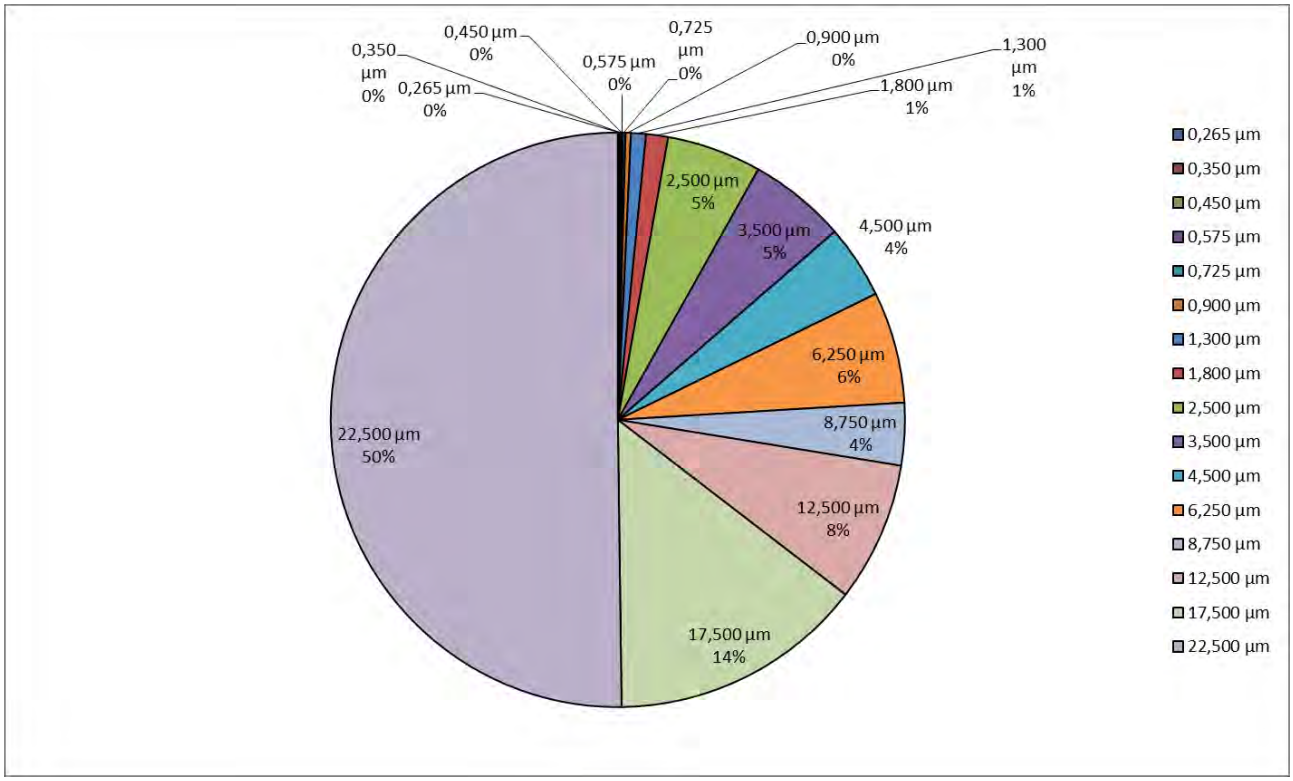
campaign 5

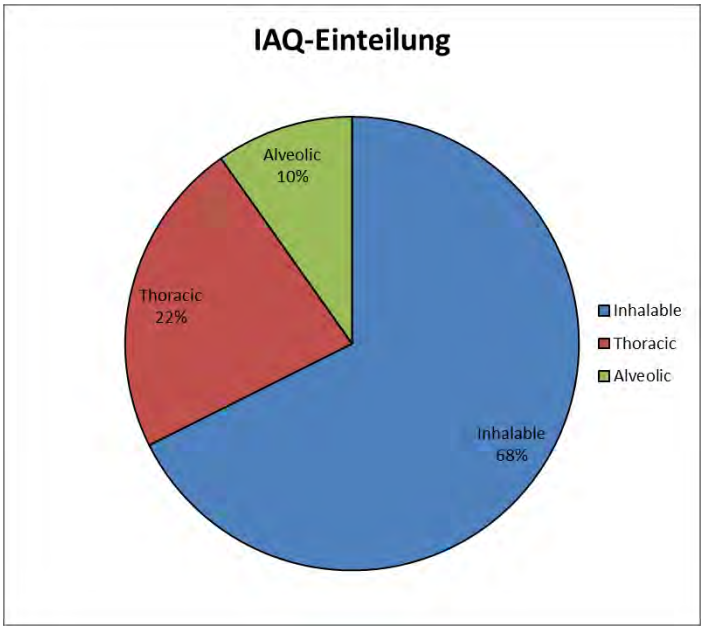
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,002	0,003	0,002	0,006	0,007	0,014	0,029	0,000	0,021	0,185	0,101	0,109	0,025	0,000	0,000	0,000
Maximum	0,011	0,015	0,010	0,019	0,030	0,086	0,283	1,070	2,406	1,238	1,109	1,595	1,318	3,697	7,758	25,519
Duchschnitt	0,006	0,008	0,003	0,008	0,012	0,027	0,074	0,109	0,469	0,484	0,365	0,552	0,309	0,692	1,266	4,422

Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,933	0,131	0,053	1,496	1,083	0,555
Maximum	8,964	2,497	0,377	45,140	11,298	4,558
Duchschnitt	2,460	0,521	0,108	8,814	2,946	1,279

- **comments:**

no comments

campaign 1

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
11.10.2014 10:18	11.10.2014 10:35	27	1014,3	~ 1,7m above the enclosure

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
360	160	>180	173	3,8

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
10:18	10:35	0,21	0,15	71,43

Comparison with the operational data collected by ILVA

The sinter cooler was not operated before the measurements have been started (from 09:50 until 10:10). Nevertheless high material temperatures have been measured by Kappa. This conflicts with the operational data (sinter temperature at the discharge of the sinter machine), where the temperature peaks at 240°C.

campaign 2

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
13.10.2014	13.10.2014	27	1012,5	~ 1,8m above the enclosure
12:32	13:31			

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
350	200	>270	265	3,8

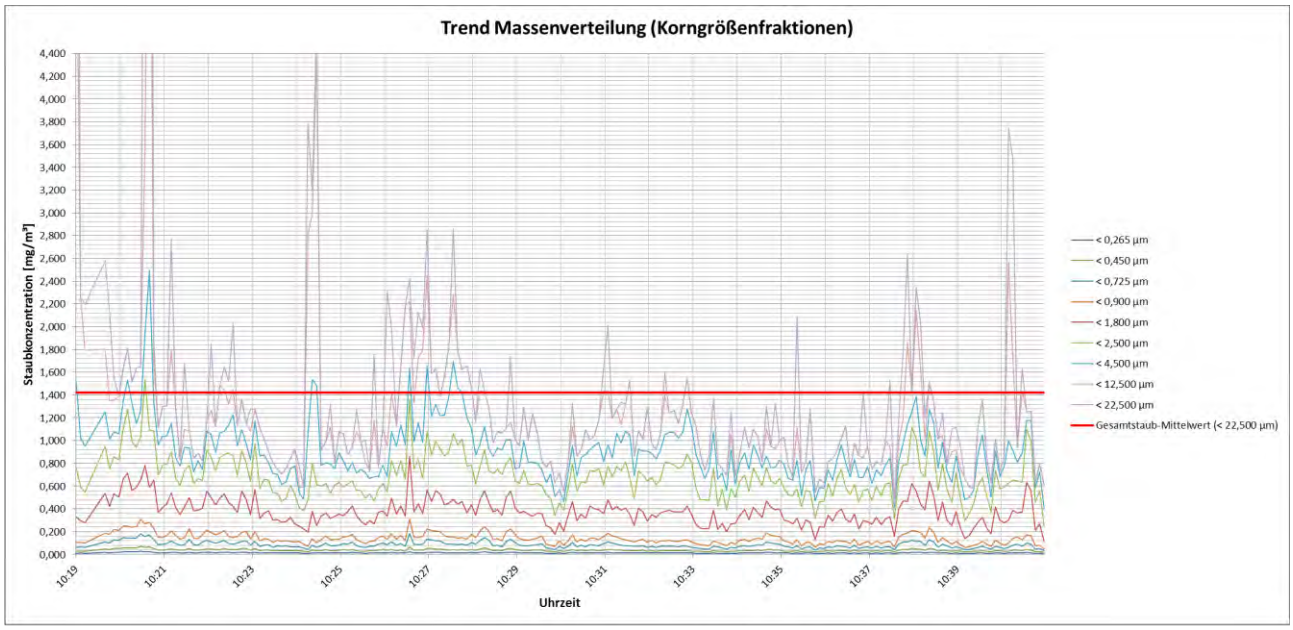
total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
12:32	13:31	1,31	0,18	13,74

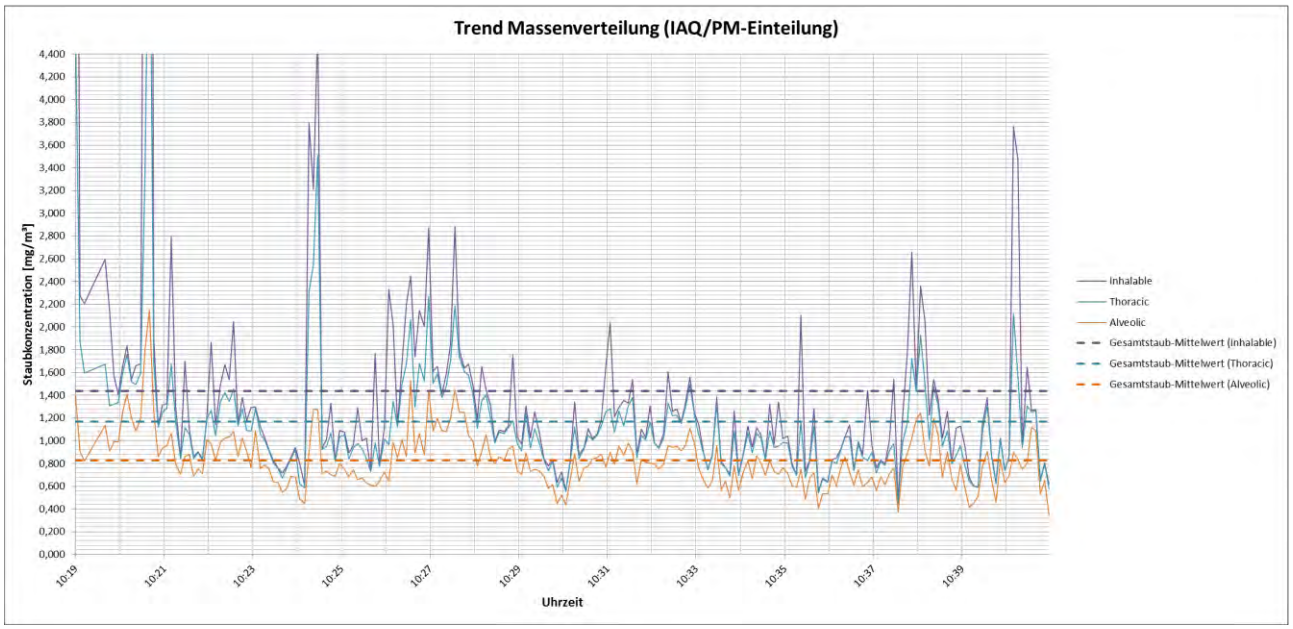
Comparison with the operational data collected by ILVA

The measurement is interrupted by a shut-down of the sinter cooler around 13:00. After the shut-down the calculated speed of the sinter cooler increases to about 1,35 m/min. The material temperature at the discharge of the sinter machine increases from about (260°C) and peaks at about 340°C.

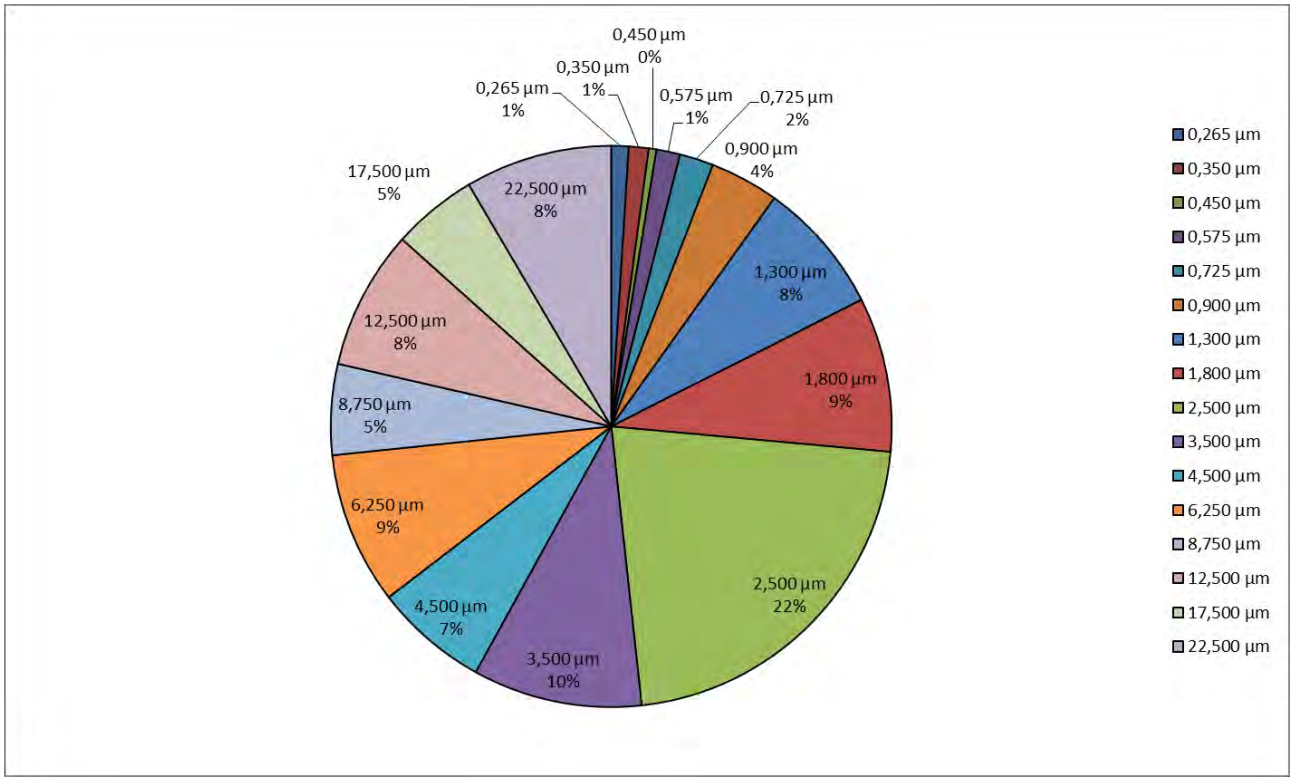
campaign 1

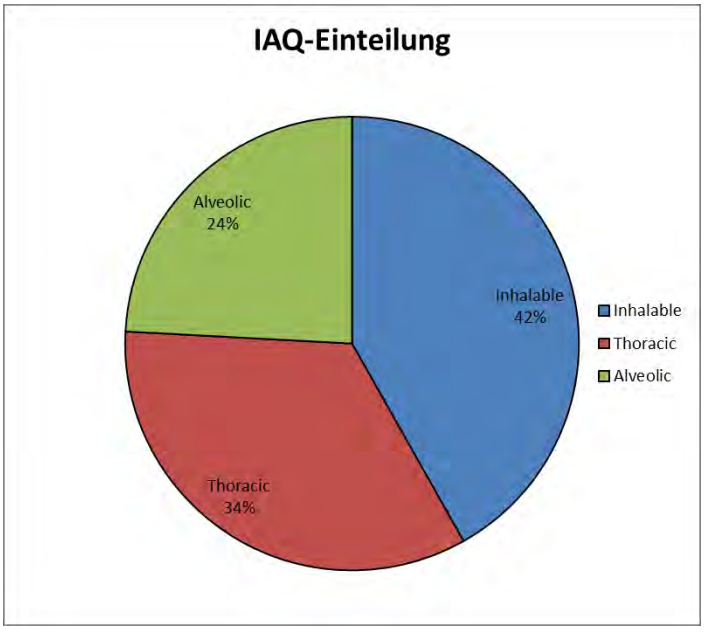
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,006	0,008	0,004	0,008	0,008	0,015	0,034	0,026	0,133	0,051	0,014	0,018	0,000	0,000	0,000	0,000
Maximum	0,027	0,031	0,012	0,047	0,071	0,132	0,254	0,328	0,753	0,625	0,778	1,486	1,119	2,827	1,591	5,800
Duchschnitt	0,014	0,016	0,006	0,019	0,028	0,056	0,109	0,126	0,310	0,138	0,093	0,125	0,074	0,114	0,070	0,120

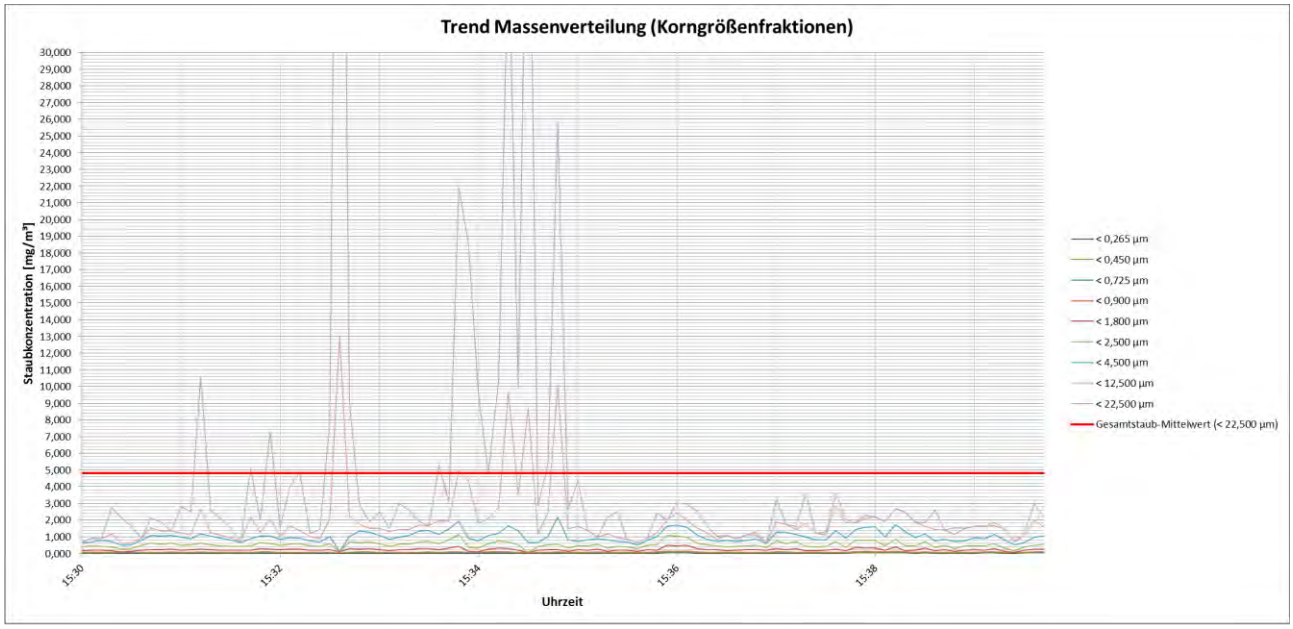
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,424	0,194	0,066	0,451	0,449	0,347
Maximum	5,513	1,176	0,388	15,148	6,361	2,149
Duchschnitt	1,083	0,547	0,180	1,435	1,167	0,829

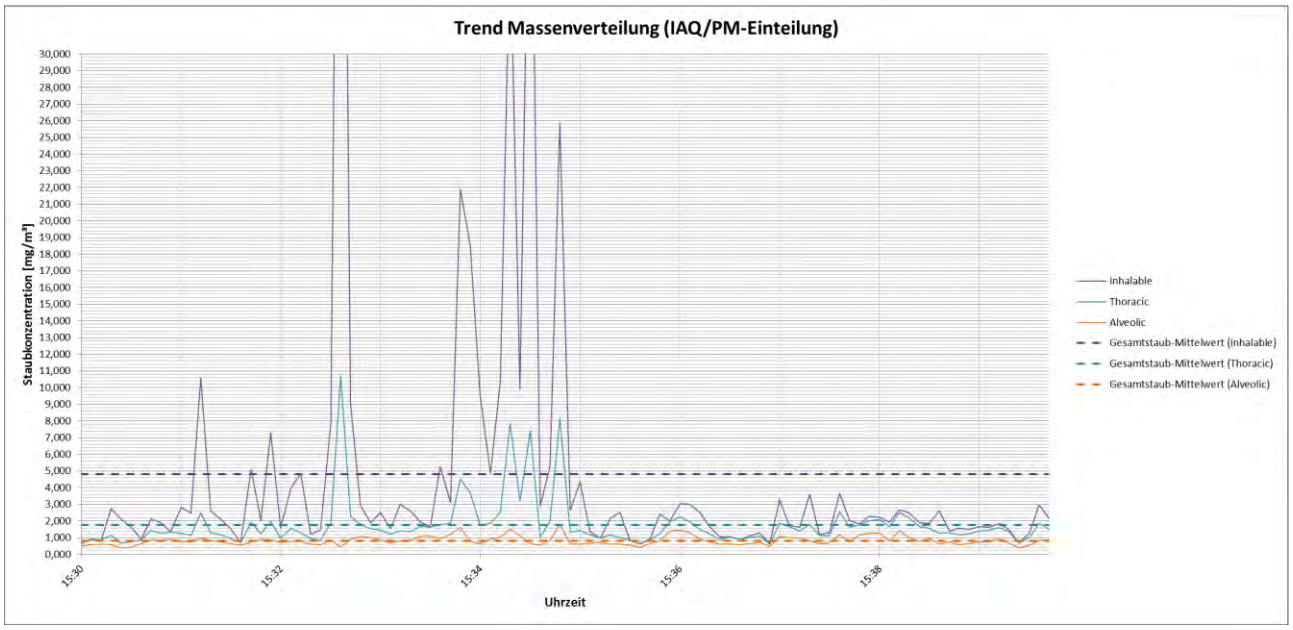
- **comments:**

Sinter cooler not operated from 10:30;
Measurement stopped at 10:35 because of a defect with the cooling tower; probably because of a collision with the lifting platform.

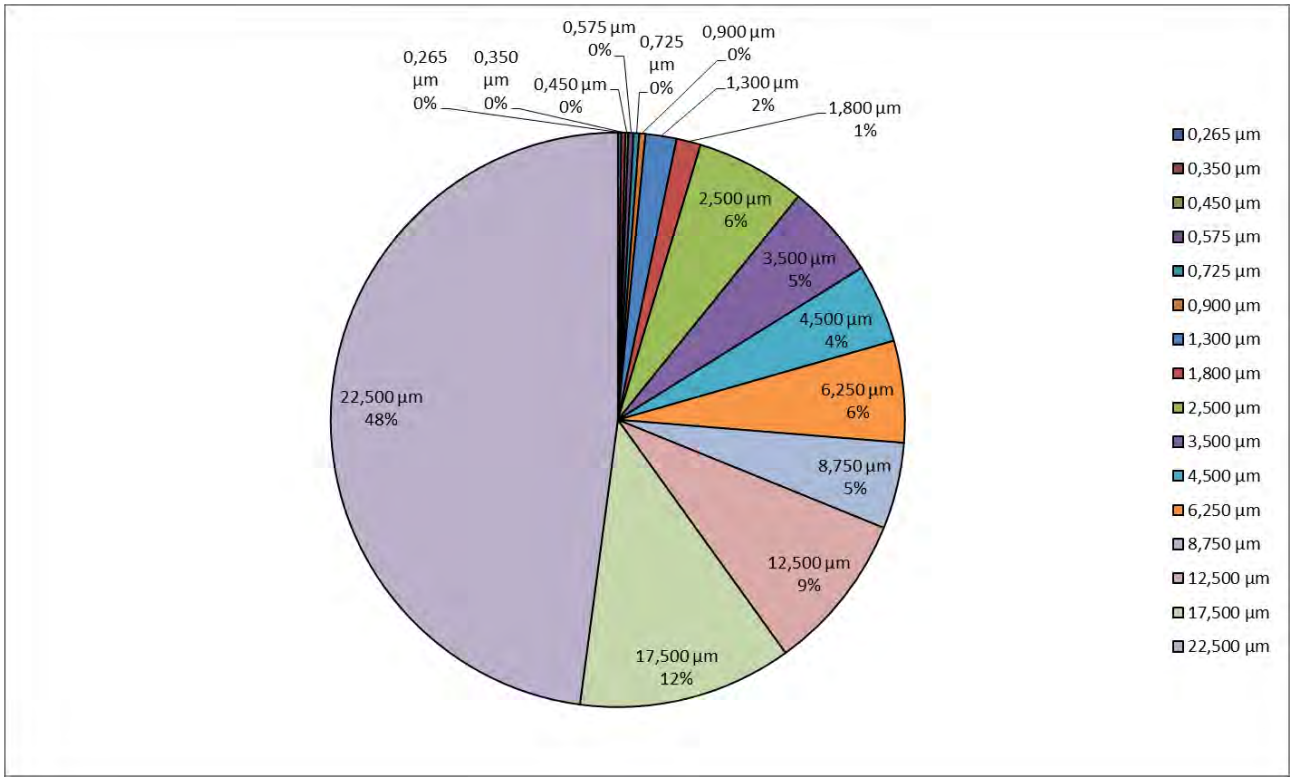
campaign 3

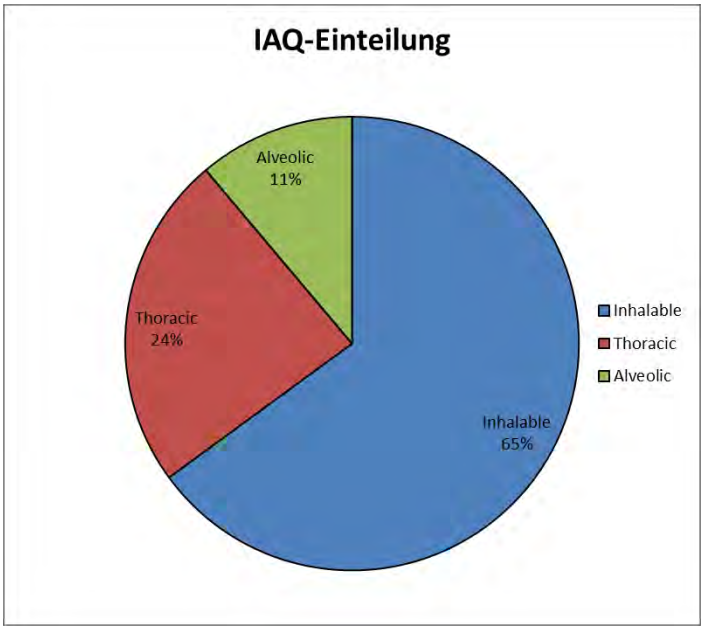
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,006	0,007	0,005	0,007	0,004	0,004	0,020	0,000	0,000	0,000	0,047	0,018	0,000	0,000	0,000	0,000
Maximum	0,015	0,018	0,012	0,028	0,036	0,037	0,196	0,186	0,720	0,678	0,961	1,803	2,860	8,772	12,931	49,298
Duchschnitt	0,009	0,011	0,008	0,014	0,015	0,017	0,084	0,066	0,297	0,256	0,214	0,276	0,234	0,431	0,581	2,308

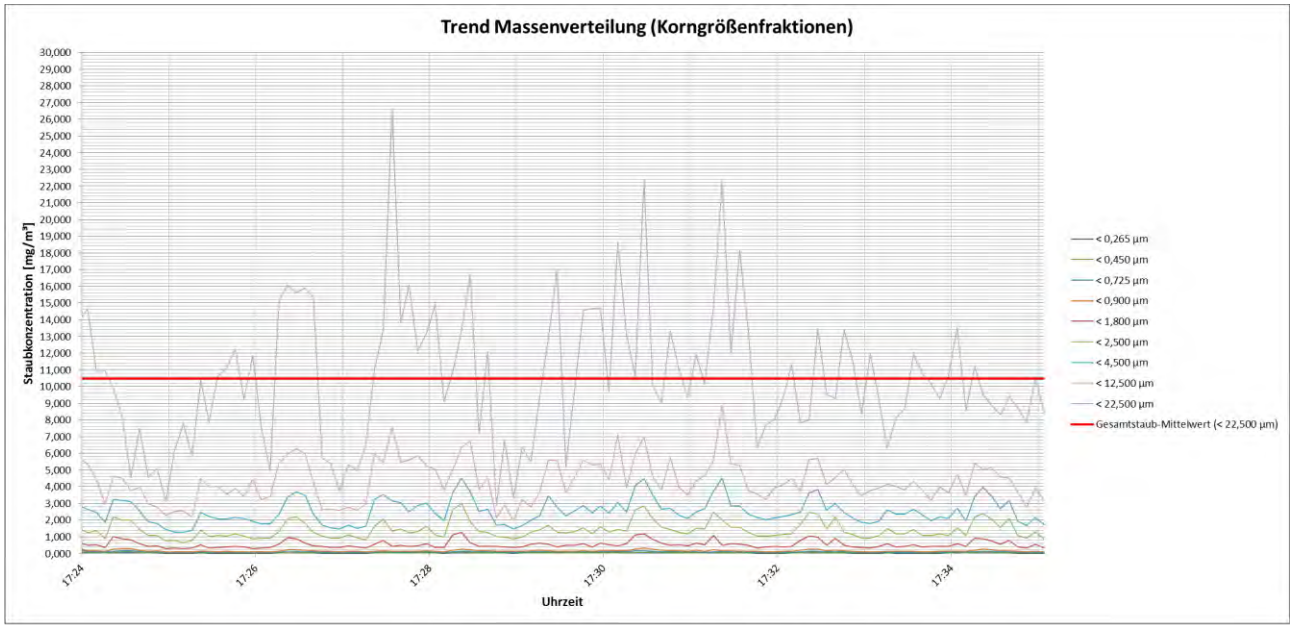
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,555	0,094	0,050	0,636	0,604	0,395
Maximum	7,181	0,822	0,220	75,225	10,696	1,820
Duchschnitt	1,518	0,399	0,115	4,830	1,778	0,829

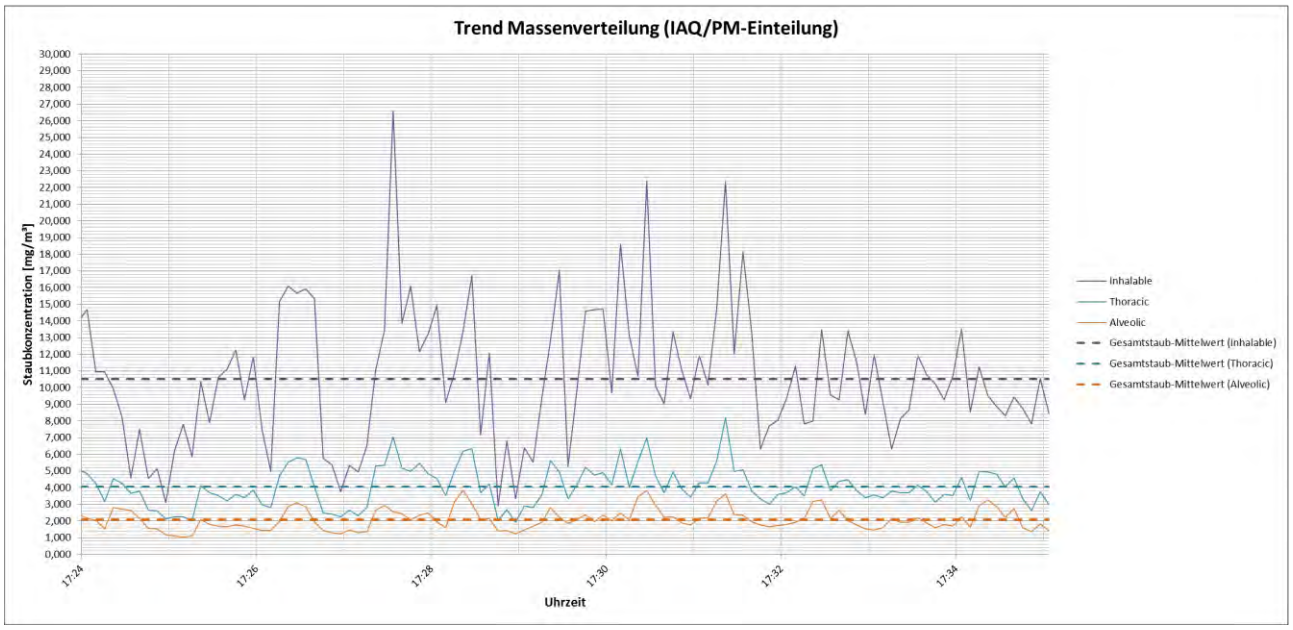
- **comments:**

no comments

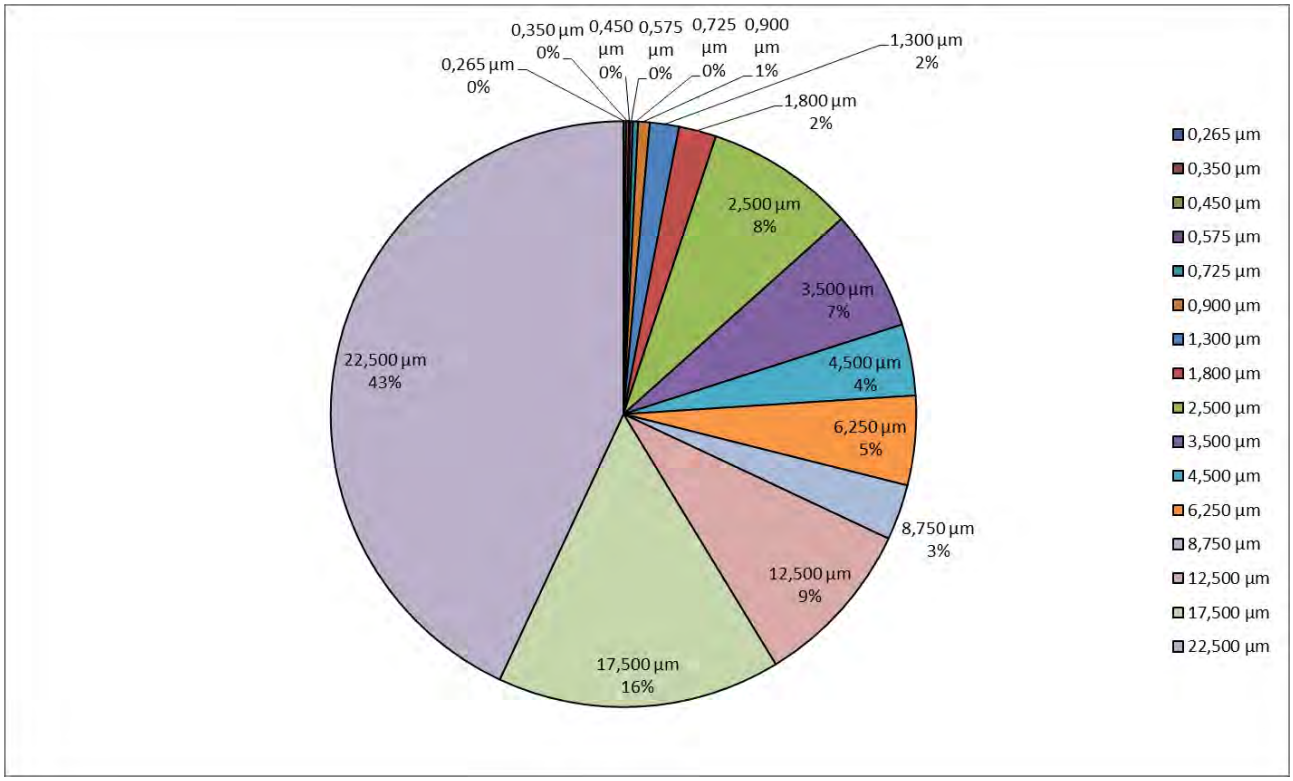
campaign 4

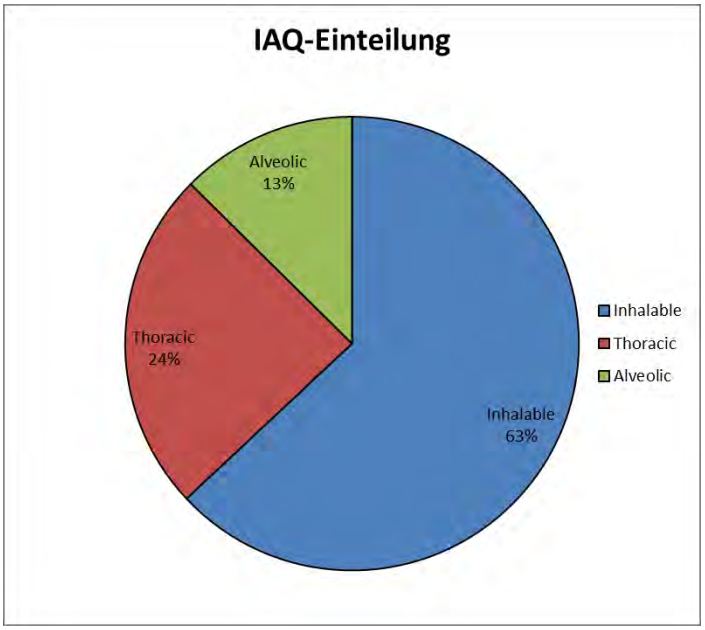
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,009	0,011	0,003	0,010	0,017	0,036	0,090	0,067	0,371	0,310	0,173	0,190	0,000	0,145	0,000	0,000
Maximum	0,037	0,054	0,008	0,031	0,065	0,149	0,374	0,647	1,750	1,630	0,910	1,296	0,995	2,392	4,178	15,079
Duchschnitt	0,015	0,018	0,005	0,017	0,030	0,067	0,169	0,217	0,867	0,699	0,413	0,517	0,322	0,976	1,642	4,514

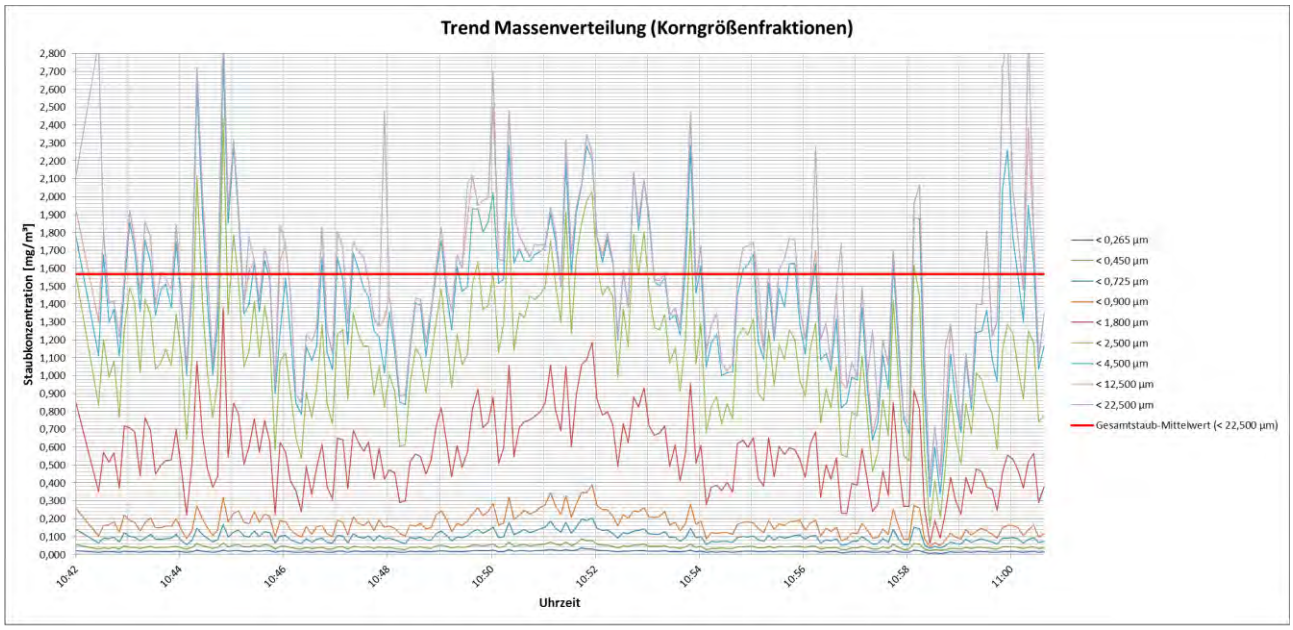
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	1,731	0,497	0,133	2,906	1,918	1,046
Maximum	6,885	2,195	0,483	26,627	8,197	3,861
Duchschnitt	3,477	1,026	0,237	10,503	4,064	2,098

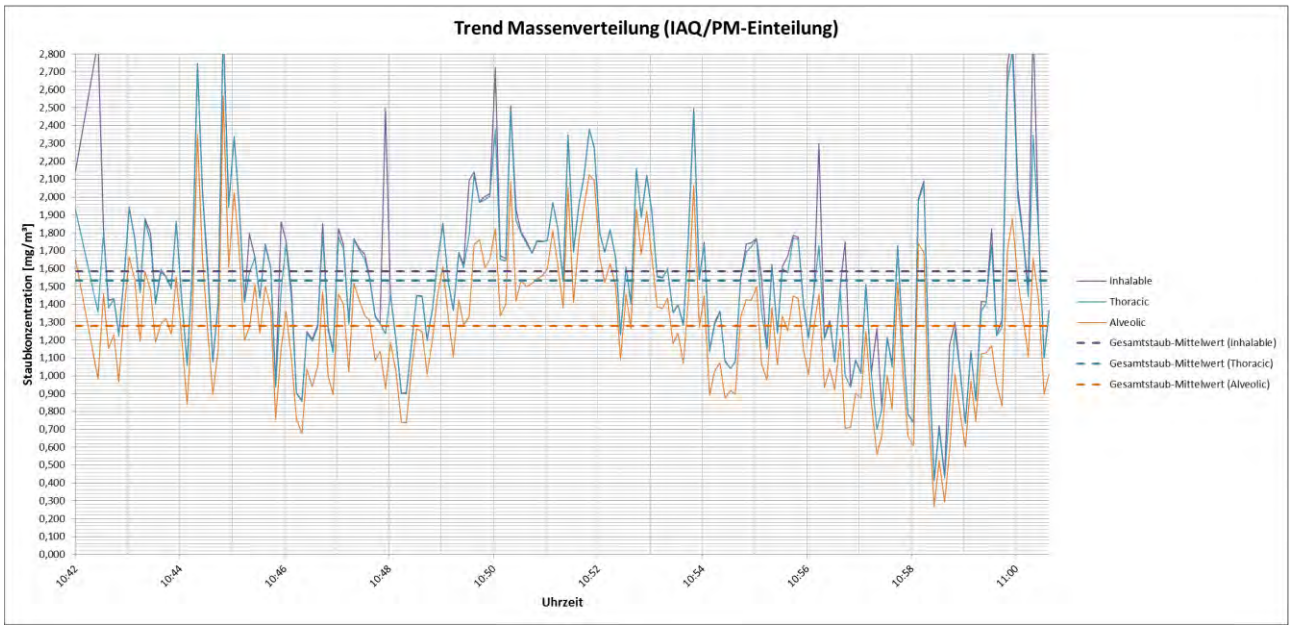
- **comments:**

no comments

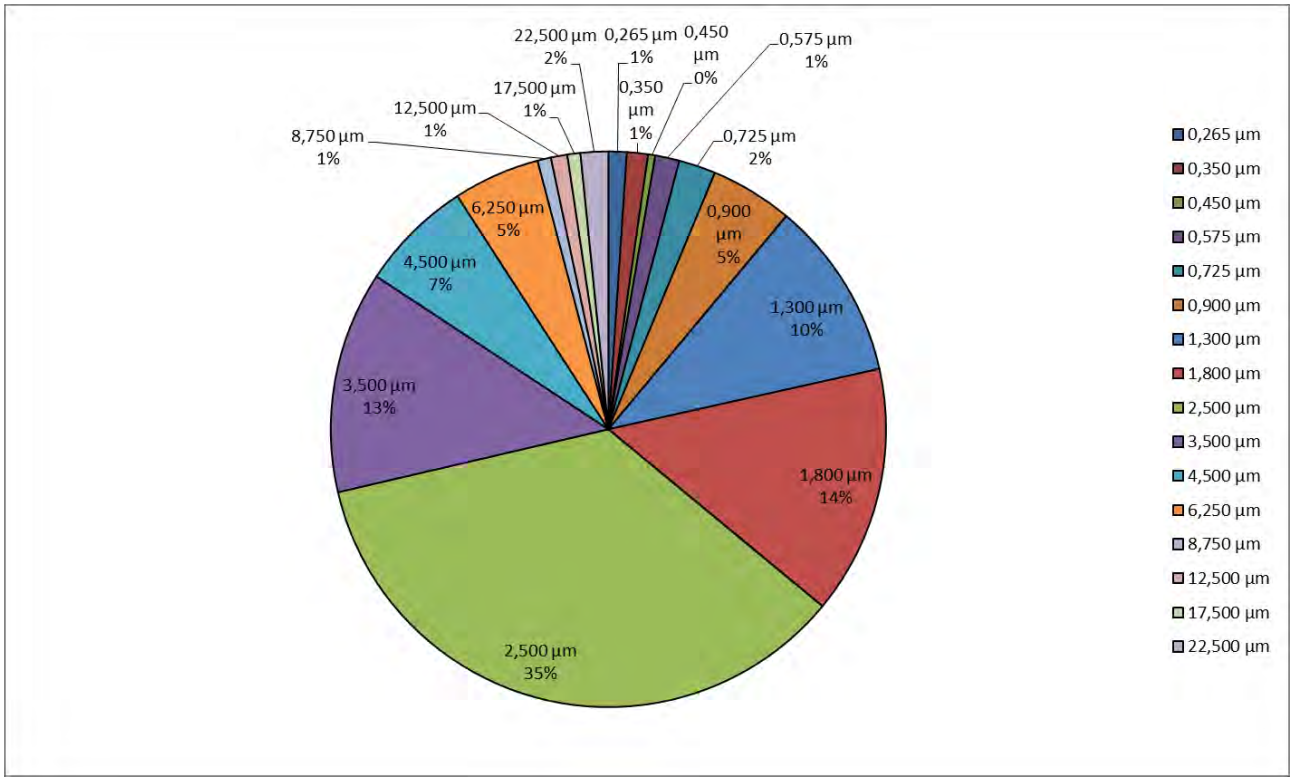
campaign 1

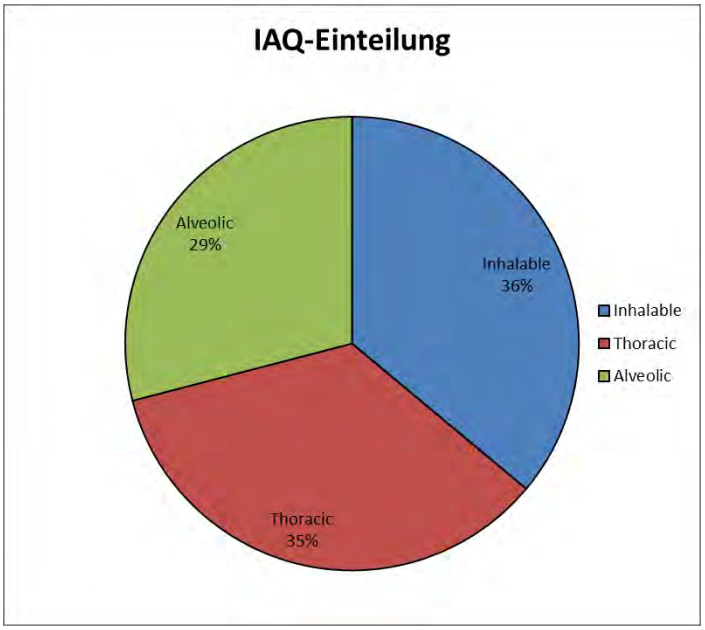
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,007	0,010	0,004	0,007	0,006	0,008	0,017	0,002	0,095	0,088	0,027	0,000	0,000	0,000	0,000	0,000
Maximum	0,036	0,041	0,011	0,051	0,075	0,188	0,387	0,674	1,056	0,547	0,426	0,480	0,124	0,362	0,398	1,160
Duchschnitt	0,017	0,019	0,007	0,022	0,034	0,075	0,164	0,227	0,554	0,202	0,103	0,079	0,012	0,015	0,012	0,025

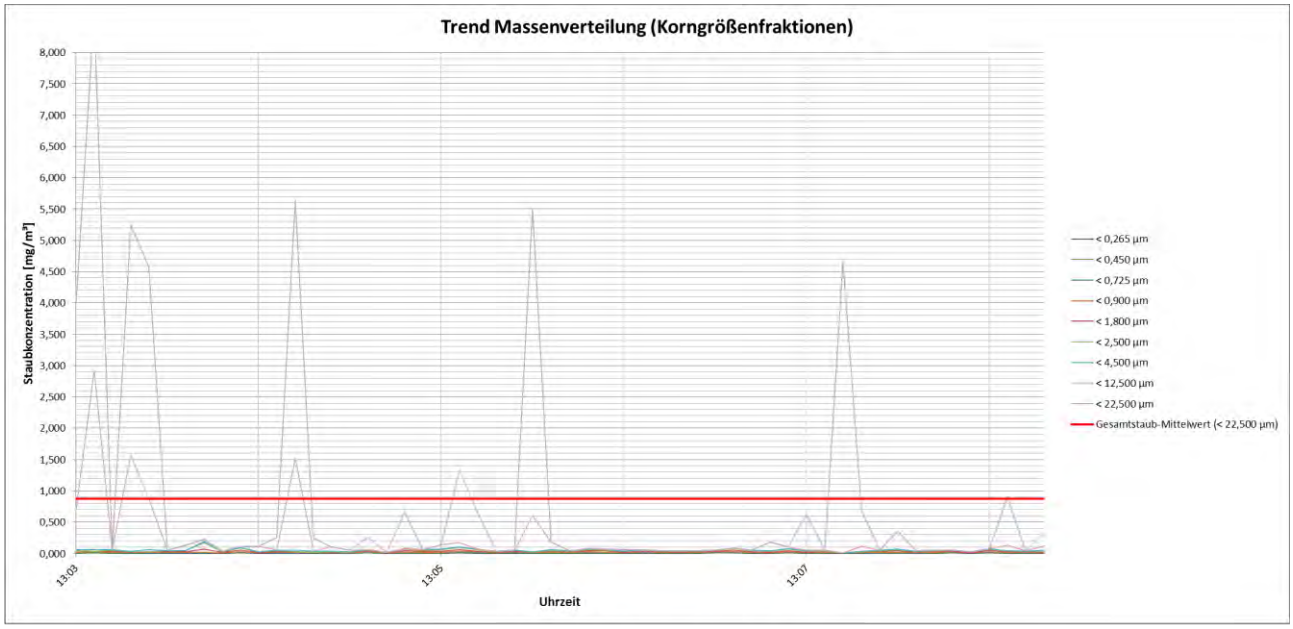
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,384	0,125	0,053	0,420	0,414	0,270
Maximum	2,774	1,899	0,507	2,982	2,928	2,567
Duchschnitt	1,445	0,858	0,243	1,585	1,533	1,277

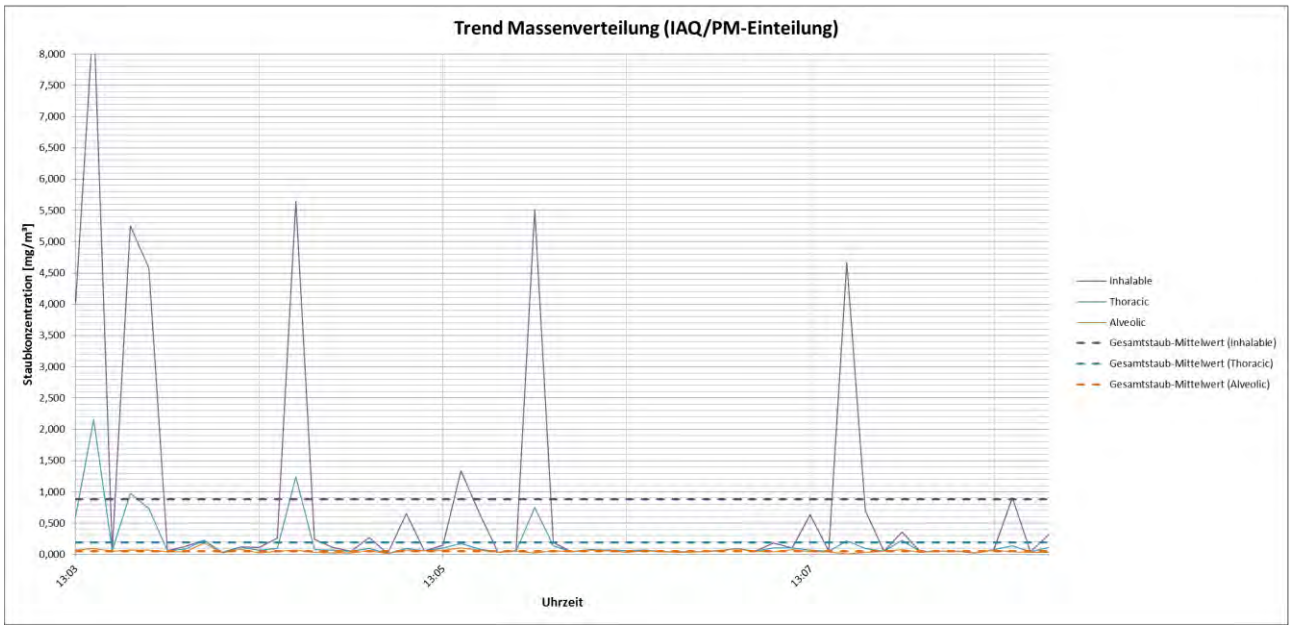
- **comments:**

no comments

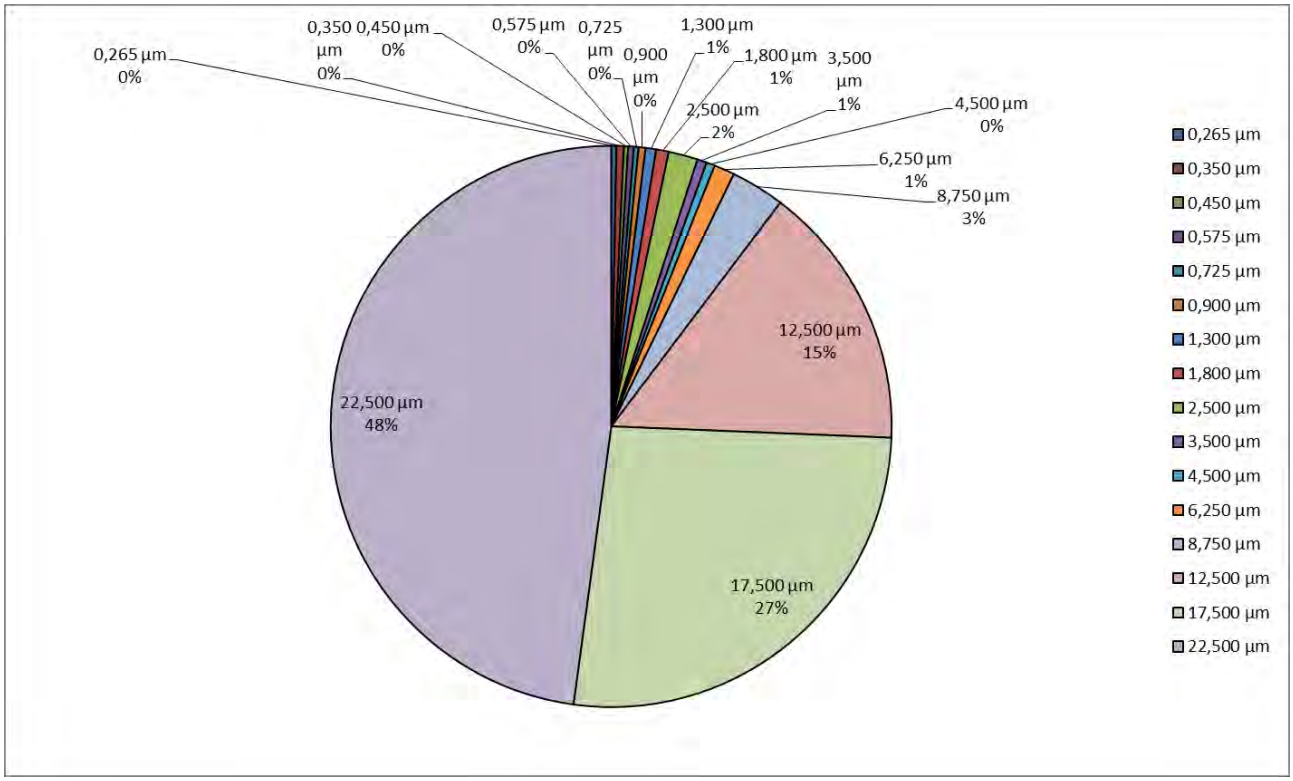
campaign 2

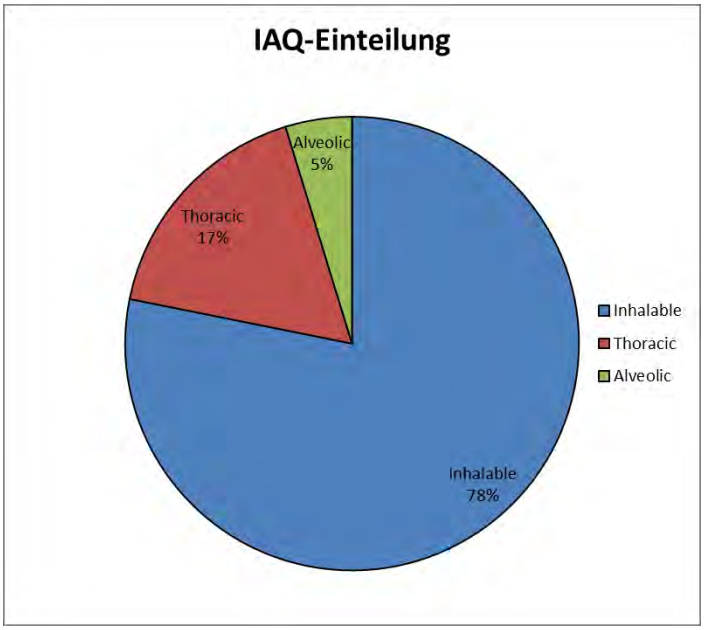
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,001	0,002	0,001	0,000	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,005	0,006	0,004	0,006	0,006	0,008	0,011	0,043	0,111	0,013	0,027	0,154	0,323	2,392	3,979	4,060
Duchschnitt	0,003	0,004	0,002	0,003	0,002	0,004	0,005	0,006	0,015	0,005	0,004	0,010	0,027	0,134	0,232	0,419

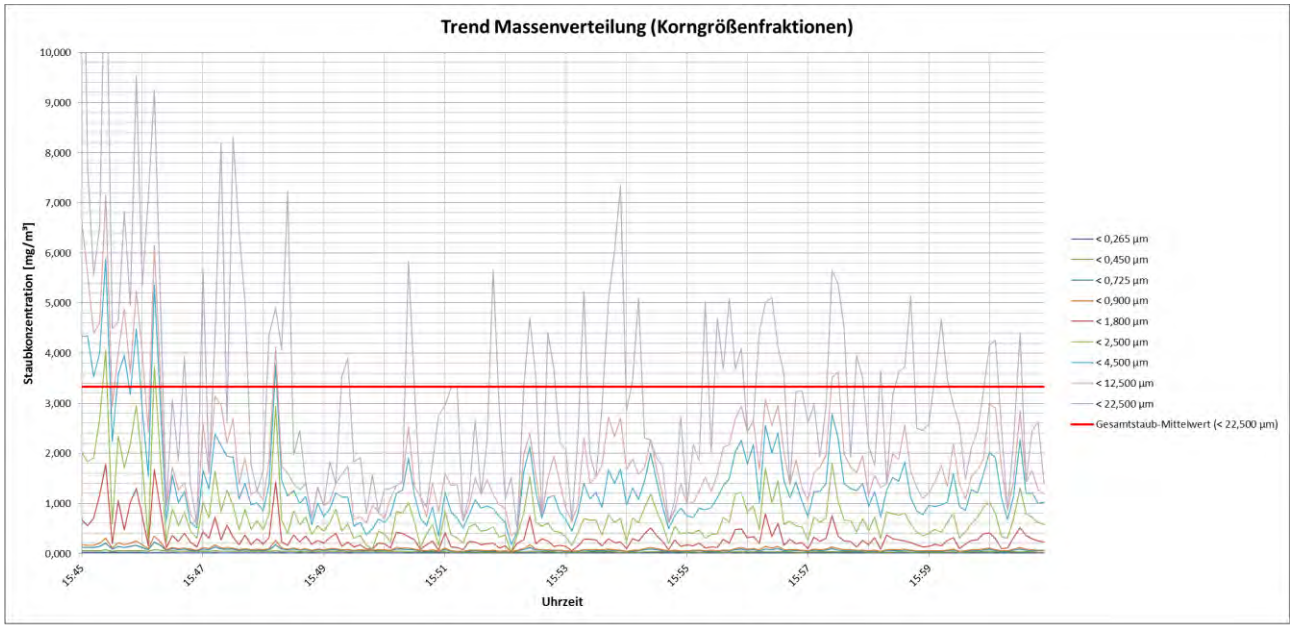
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,020	0,008	0,007	0,021	0,021	0,008
Maximum	1,554	0,122	0,038	8,650	2,157	0,180
Duchschnitt	0,145	0,039	0,020	0,878	0,192	0,053

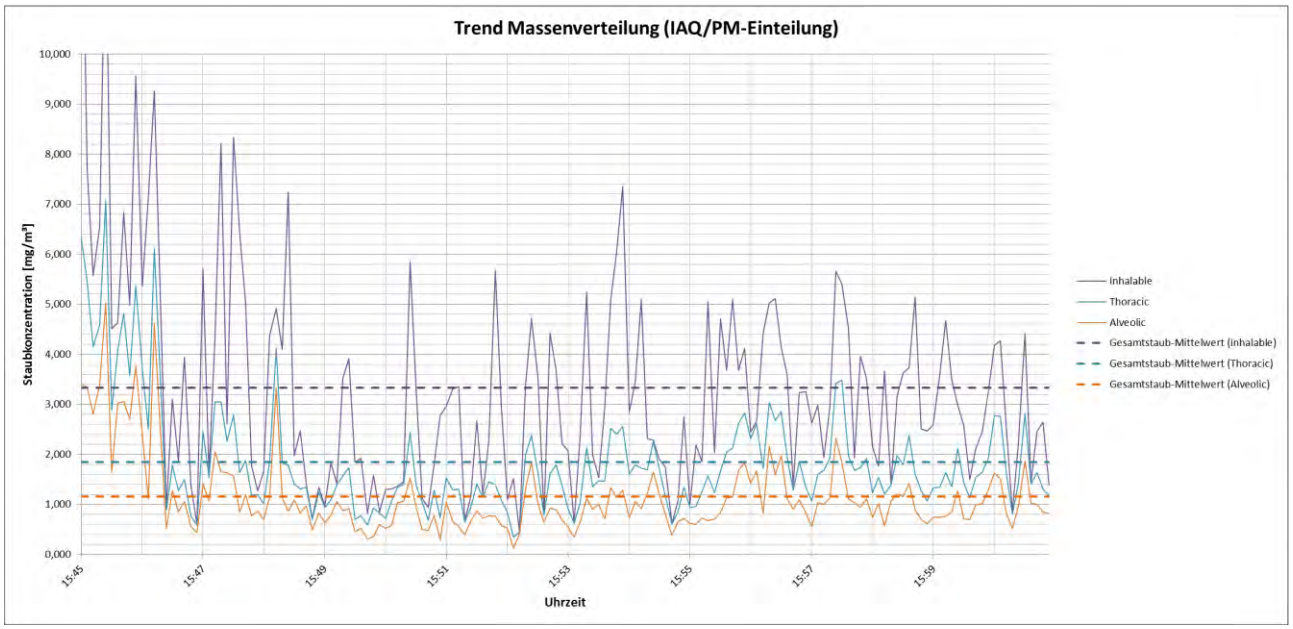
- **comments:**

Defect of the aerosol spectrometer (dust monitor). Measurement results must be dismissed because of a lack of significance.

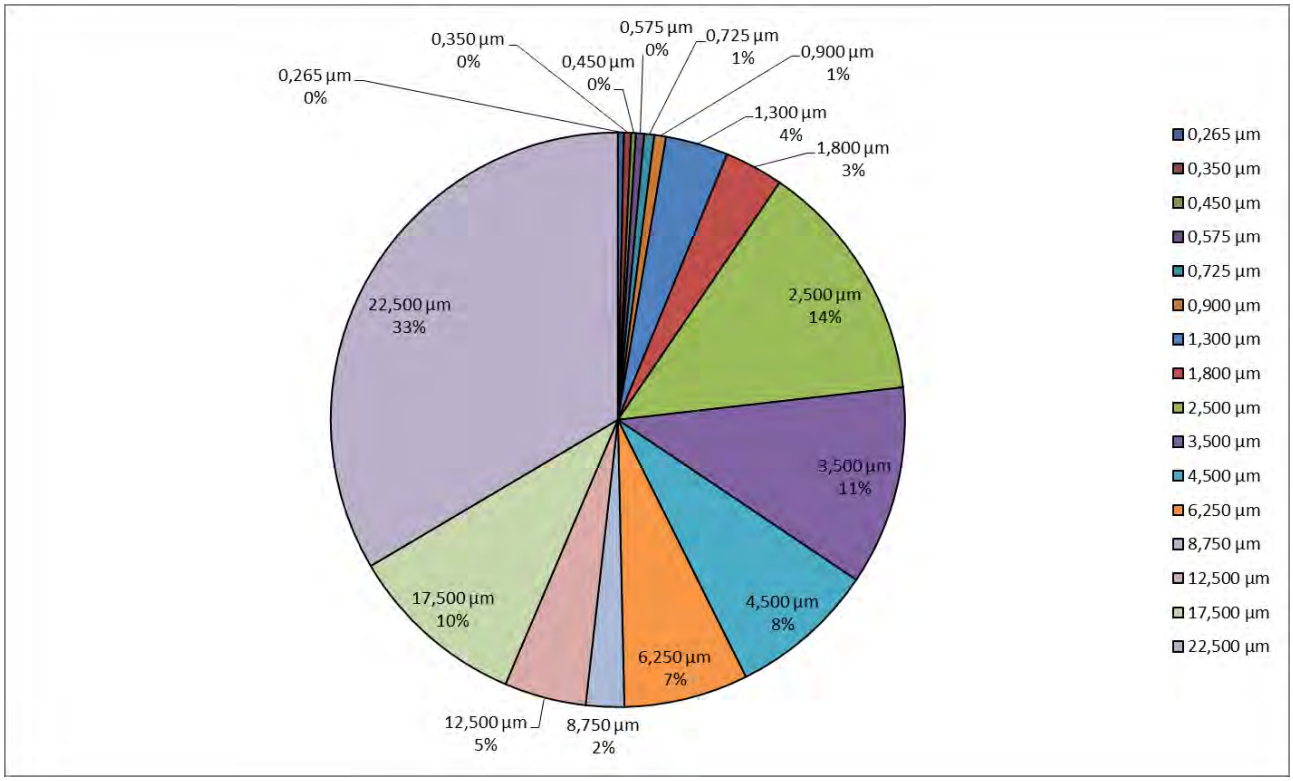
campaign 3

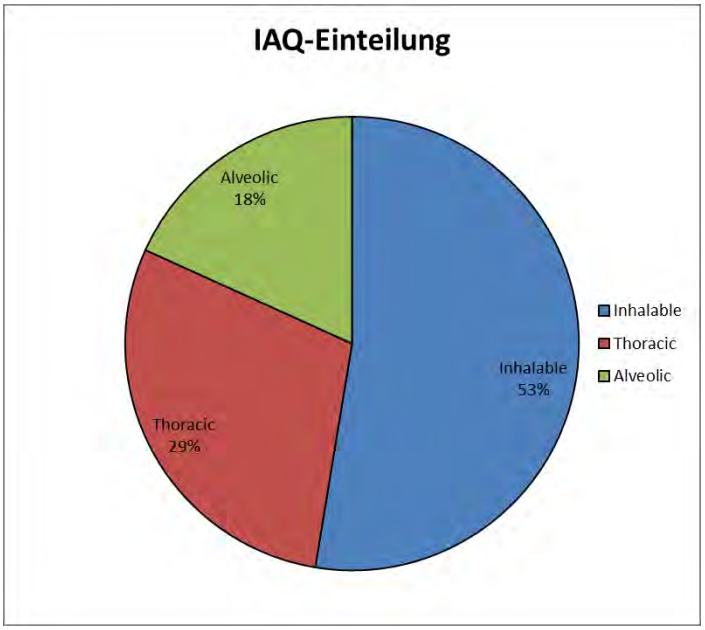
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,006	0,008	0,004	0,006	0,002	0,001	0,005	0,000	0,000	0,027	0,020	0,009	0,000	0,000	0,000	0,000
Maximum	0,024	0,031	0,018	0,060	0,095	0,120	0,608	0,870	2,271	1,455	1,052	0,797	0,448	1,087	1,591	6,960
Duchschnitt	0,011	0,014	0,009	0,015	0,019	0,022	0,117	0,110	0,454	0,372	0,274	0,232	0,072	0,153	0,336	1,113

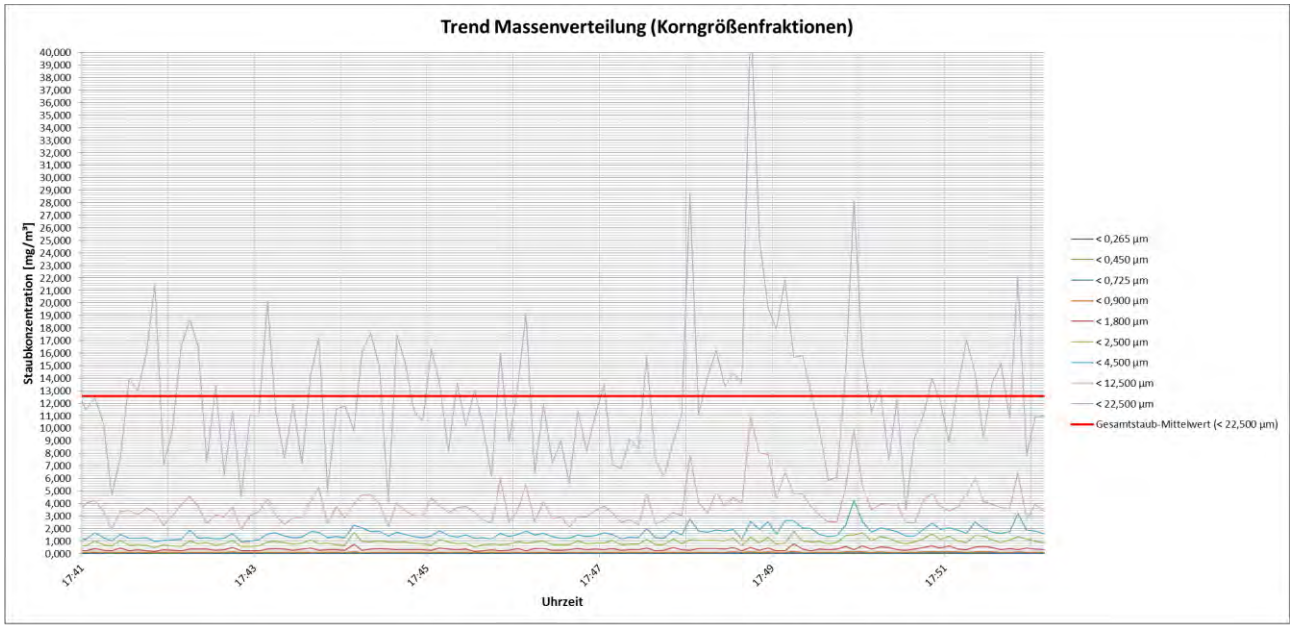
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,286	0,046	0,037	0,453	0,347	0,129
Maximum	6,395	2,960	0,626	15,230	7,068	5,028
Duchschnitt	1,652	0,578	0,150	3,335	1,849	1,156

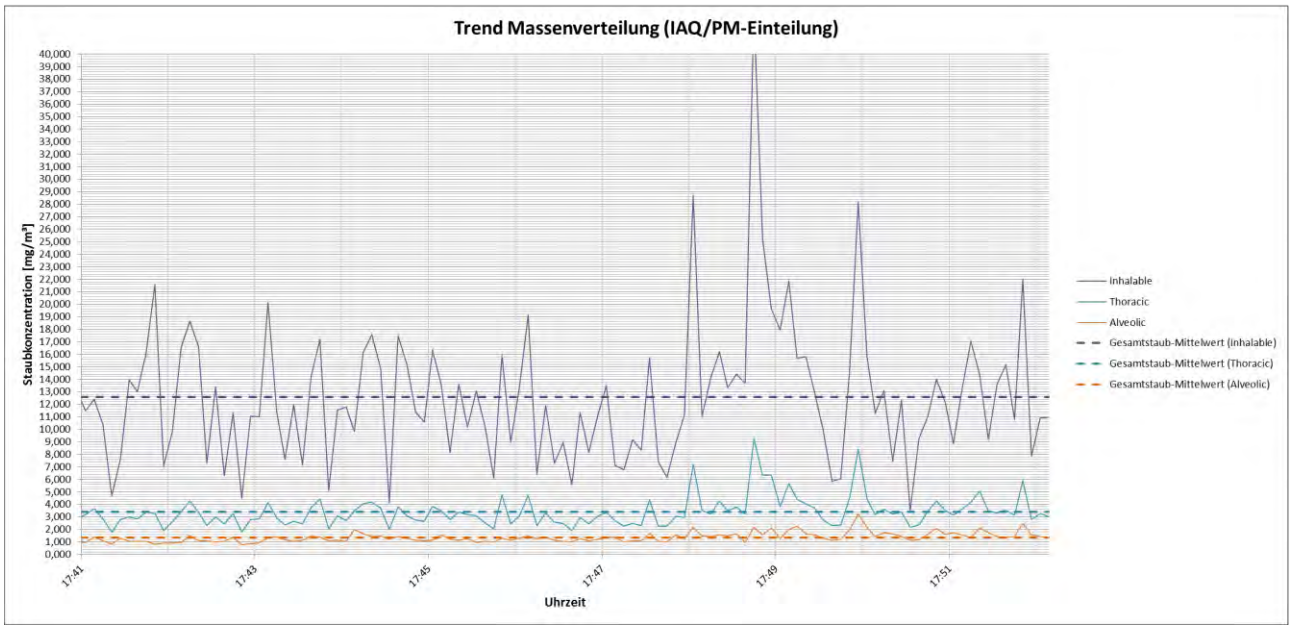
- **comments:**

no comments

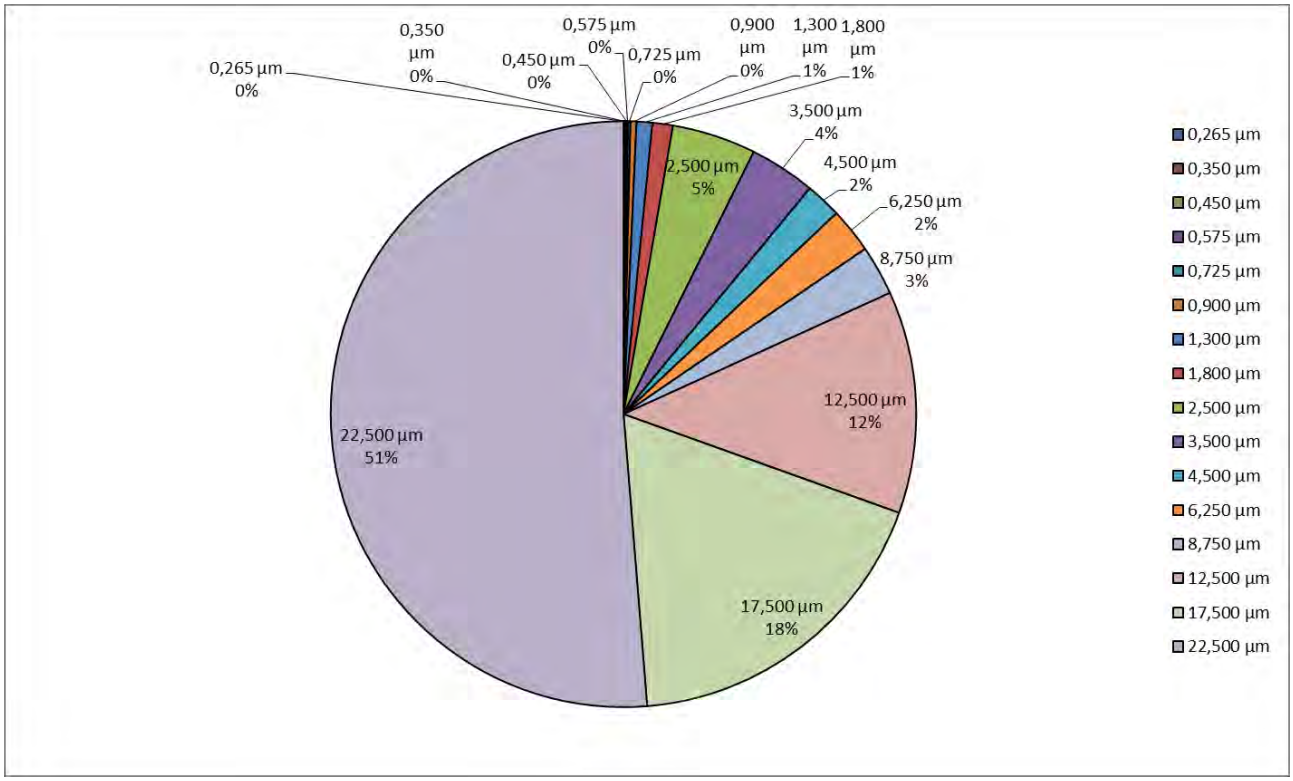
campaign 4

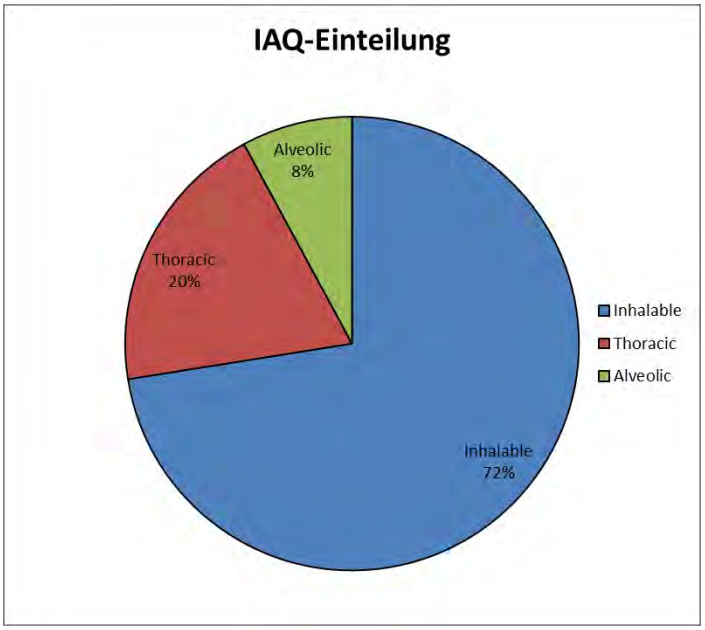
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,006	0,007	0,002	0,006	0,011	0,026	0,070	0,000	0,306	0,221	0,112	0,109	0,000	0,290	0,199	0,000
Maximum	0,014	0,017	0,004	0,014	0,028	0,073	0,198	0,429	1,155	1,856	0,893	0,807	1,641	6,017	9,947	22,619
Duchschnitt	0,009	0,011	0,003	0,009	0,017	0,041	0,109	0,141	0,582	0,457	0,250	0,312	0,345	1,539	2,289	6,437

Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	1,465	0,357	0,092	3,506	1,771	0,777
Maximum	6,957	1,312	0,268	43,487	9,271	3,233
Duchschnitt	2,746	0,666	0,147	12,560	3,398	1,369

- **comments:**

no comments

campaign 1

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
11.10.2014 09:04	11.10.2014 09:50	25	1016,4	~ 1,6m above the enclosure

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
415	210	>250	227	3,5-4,0

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
09:04	09:50	0,55	0,21	38,18

Comparison with the operational data collected by ILVA

During the measurement period the cooling time of the sinter material fluctuates at around 95min. The calculated speed of the sinter cooler had a value of about 1,4 m/min. The sinter temperature at the discharge point of the sinter machine dips at about 350°C and peaks at about 370°C. This differs from the measured value of 415°C.

campaign 2

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
13.10.2014	13.10.2014	27	1011,0	~ 1,7m above the enclosure
15:32	16:30			

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
52	36	36	36	3,42

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
15:32	16:30	1,37	0,17	12,41

Comparison with the operational data collected by ILVA

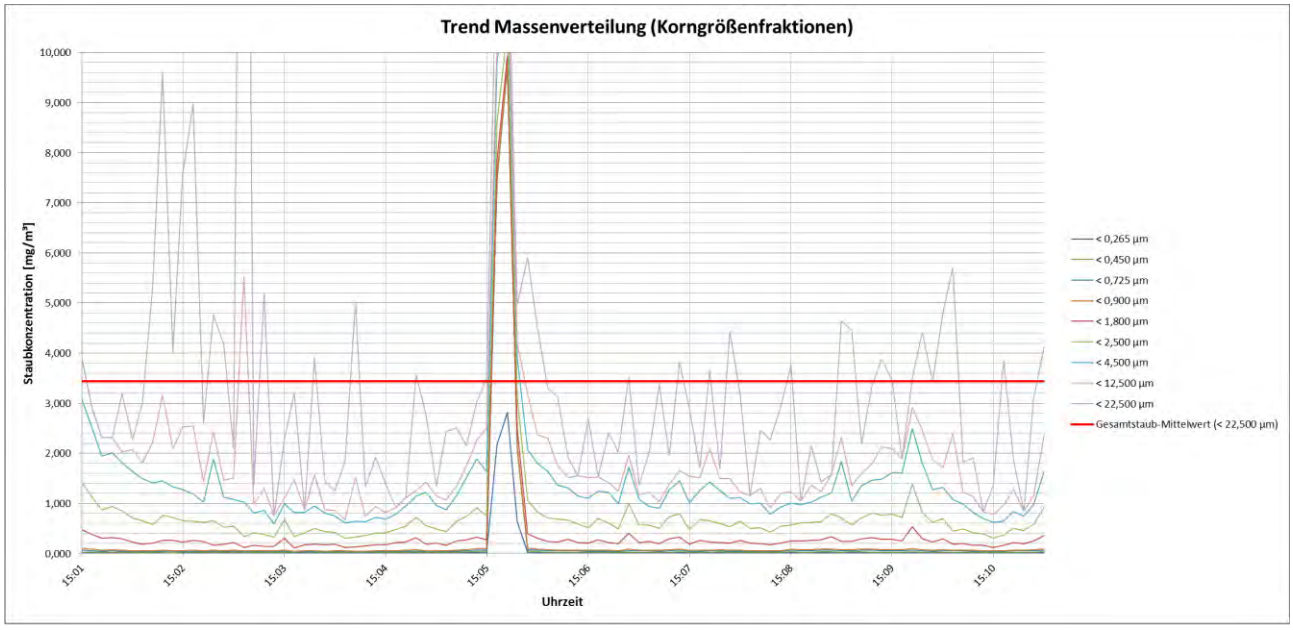
Sinter cooler is not operating in full load. Since the sinter cooler was not operated between 13:40 and 14:10, only already cooled down material passes the measuring point. Material temperature increases at about 15:40 and decreases at about 16:00. An increase in material temperature was measured from about 16:25 to ~500°C. This observation differs from the operating data collected by ILVA, where the material temperature increases from about 15:45 to a maximum of 300°C.

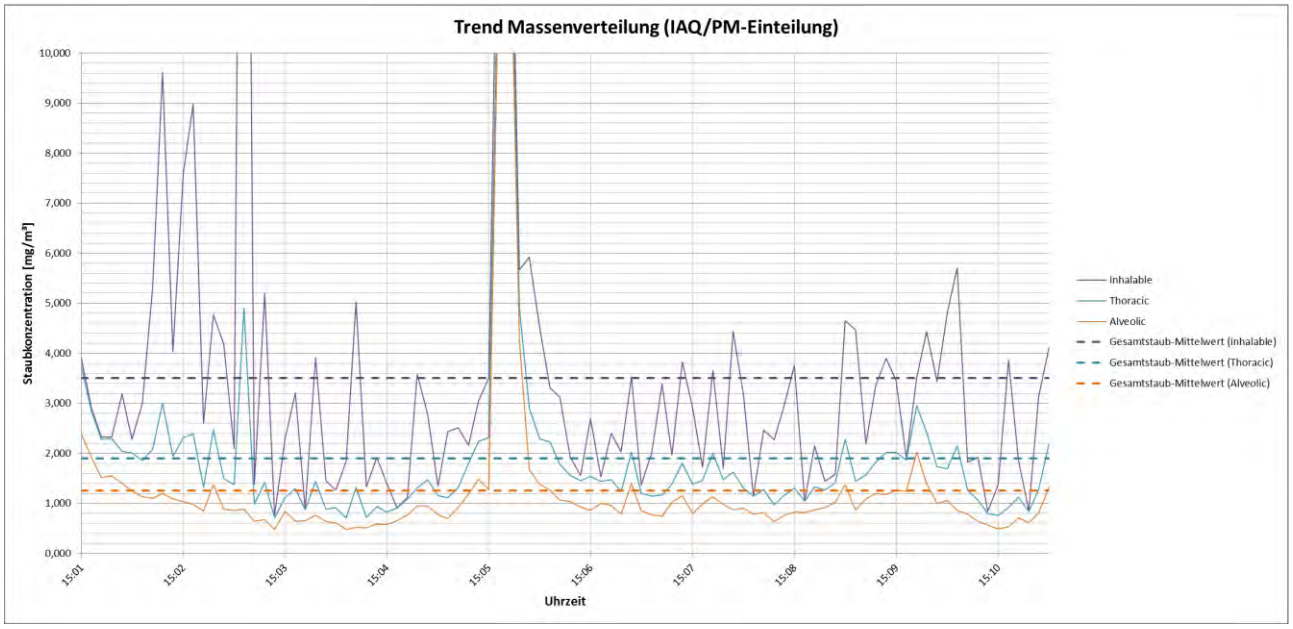
- **comments:**

no comments

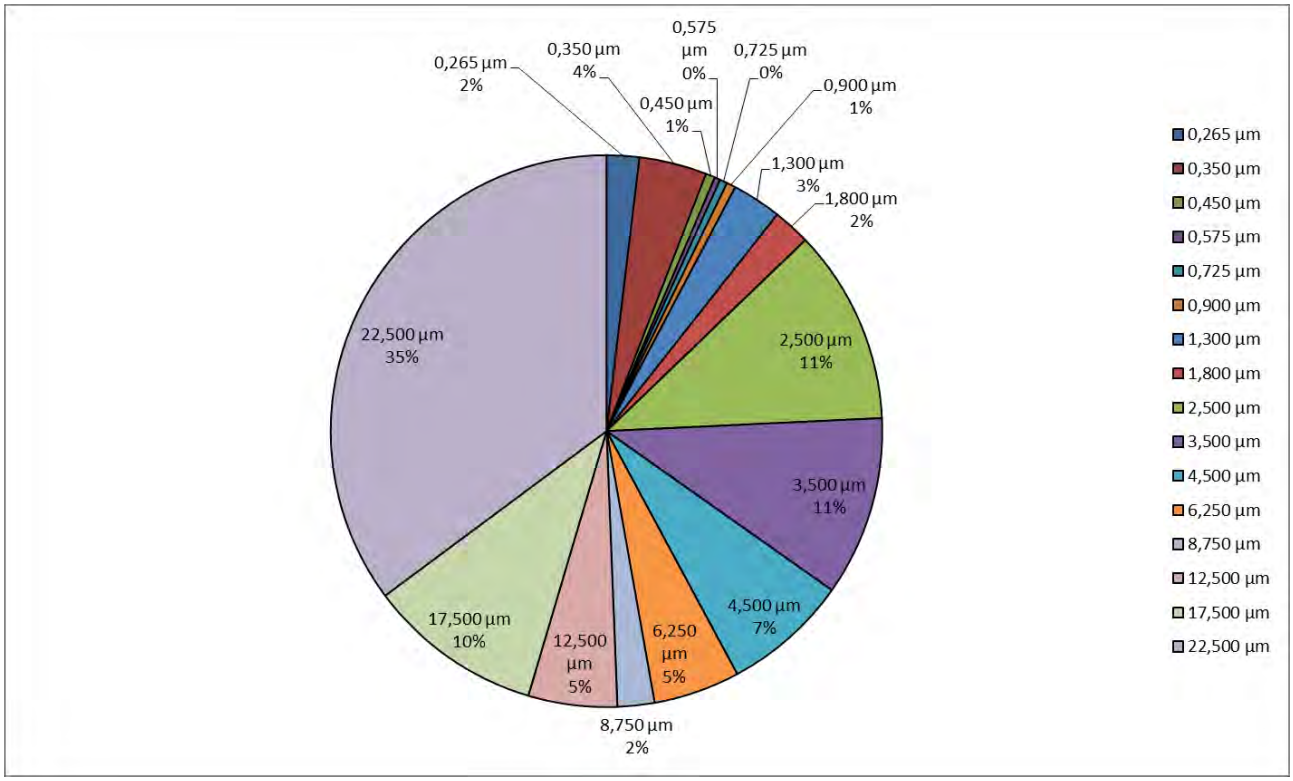
campaign 3

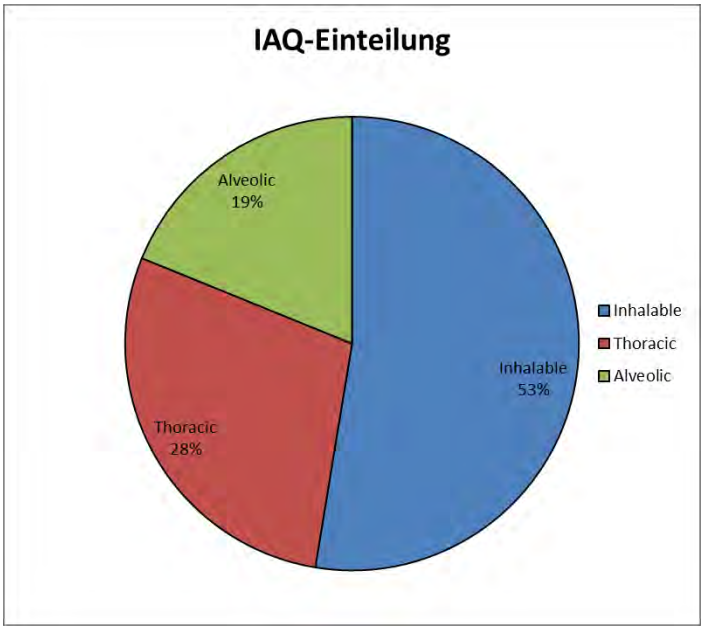
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,006	0,003	0,008	0,009	0,010	0,045	0,000	0,180	0,166	0,095	0,045	0,000	0,000	0,000	0,000
Maximum	2,812	6,067	0,849	0,016	0,024	0,033	0,196	0,248	0,952	0,933	0,724	0,788	1,094	2,610	3,979	19,139
Duchschnitt	0,066	0,136	0,019	0,011	0,015	0,018	0,100	0,075	0,393	0,362	0,253	0,174	0,074	0,179	0,352	1,208

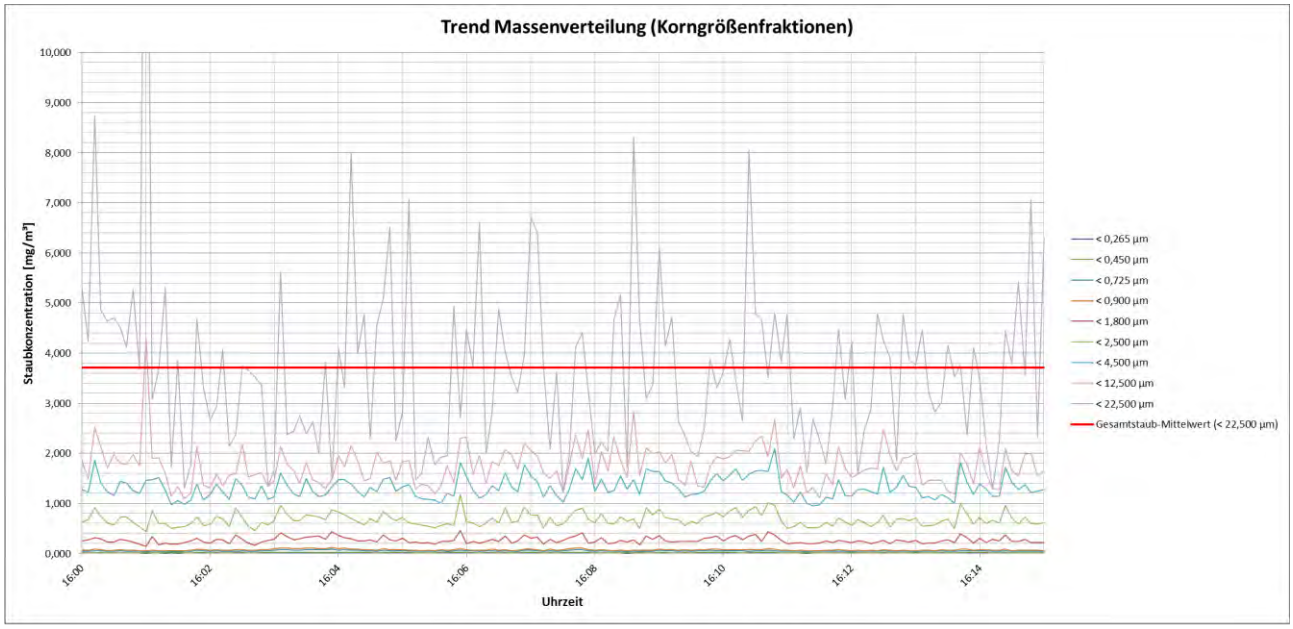
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,626	0,229	0,069	0,763	0,706	0,479
Maximum	14,732	13,336	12,834	28,642	14,945	14,038
Duchschnitt	1,718	0,733	0,377	3,508	1,904	1,258

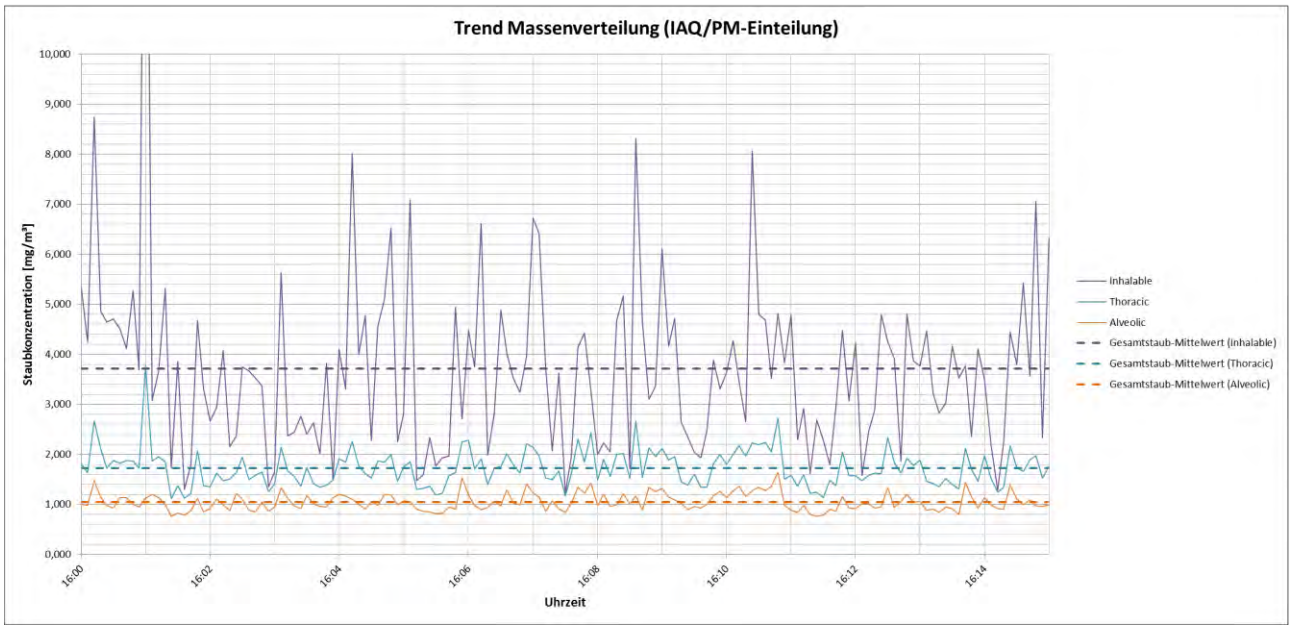
- **comments:**

no comments

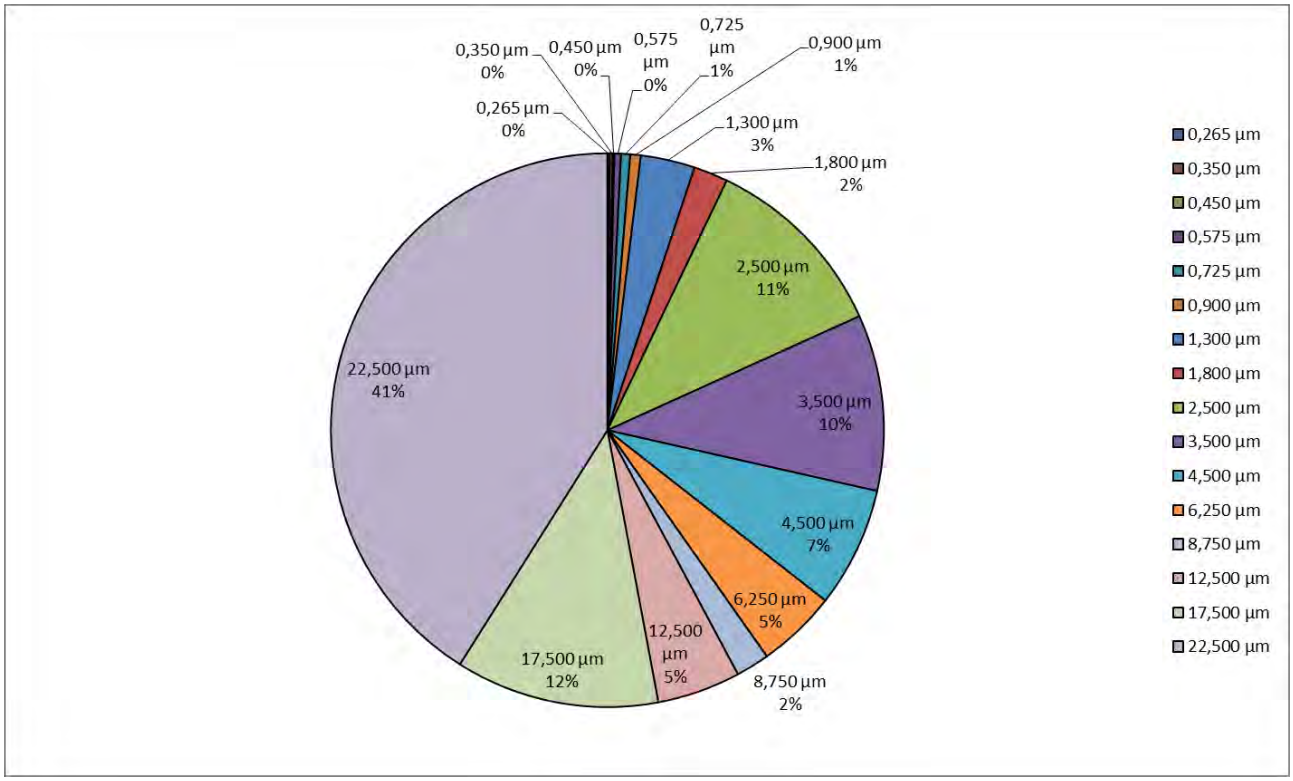
campaign 4

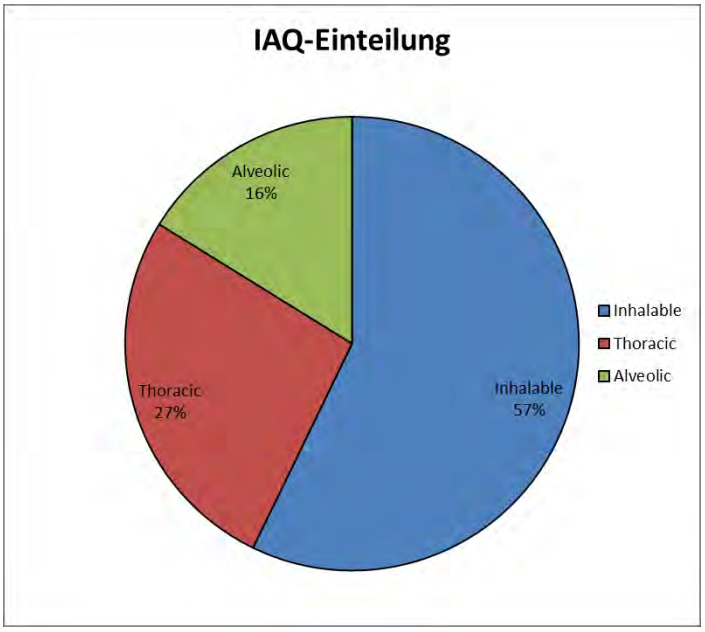
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,005	0,002	0,008	0,013	0,014	0,078	0,000	0,283	0,258	0,129	0,045	0,000	0,000	0,000	0,000
Maximum	0,008	0,010	0,006	0,026	0,035	0,037	0,181	0,200	0,712	0,708	0,511	0,634	0,472	1,740	1,989	12,759
Duchschnitt	0,005	0,006	0,004	0,014	0,020	0,023	0,117	0,074	0,413	0,381	0,260	0,173	0,073	0,181	0,441	1,521

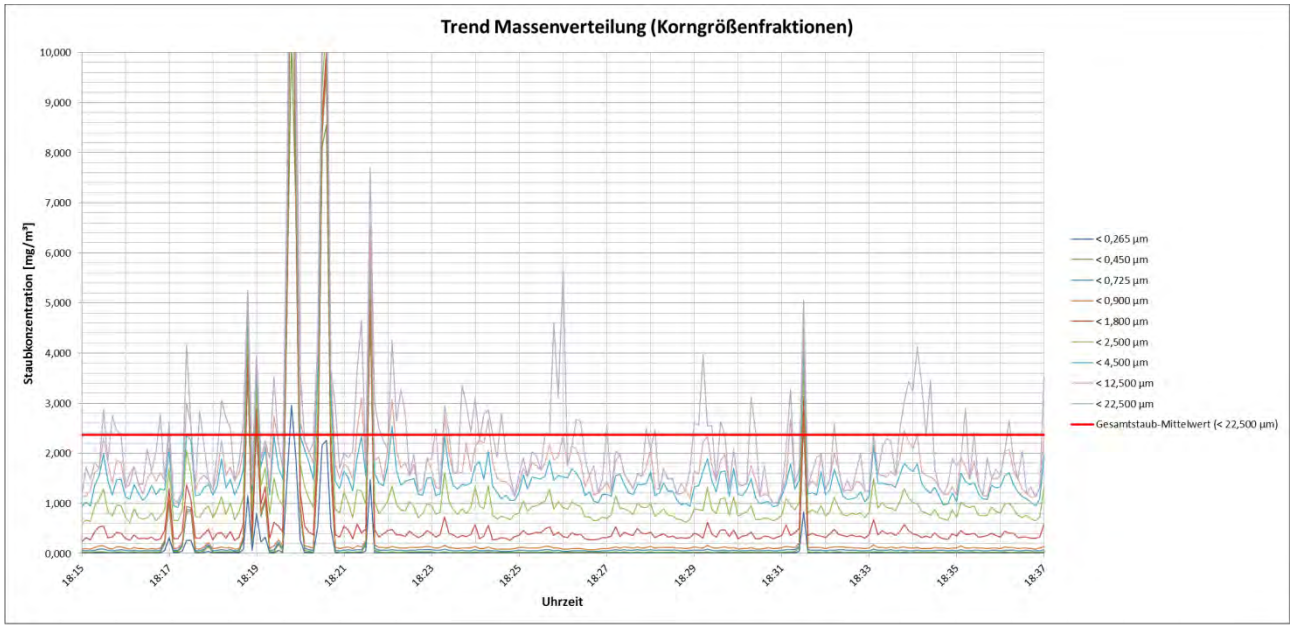
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	1,021	0,333	0,081	1,230	1,114	0,768
Maximum	2,961	0,840	0,186	18,662	3,781	1,634
Duchschnitt	1,520	0,500	0,120	3,712	1,729	1,050

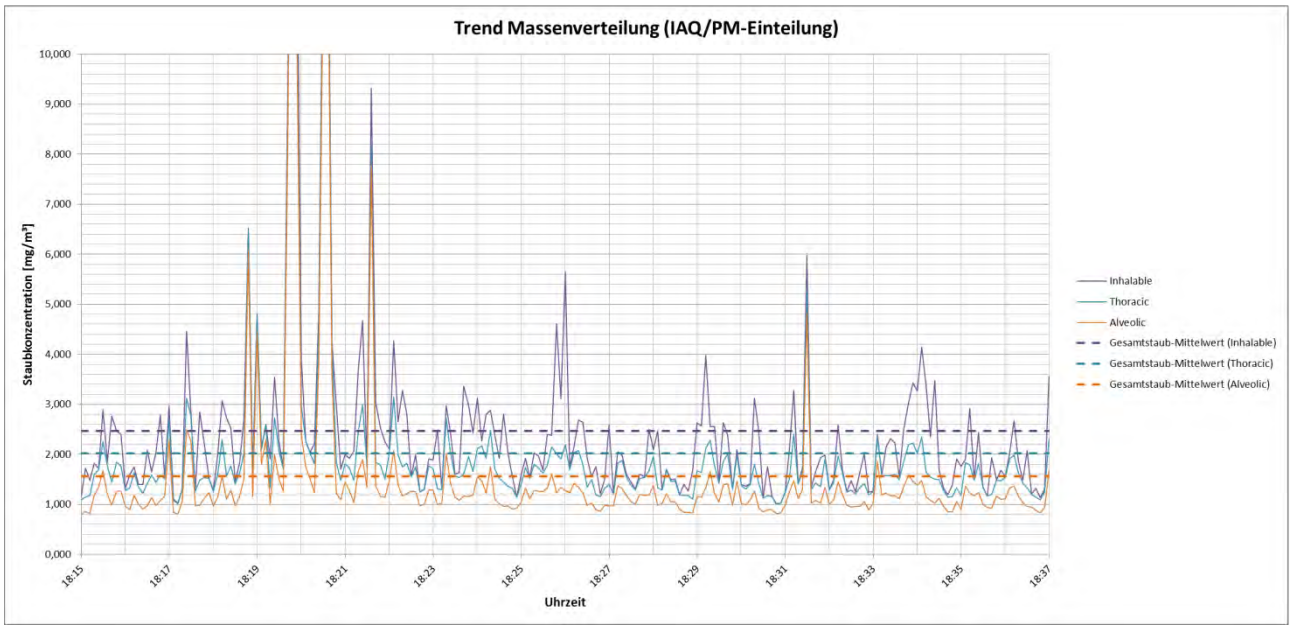
- **comments:**

no comments

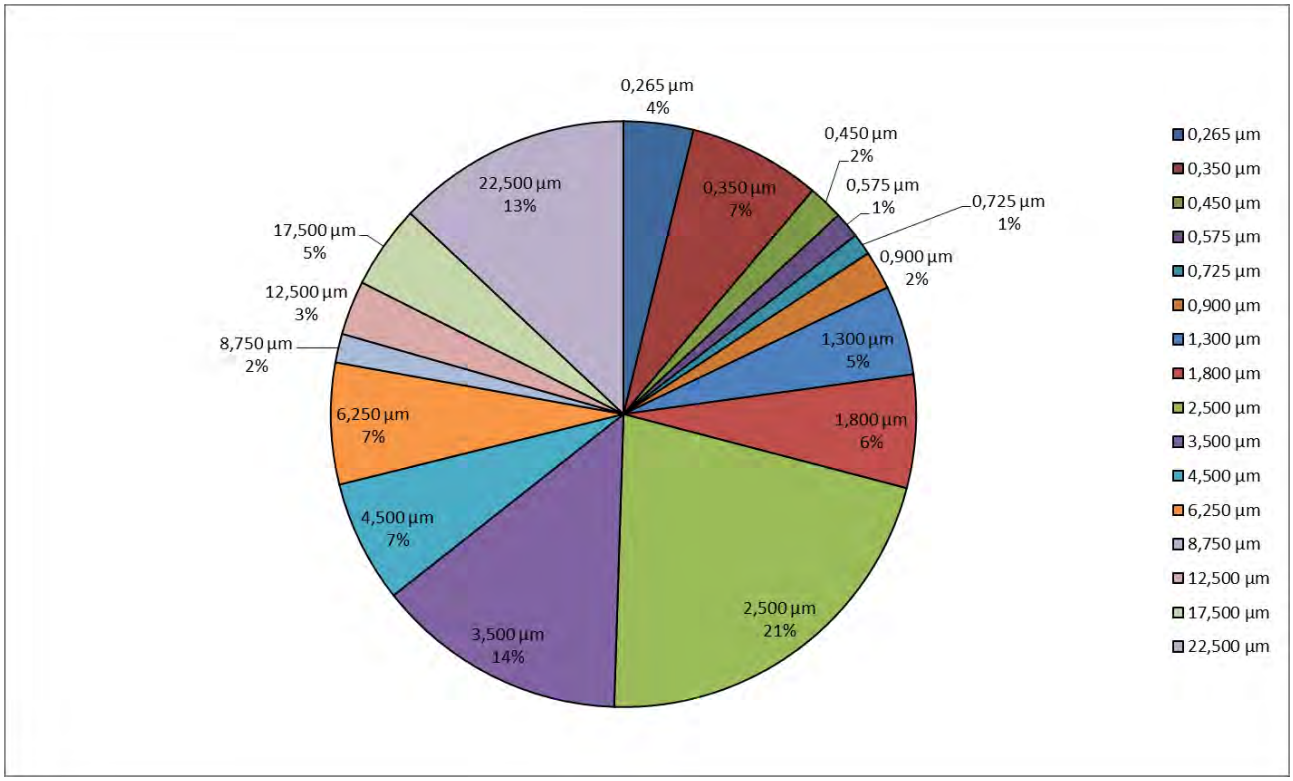
campaign 5

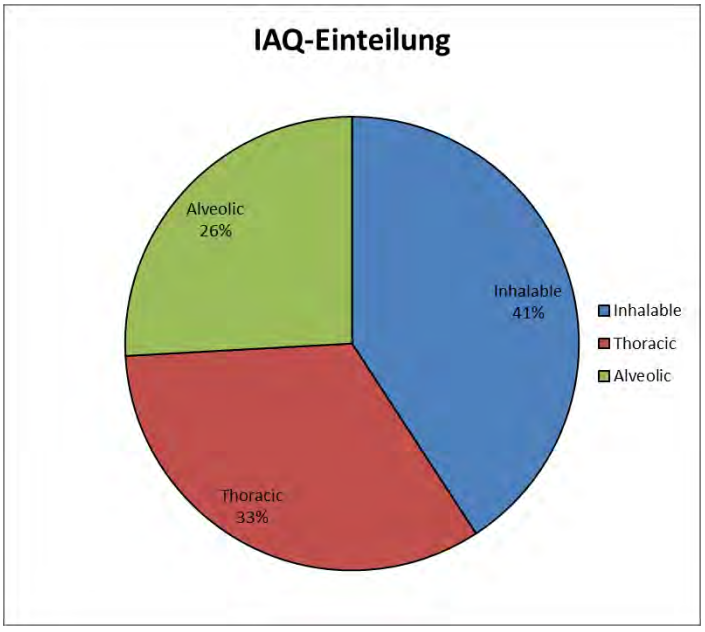
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,007	0,008	0,002	0,008	0,016	0,030	0,067	0,049	0,320	0,161	0,064	0,045	0,000	0,000	0,000	0,000
Maximum	2,958	4,672	2,680	3,273	1,071	0,232	0,208	0,353	0,894	0,826	0,375	0,444	0,199	0,507	0,995	2,900
Duchschnitt	0,091	0,173	0,046	0,034	0,028	0,050	0,117	0,148	0,507	0,328	0,160	0,159	0,038	0,071	0,109	0,307

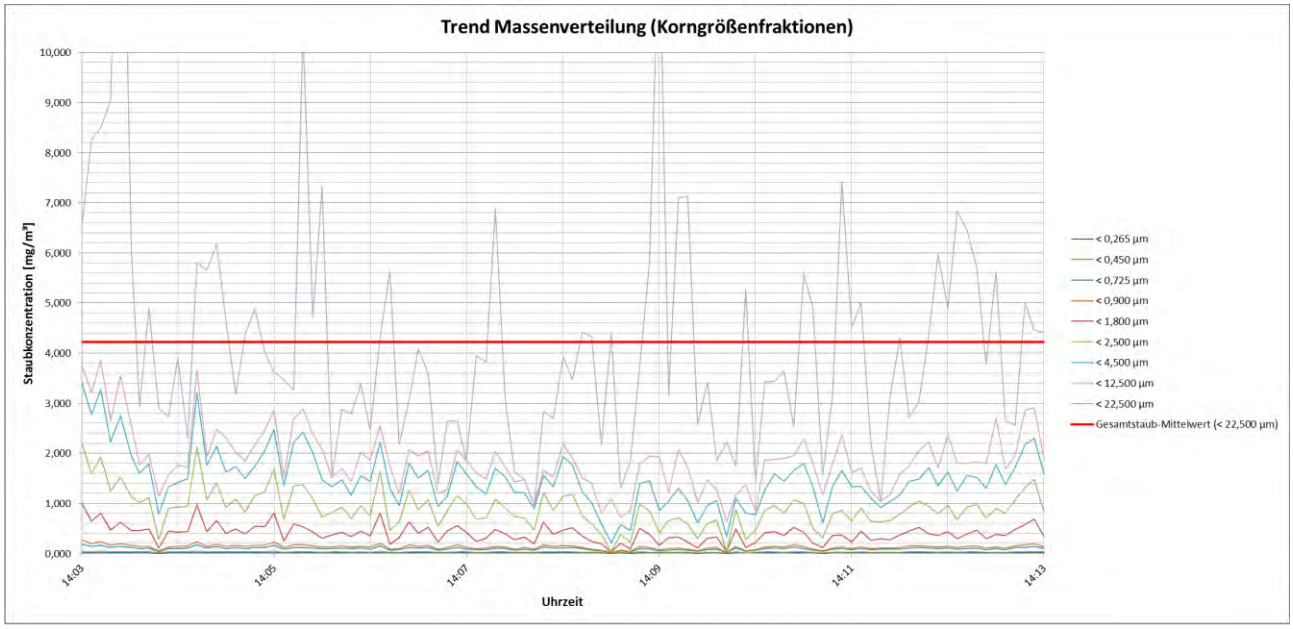
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,948	0,438	0,119	1,014	1,009	0,798
Maximum	20,111	19,000	17,132	21,643	20,315	19,445
Duchschnitt	1,889	1,056	0,556	2,466	2,015	1,564

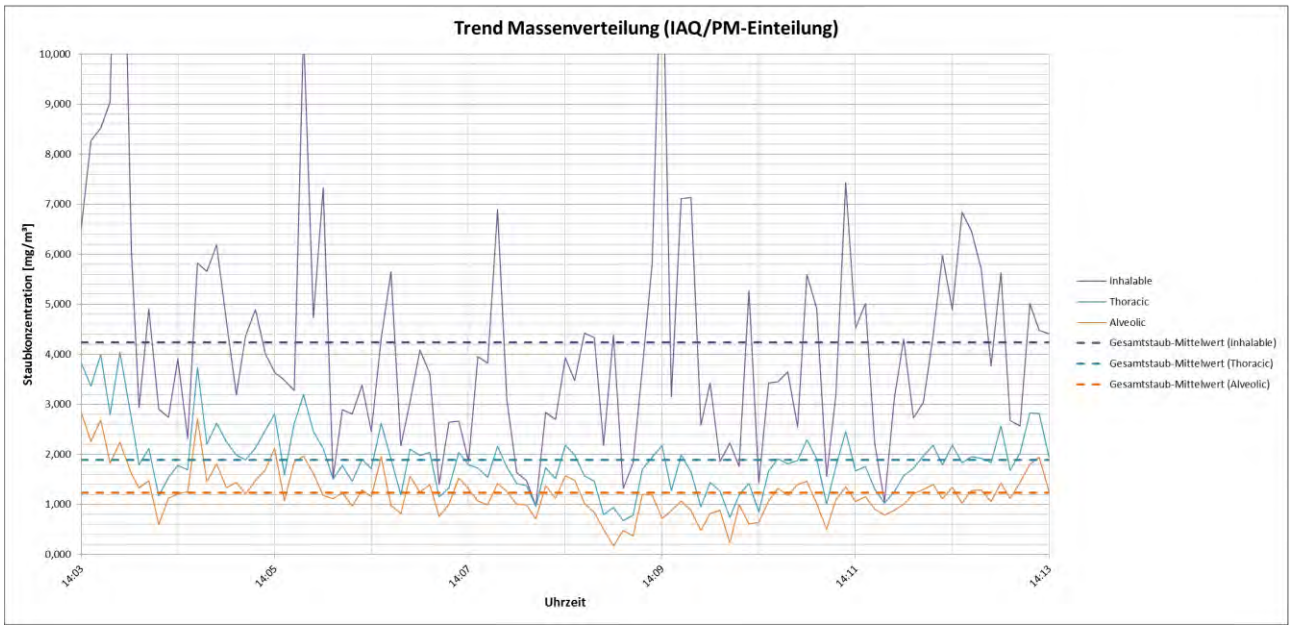
- **comments:**

no comments

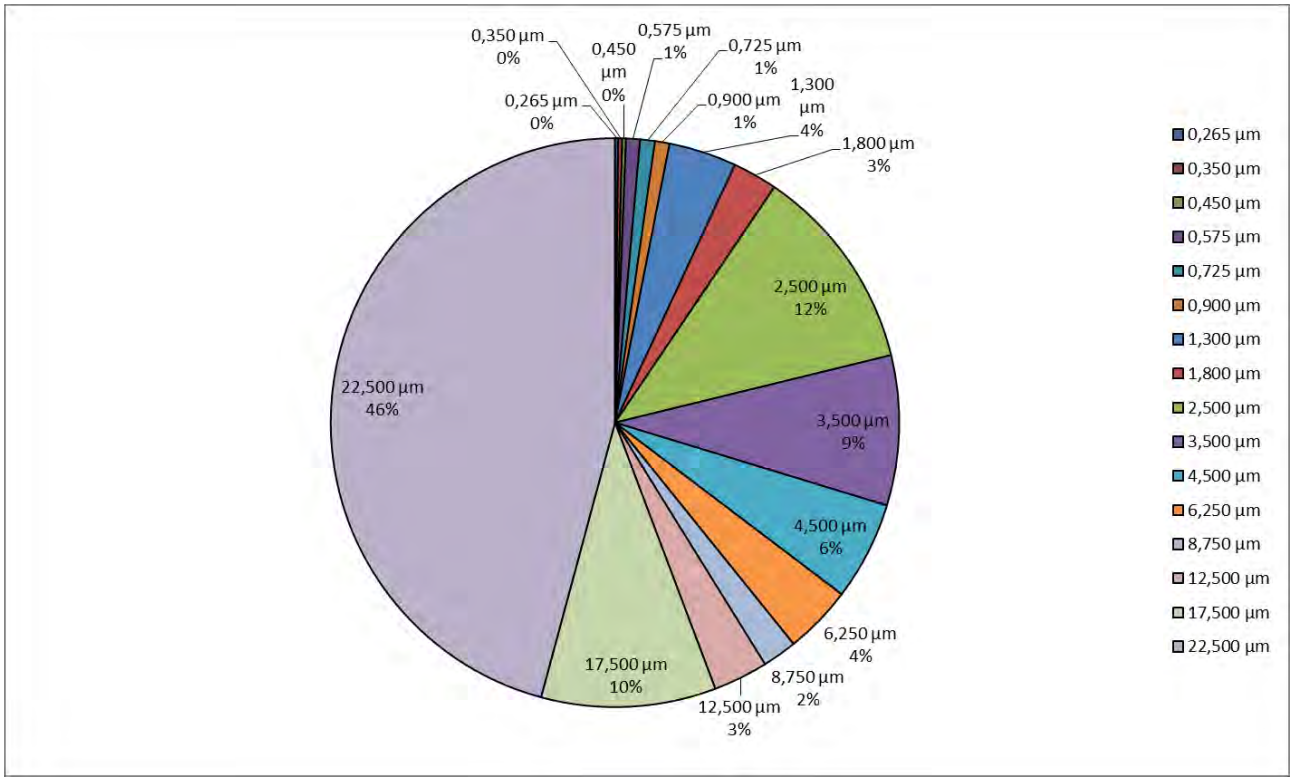
campaign 6

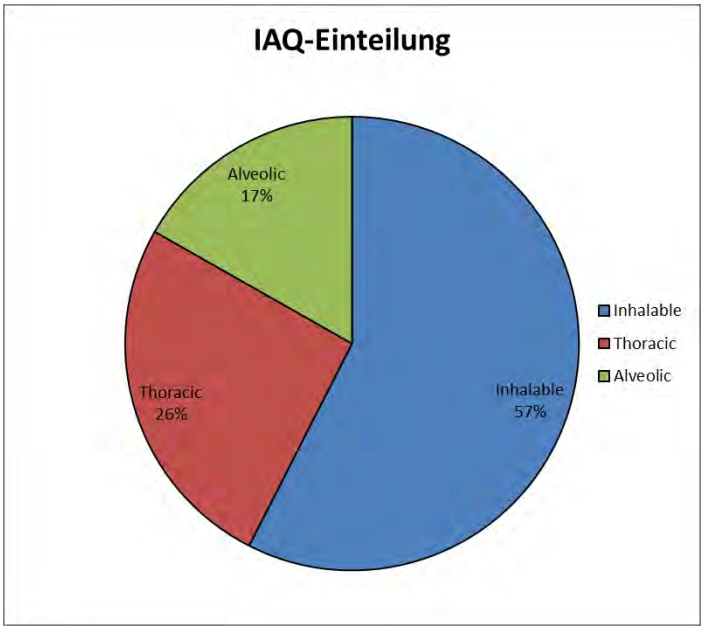
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,002	0,002	0,003	0,006	0,003	0,003	0,011	0,000	0,000	0,000	0,081	0,009	0,000	0,000	0,000	0,000
Maximum	0,014	0,018	0,016	0,062	0,072	0,086	0,389	0,359	1,204	0,804	0,541	0,399	0,398	0,507	2,188	11,599
Duchschnitt	0,008	0,010	0,009	0,033	0,036	0,035	0,163	0,108	0,495	0,360	0,237	0,164	0,083	0,131	0,420	1,935

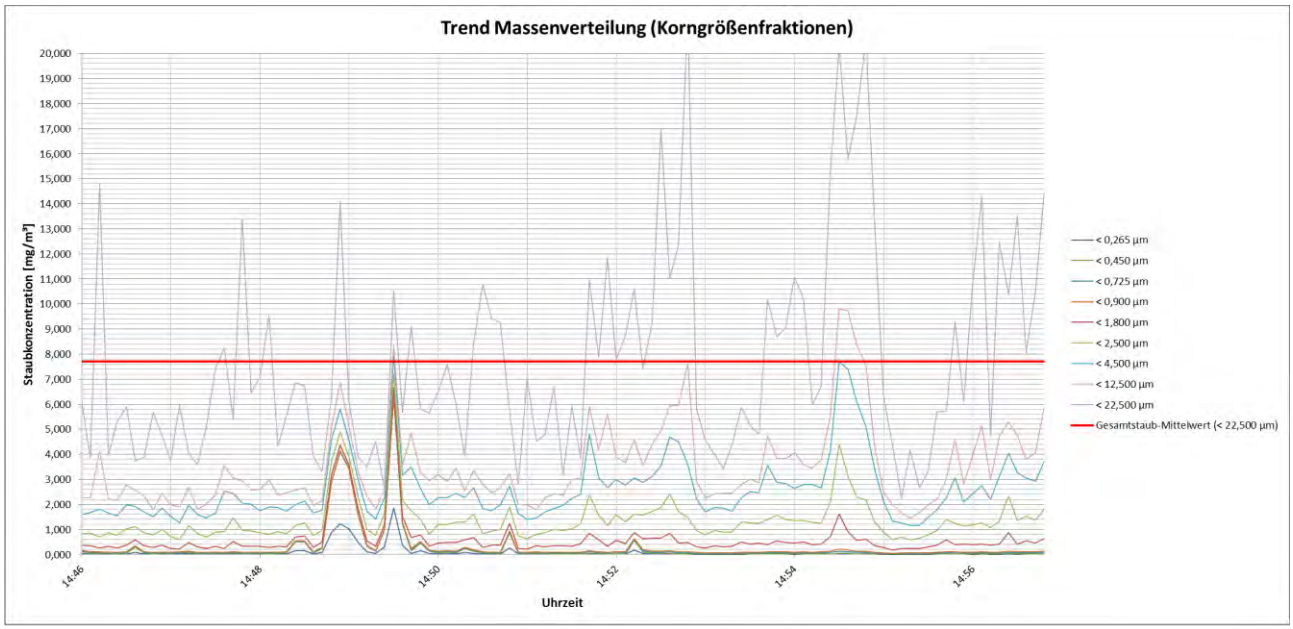
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,569	0,035	0,023	0,967	0,672	0,171
Maximum	3,549	1,652	0,419	16,943	4,044	2,853
Duchschnitt	1,670	0,676	0,189	4,233	1,892	1,236

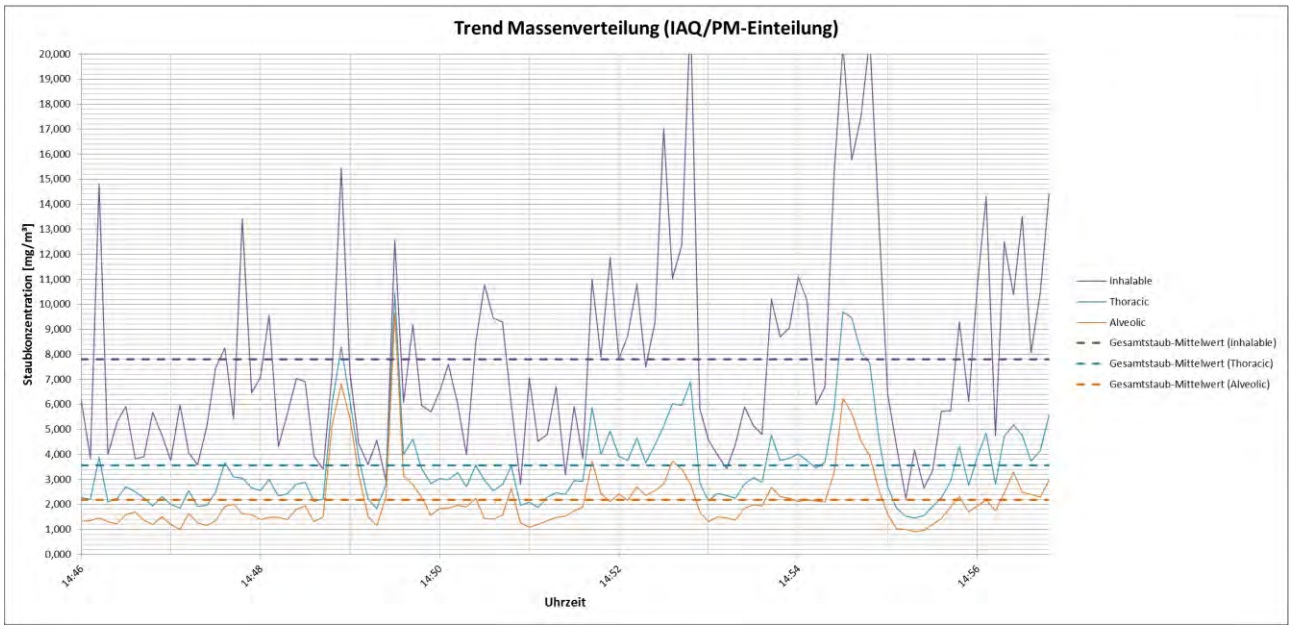
- **comments:**

Strong winds and light rainfall during the measurement.

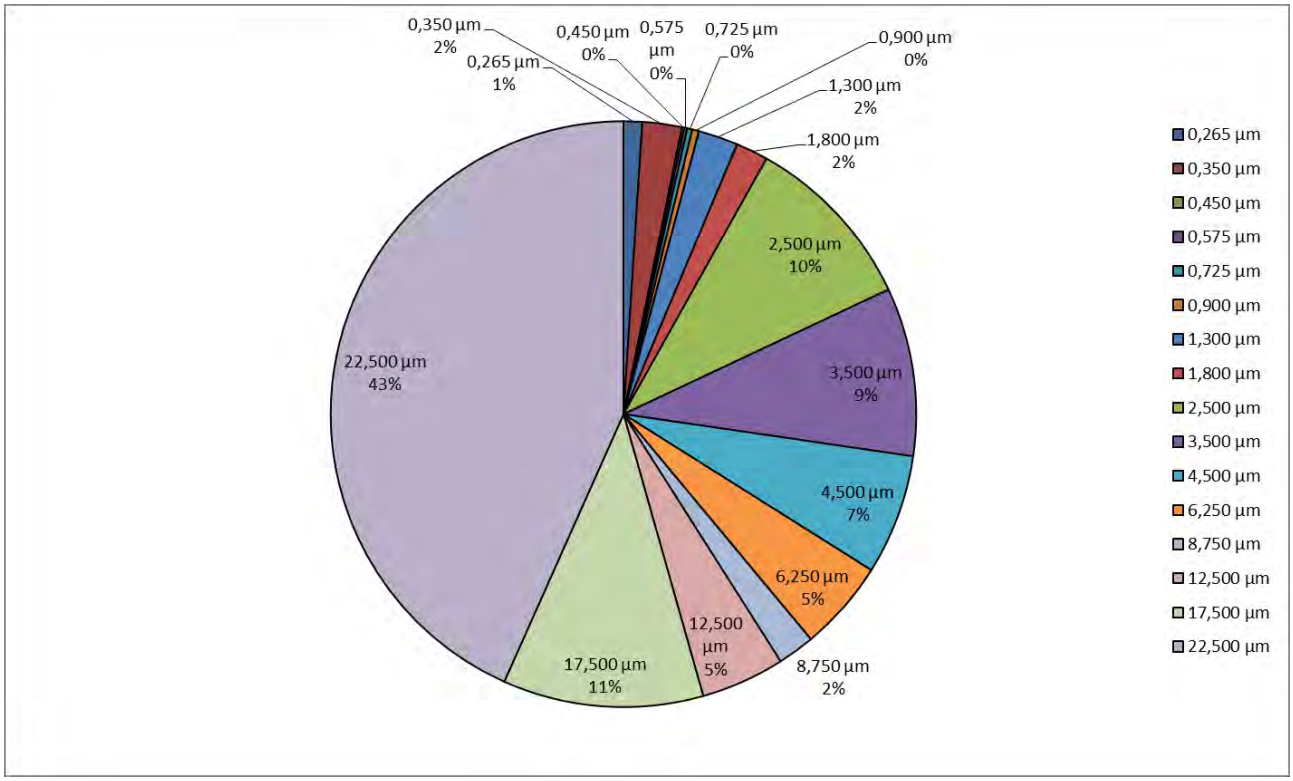
campaign 3

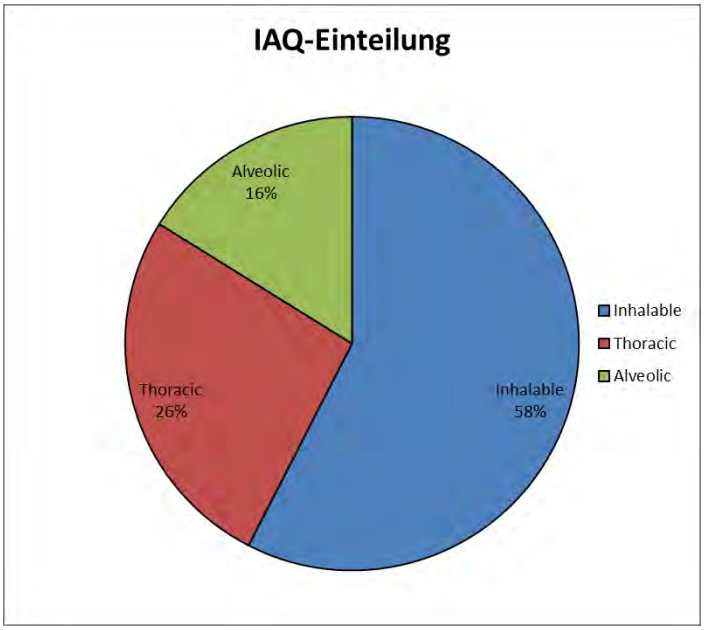
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,006	0,003	0,007	0,011	0,013	0,076	0,000	0,343	0,321	0,186	0,100	0,000	0,000	0,000	0,000
Maximum	1,855	4,079	0,388	0,028	0,060	0,086	0,539	0,852	2,800	2,489	1,766	1,214	0,870	2,320	3,780	10,440
Duchschnitt	0,079	0,168	0,010	0,012	0,022	0,029	0,169	0,137	0,762	0,717	0,512	0,387	0,157	0,357	0,854	3,342

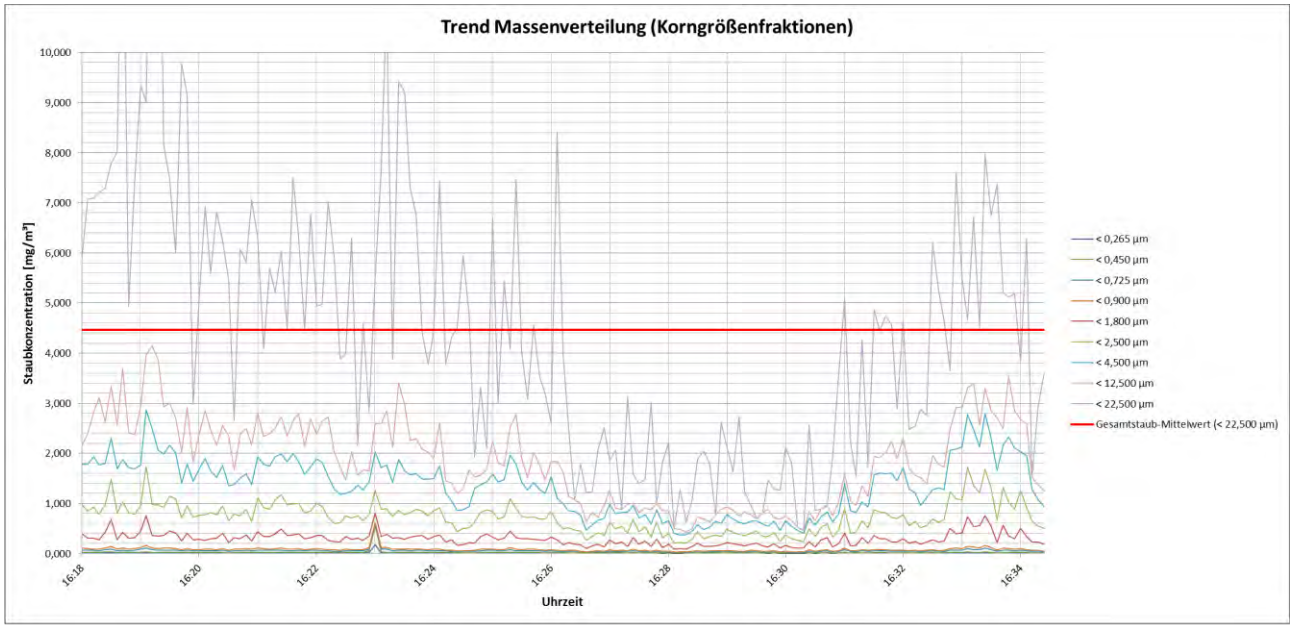
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	1,266	0,424	0,092	2,236	1,471	0,904
Maximum	10,207	8,997	8,446	21,641	10,448	9,632
Duchschnitt	3,147	1,142	0,483	7,801	3,565	2,191

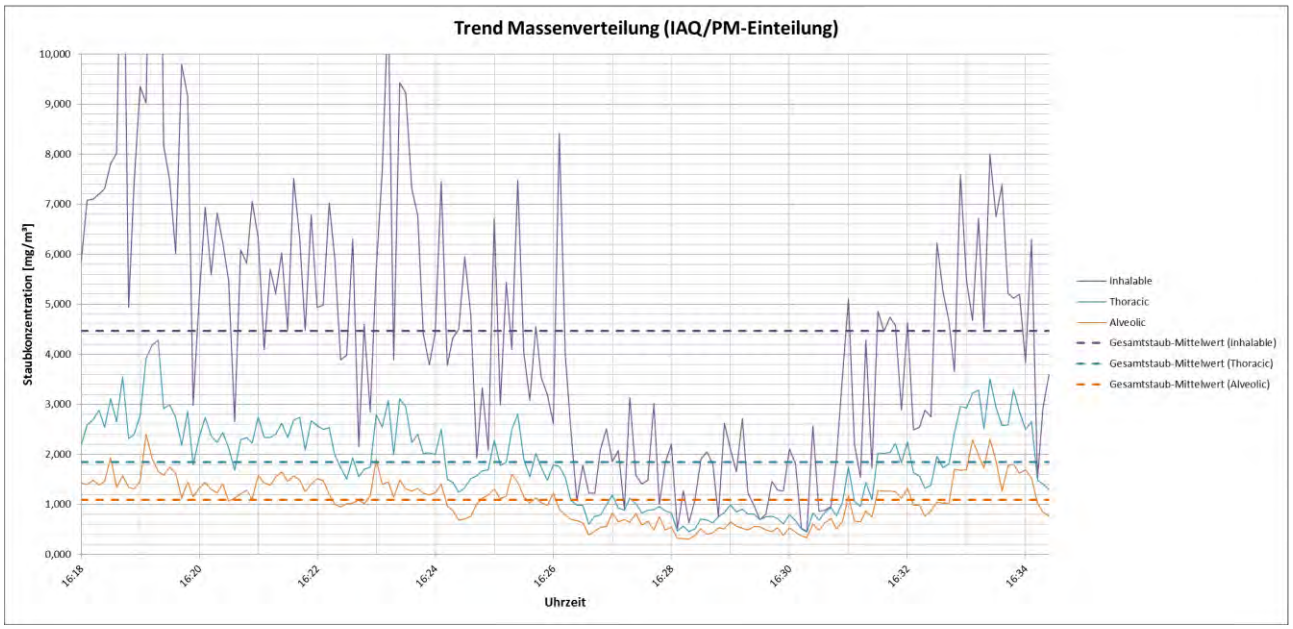
- **comments:**

no comments

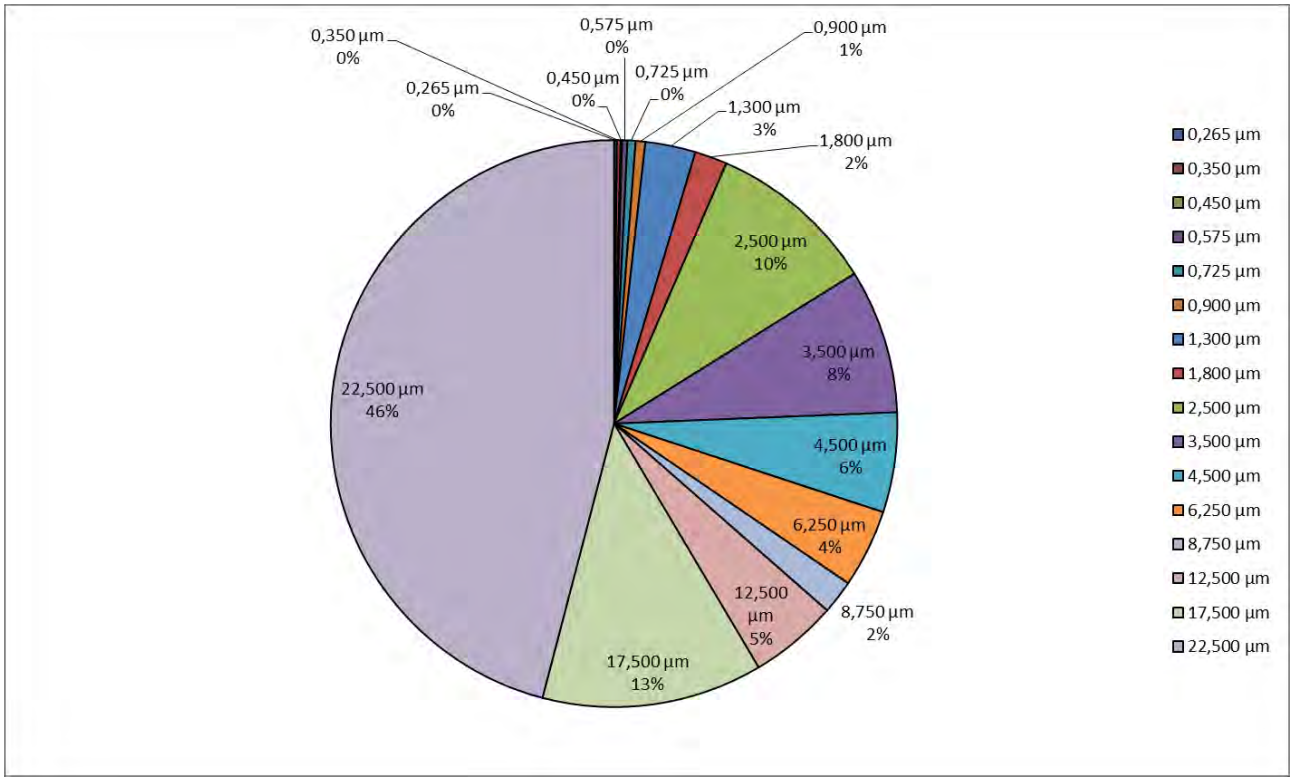
campaign 4

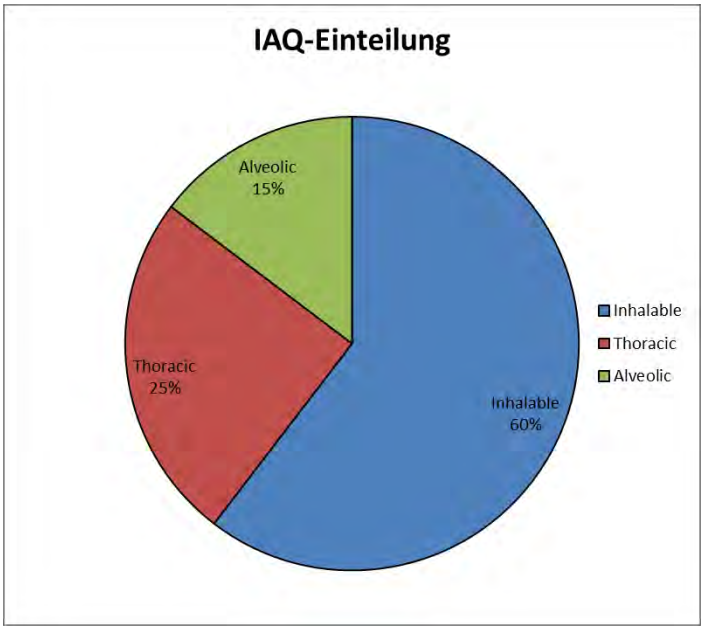
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,002	0,006	0,007	0,008	0,041	0,009	0,119	0,083	0,044	0,018	0,000	0,000	0,000	0,000
Maximum	0,170	0,377	0,007	0,028	0,048	0,059	0,320	0,297	0,996	0,845	0,653	0,544	0,448	1,087	4,973	9,280
Duchschnitt	0,007	0,010	0,003	0,013	0,021	0,024	0,128	0,083	0,430	0,367	0,254	0,199	0,086	0,224	0,562	2,049

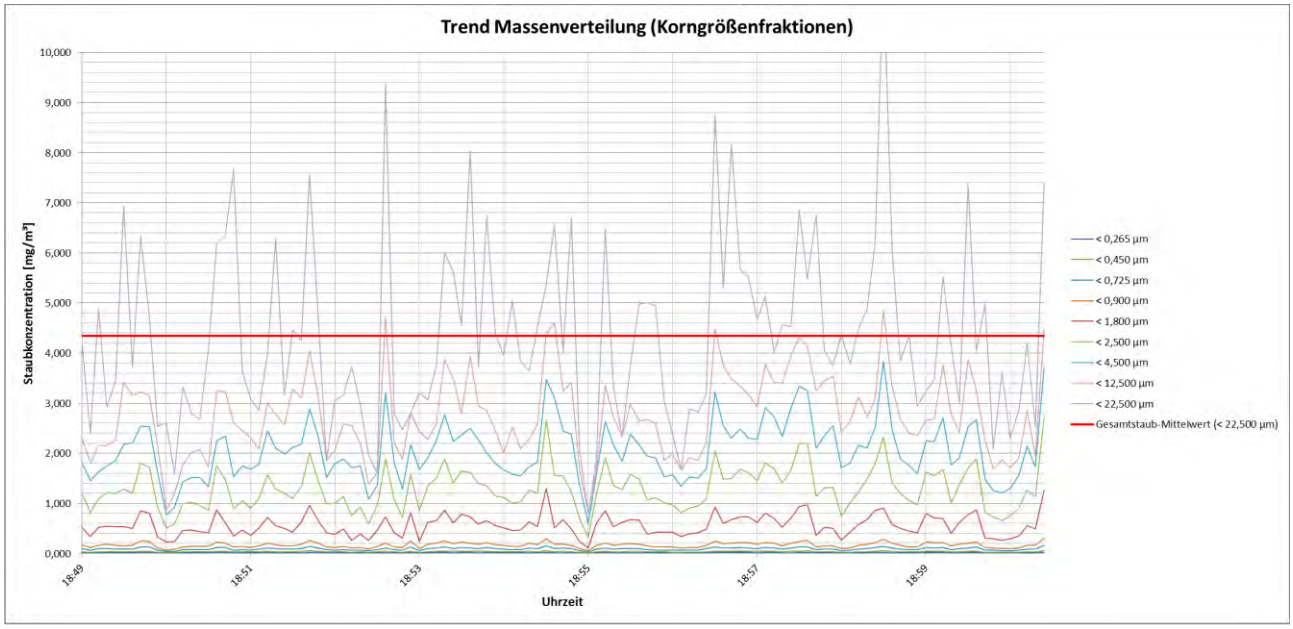
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,407	0,157	0,050	0,455	0,452	0,307
Maximum	3,433	1,282	0,852	18,124	4,283	2,401
Duchschnitt	1,599	0,535	0,133	4,470	1,842	1,087

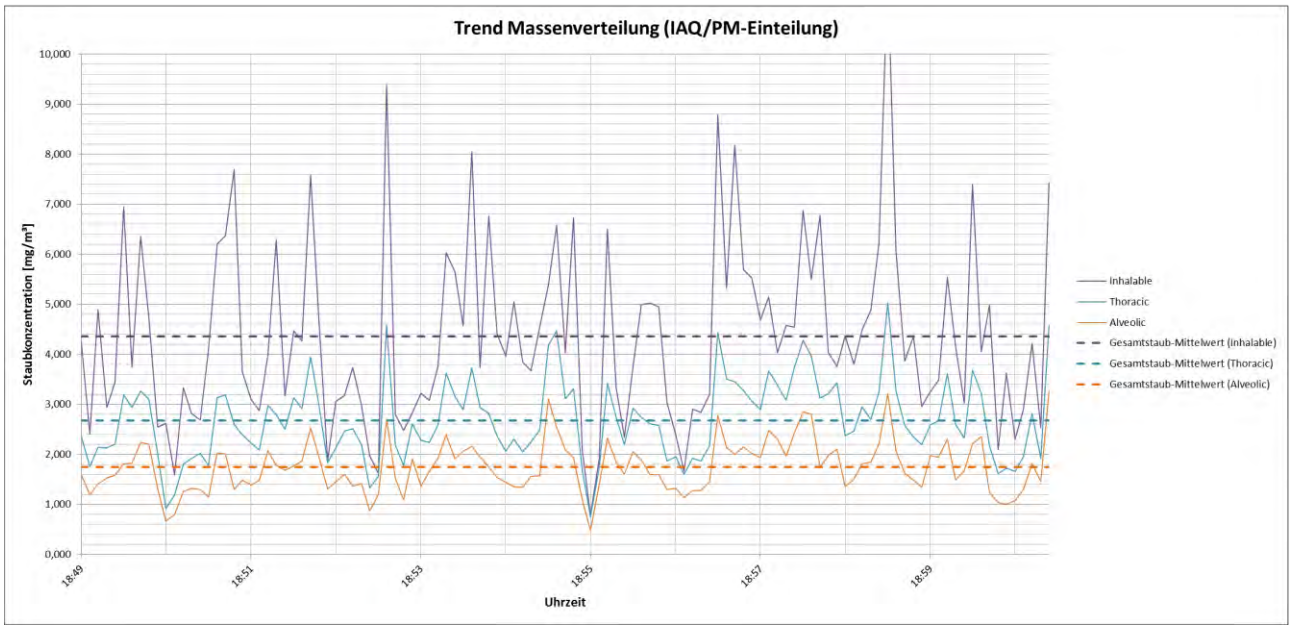
- **comments:**

no comments

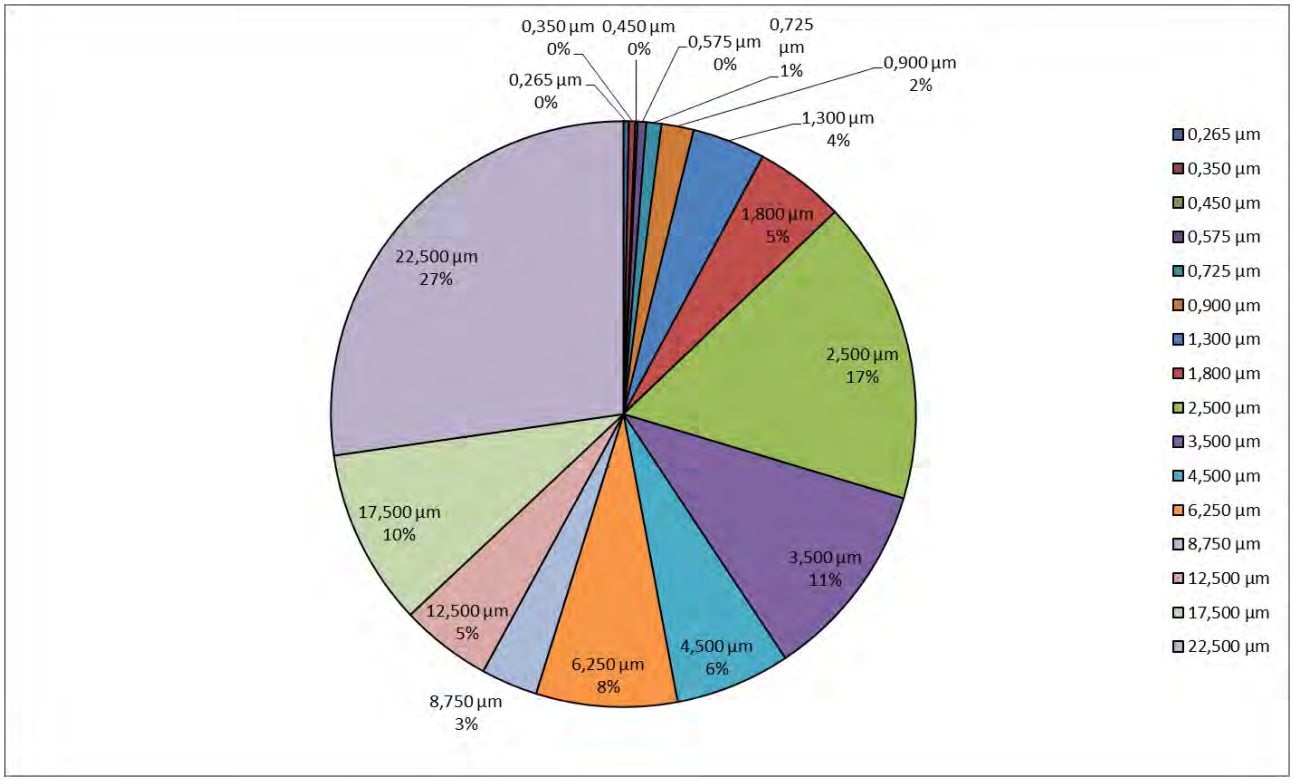
campaign 5

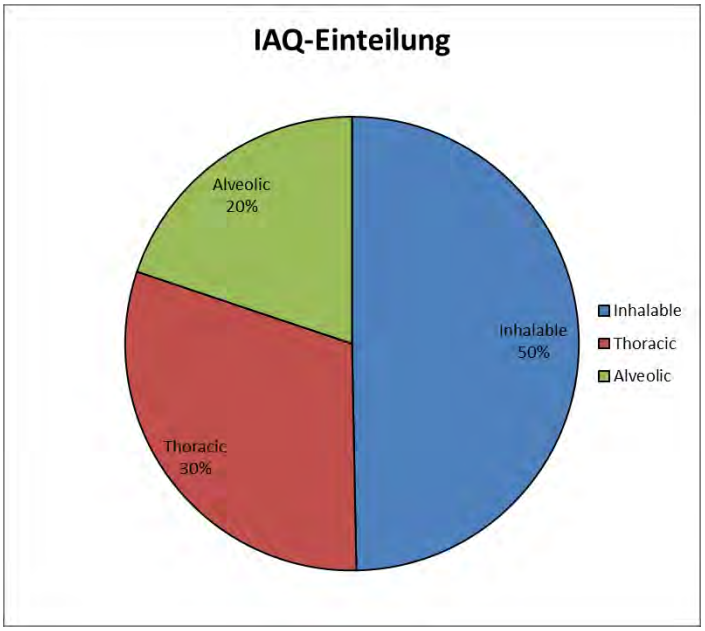
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,006	0,002	0,007	0,010	0,019	0,040	0,022	0,219	0,148	0,078	0,072	0,000	0,000	0,000	0,000
Maximum	0,021	0,026	0,009	0,034	0,069	0,150	0,348	0,664	1,452	0,976	0,612	0,861	0,423	0,797	1,591	5,220
Duchschnitt	0,013	0,016	0,005	0,021	0,036	0,077	0,175	0,216	0,729	0,479	0,277	0,339	0,136	0,219	0,424	1,185

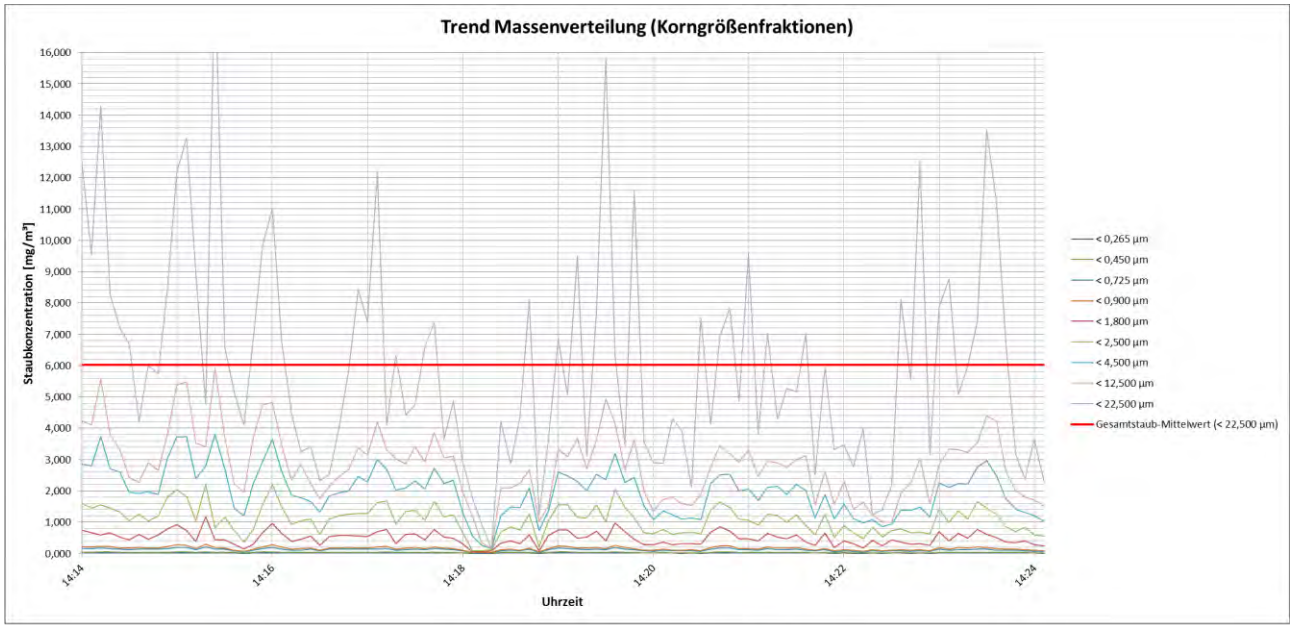
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,699	0,237	0,066	0,788	0,757	0,483
Maximum	4,381	2,017	0,471	11,684	5,027	3,266
Duchschnitt	2,410	0,960	0,242	4,362	2,672	1,744

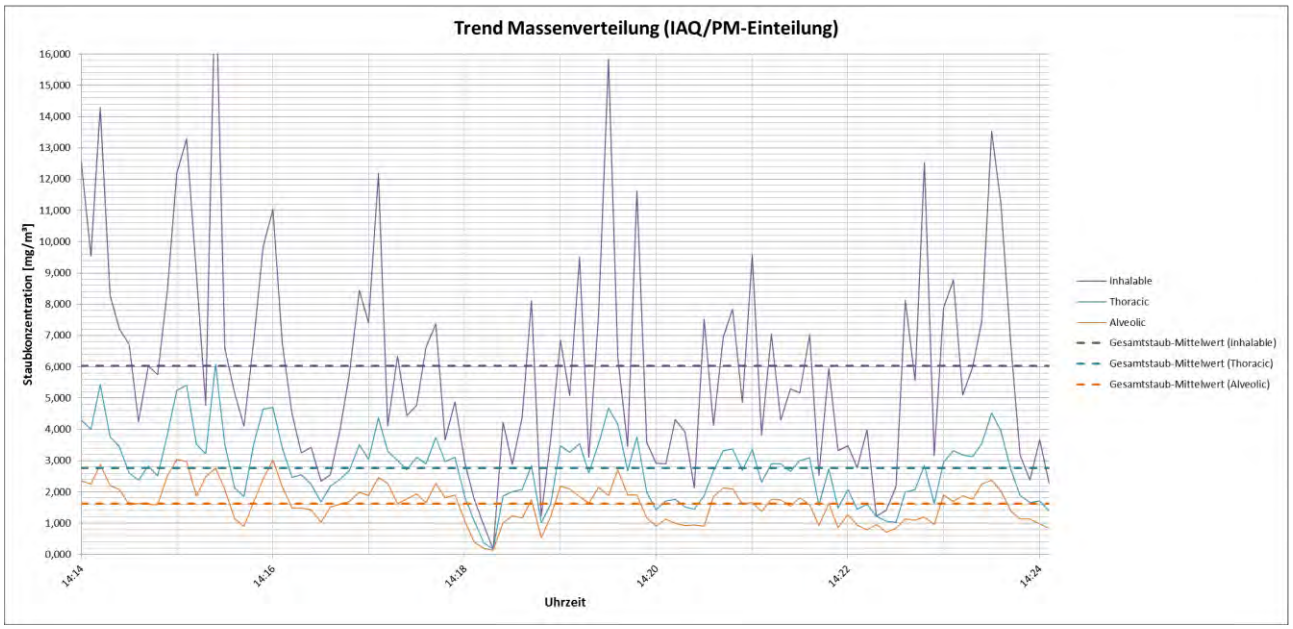
- **comments:**

no comments

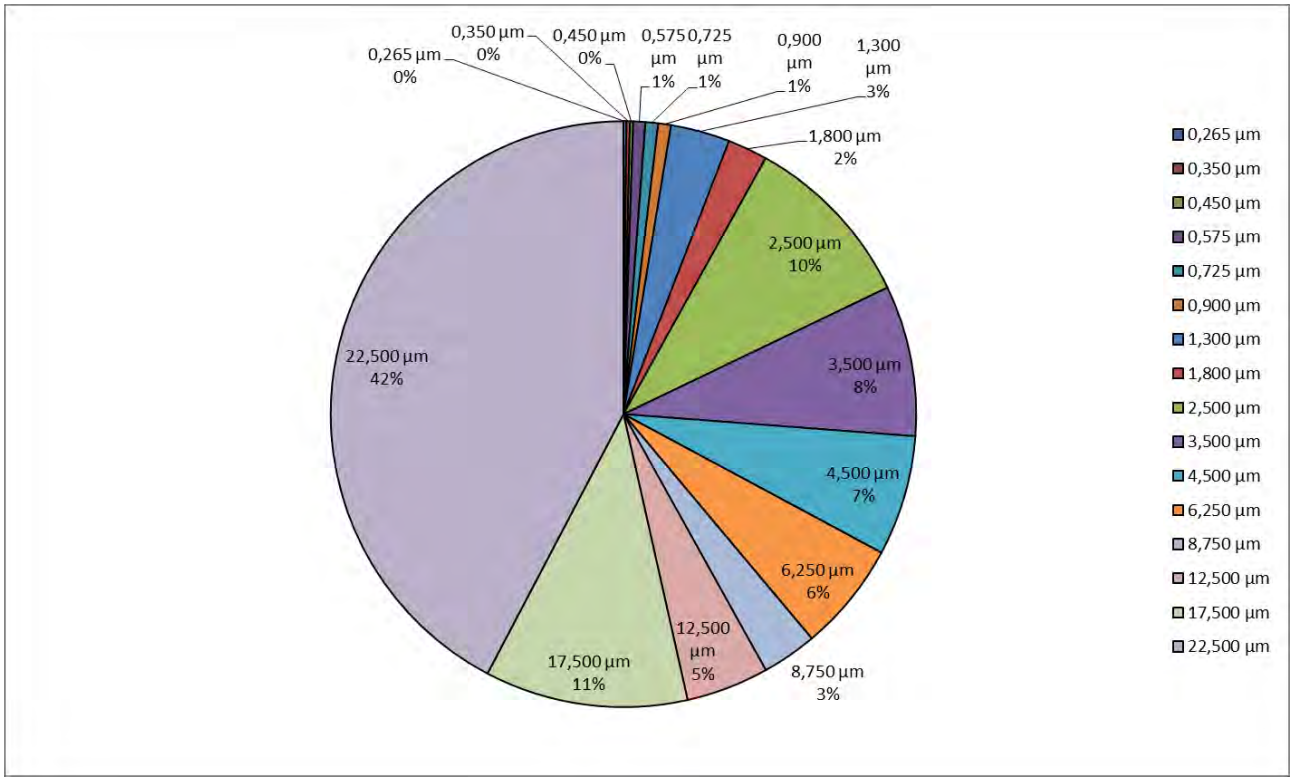
campaign 6

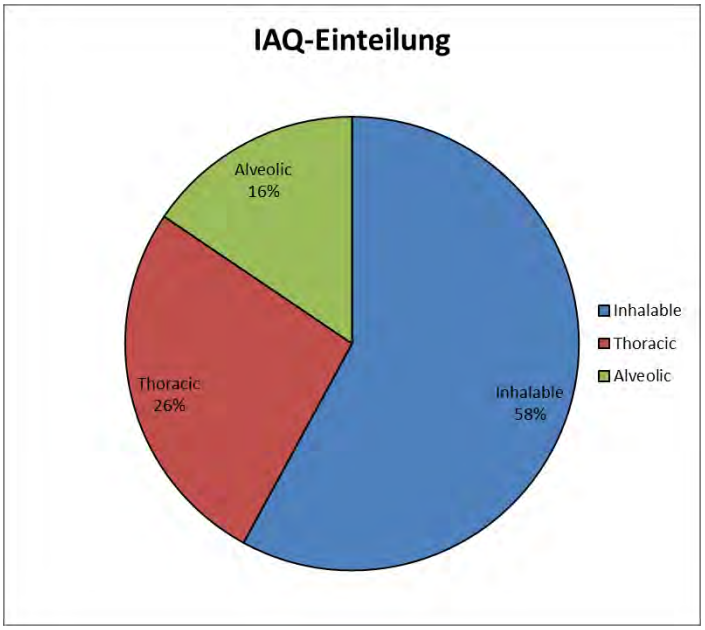
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,003	0,007	0,005	0,004	0,018	0,000	0,023	0,022	0,010	0,009	0,000	0,000	0,000	0,000
Maximum	0,015	0,020	0,018	0,071	0,078	0,087	0,385	0,496	1,242	1,738	1,245	1,178	0,845	1,087	2,188	11,020
Duchschnitt	0,009	0,012	0,011	0,040	0,042	0,042	0,197	0,133	0,591	0,501	0,399	0,364	0,183	0,275	0,675	2,547

Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,158	0,073	0,032	0,167	0,166	0,142
Maximum	5,088	1,689	0,445	18,738	6,074	3,036
Duchschnitt	2,423	0,821	0,228	6,031	2,761	1,617

- **comments:**

Strong winds and light rainfall during the measurement.

campaign 1

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
13.10.2014 08:52	13.10.2014 09:51	27,3	1012,5	~ 1,8m above the enclosure

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
280	150	100	87	2,0

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
08:52	09:51	0,54	0,19	35,19

Comparison with the operational data collected by ILVA

During the measurement period the cooling time of the sinter material fluctuates at around 95min. The calculated speed of the sinter cooler had a value of about 1,4 m/min. The sinter temperature at the discharge point of the sinter machine dips at about 300°C and peaks at about 325°C. Since measurement point 2 is about in the middle between the material charge and the discharge, the material had already time to cool down until reaching the measurement point, where a lower material temperature was measured (280°C)

campaign 2

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
13.10.2014	13.10.2014	27,3	1012,5	~ 1,7m above the enclosure
17:06	18:05			

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
410	110	100	72	1,44

total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
17:06	18:05	0,26	0,32	123,08

Comparison with the operational data collected by ILVA

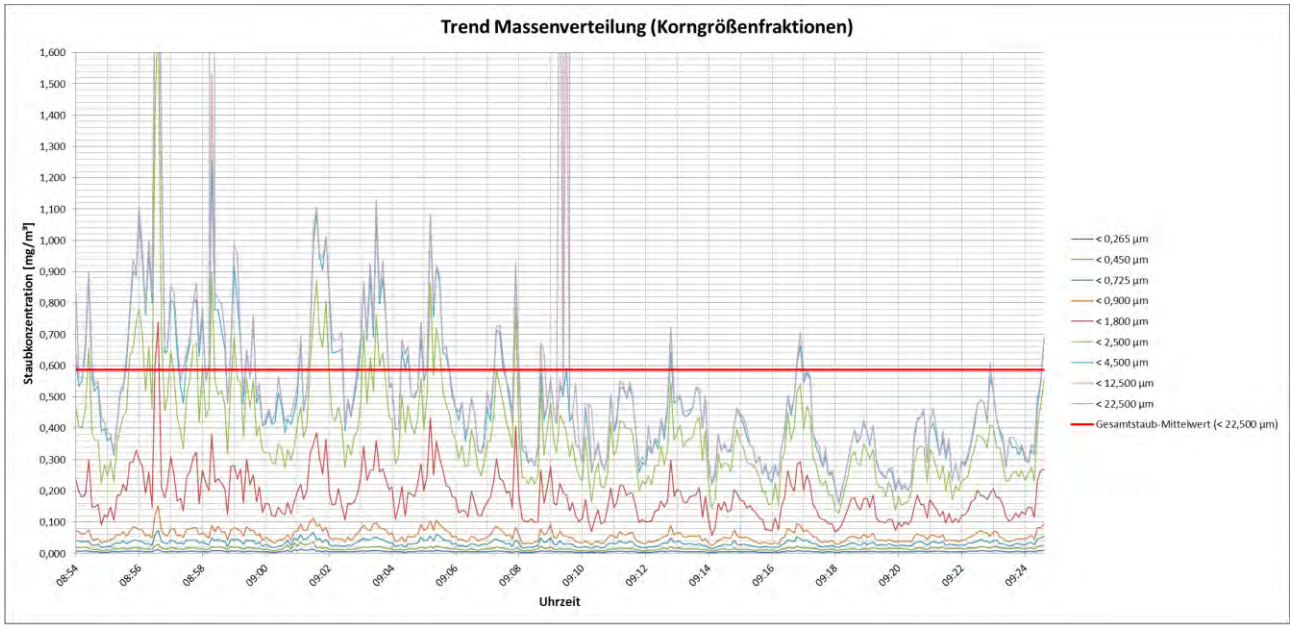
Since the sinter cooler was not operated between 17:20 to 17:30 and 17:35 to 17:38, already cooled down material passes the measuring point. Material temperature increases from about 240°C to 310°C. Nevertheless, the material temperature measured by Kappa is higher.

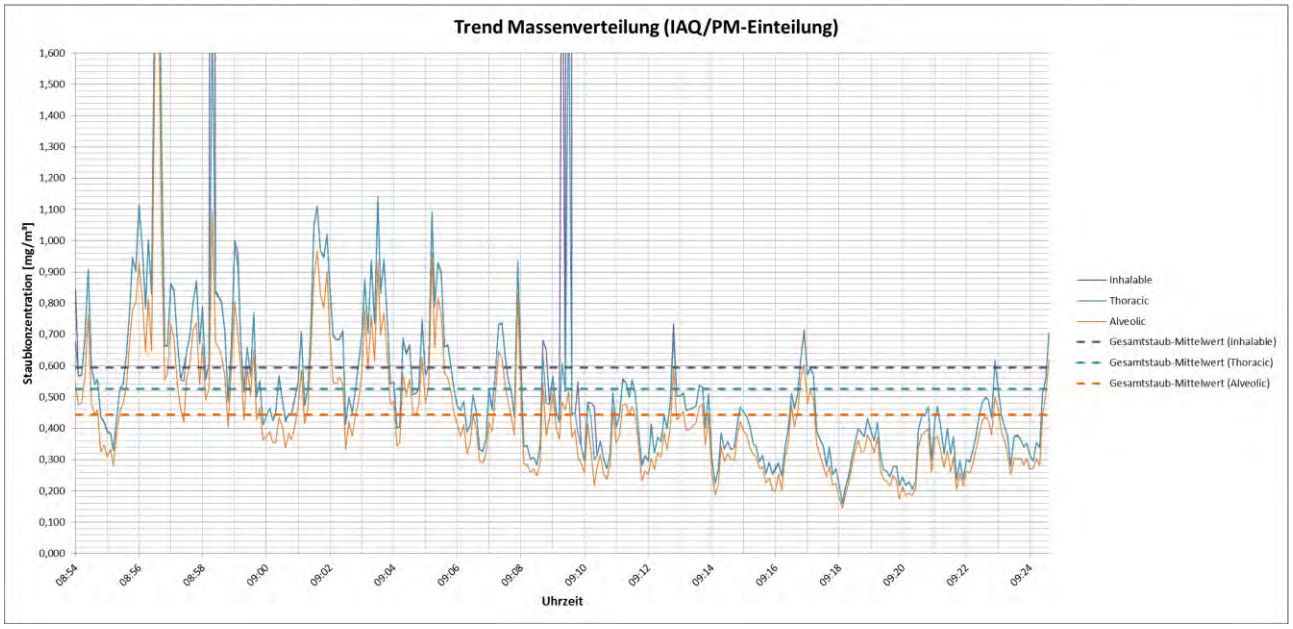
- **comments:**

Cooler out of operation from 17:20 to 17:30
Cooler out of operation from 17:35 to 17:38
Temperature of the sinter material (17:55) ~ 80°C
Temperature of the enclosure <80°C
Surface temperature of the enclosure ~ 55°C

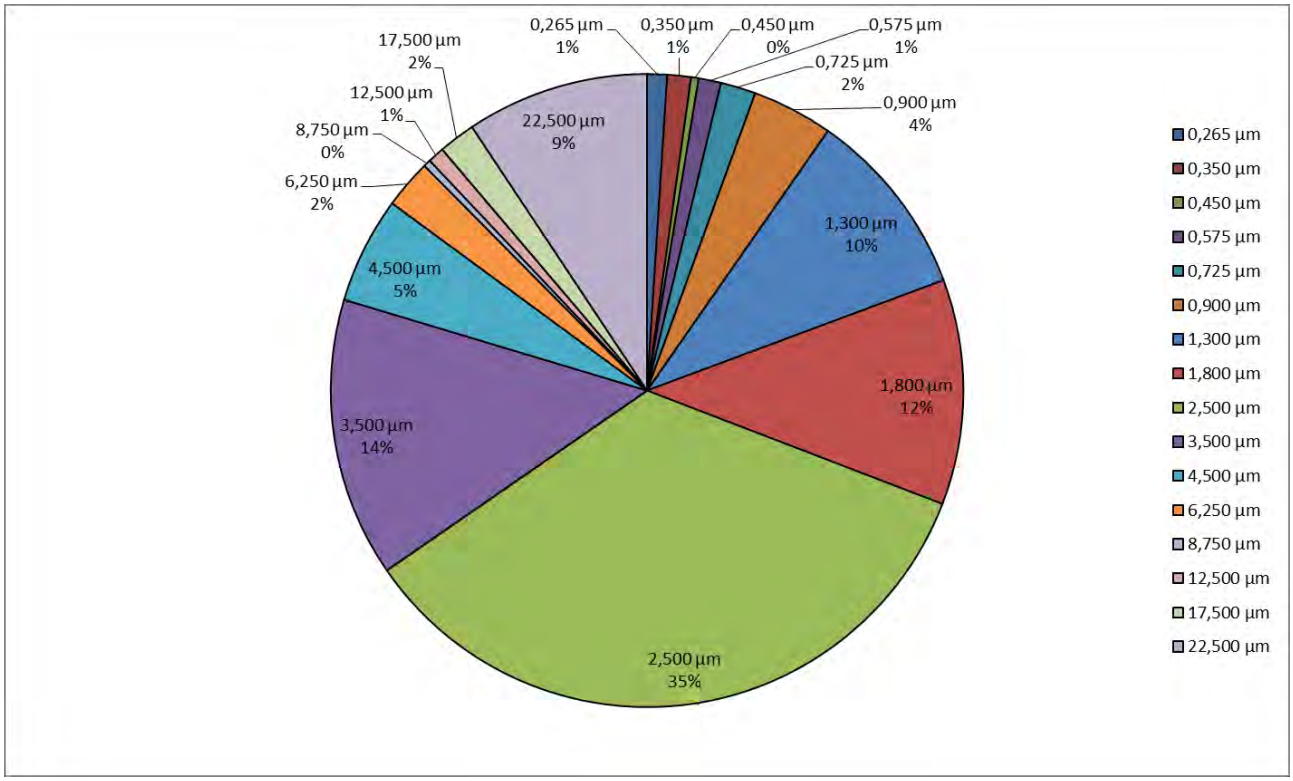
campaign 1

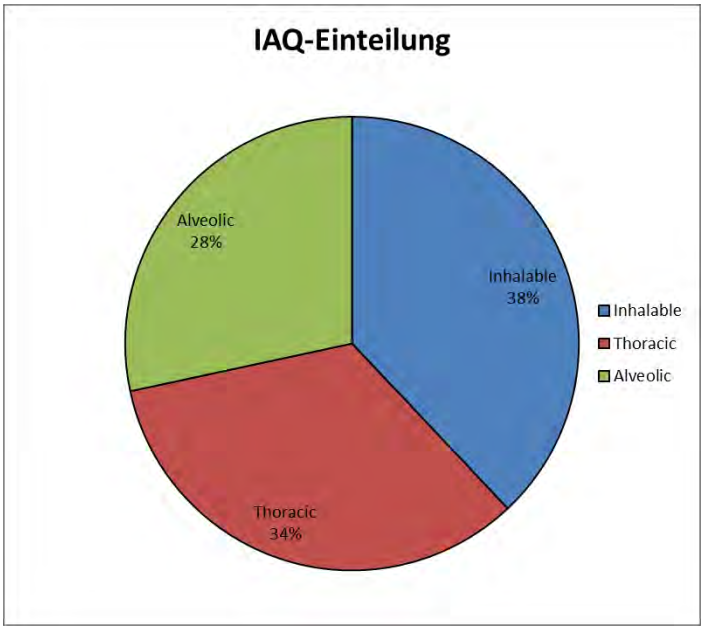
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,003	0,001	0,003	0,005	0,010	0,017	0,012	0,052	0,019	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,014	0,021	0,005	0,016	0,029	0,076	0,229	0,359	1,021	0,371	0,186	0,127	0,124	1,015	1,591	11,599
Duchschnitt	0,006	0,007	0,002	0,007	0,011	0,024	0,057	0,067	0,203	0,084	0,032	0,015	0,002	0,005	0,011	0,055

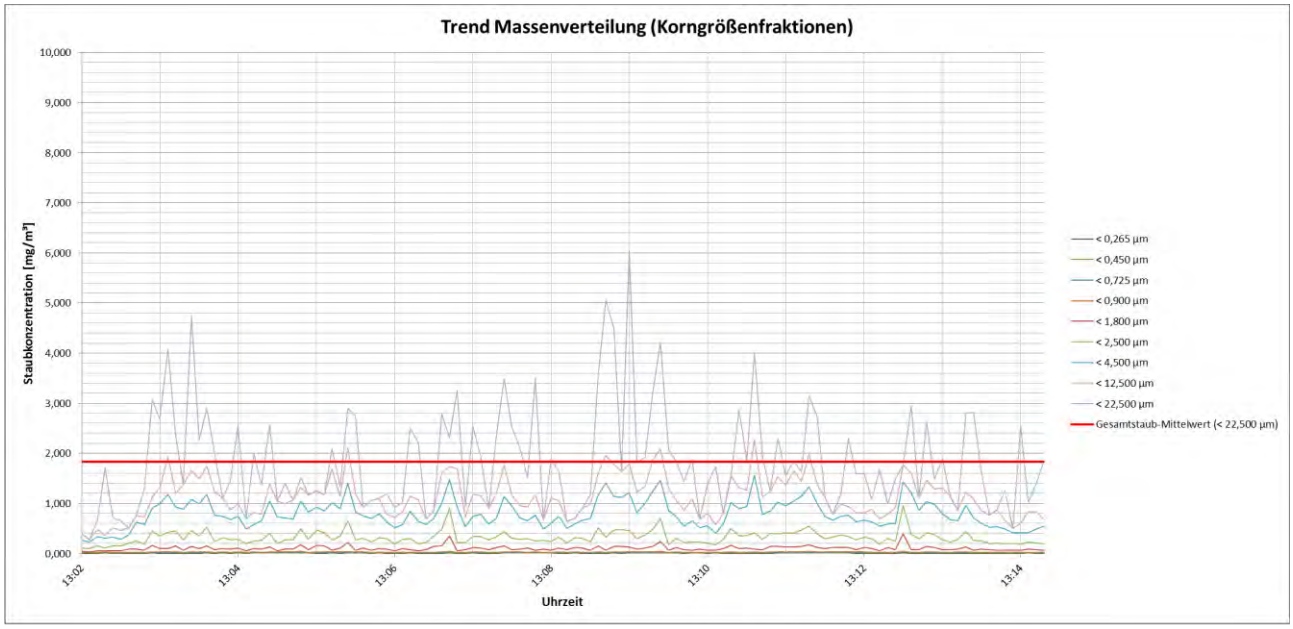
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,154	0,106	0,034	0,161	0,161	0,144
Maximum	2,161	1,263	0,269	15,054	2,291	1,980
Duchschnitt	0,494	0,290	0,082	0,593	0,526	0,443

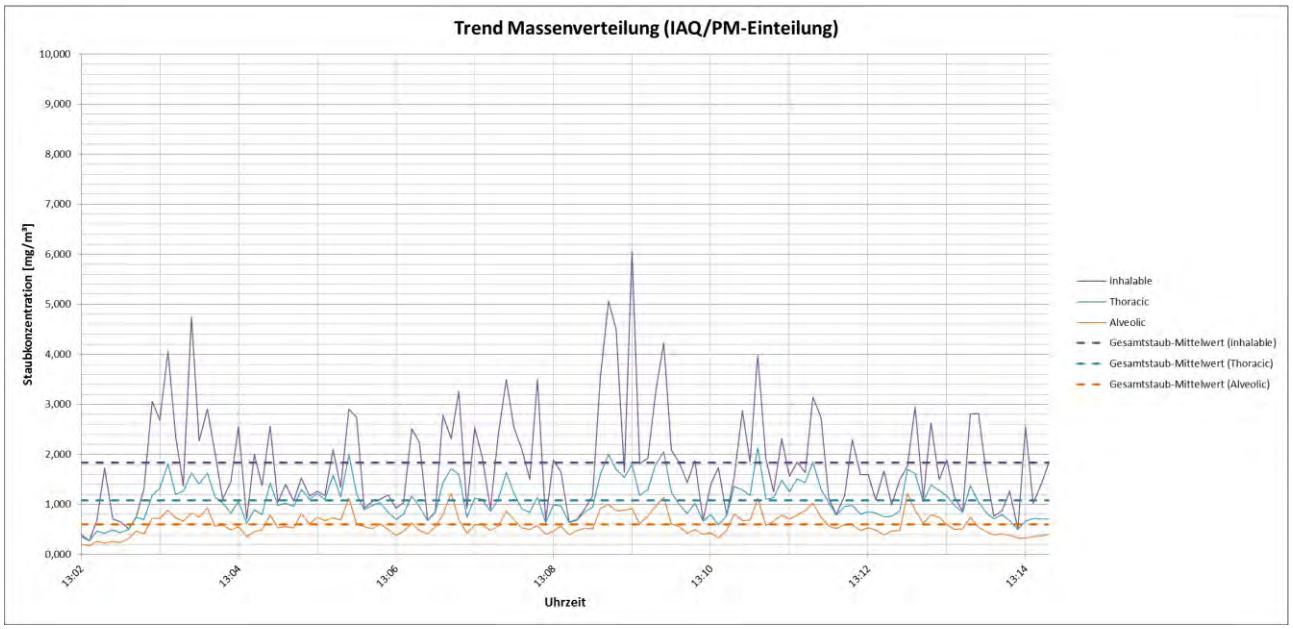
- **comments:**

no comments

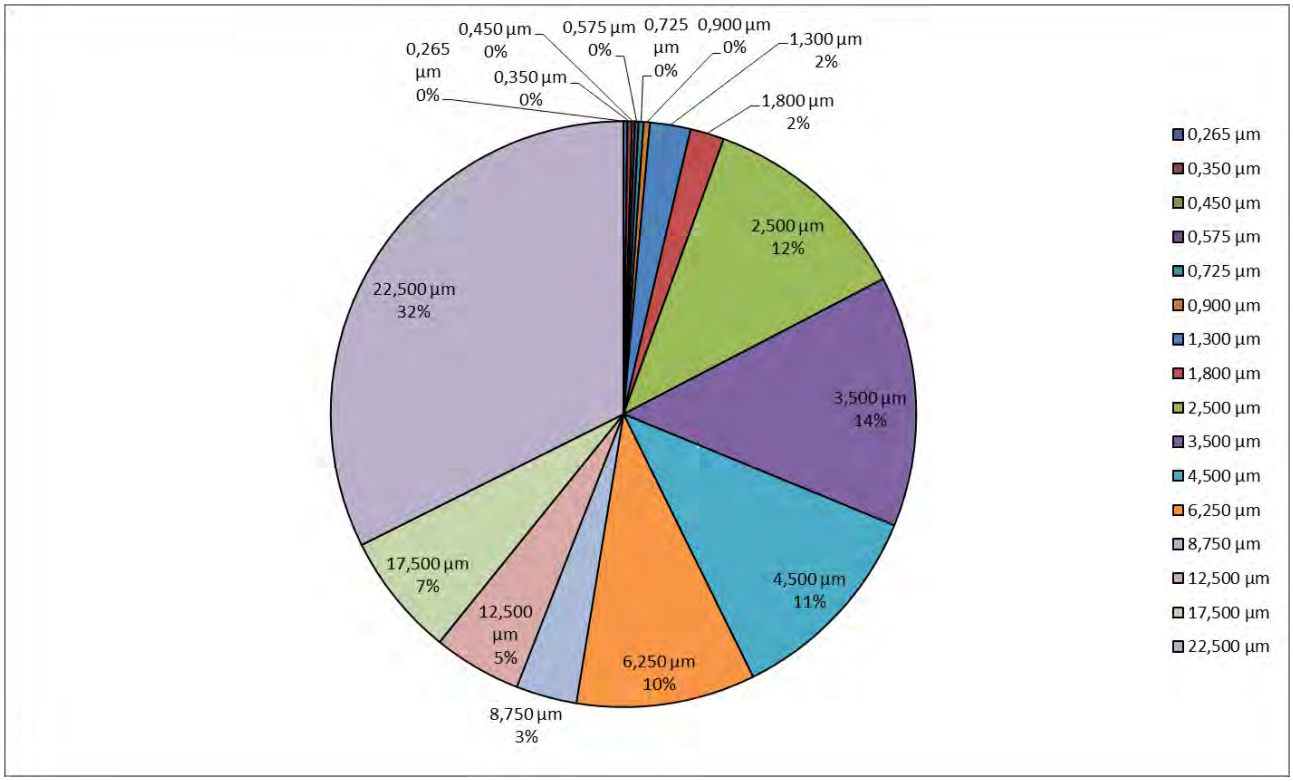
campaign 3

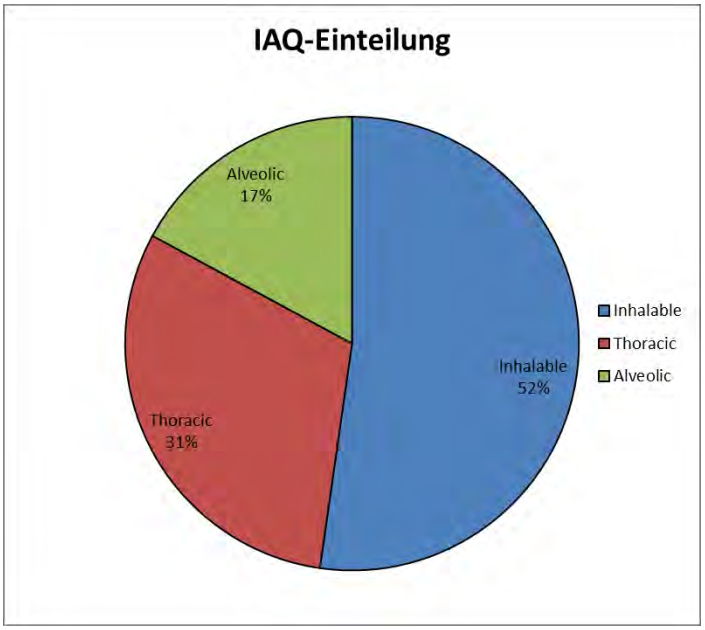
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,003	0,002	0,003	0,002	0,001	0,012	0,000	0,057	0,067	0,047	0,045	0,000	0,000	0,000	0,000
Maximum	0,005	0,006	0,004	0,007	0,010	0,015	0,105	0,240	0,564	0,648	0,501	0,426	0,199	0,362	0,995	4,060
Duchschnitt	0,004	0,005	0,003	0,004	0,005	0,006	0,041	0,034	0,217	0,254	0,211	0,181	0,062	0,089	0,125	0,594

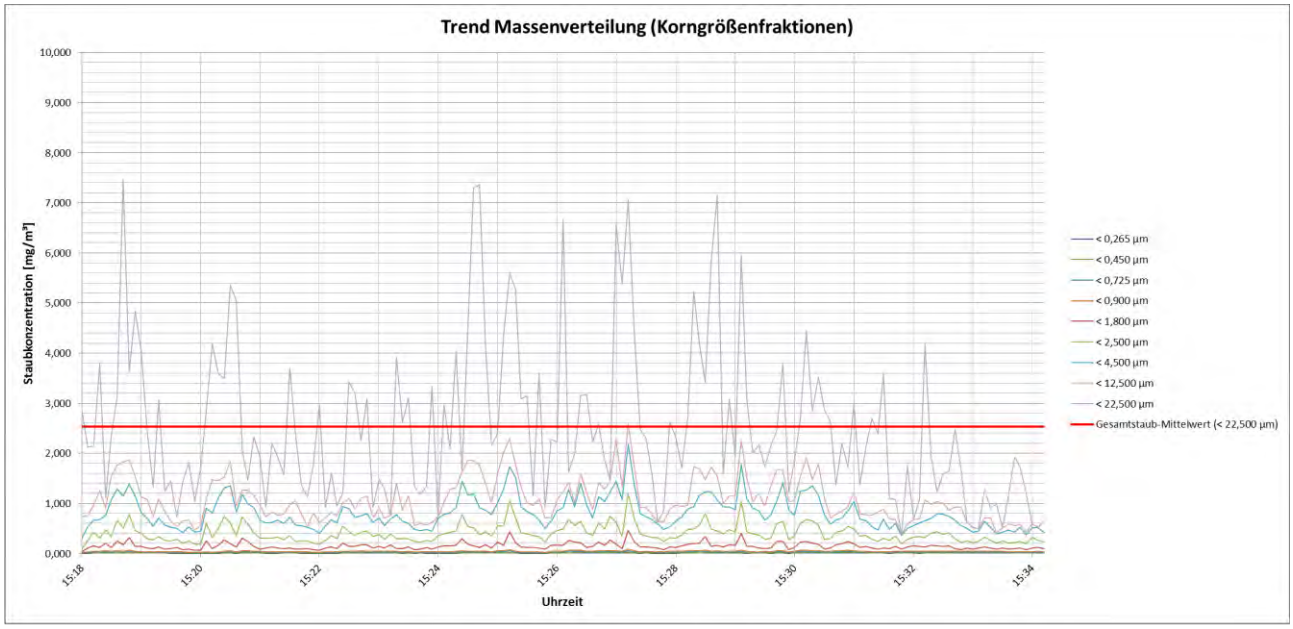
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,249	0,073	0,025	0,273	0,270	0,173
Maximum	1,910	0,684	0,120	6,054	2,136	1,220
Duchschnitt	0,963	0,233	0,051	1,839	1,078	0,602

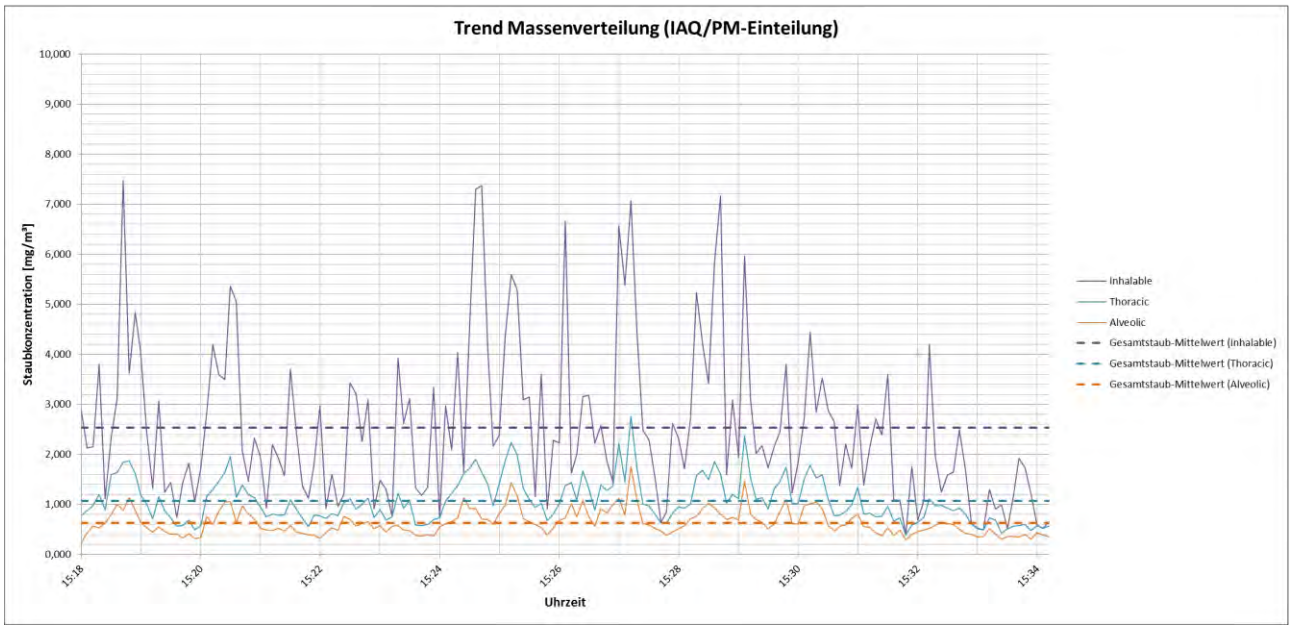
- **comments:**

no comments

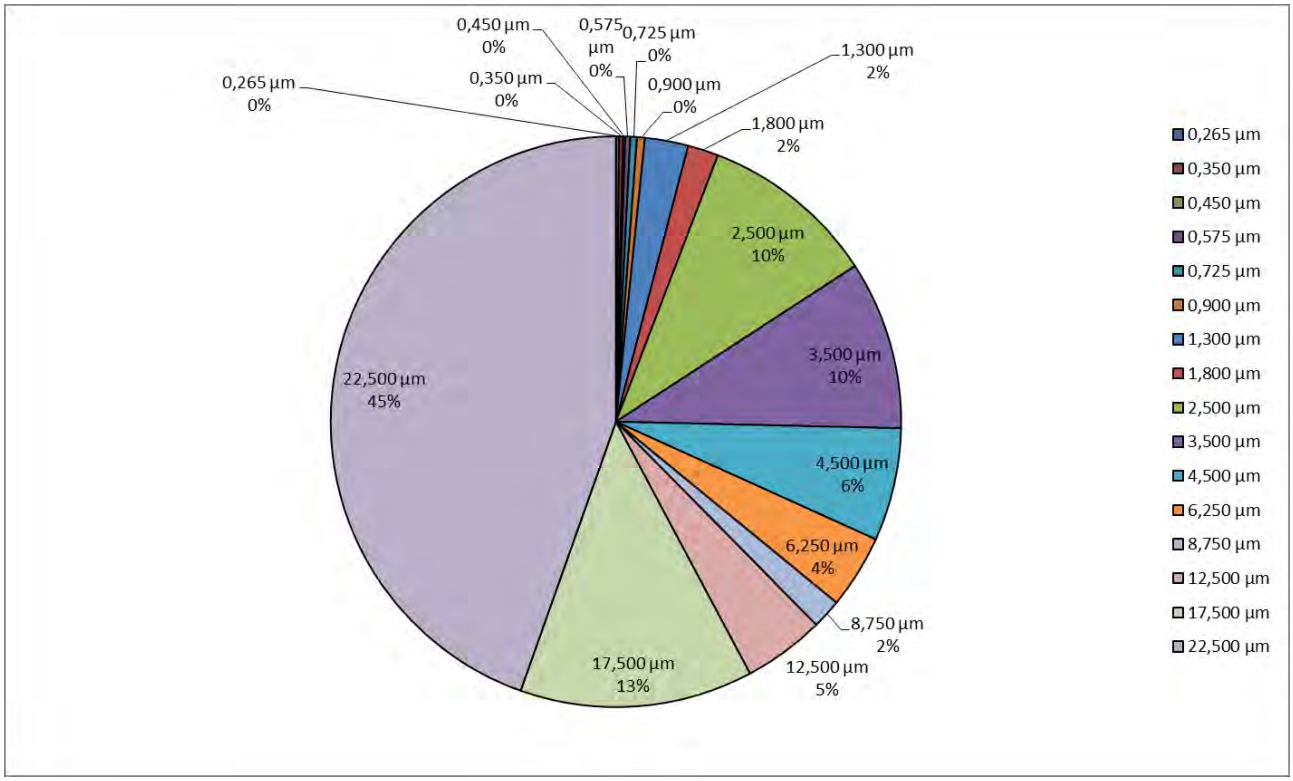
campaign 4

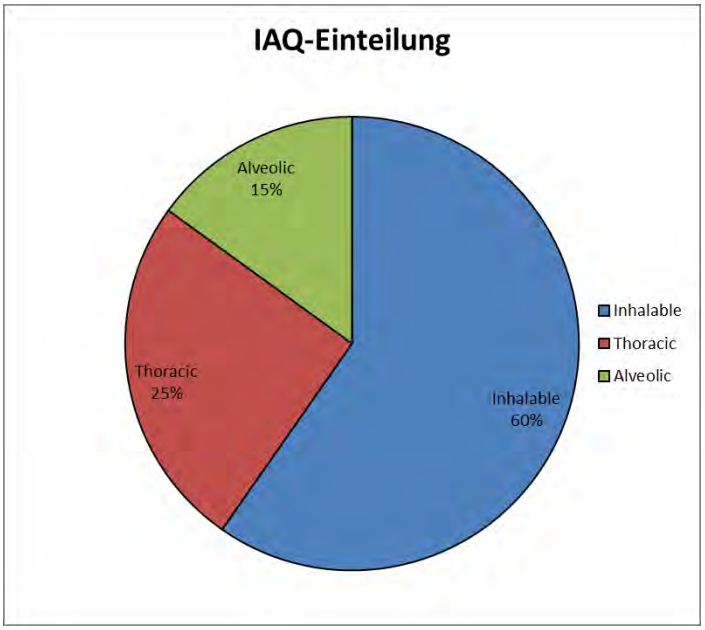
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,003	0,002	0,003	0,004	0,004	0,015	0,000	0,037	0,100	0,058	0,009	0,000	0,000	0,000	0,000
Maximum	0,007	0,009	0,005	0,012	0,022	0,030	0,173	0,197	0,748	0,579	0,399	0,308	0,224	0,507	1,790	5,220
Duchschnitt	0,005	0,006	0,003	0,007	0,010	0,011	0,062	0,044	0,253	0,242	0,162	0,106	0,042	0,117	0,334	1,128

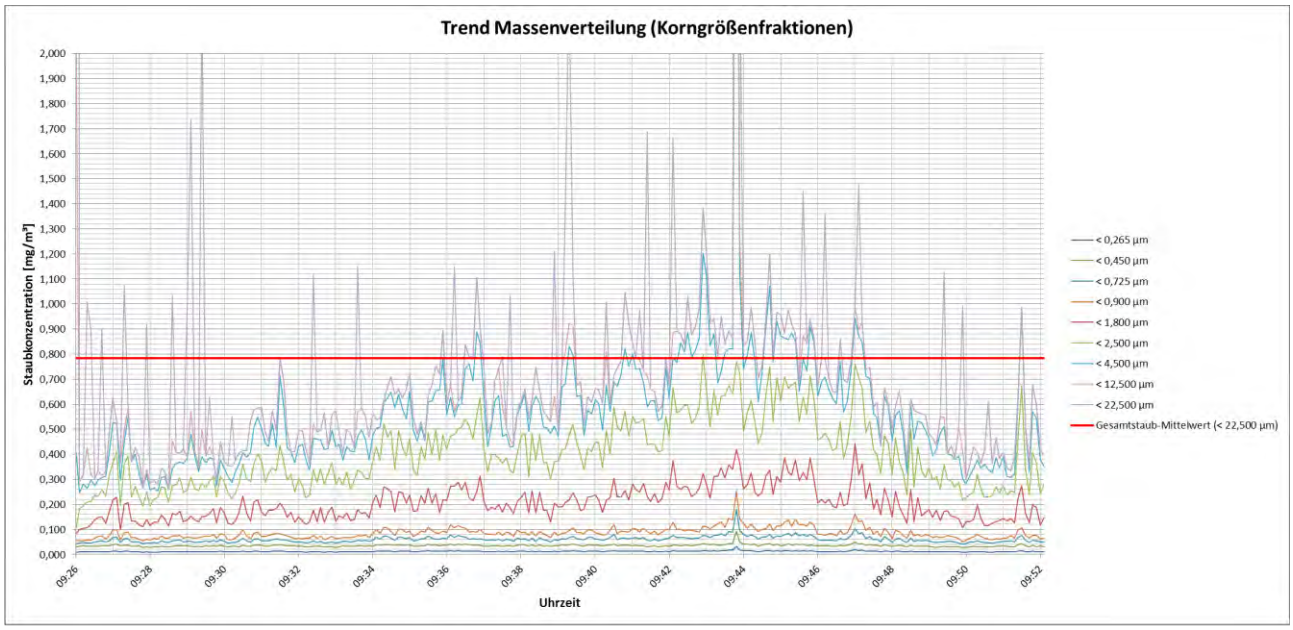
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,363	0,066	0,027	0,390	0,388	0,220
Maximum	2,380	0,868	0,174	7,470	2,767	1,755
Duchschnitt	0,932	0,295	0,071	2,535	1,073	0,637

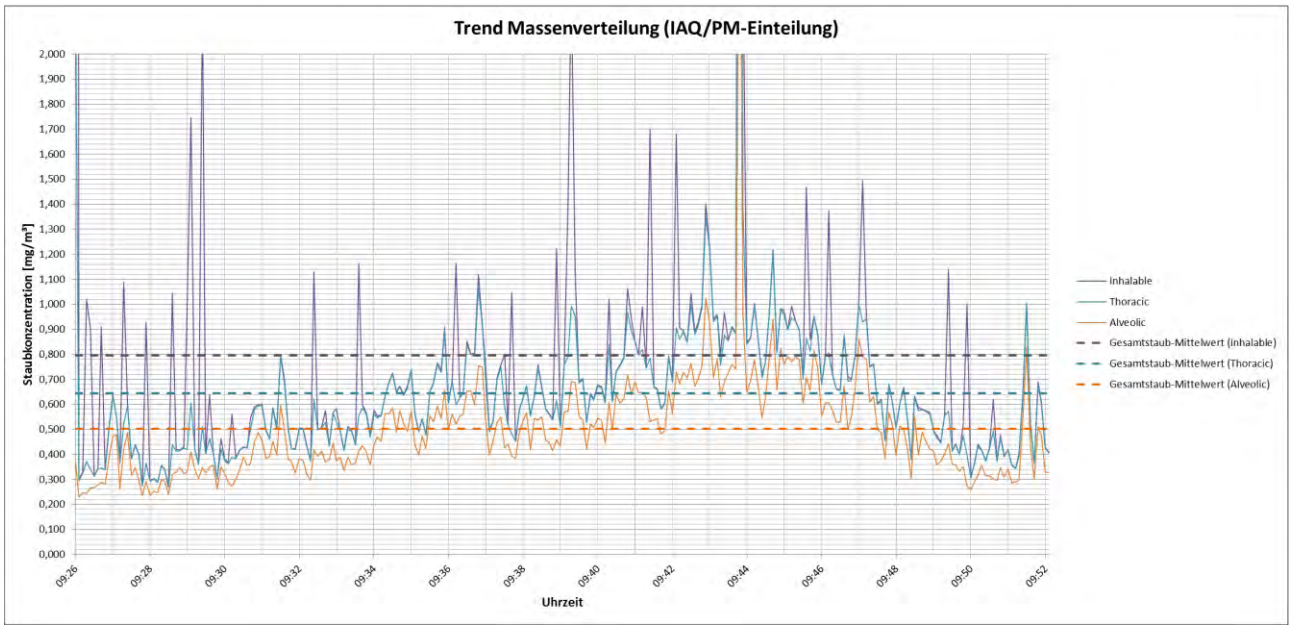
- **comments:**

no comments

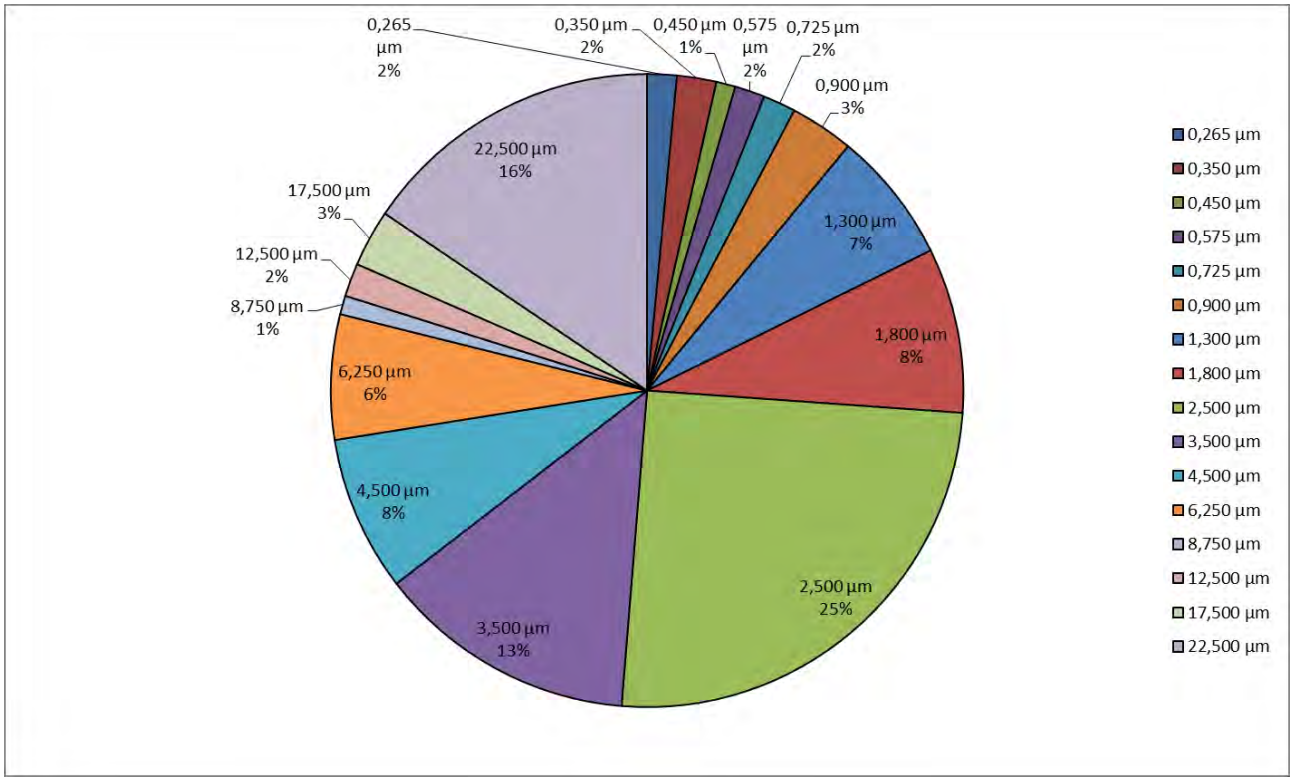
campaign 1

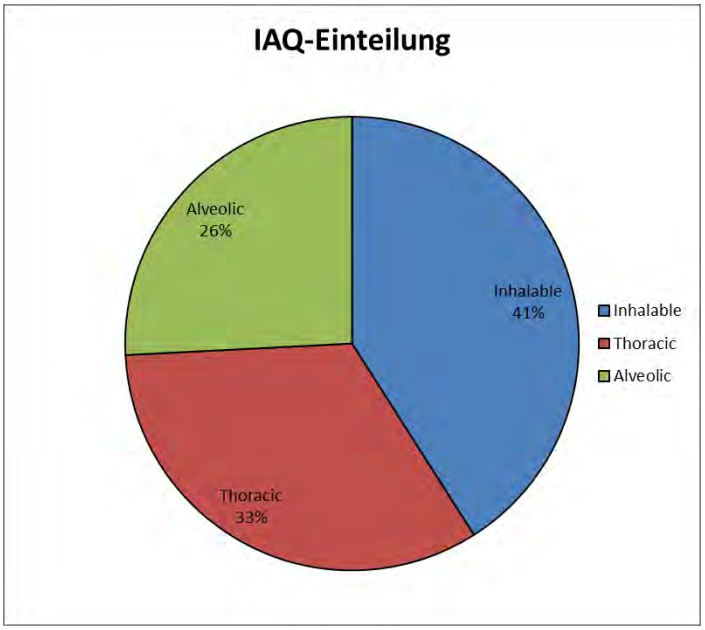
dust monitoring (Aerosol spectrometer)





particle size distribution





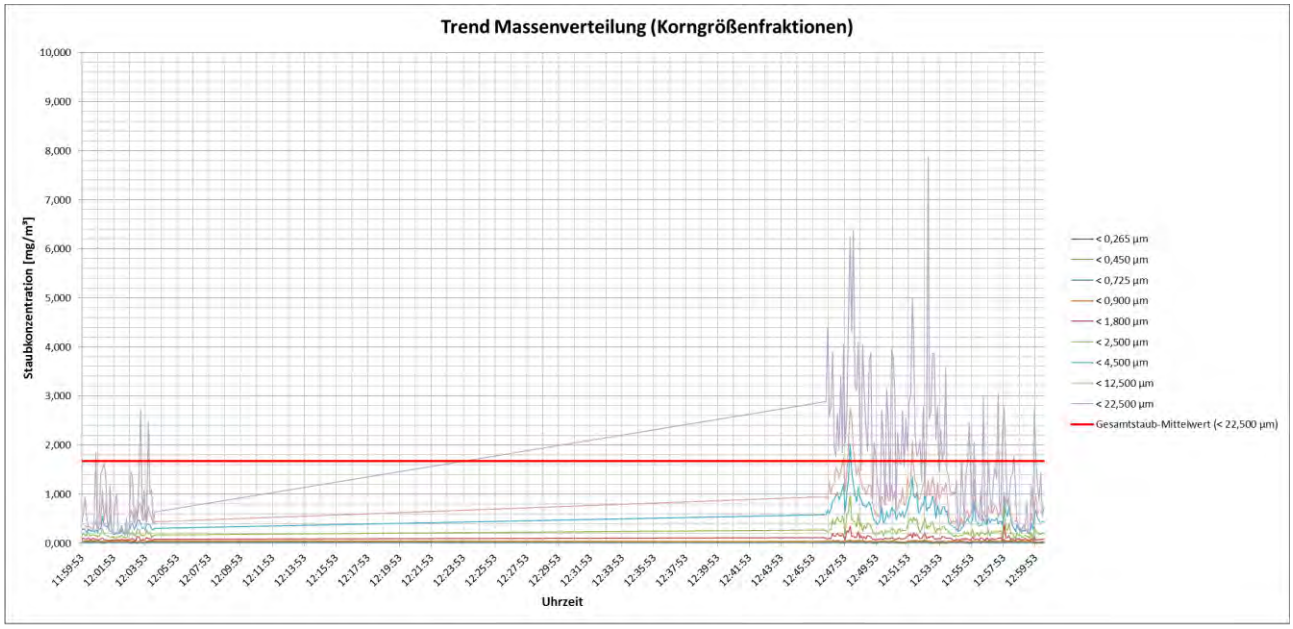
Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,009	0,012	0,006	0,006	0,005	0,007	0,015	0,000	0,022	0,019	0,003	0,000	0,000	0,000	0,000	0,000
Maximum	0,032	0,036	0,024	0,044	0,042	0,078	0,163	0,144	0,473	2,016	1,583	1,205	0,348	0,942	2,387	15,659
Duchschnitt	0,012	0,016	0,008	0,012	0,013	0,026	0,053	0,066	0,197	0,104	0,062	0,050	0,007	0,013	0,023	0,122

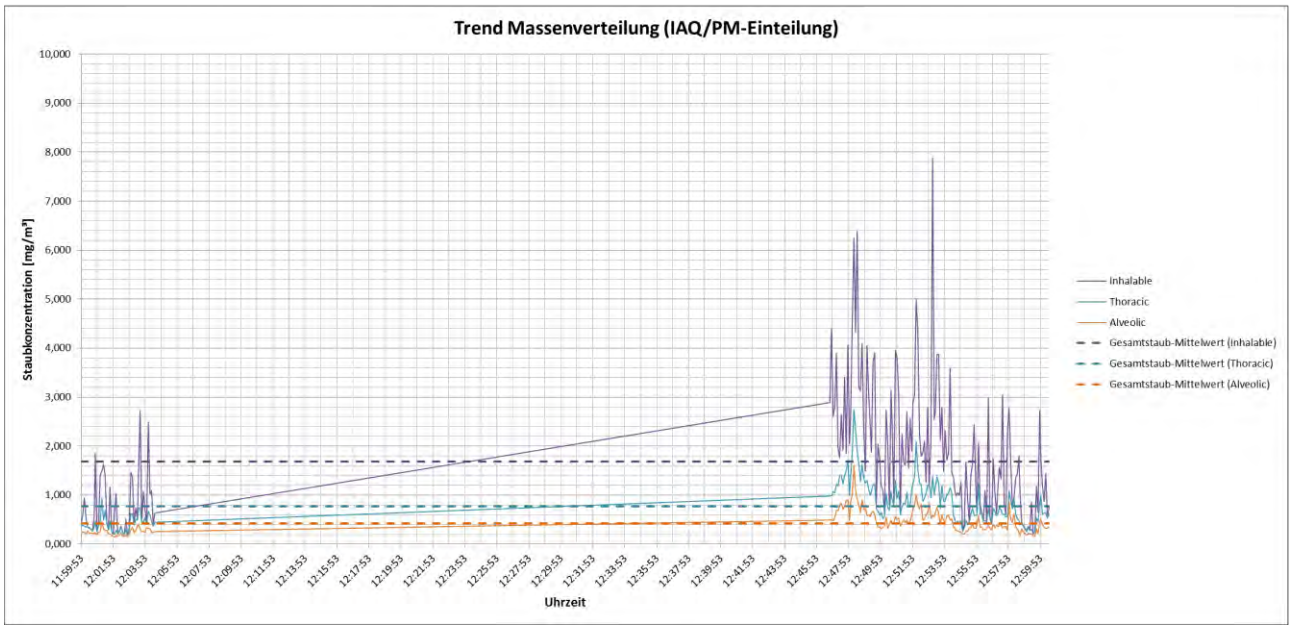
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,256	0,116	0,067	0,267	0,267	0,229
Maximum	5,393	0,795	0,303	20,147	5,954	3,071
Duchschnitt	0,602	0,319	0,113	0,796	0,645	0,501

- **comments:**

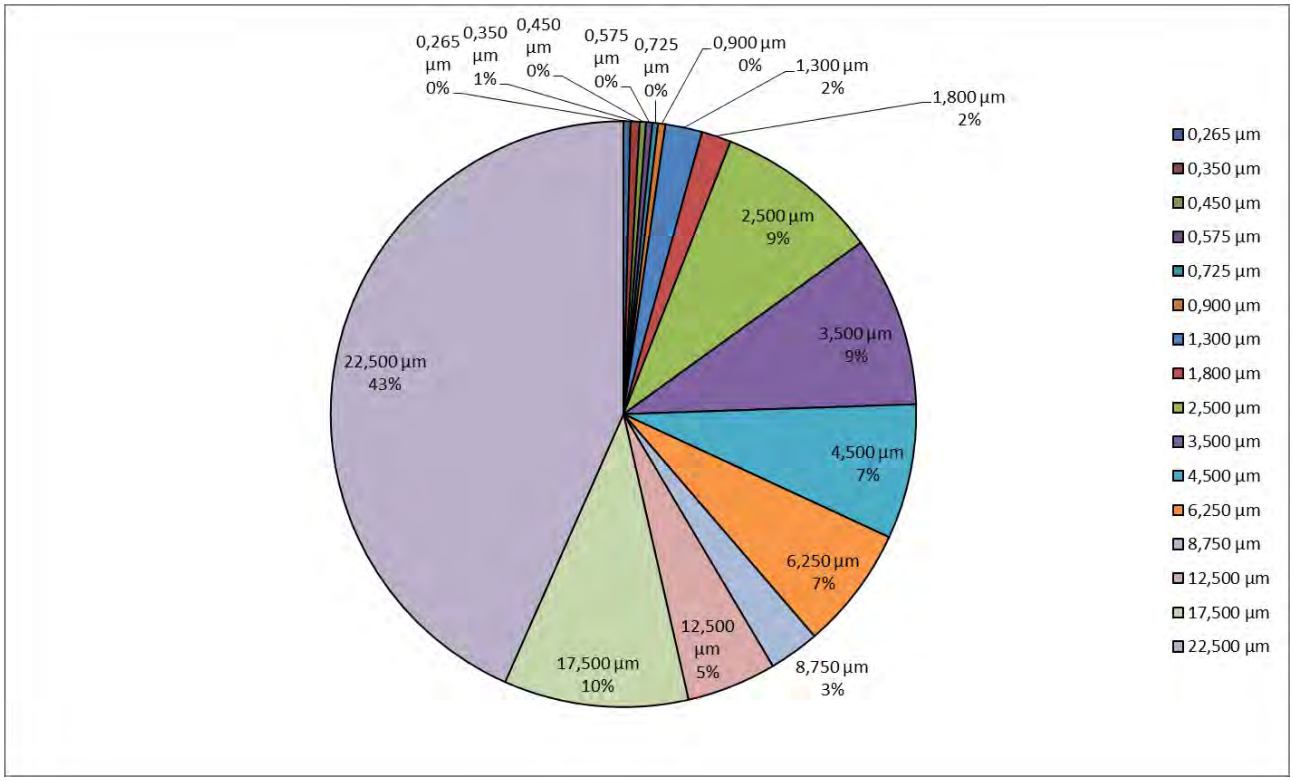
no comments

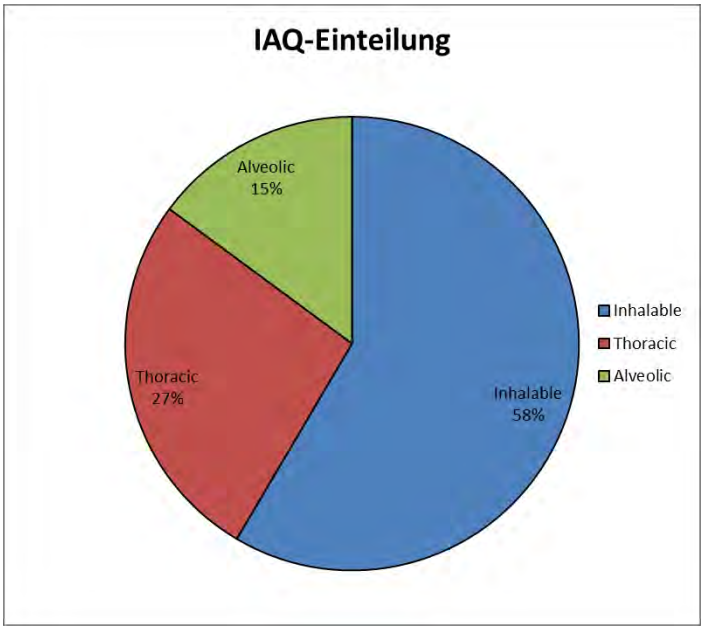
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,002	0,002	0,001	0,001	0,008	0,000	0,020	0,019	0,014	0,009	0,000	0,000	0,000	0,000
Maximum	0,011	0,013	0,011	0,011	0,015	0,022	0,118	0,199	0,674	0,562	0,453	0,390	0,199	0,507	1,591	5,800
Duchschnitt	0,006	0,008	0,006	0,006	0,005	0,007	0,034	0,027	0,152	0,158	0,125	0,114	0,047	0,083	0,171	0,727

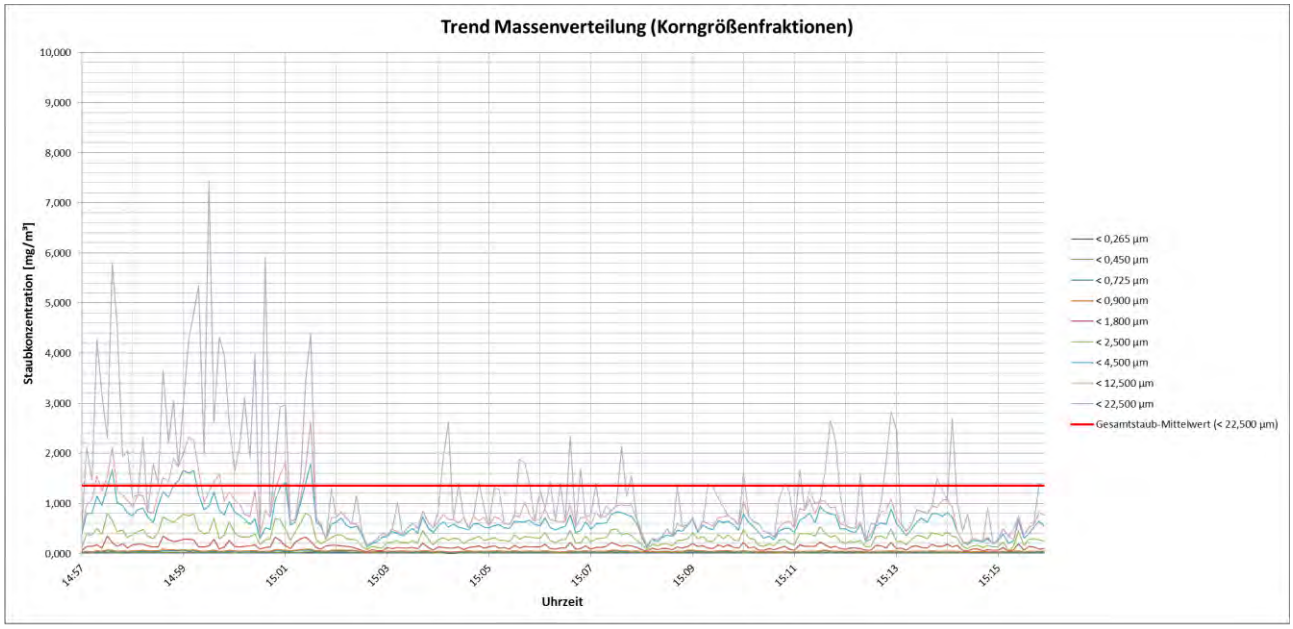
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,177	0,082	0,030	0,187	0,186	0,149
Maximum	2,401	0,725	0,140	7,881	2,747	1,611
Duchschnitt	0,672	0,194	0,059	1,684	0,767	0,429

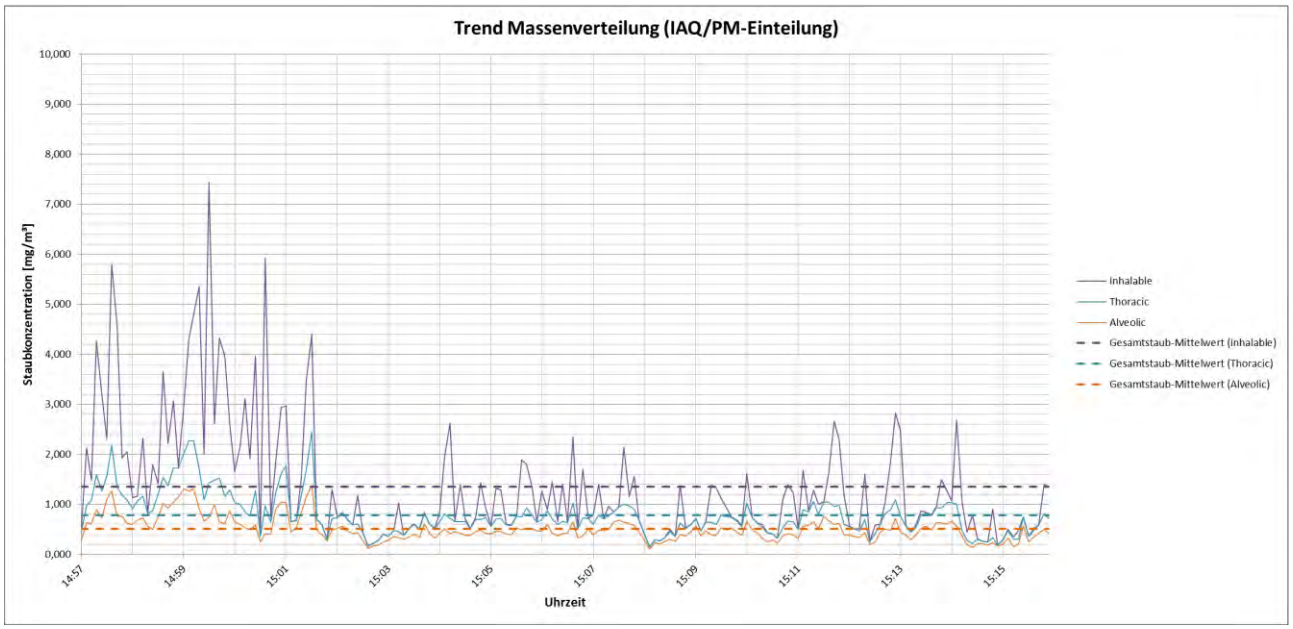
- **comments:**

Interruption of the measurement due to a connection problem.

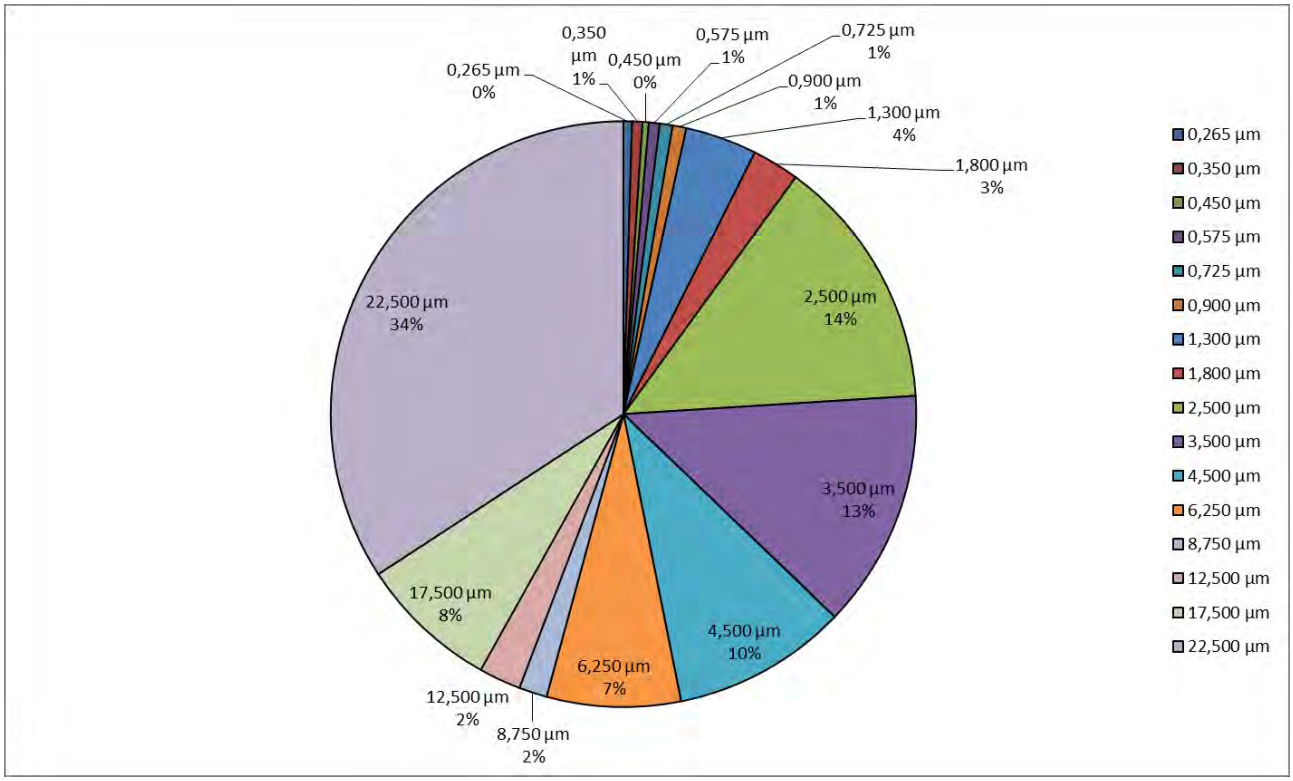
campaign 4

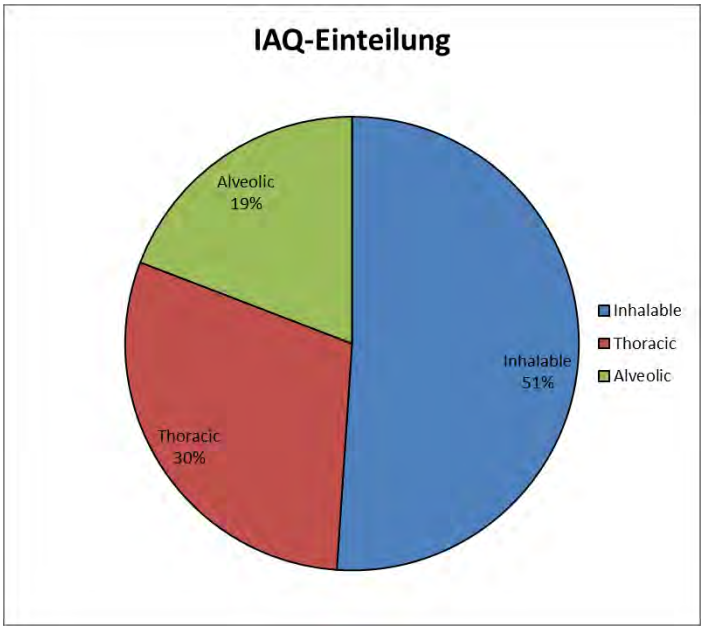
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,002	0,004	0,002	0,002	0,009	0,000	0,017	0,029	0,010	0,000	0,000	0,000	0,000	0,000
Maximum	0,010	0,013	0,008	0,015	0,022	0,028	0,140	0,148	0,517	0,606	0,443	0,344	0,199	0,507	0,995	5,800
Duchschnitt	0,006	0,008	0,005	0,008	0,010	0,010	0,053	0,035	0,189	0,177	0,130	0,100	0,021	0,031	0,104	0,461

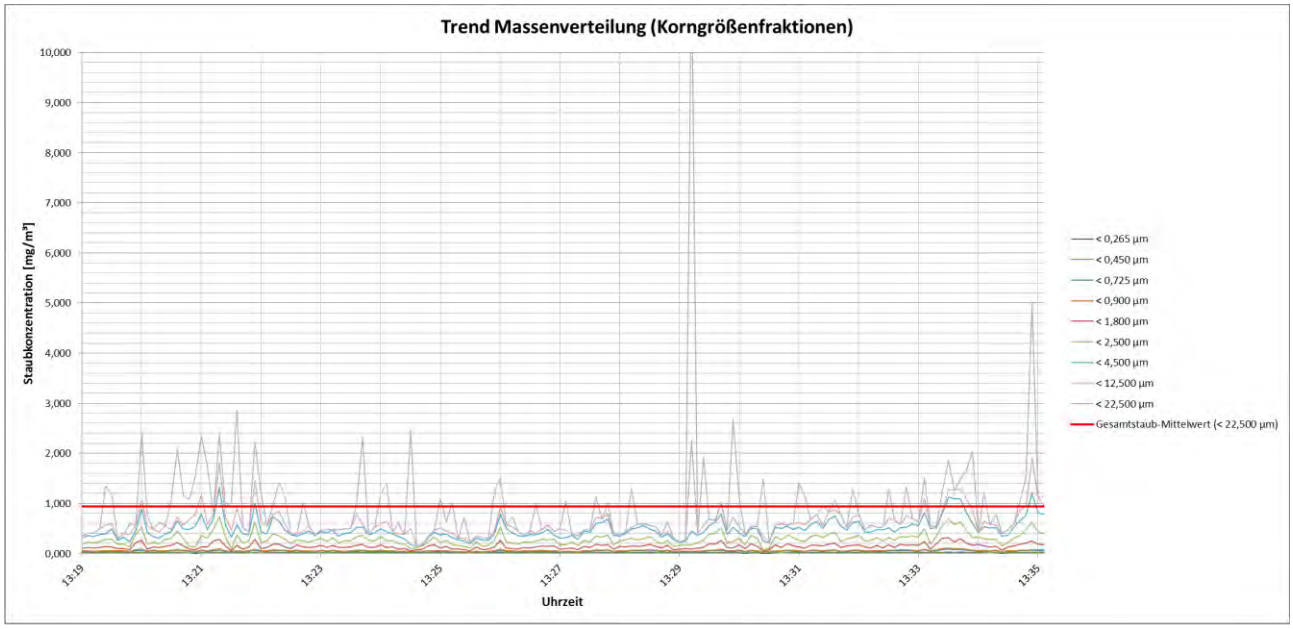
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,142	0,059	0,033	0,153	0,151	0,108
Maximum	2,178	0,600	0,148	7,443	2,451	1,370
Duchschnitt	0,710	0,248	0,072	1,355	0,789	0,509

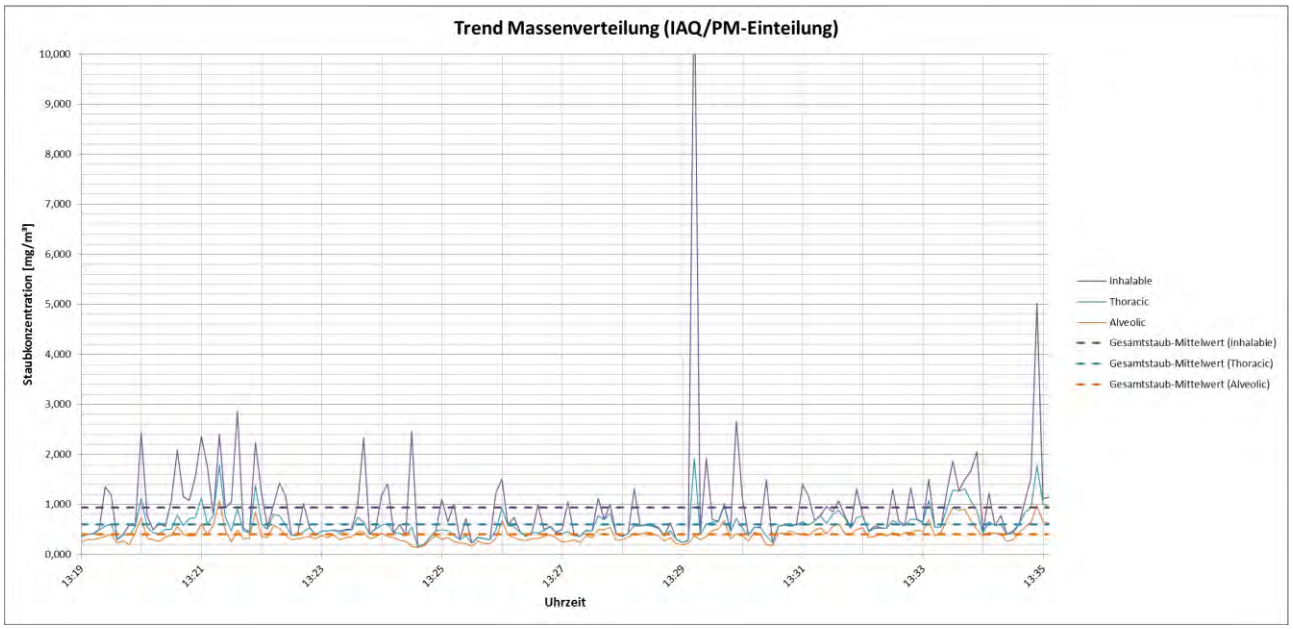
- **comments:**

no comments

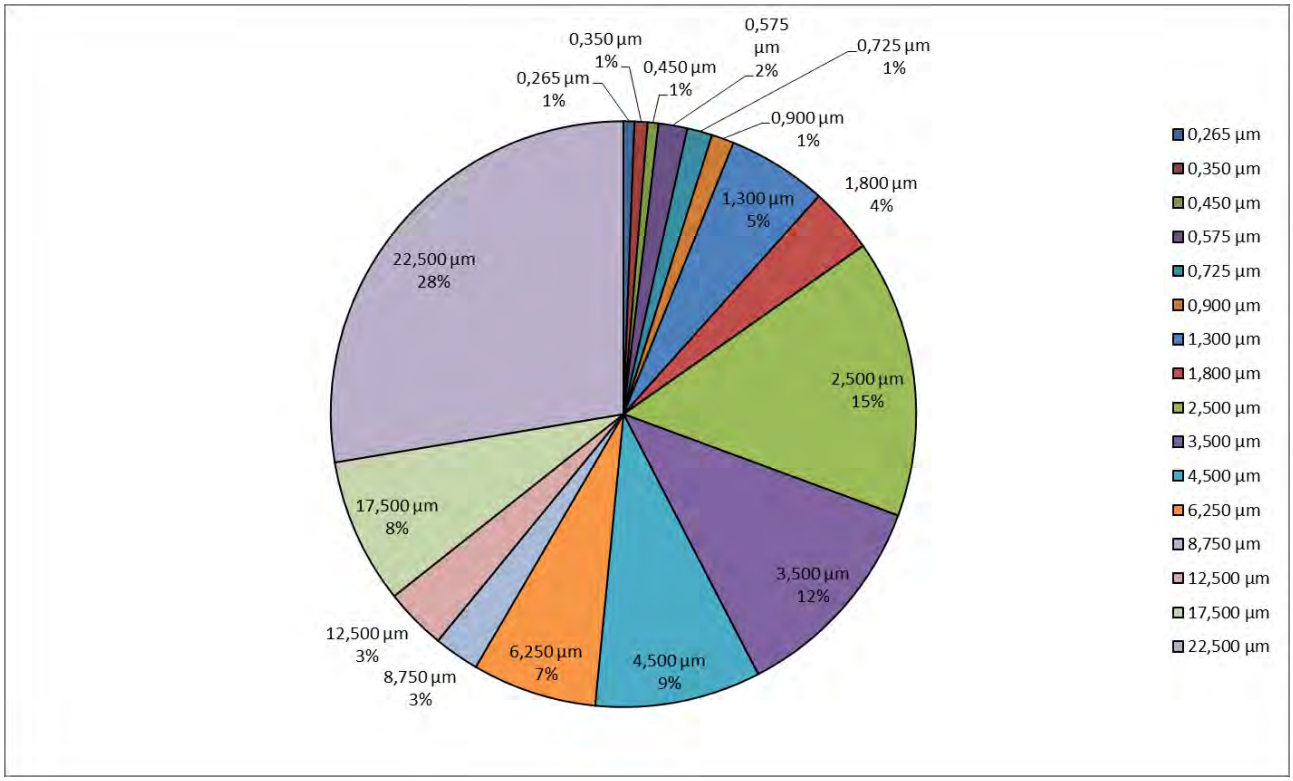
campaign 5

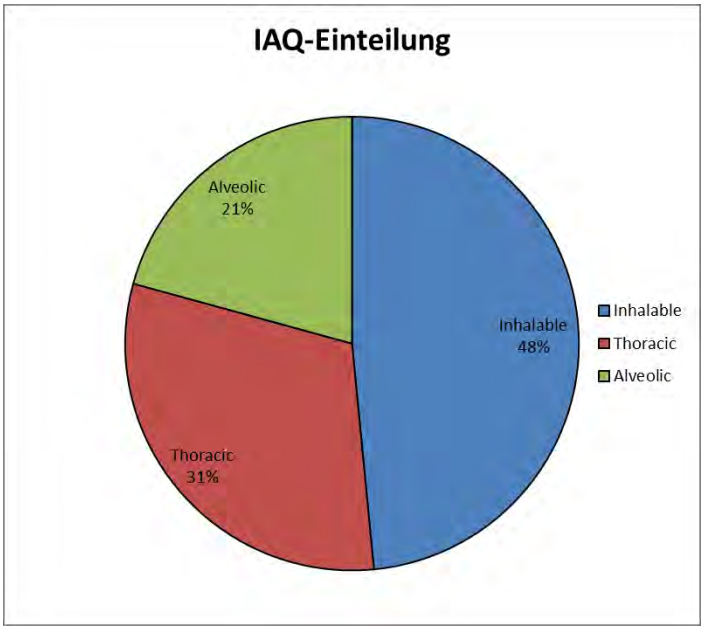
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,004	0,004	0,007	0,005	0,003	0,016	0,000	0,015	0,019	0,003	0,000	0,000	0,000	0,000	0,000
Maximum	0,009	0,010	0,009	0,028	0,028	0,028	0,121	0,100	0,448	0,341	0,254	0,254	0,472	1,160	1,393	8,120
Duchschnitt	0,006	0,007	0,006	0,015	0,013	0,012	0,051	0,034	0,143	0,110	0,085	0,064	0,023	0,032	0,075	0,258

Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,151	0,071	0,037	0,158	0,158	0,141
Maximum	1,589	0,534	0,154	11,772	1,927	1,084
Duchschnitt	0,542	0,226	0,077	0,939	0,597	0,402

- **comments:**

no comments

campaign 1

environmental conditions				
measurement period		**temperature**	**atmospheric pressure**	**positioning of the measuring rod**
Start	**End**	**°C**	**mbar**	**m**
13.10.2014 10:43	13.10.2014 11:43	27	1012,5	~ 1,8m above the enclosure

temperature and flow velocity measurements				
material temperature	**temperature of the enclosure**	**estimated temperature at the inlet**	**measured gas temperature in height of the expanded metal mesh**	**vertical flow velocity**
°C	**°C**	**°C**	**°C**	**m/s**
50	40	31	31	2,28

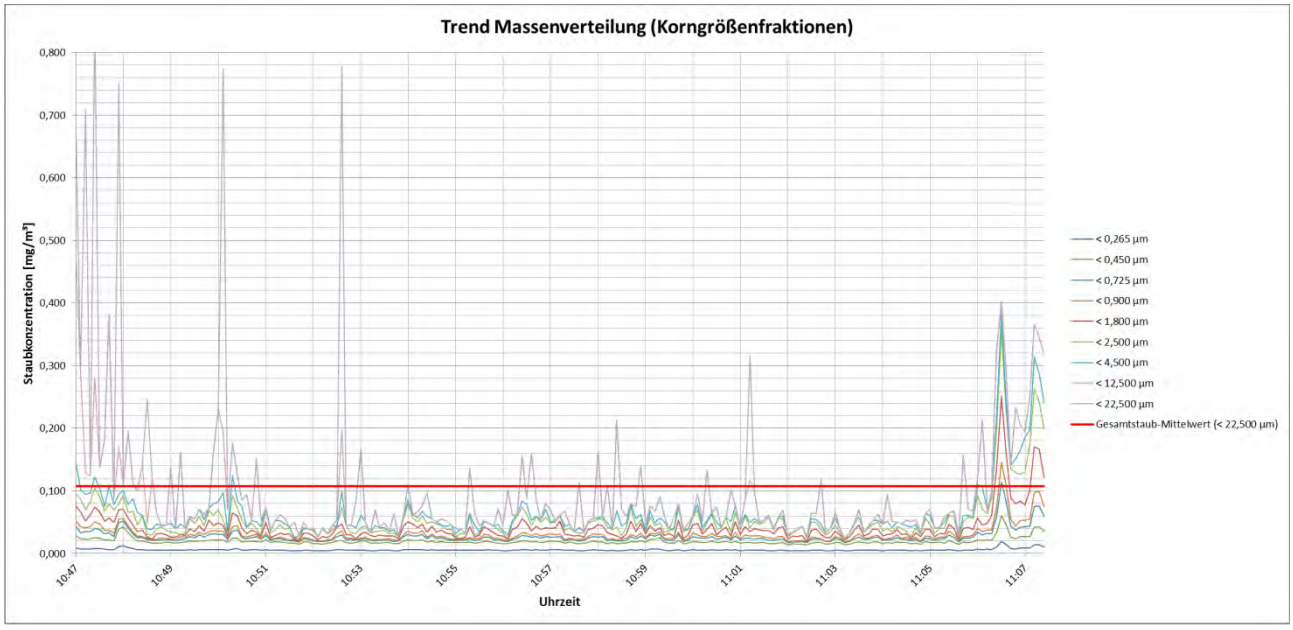
total dust				
Measurement period		**dust concentration**	**absolute measurement uncertainty**	**relative measurement uncertainty**
Start	**End**	**mg/Nm³**	**mg/Nm³**	**%**
10:43	11:43	0,12	0,23	191,67

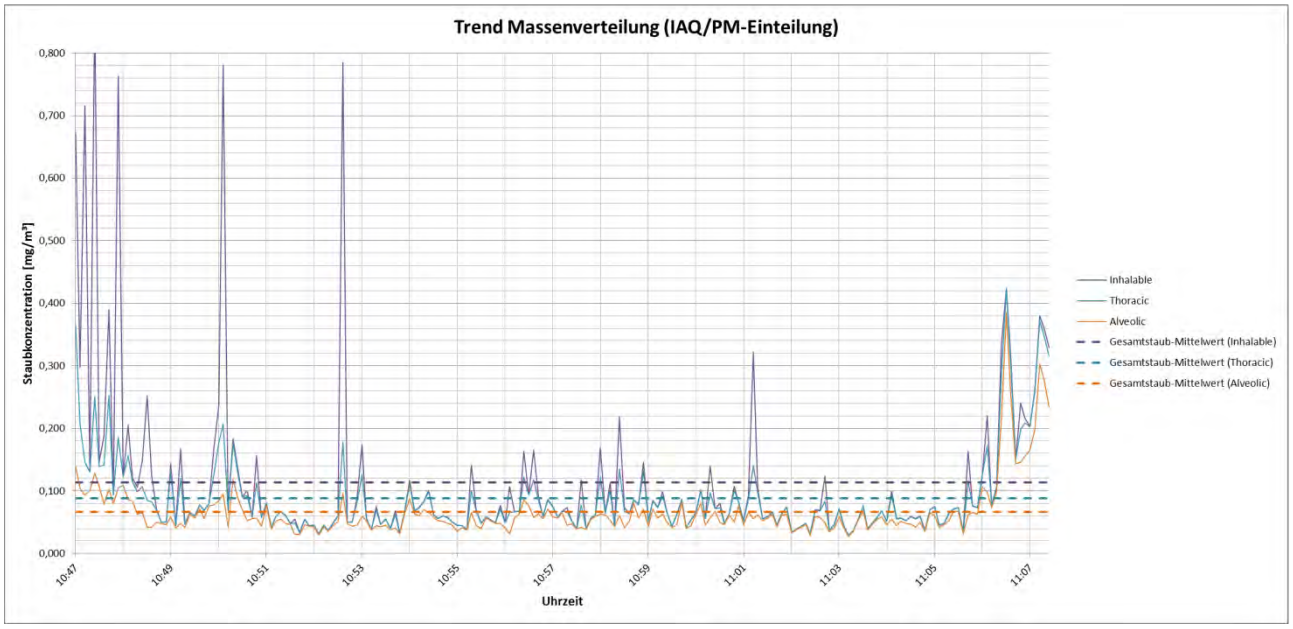
Comparison with the operational data collected by ILVA

The sinter cooler was not operated until 11:15, therefore only cooled down material passed the measurement point. When operated, the sinter cooler rotated at about 1,4 m/min.

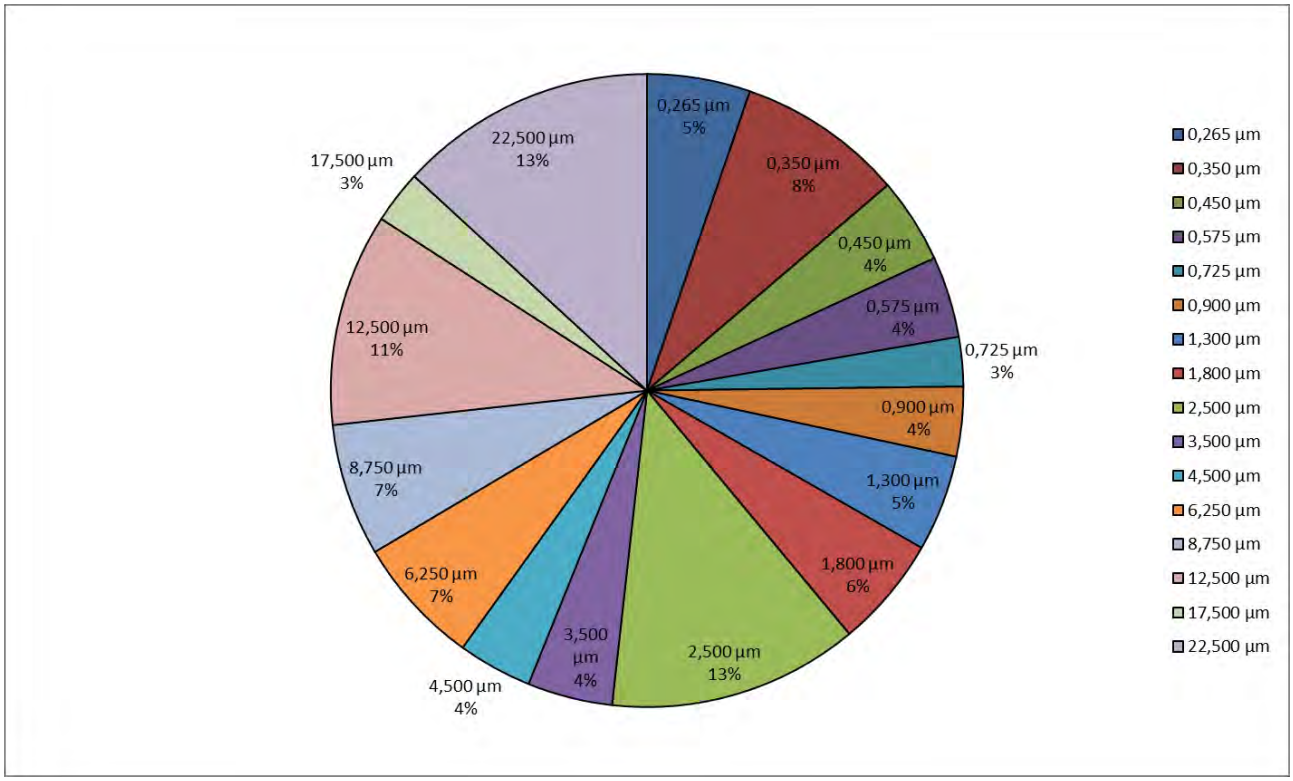
campaign 1

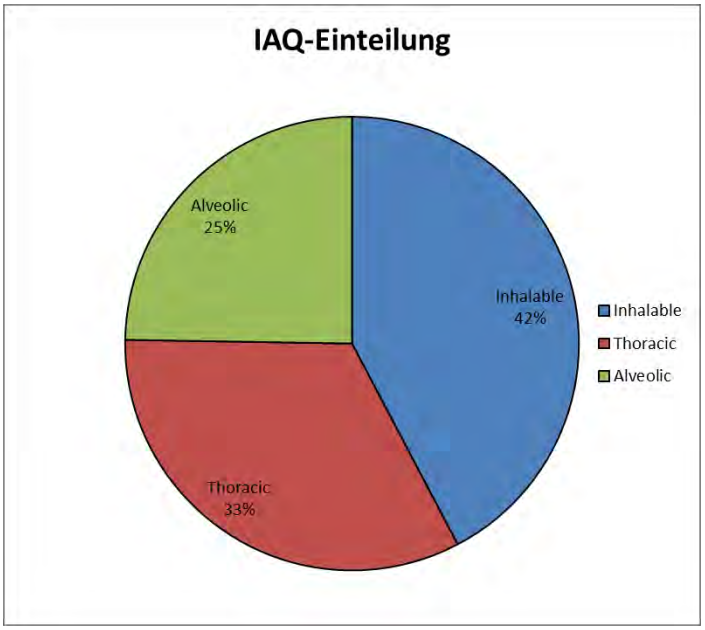
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,007	0,003	0,002	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,019	0,023	0,017	0,032	0,022	0,032	0,044	0,062	0,106	0,030	0,030	0,072	0,075	0,217	0,199	0,580
Duchschnitt	0,006	0,009	0,005	0,004	0,003	0,004	0,005	0,006	0,014	0,005	0,004	0,007	0,007	0,012	0,003	0,014

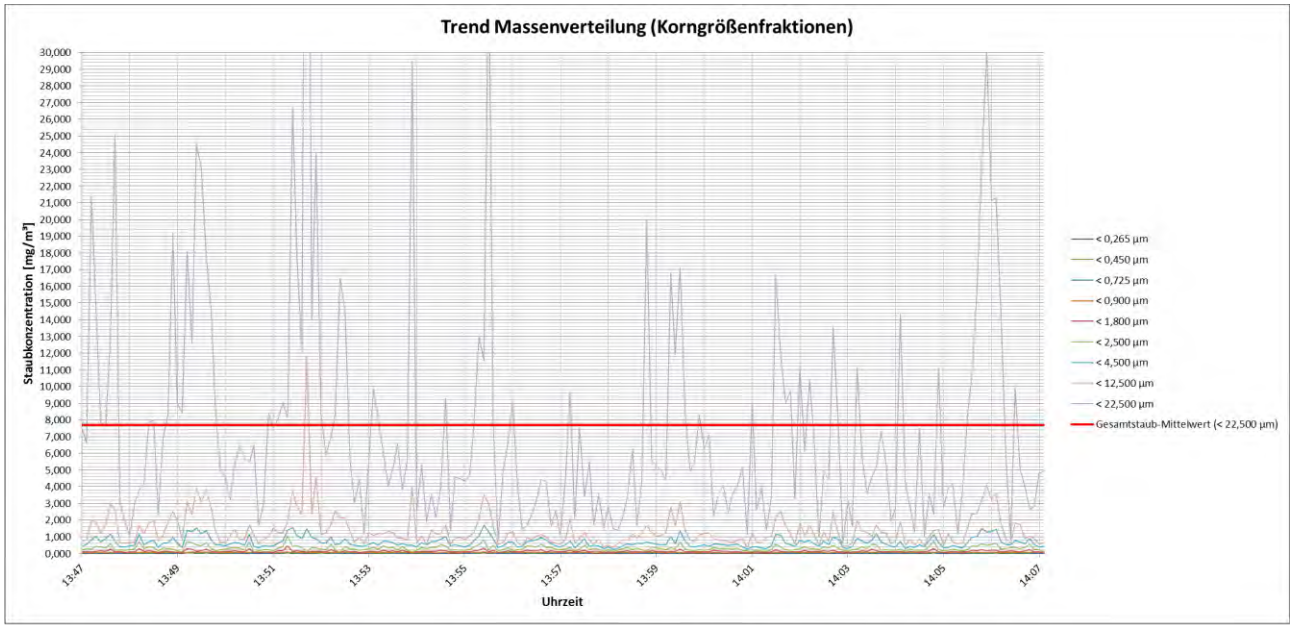
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,029	0,026	0,022	0,029	0,029	0,027
Maximum	0,407	0,322	0,166	0,869	0,423	0,386
Duchschnitt	0,084	0,055	0,036	0,114	0,089	0,066

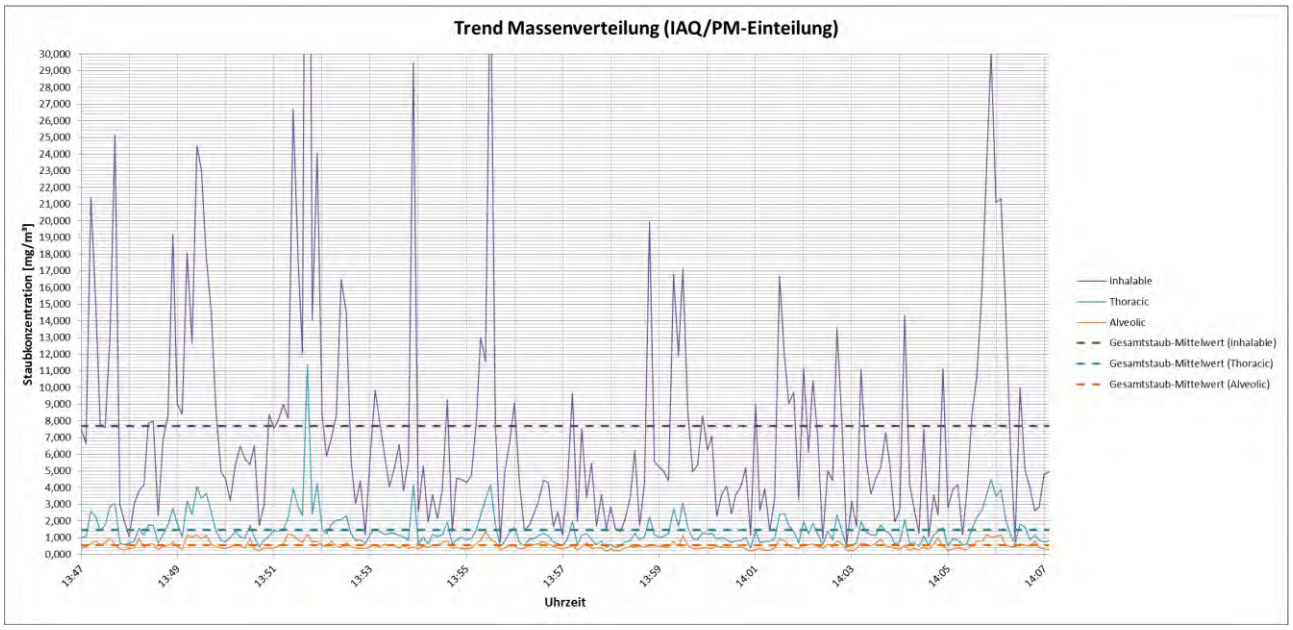
- **comments:**

Sinter cooler not operated at the beginning of the measurement until 11:10. Because of the downtime only already cooled down material passes the measurement point.

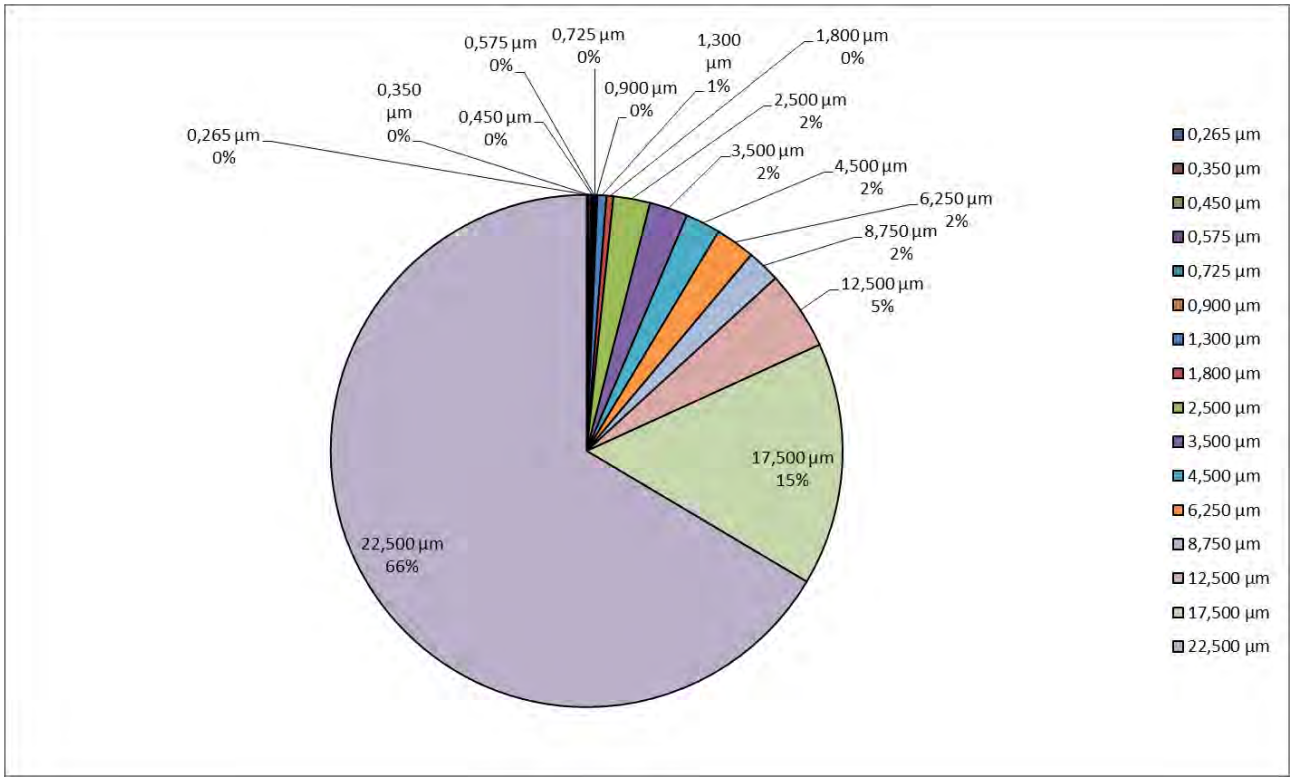
campaign 4

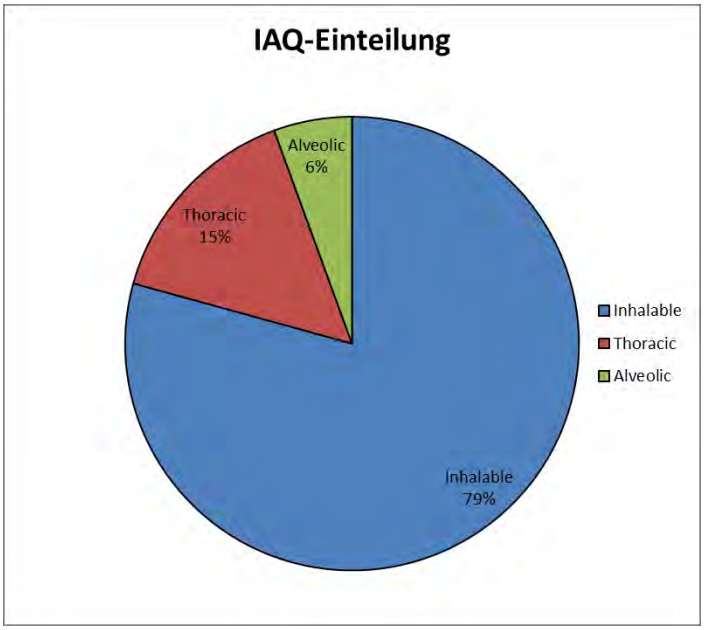
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,007	0,009	0,005	0,005	0,003	0,002	0,016	0,000	0,000	0,025	0,037	0,018	0,000	0,000	0,000	0,000
Maximum	0,013	0,016	0,011	0,013	0,014	0,018	0,112	0,271	0,586	0,560	1,231	2,066	1,964	6,307	16,113	42,918
Duchschnitt	0,009	0,012	0,008	0,008	0,007	0,007	0,043	0,033	0,178	0,186	0,170	0,192	0,161	0,383	1,179	5,108

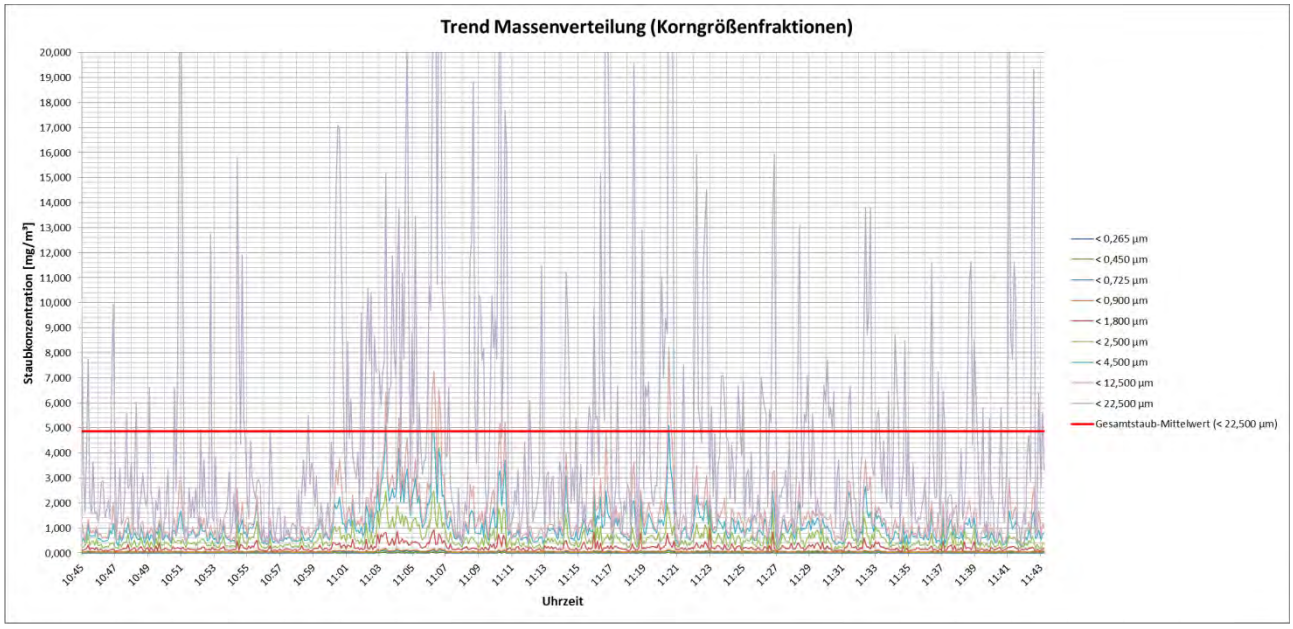
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,317	0,093	0,051	0,637	0,375	0,218
Maximum	7,659	0,759	0,162	70,844	11,383	1,372
Duchschnitt	1,103	0,240	0,079	7,694	1,471	0,541

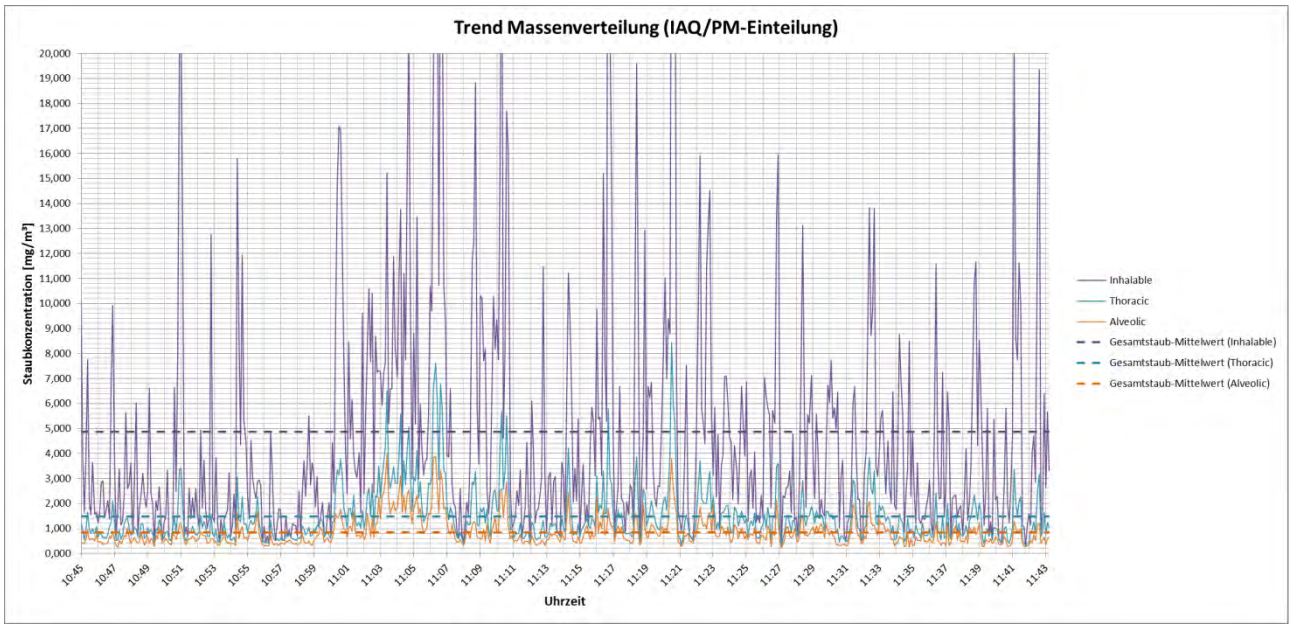
- **comments:**

no comments

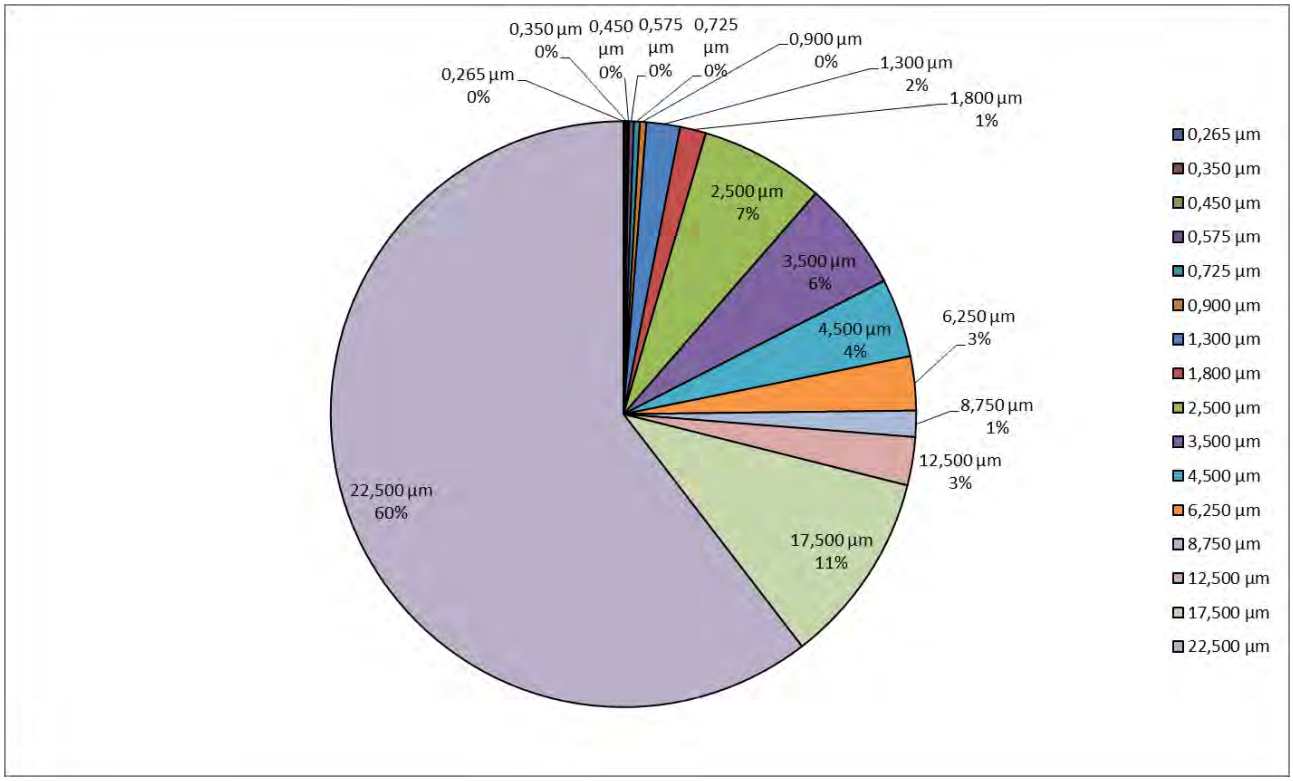
campaign 5

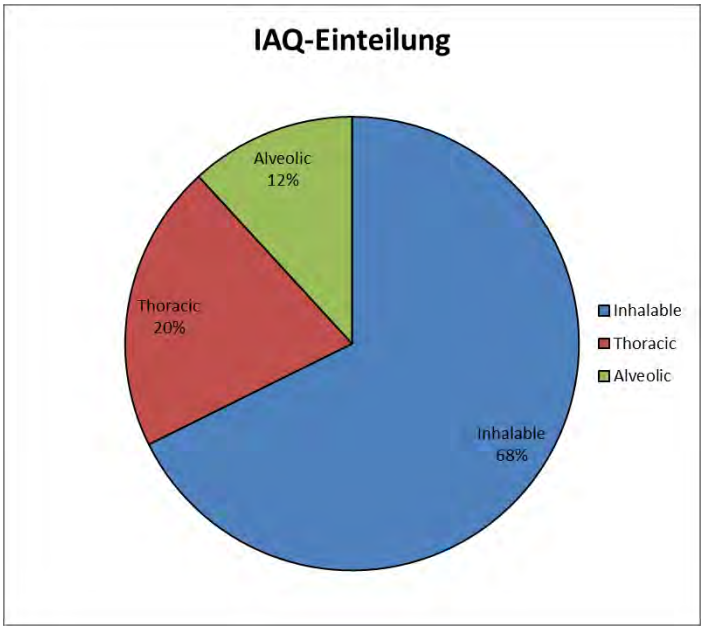
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,003	0,006	0,006	0,006	0,023	0,000	0,000	0,040	0,020	0,009	0,000	0,000	0,000	0,000
Maximum	0,013	0,017	0,010	0,044	0,068	0,070	0,385	0,488	1,629	1,913	1,583	1,305	0,821	1,377	4,575	31,899
Duchschnitt	0,005	0,006	0,004	0,013	0,016	0,017	0,090	0,070	0,334	0,295	0,212	0,145	0,070	0,130	0,519	2,943

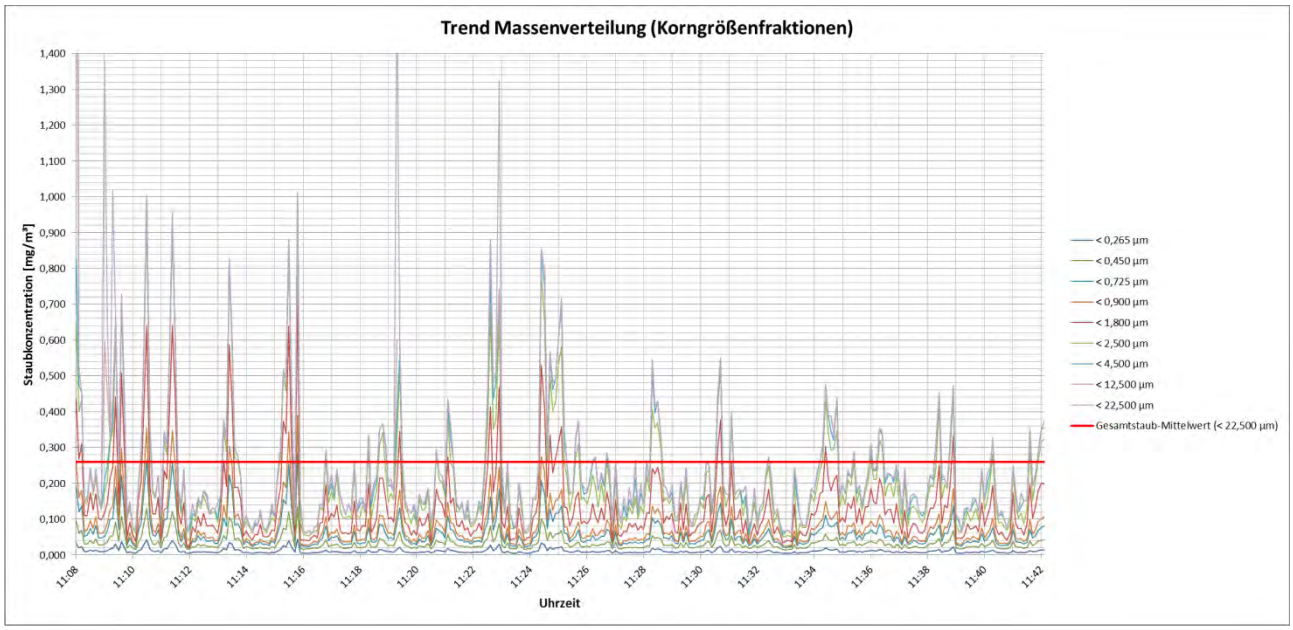
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,255	0,068	0,034	0,273	0,271	0,212
Maximum	6,858	1,791	0,364	41,412	8,437	3,977
Duchschnitt	1,241	0,412	0,101	4,874	1,478	0,851

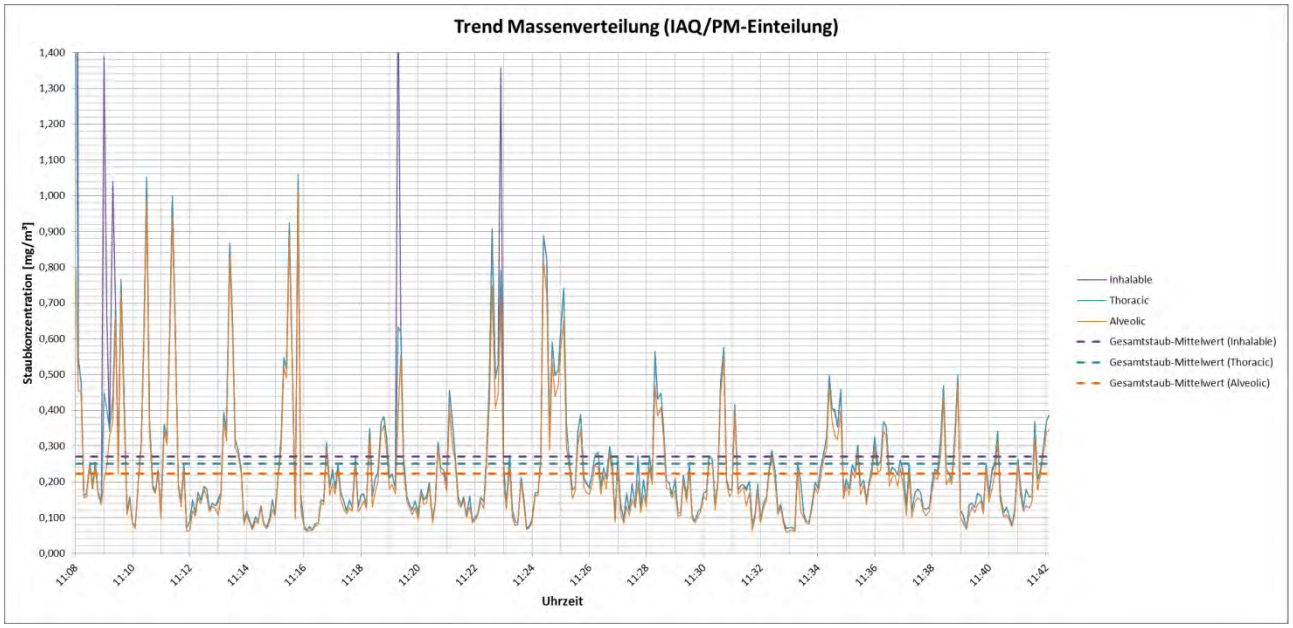
- **comments:**

no comments

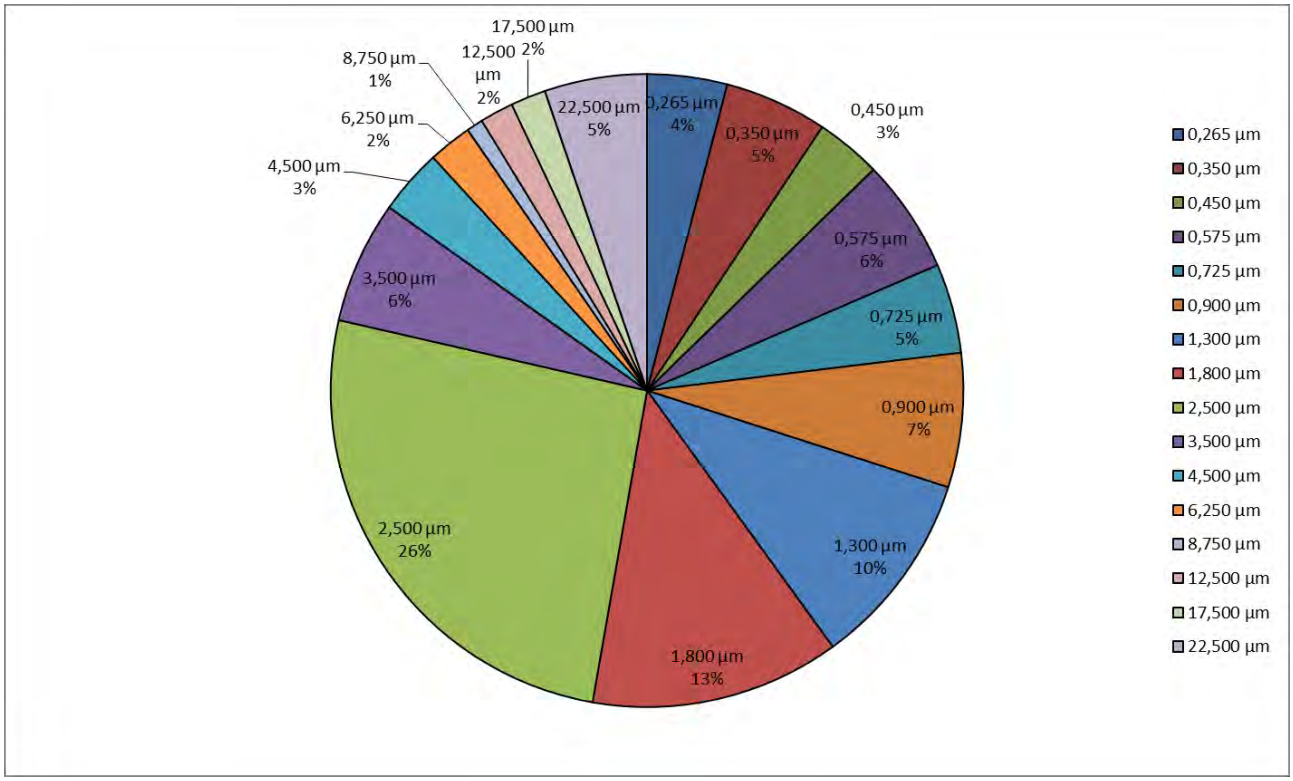
campaign 1

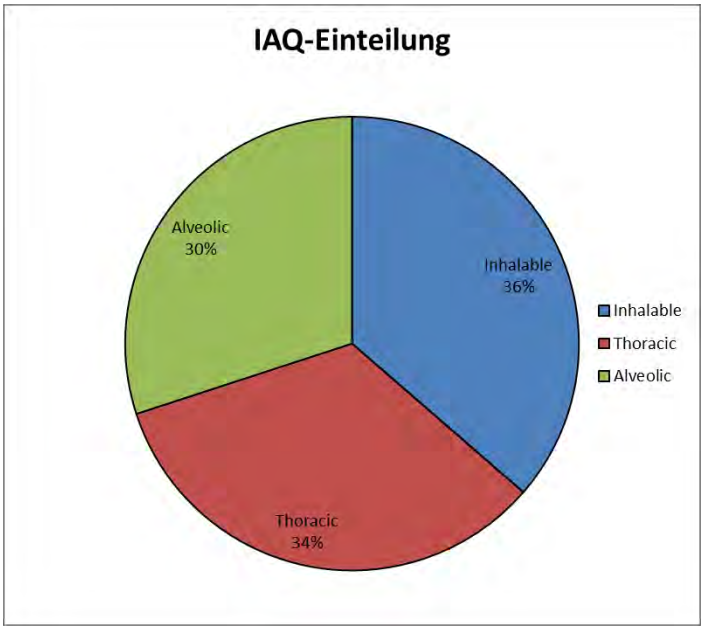
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,004	0,007	0,003	0,003	0,000	0,002	0,002	0,000	0,006	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,045	0,051	0,040	0,085	0,065	0,104	0,143	0,183	0,307	0,102	0,081	0,136	0,199	0,870	0,796	2,320
Duchschnitt	0,011	0,014	0,009	0,015	0,012	0,018	0,026	0,033	0,067	0,016	0,009	0,006	0,002	0,004	0,005	0,014

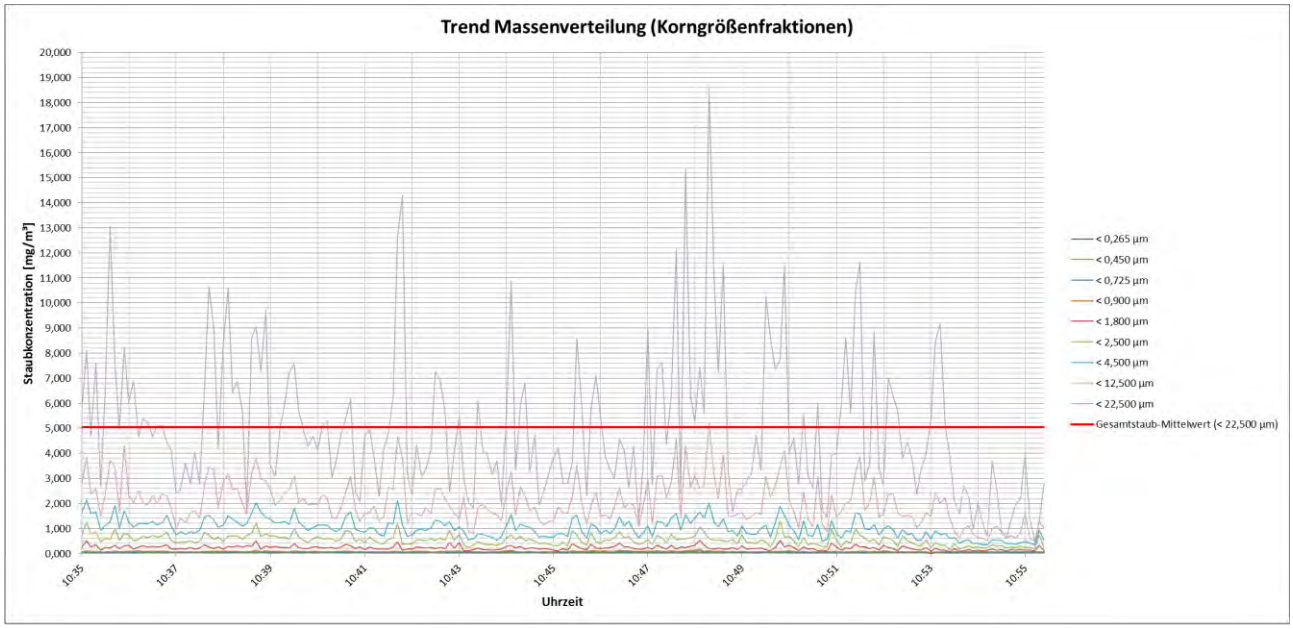
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,064	0,038	0,025	0,066	0,066	0,058
Maximum	1,458	0,883	0,437	5,185	1,709	1,016
Duchschnitt	0,239	0,180	0,090	0,271	0,250	0,223

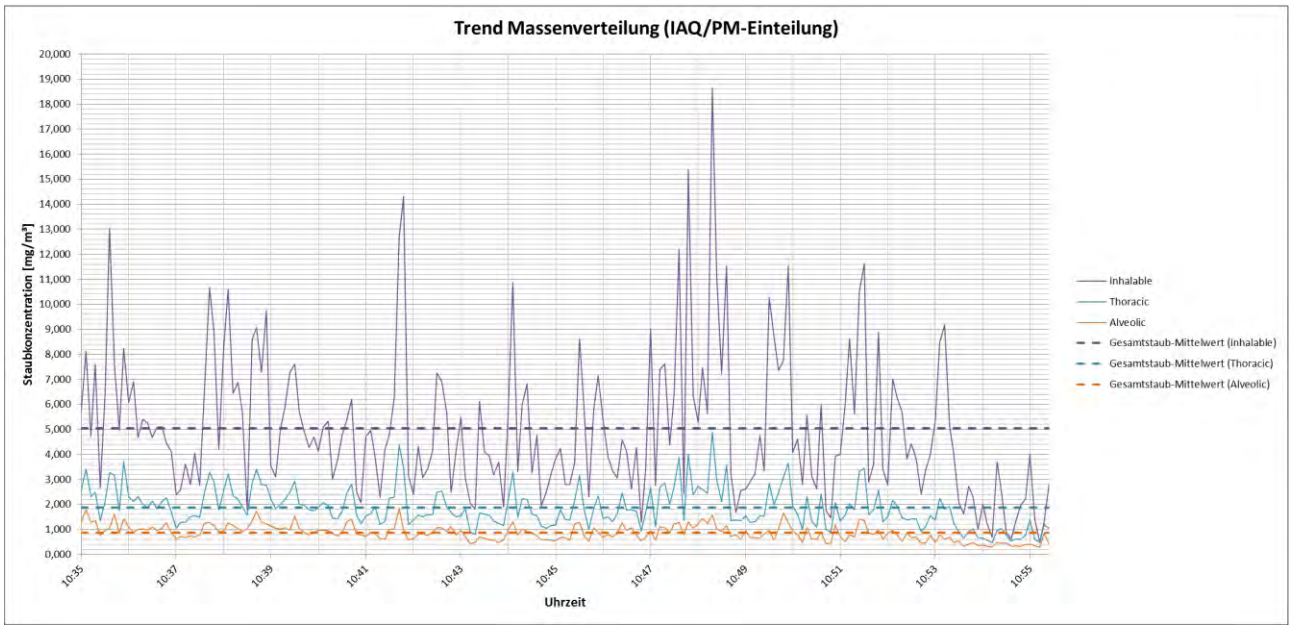
- **comments:**

no comments

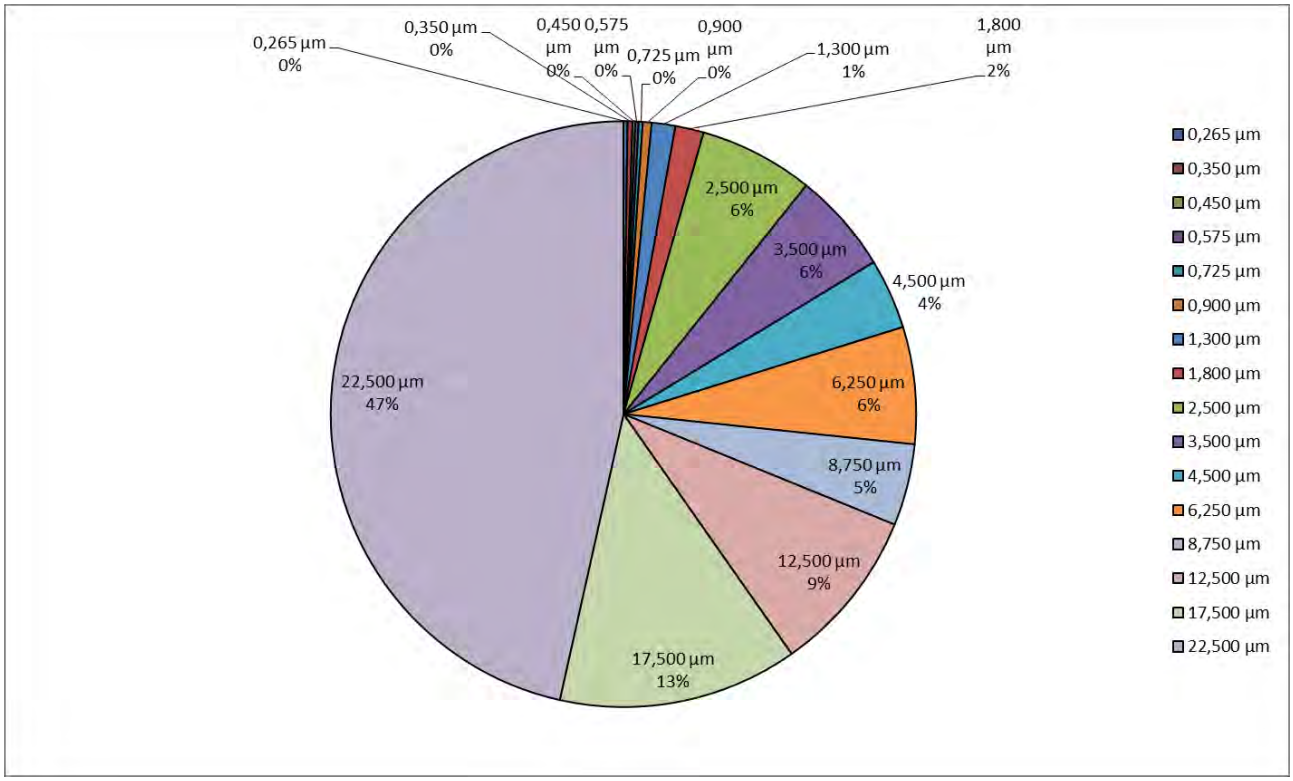
campaign 3

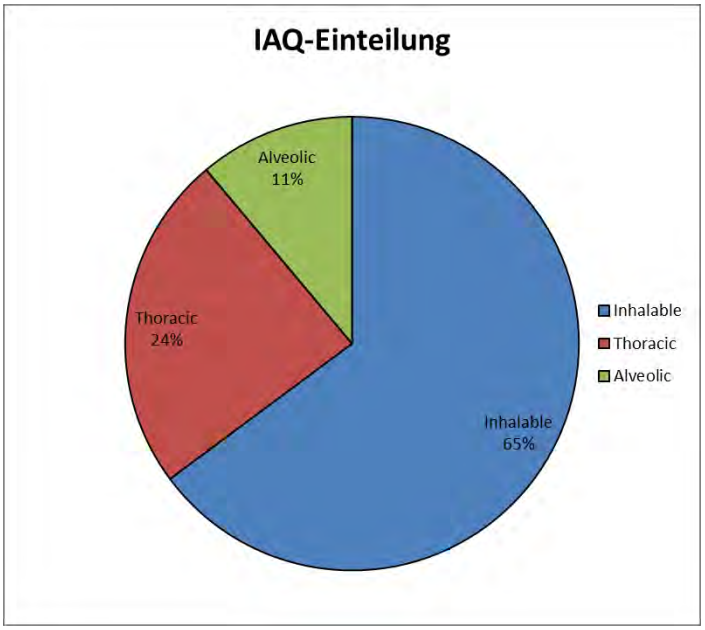
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,007	0,010	0,004	0,006	0,005	0,007	0,019	0,000	0,075	0,068	0,044	0,045	0,000	0,000	0,000	0,000
Maximum	0,019	0,022	0,011	0,018	0,033	0,063	0,167	0,329	0,786	0,750	0,653	0,952	0,970	1,595	2,586	11,020
Duchschnitt	0,011	0,014	0,008	0,009	0,011	0,025	0,065	0,079	0,318	0,281	0,195	0,324	0,227	0,458	0,666	2,340

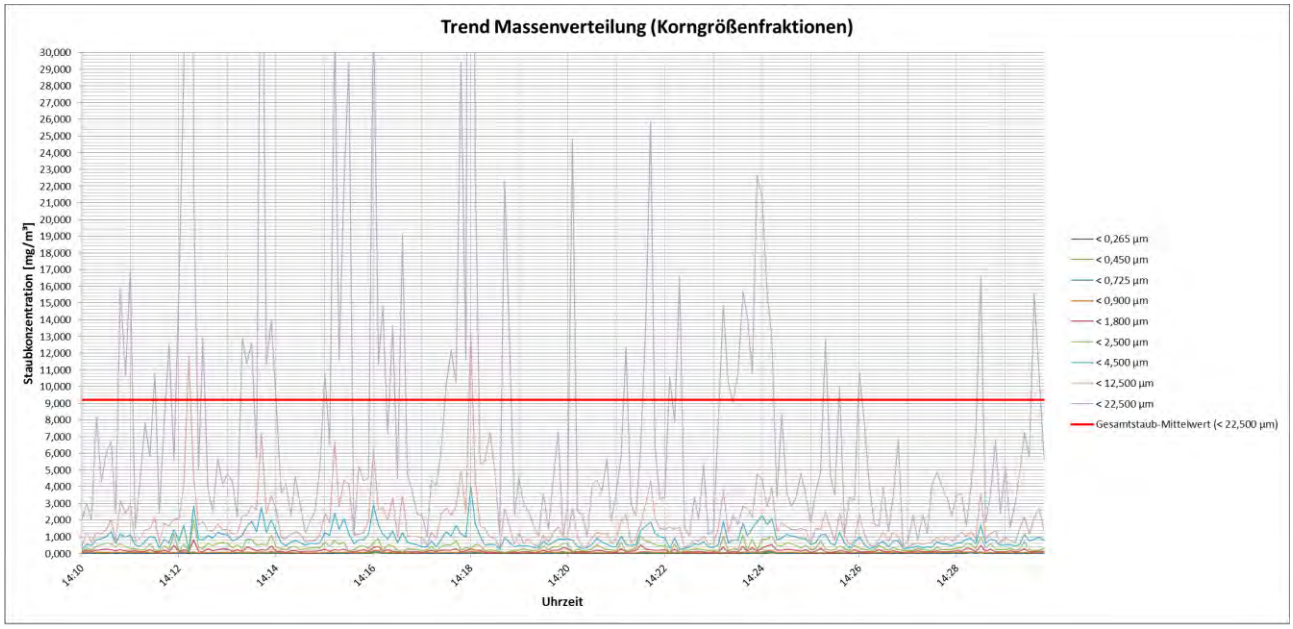
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,429	0,144	0,063	0,492	0,469	0,287
Maximum	3,921	0,933	0,239	18,641	4,886	1,846
Duchschnitt	1,594	0,410	0,115	5,043	1,872	0,864

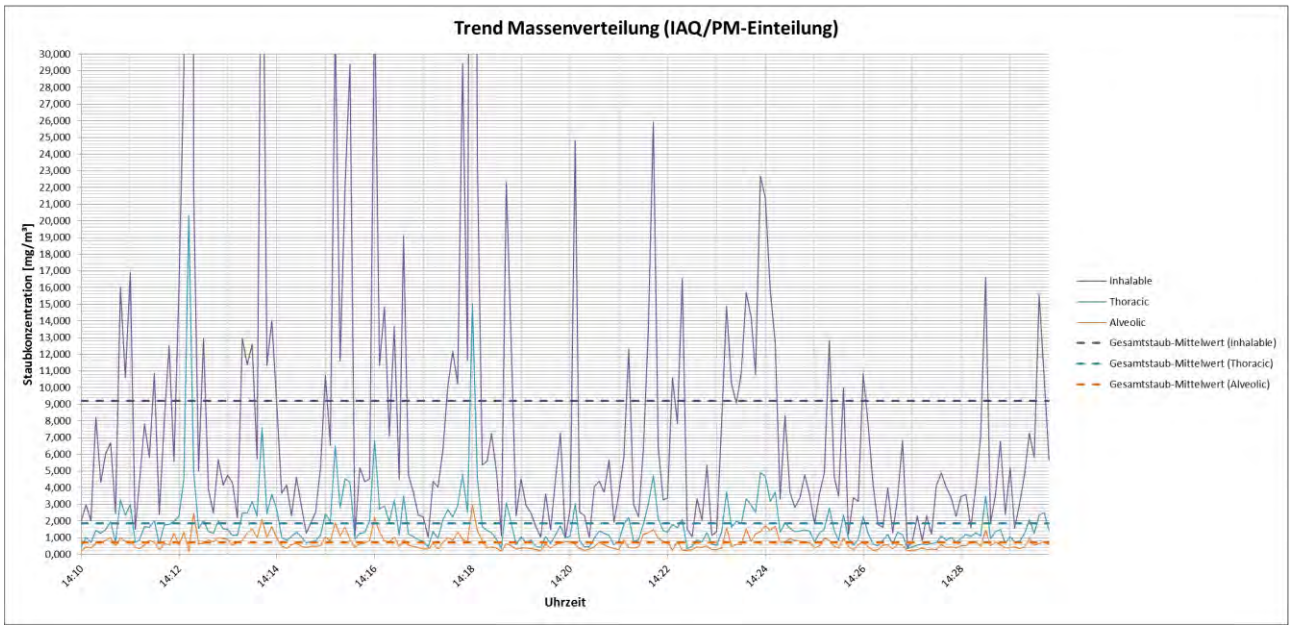
- **comments:**

no comments

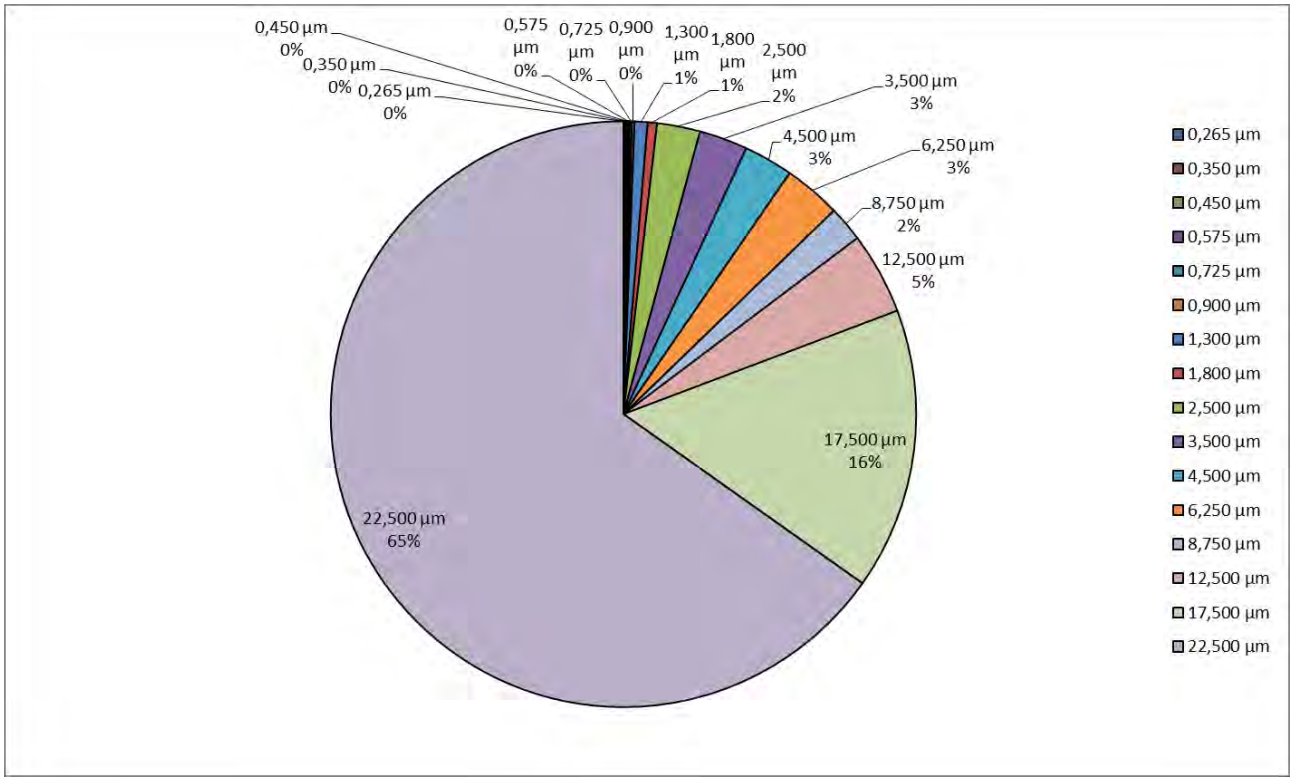
campaign 4

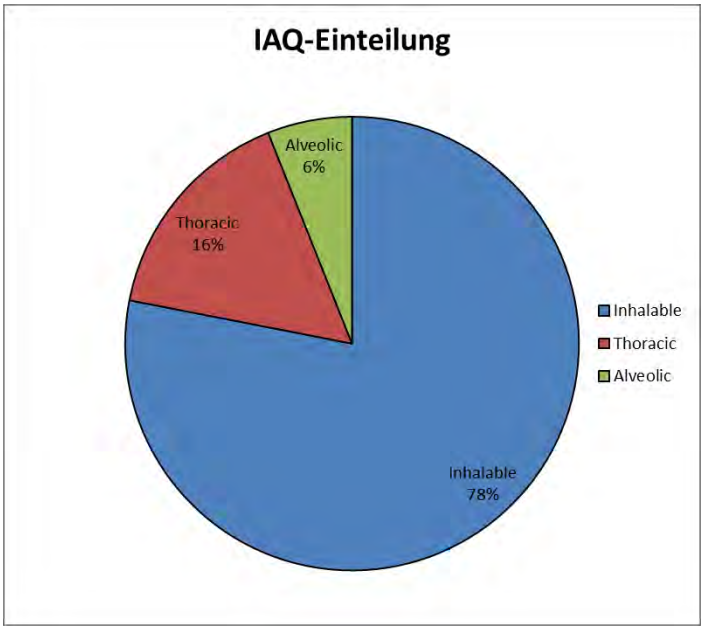
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,005	0,006	0,003	0,004	0,003	0,003	0,018	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Maximum	0,013	0,016	0,009	0,032	0,042	0,048	0,220	0,484	1,205	1,133	2,618	3,661	2,536	11,672	59,480	200,091
Duchschnitt	0,008	0,009	0,005	0,009	0,011	0,013	0,066	0,047	0,219	0,246	0,251	0,291	0,181	0,416	1,432	6,004

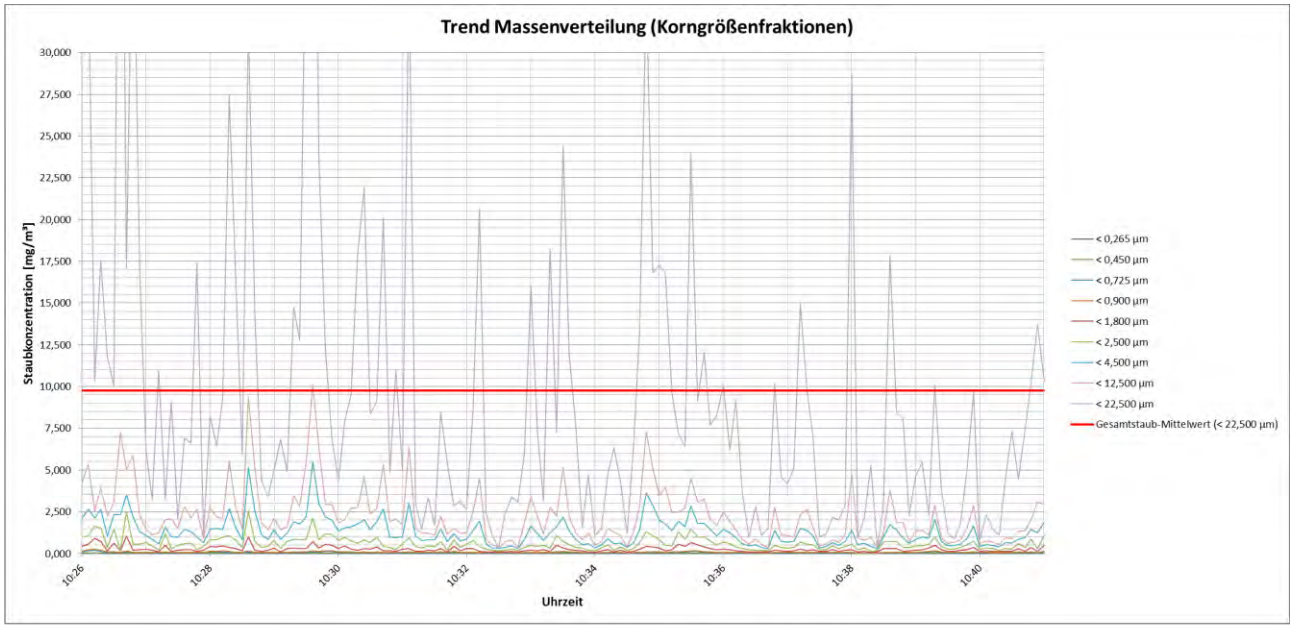
Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,300	0,053	0,035	0,413	0,362	0,184
Maximum	10,258	1,416	0,251	271,371	20,308	2,964
Duchschnitt	1,428	0,303	0,087	9,217	1,879	0,712

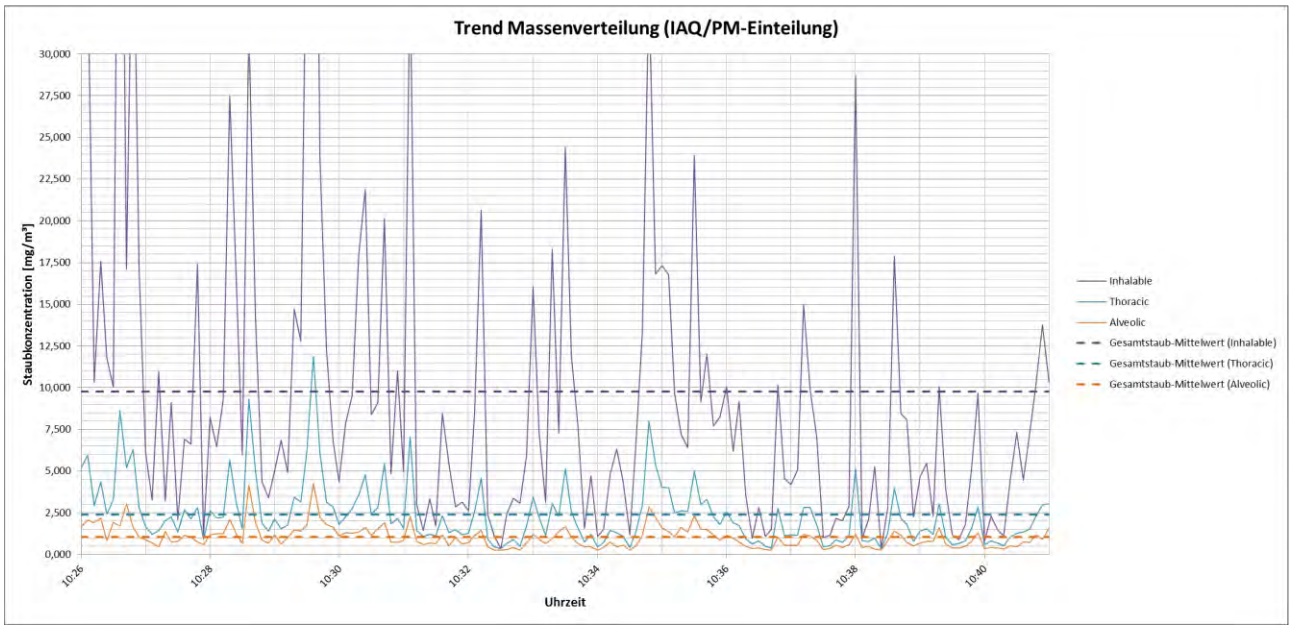
- **comments:**

no comments

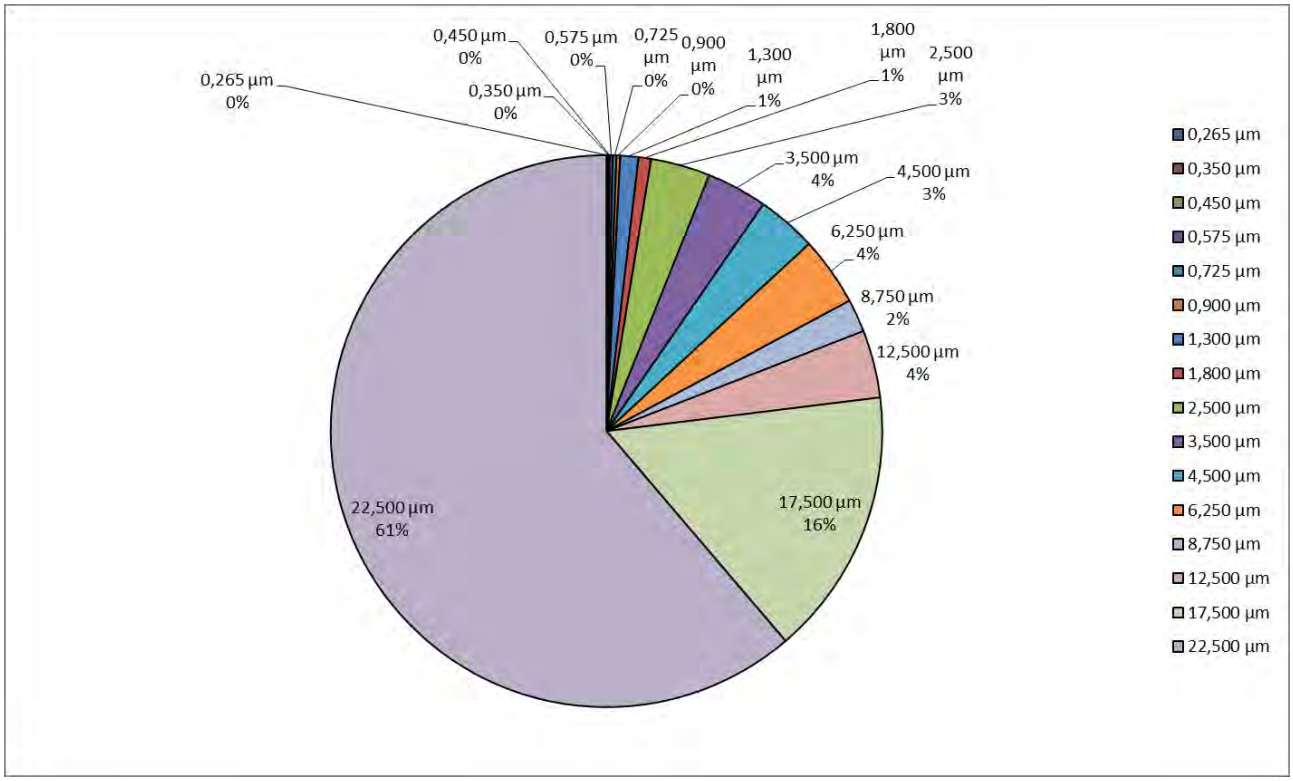
campaign 5

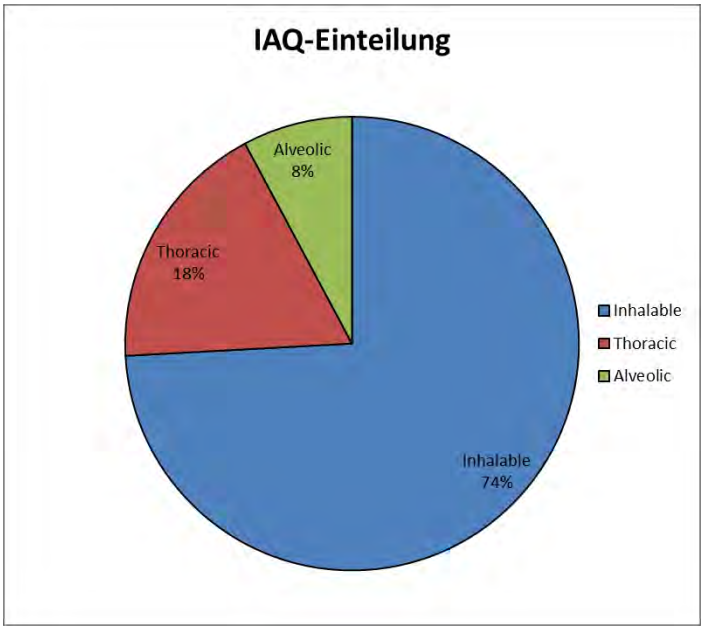
dust monitoring (Aerosol spectrometer)





particle size distribution





Statistik																
	[mg/m³]															
	0,265 µm	0,350 µm	0,450 µm	0,575 µm	0,725 µm	0,900 µm	1,300 µm	1,800 µm	2,500 µm	3,500 µm	4,500 µm	6,250 µm	8,750 µm	12,500 µm	17,500 µm	22,500 µm
Minimum	0,003	0,004	0,003	0,009	0,007	0,007	0,031	0,000	0,000	0,062	0,041	0,027	0,000	0,000	0,000	0,000
Maximum	0,014	0,018	0,013	0,067	0,083	0,079	0,370	0,595	1,533	1,642	1,674	1,985	1,119	2,247	11,538	43,498
Duchschnitt	0,006	0,007	0,005	0,017	0,021	0,021	0,104	0,072	0,339	0,347	0,342	0,394	0,188	0,386	1,533	5,980

Statistik						
	[mg/m³]					
	PM10	PM2,5	PM1	Inhalable	Thoracic	Alveolic
Minimum	0,321	0,119	0,048	0,345	0,343	0,247
Maximum	8,615	1,824	0,392	65,153	11,884	4,265
Duchschnitt	1,879	0,453	0,119	9,771	2,378	1,031

- **comments:**

no comments

8. SUMMARISATION OF THE MEASUREMENT RESULTS

Sinter Cooler D

data	campaing 1	campaign 2	campaign 3	campaign 4	campaign 5	campaign 6	campaign 7
measurement point	mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	mg/m³
D 4.2g	3,65	0,93					
D 4.2a	1,82	1,98		7,54			
D 4.3a		1,93	10,98	2,24	9,95		
D 1.2g	0,53	0,96					
D 1.2a	0,82	0,85	3,12	1,64	3,27		
D 1.3a			2,15	3,23	3,12		
D 2.2g	1,43	0,41				0,86	3,54
D 2.2a	1,59	2,77	4,39	4,29		0,88	1,45
D 2.3a	2,52	1,56	3,04	3,47			
D 3.2g	2,66	0,49				2,49	0,97
D 3.2a	2,94	4,29	3,57	3,42		1,10	1,04
D 3.3a		1,07	0,99	4,69	8,81		

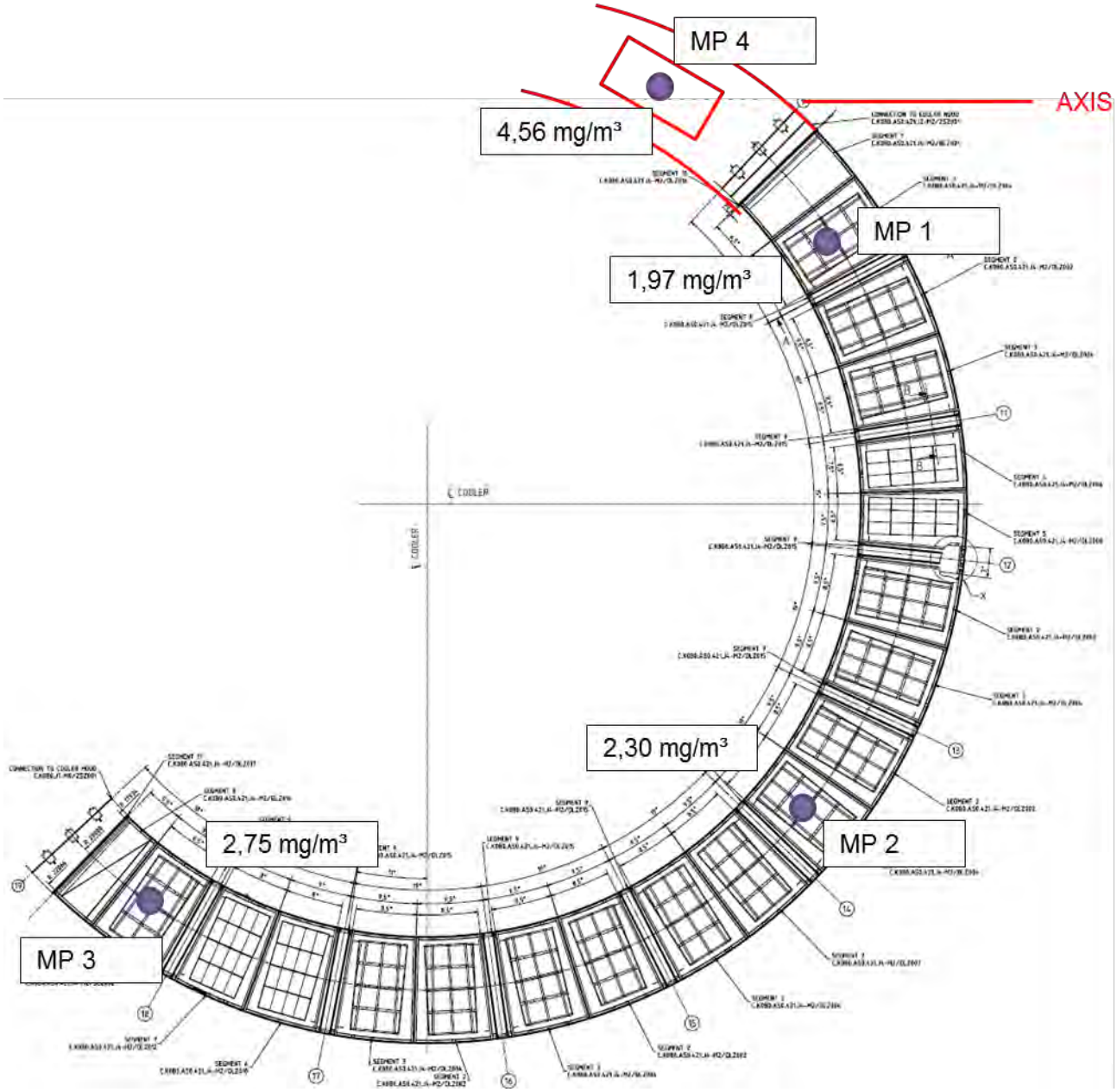
Sinter Cooler E

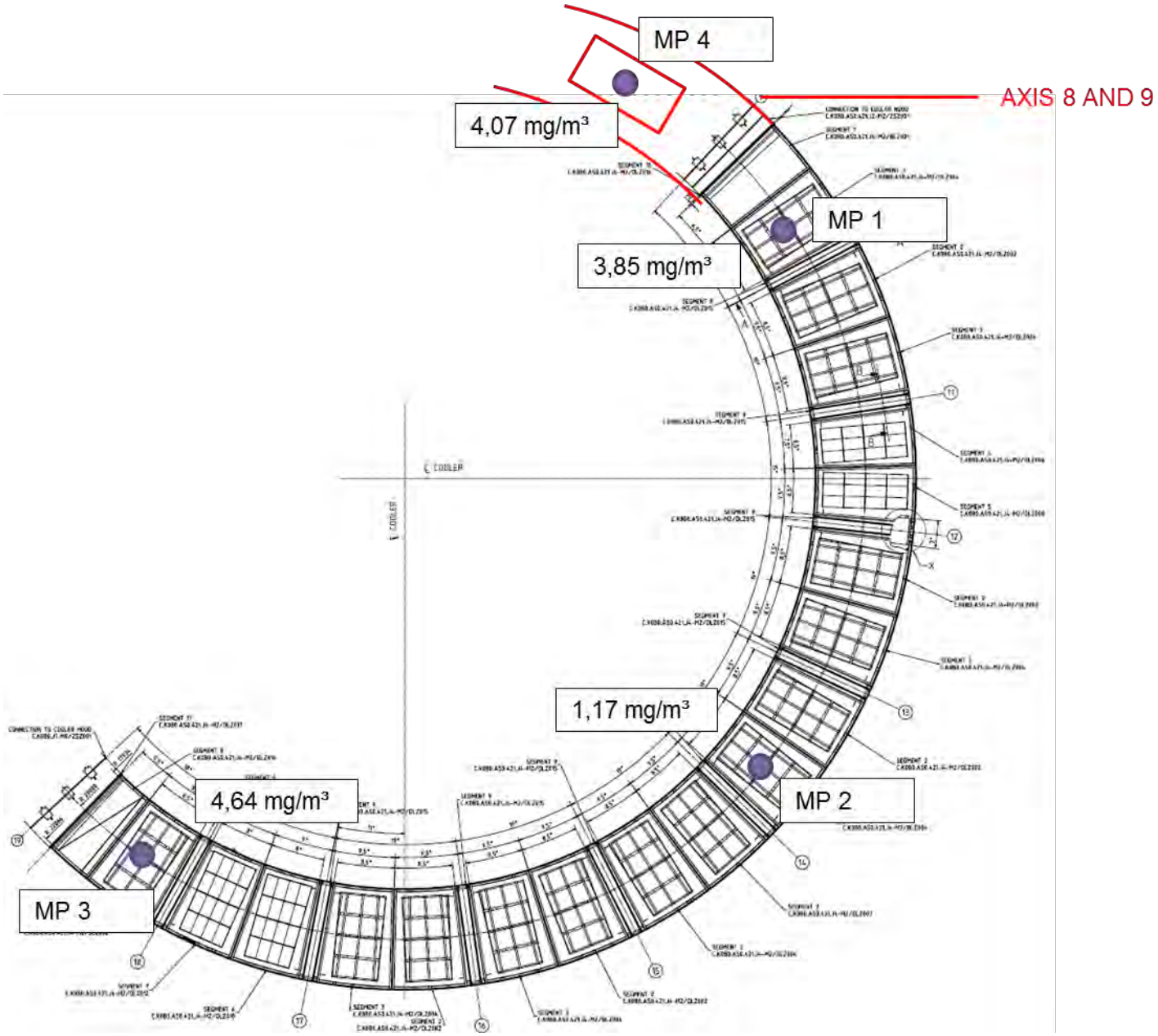
data	campaing 1	campaign 2	campaign 3	campaign 4	campaign 5	campaign 6	campaign 7
measurement point	mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	mg/m³
E 4.2g	0,21	1,31					
E 4.2a	1,44		4,83	10,50			
E 4.3a	1,59	0,88	3,33	12,56			
E 1.2g	0,55	1,37					
E 1.2a			3,51	3,71	2,47	4,23	
E 1.3a			7,80	4,47	4,36	6,03	
E 2.2g	0,54	0,26					
E 2.2a	0,59		1,84	2,54			
E 2.3a	0,80		1,68	1,36	0,94		
E 3.2g	0,12						
E 3.2a	0,11			7,69	4,87		
E 3.3a	0,27		5,04	9,22	9,77		

9. INTERPRETATION OF THE MEASUREMENT RESULTS AND DISCUSSION

With the measurement results from the summarisation, for each measurement point a single, mean dust concentration can be calculated. The results are displayed in the following illustration:

Sinter Cooler D





As the illustrations show, the dust emitted is the highest at the material charge and discharge for both sinter coolers. However, the dust emitted for sinter cooler D is highest at the material charge, whether for sinter cooler E it is highest at the material discharge.

In total the mean dust concentration for each measurement point is below 10 mg/m³. Only for three single measurements the emitted dust concentration has been measured slightly higher than 10 mg/m³.

In our opinion, the discrepancy of the measurement values is the result of different modes of operation of the sinter cooler. (e.g. measurement of the start-up procedure of a sinter cooler)

However the start-up procedure is part of the usual operation of the sinter cooler and describes a usual operating state. Single higher measurement values for certain measurement points can be caused by different moments of sampling and different operating conditions of the sinter cooler. The discrepancy of single measurements requires for an evaluation to be carried out. This was done by statistical evaluation of all the measurements performed at a single measurement point. The mentioned difference between sinter cooler E and sinter cooler D refers to the measurement points, where the highest dust concentration has been measured, only. If the two sinter coolers are compared directly, a basic difference in the mean dust concentration cannot be derived. This is evident by comparing the total means for each of the sinter coolers.

Mean dust concentration Sinter cooler D= 2,89 [mg/Nm3]
Mean dust concentration Sinter cooler E= 3,43 [mg/Nm3]

In our opinion, when considering the amount of samples and the different moments of sampling, the difference between both sinter coolers is not significant. The difference in dust concentration appears in the location of higher dust concentration. (material charge for cooler D and material discharge for cooler E)

If both sinter coolers are taken into consideration as a whole, we can conclude for the emitted dust concentration (for both sinter coolers) to be below 10mg/m³.

10. ANNOTATION

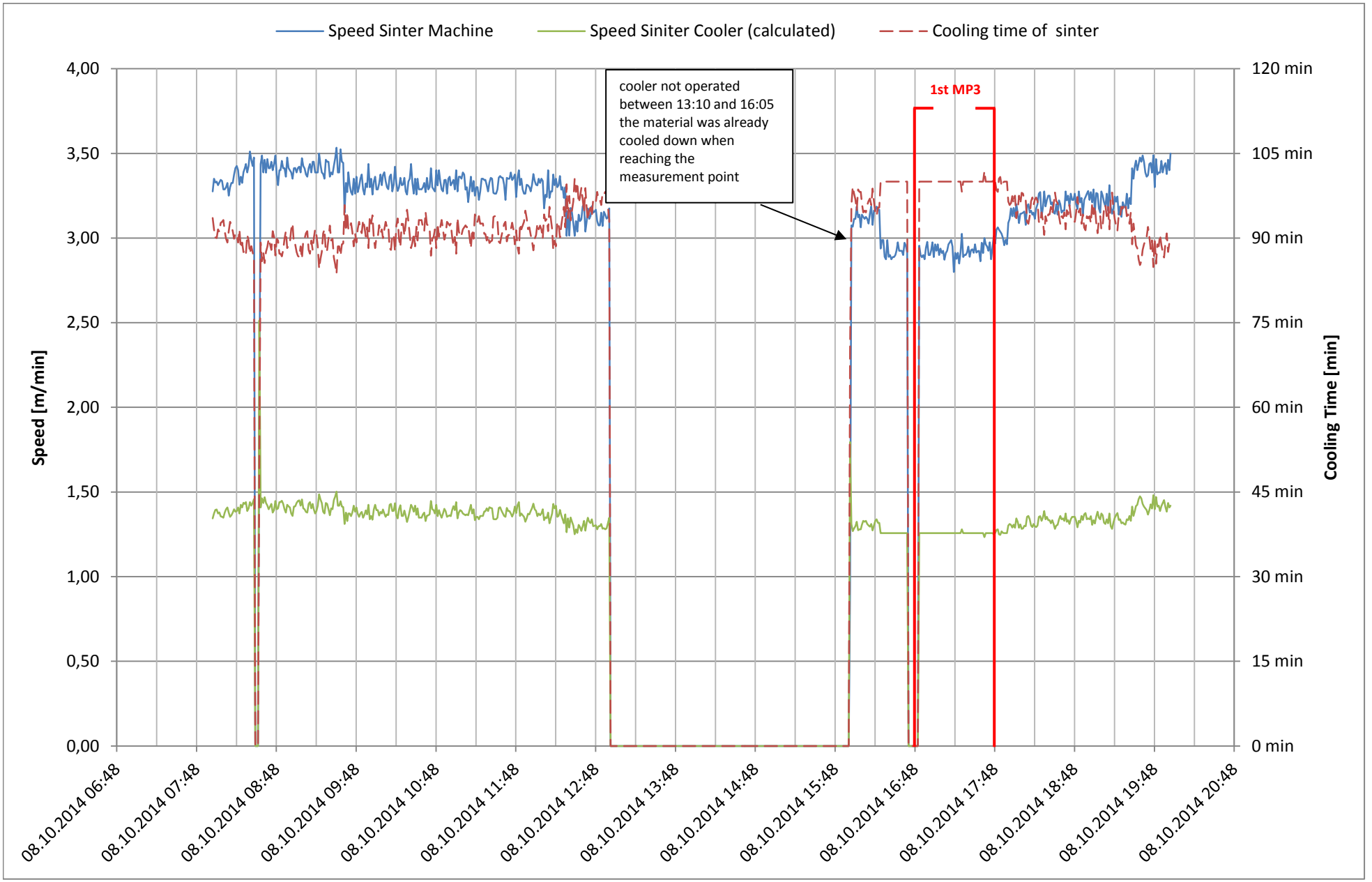
The results relate only to the time of the measurement system prevailing operating conditions, taking into account the applied measurement methods and procedures. We are committed to confidentiality of information known to us, methods and analysis results to third parties. This report may not be reproduced in part without permission.

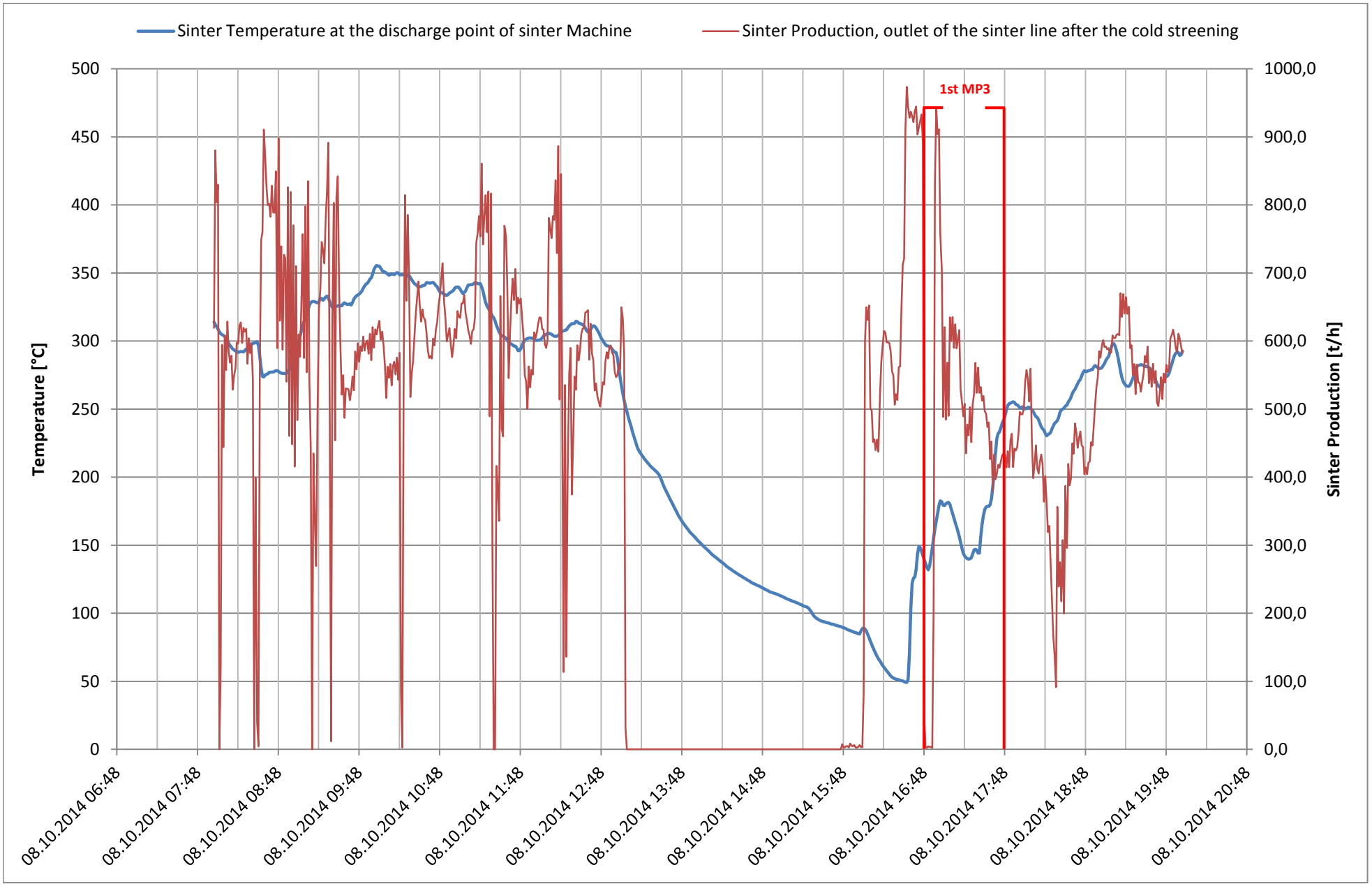
KAPPA
Filter Systems GmbH

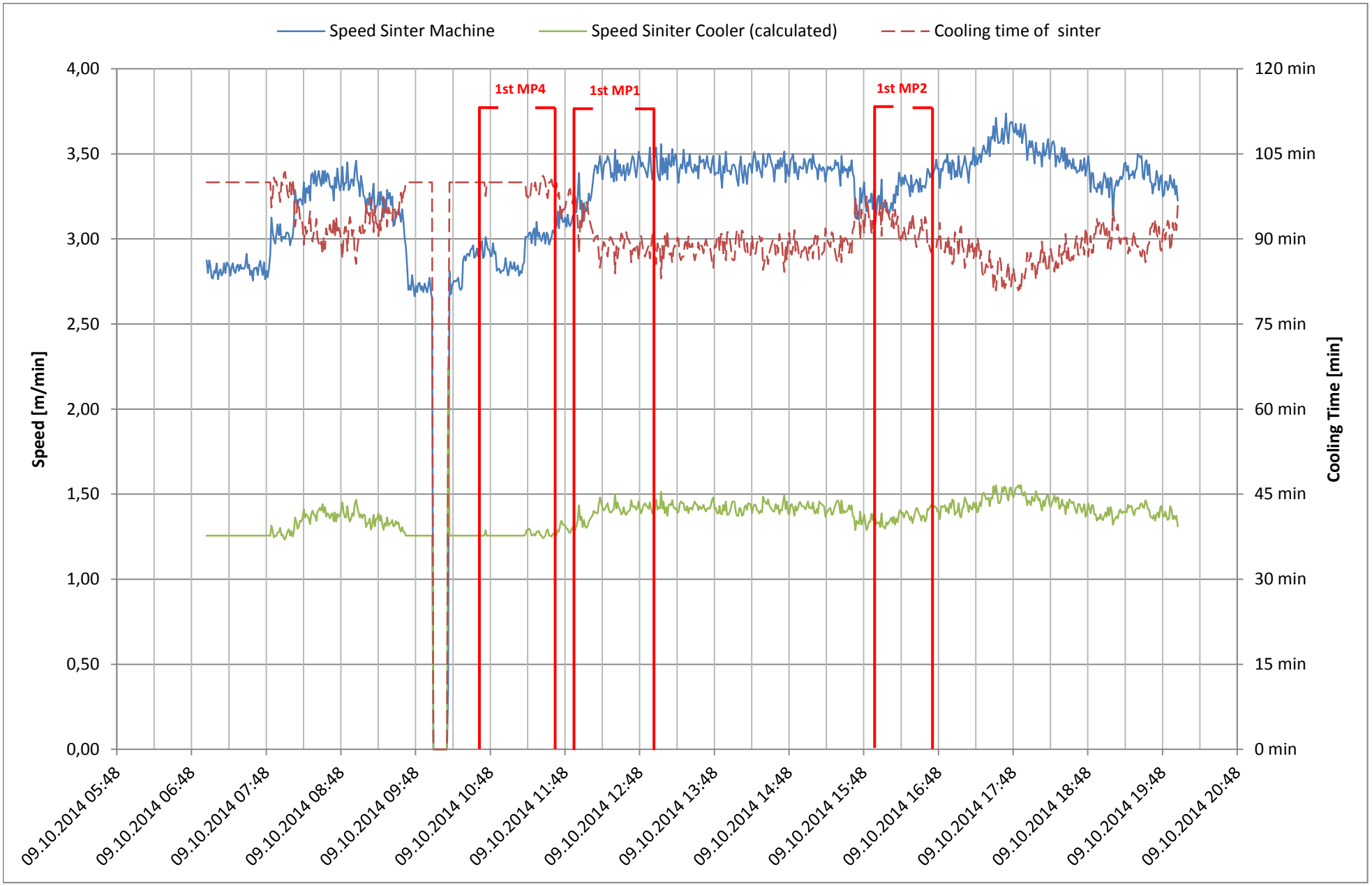
		date	signature
measurement execution:	Mr. Aschauer, Dominik Mr. Huber, Helmut Mr. Tscheliesnig, Martin	11.06.2015	
report generation:	Mr. Aschauer, Dominik Mr. Huber, Helmut Mr. Tscheliesnig, Martin	11.06.2015	
responsible technician in measurement technology:	Mr. Aschauer, Dominik	11.06.2015	
project management:	Ing. Mag. Krüger, Klaus	16.06.2015	

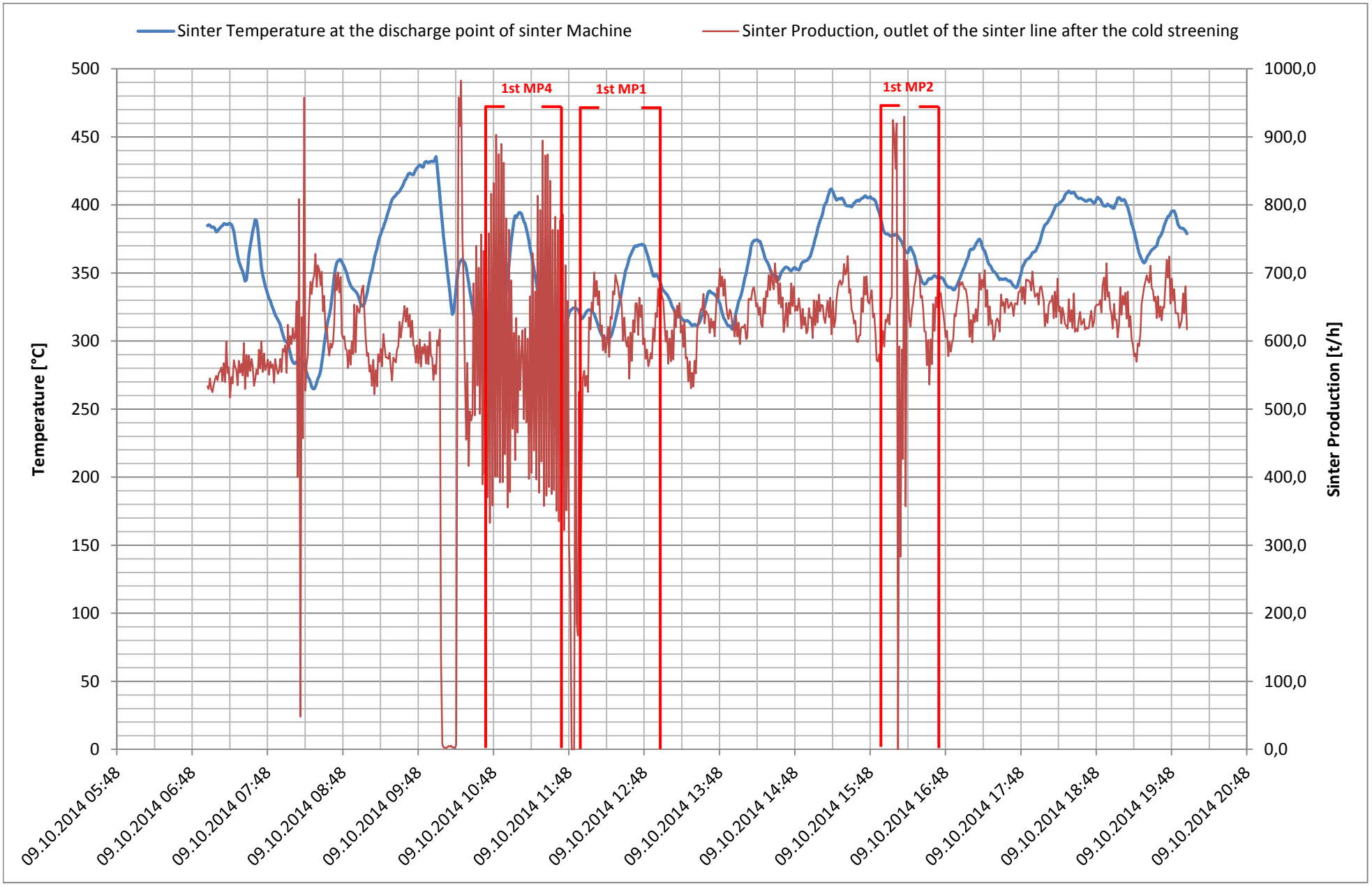
ANNEX

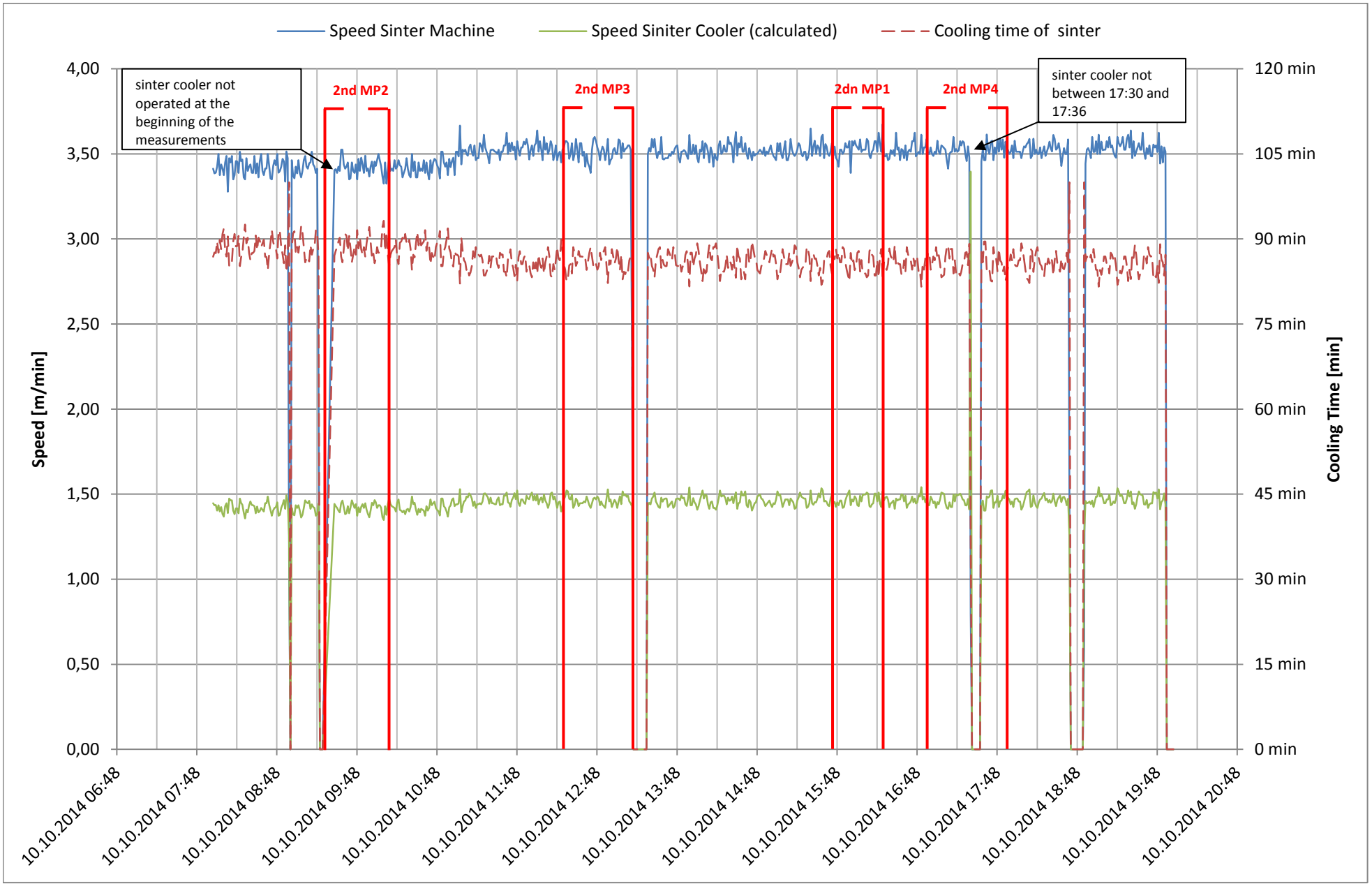
- Operational data of the sinter cooler (collected by ILVA)

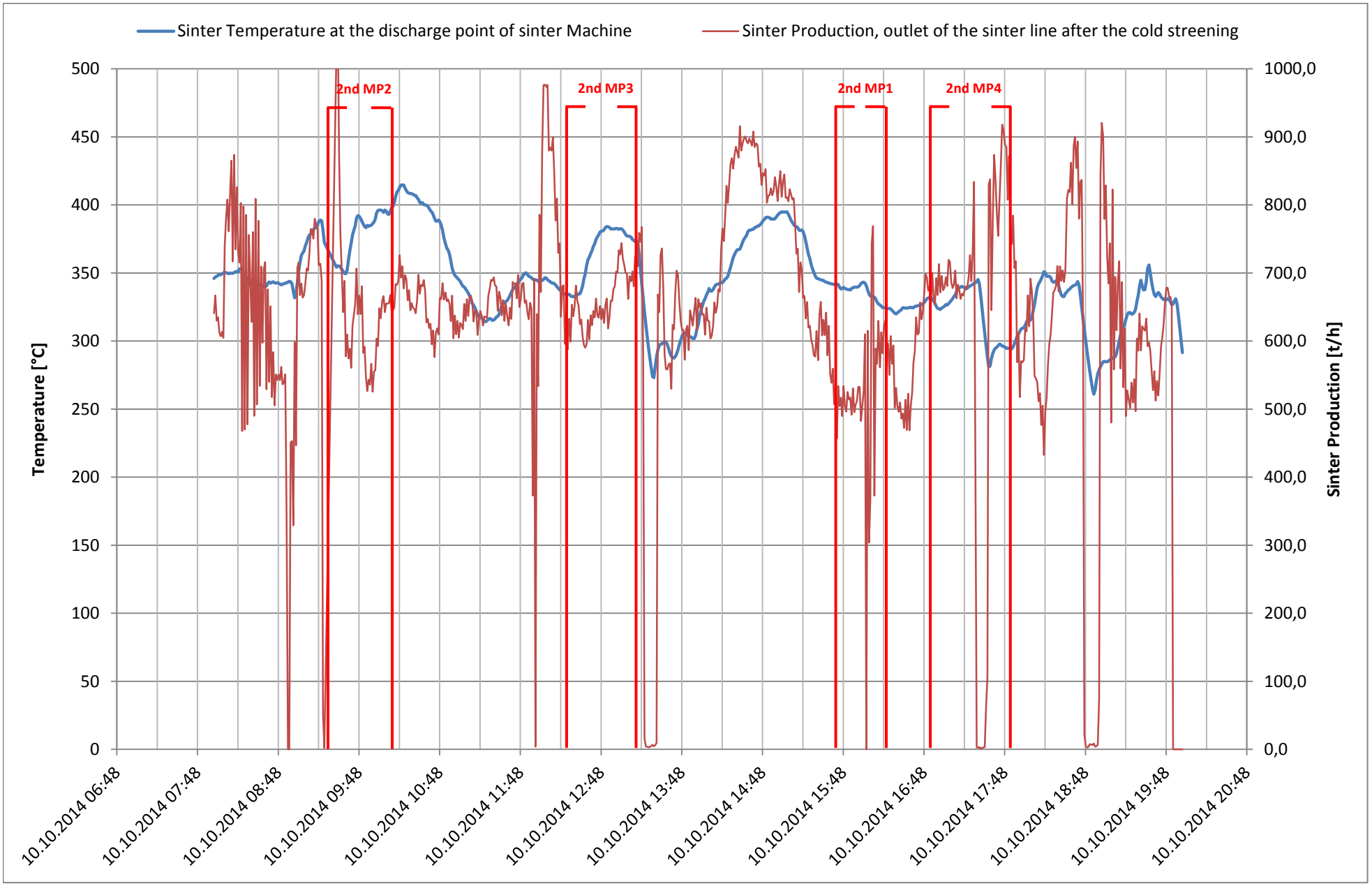

Speed Sinter Machine
Speed Siniter Cooler (calculated)
Cooling time of sinter
cooler not operated between 13:10 and 16:05 the material was already cooled down when reaching the measurement point
1st MP3
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
45 min
30 min
15 min
0 min
08.10.2014 06:48
08.10.2014 07:48
08.10.2014 08:48
08.10.2014 09:48
08.10.2014 10:48
08.10.2014 11:48
08.10.2014 12:48
08.10.2014 13:48
08.10.2014 14:48
08.10.2014 15:48
08.10.2014 16:48
08.10.2014 17:48
08.10.2014 18:48
08.10.2014 19:48
08.10.2014 20:48


Sinter Temperature at the discharge point of sinter Machine
Sinter Production, outlet of the sinter line after the cold streening
1st MP3
Temperature [°C]
Sinter Production [t/h]
500
450
400
350
300
250
200
150
100
50
0
1000,0
900,0
800,0
700,0
600,0
500,0
400,0
300,0
200,0
100,0
0,0
08.10.2014 06:48
08.10.2014 07:48
08.10.2014 08:48
08.10.2014 09:48
08.10.2014 10:48
08.10.2014 11:48
08.10.2014 12:48
08.10.2014 13:48
08.10.2014 14:48
08.10.2014 15:48
08.10.2014 16:48
08.10.2014 17:48
08.10.2014 18:48
08.10.2014 19:48
08.10.2014 20:48

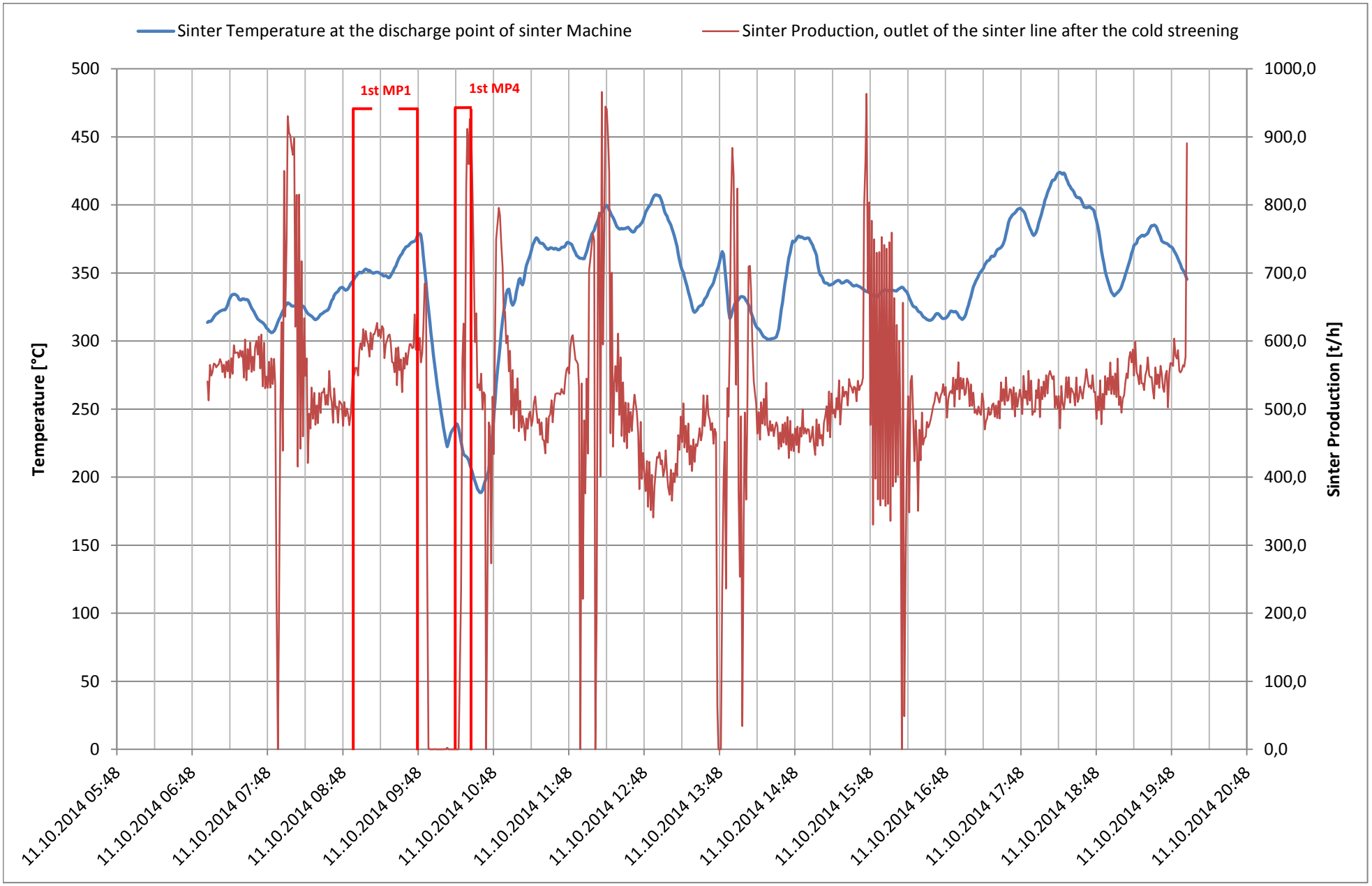

Speed Sinter Machine
Speed Siniter Cooler (calculated)
Cooling time of sinter
1st MP4
1st MP1
1st MP2
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
45 min
30 min
15 min
0 min
09.10.2014 05:48
09.10.2014 06:48
09.10.2014 07:48
09.10.2014 08:48
09.10.2014 09:48
09.10.2014 10:48
09.10.2014 11:48
09.10.2014 12:48
09.10.2014 13:48
09.10.2014 14:48
09.10.2014 15:48
09.10.2014 16:48
09.10.2014 17:48
09.10.2014 18:48
09.10.2014 19:48
09.10.2014 20:48

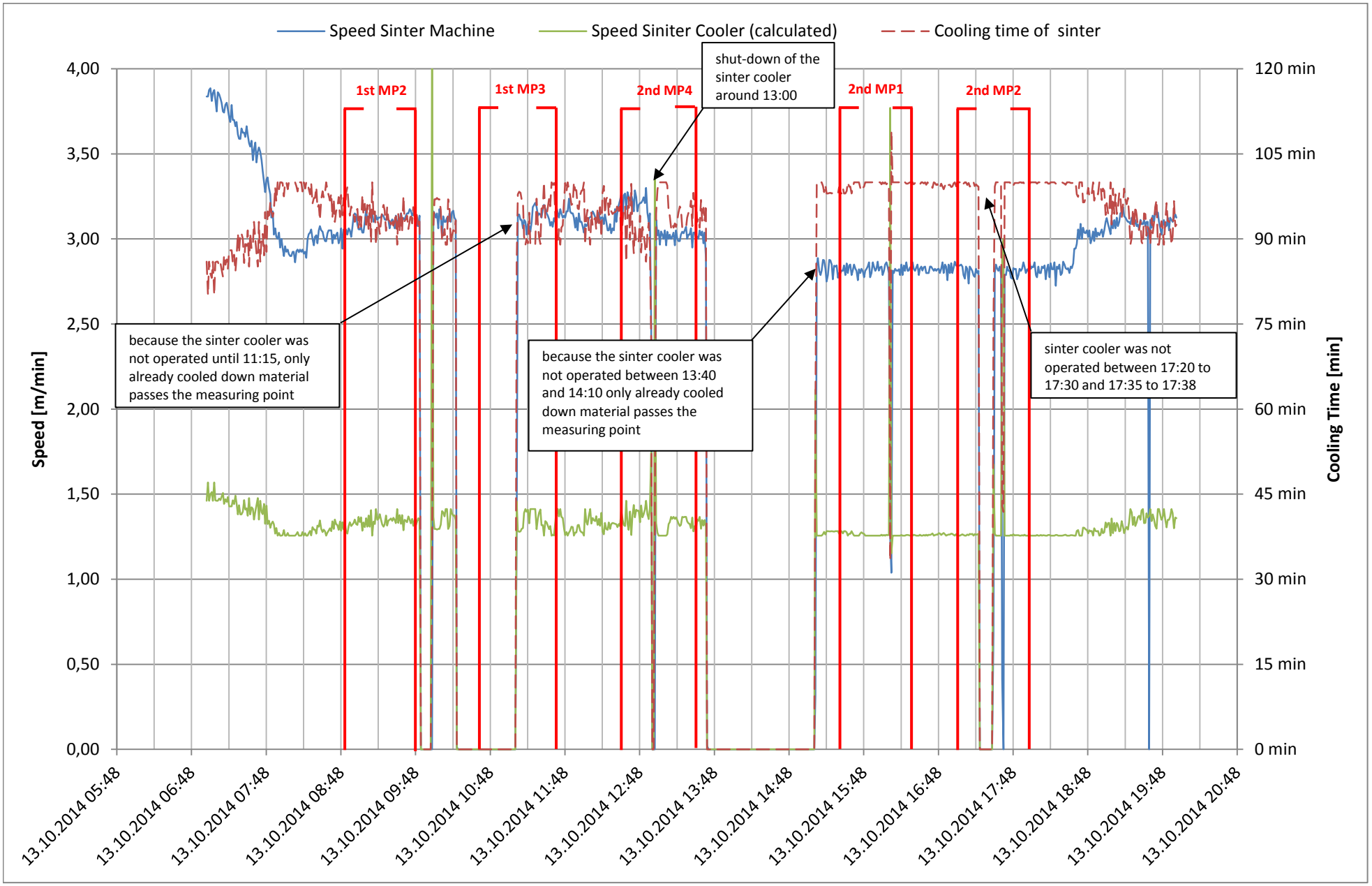

Sinter Temperature at the discharge point of sinter Machine
Sinter Production, outlet of the sinter line after the cold streening
1st MP4
1st MP1
1st MP2
Temperature [°C]
Sinter Production [t/h]
500
450
400
350
300
250
200
150
100
50
0
1000,0
900,0
800,0
700,0
600,0
500,0
400,0
300,0
200,0
100,0
0,0
09.10.2014 05:48
09.10.2014 06:48
09.10.2014 07:48
09.10.2014 08:48
09.10.2014 09:48
09.10.2014 10:48
09.10.2014 11:48
09.10.2014 12:48
09.10.2014 13:48
09.10.2014 14:48
09.10.2014 15:48
09.10.2014 16:48
09.10.2014 17:48
09.10.2014 18:48
09.10.2014 19:48
09.10.2014 20:48

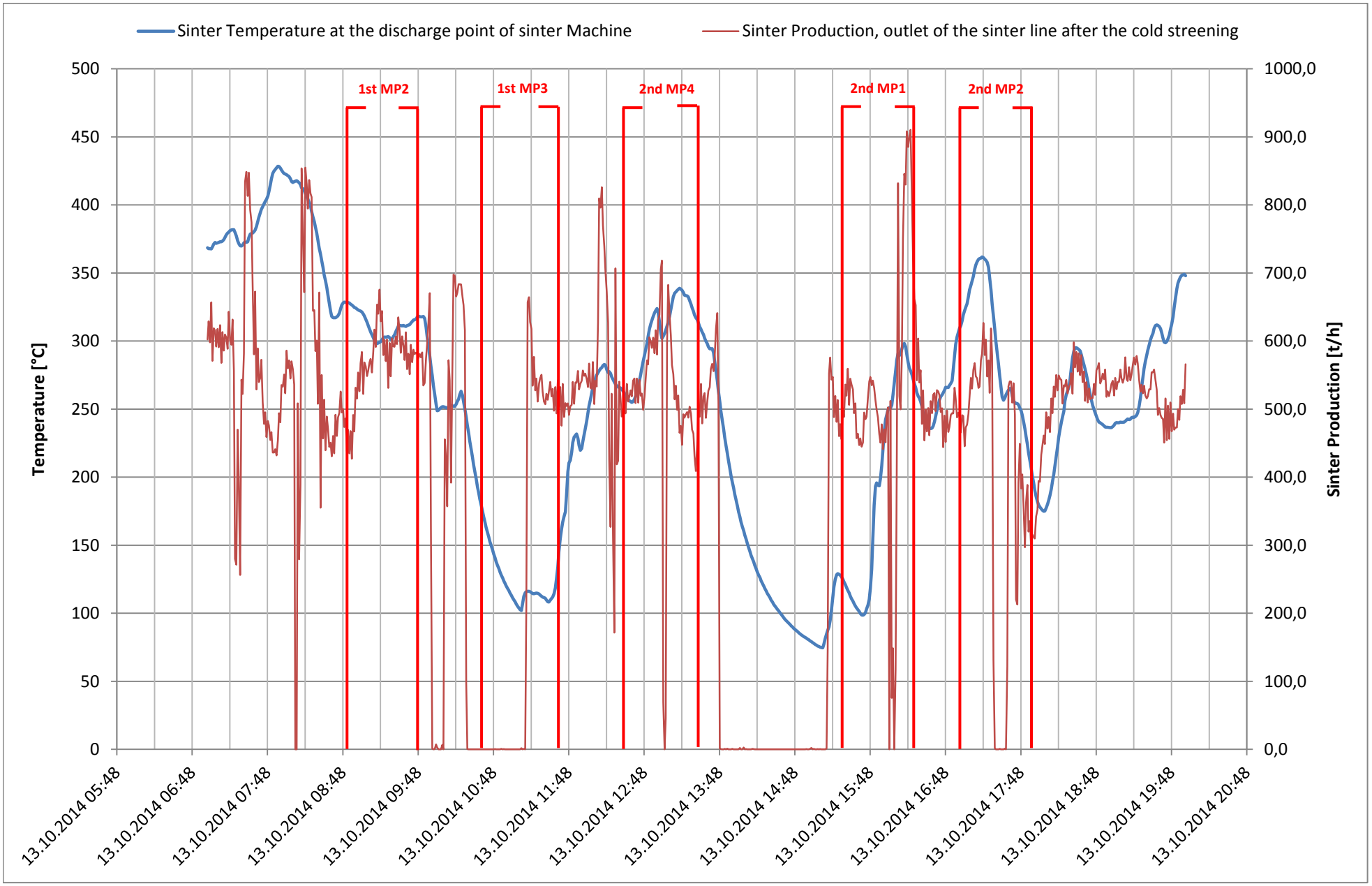

Speed Sinter Machine
Speed Siniter Cooler (calculated)
Cooling time of sinter
sinter cooler not operated at the beginning of the measurements
2nd MP2
2nd MP3
2dn MP1
2nd MP4
sinter cooler not between 17:30 and 17:36
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
45 min
30 min
15 min
0 min
10.10.2014 06:48
10.10.2014 07:48
10.10.2014 08:48
10.10.2014 09:48
10.10.2014 10:48
10.10.2014 11:48
10.10.2014 12:48
10.10.2014 13:48
10.10.2014 14:48
10.10.2014 15:48
10.10.2014 16:48
10.10.2014 17:48
10.10.2014 18:48
10.10.2014 19:48
10.10.2014 20:48

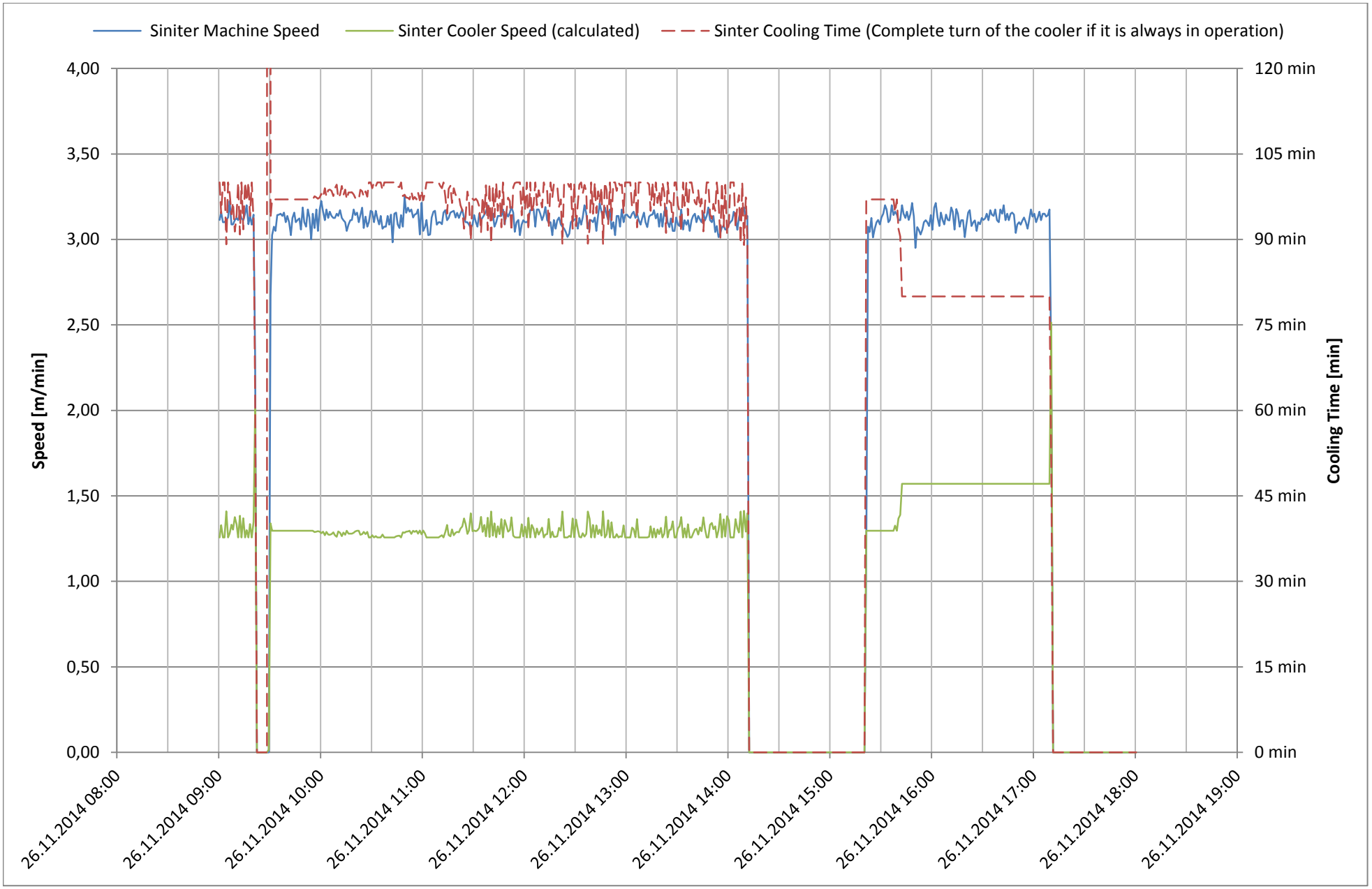

Sinter Temperature at the discharge point of sinter Machine
Sinter Production, outlet of the sinter line after the cold streening
2nd MP2
2nd MP3
2nd MP1
2nd MP4
Temperature [°C]
Sinter Production [t/h]
500
450
400
350
300
250
200
150
100
50
0
1000,0
900,0
800,0
700,0
600,0
500,0
400,0
300,0
200,0
100,0
0,0
10.10.2014 06:48
10.10.2014 07:48
10.10.2014 08:48
10.10.2014 09:48
10.10.2014 10:48
10.10.2014 11:48
10.10.2014 12:48
10.10.2014 13:48
10.10.2014 14:48
10.10.2014 15:48
10.10.2014 16:48
10.10.2014 17:48
10.10.2014 18:48
10.10.2014 19:48
10.10.2014 20:48

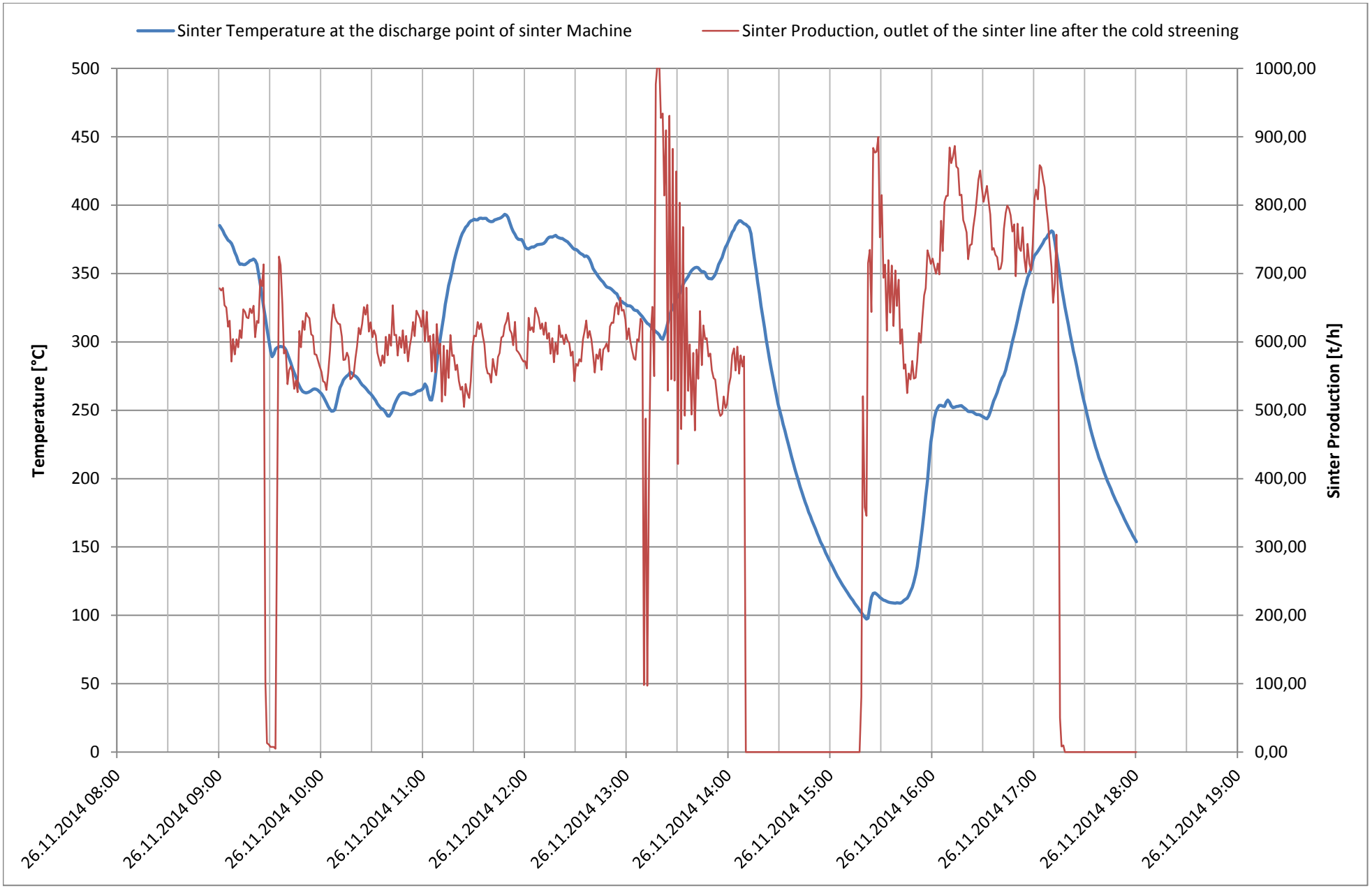

Speed Sinter Machine
Speed Siniter Cooler (calculated)
Cooling time of sinter
1st MP1
1st MP4
Defect of the cooling tower.
sinter cooler not operated between 09:50 and 10:10 and 10:30 to 10:32
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
45 min
30 min
15 min
0 min
11.10.2014 05:48
11.10.2014 06:48
11.10.2014 07:48
11.10.2014 08:48
11.10.2014 09:48
11.10.2014 10:48
11.10.2014 11:48
11.10.2014 12:48
11.10.2014 13:48
11.10.2014 14:48
11.10.2014 15:48
11.10.2014 16:48
11.10.2014 17:48
11.10.2014 18:48
11.10.2014 19:48
11.10.2014 20:48

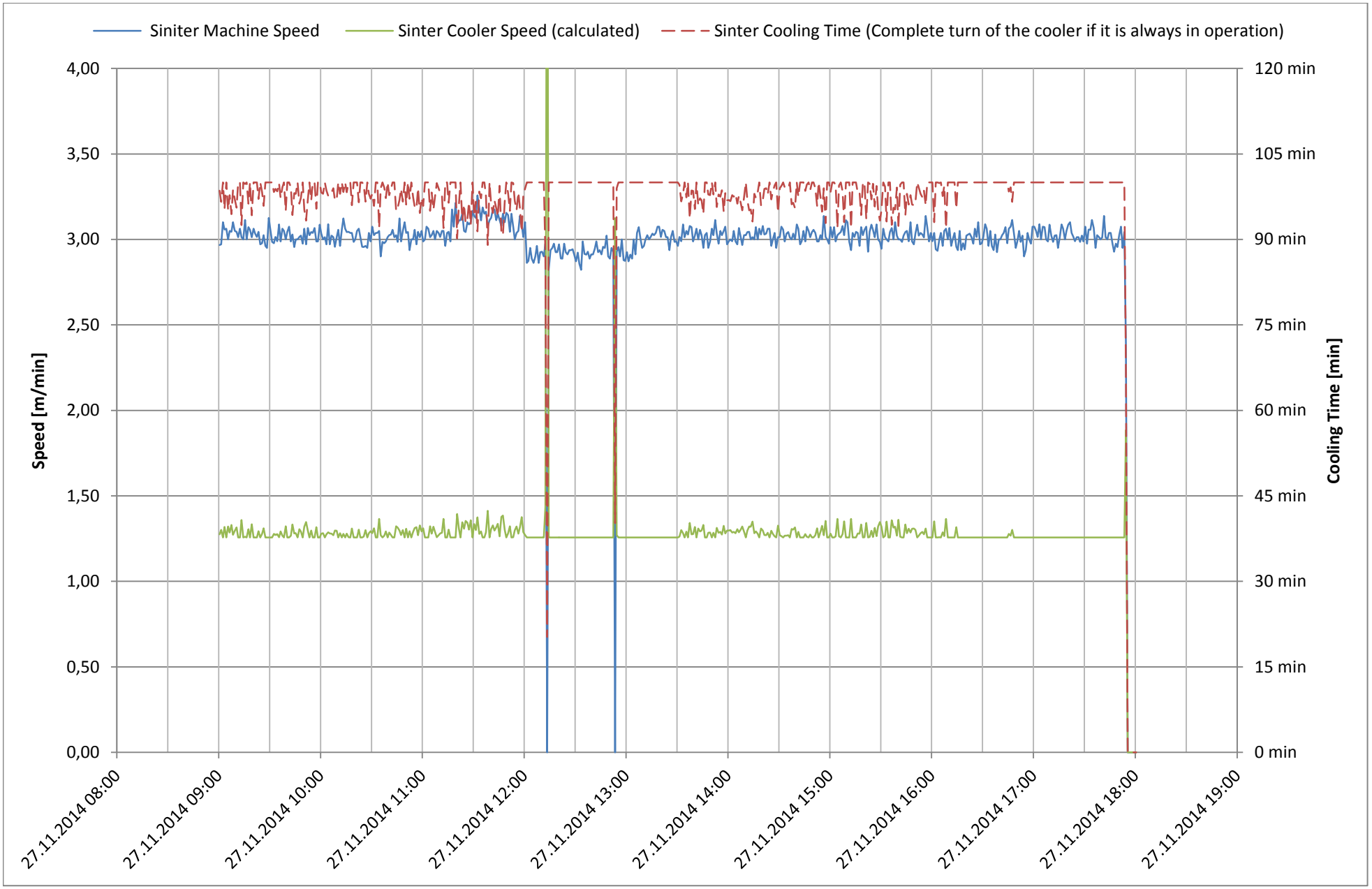

Sinter Temperature at the discharge point of sinter Machine
Sinter Production, outlet of the sinter line after the cold streening
1st MP1
1st MP4
Temperature [°C]
Sinter Production [t/h]
500
450
400
350
300
250
200
150
100
50
0
1000,0
900,0
800,0
700,0
600,0
500,0
400,0
300,0
200,0
100,0
0,0
11.10.2014 05:48
11.10.2014 06:48
11.10.2014 07:48
11.10.2014 08:48
11.10.2014 09:48
11.10.2014 10:48
11.10.2014 11:48
11.10.2014 12:48
11.10.2014 13:48
11.10.2014 14:48
11.10.2014 15:48
11.10.2014 16:48
11.10.2014 17:48
11.10.2014 18:48
11.10.2014 19:48
11.10.2014 20:48

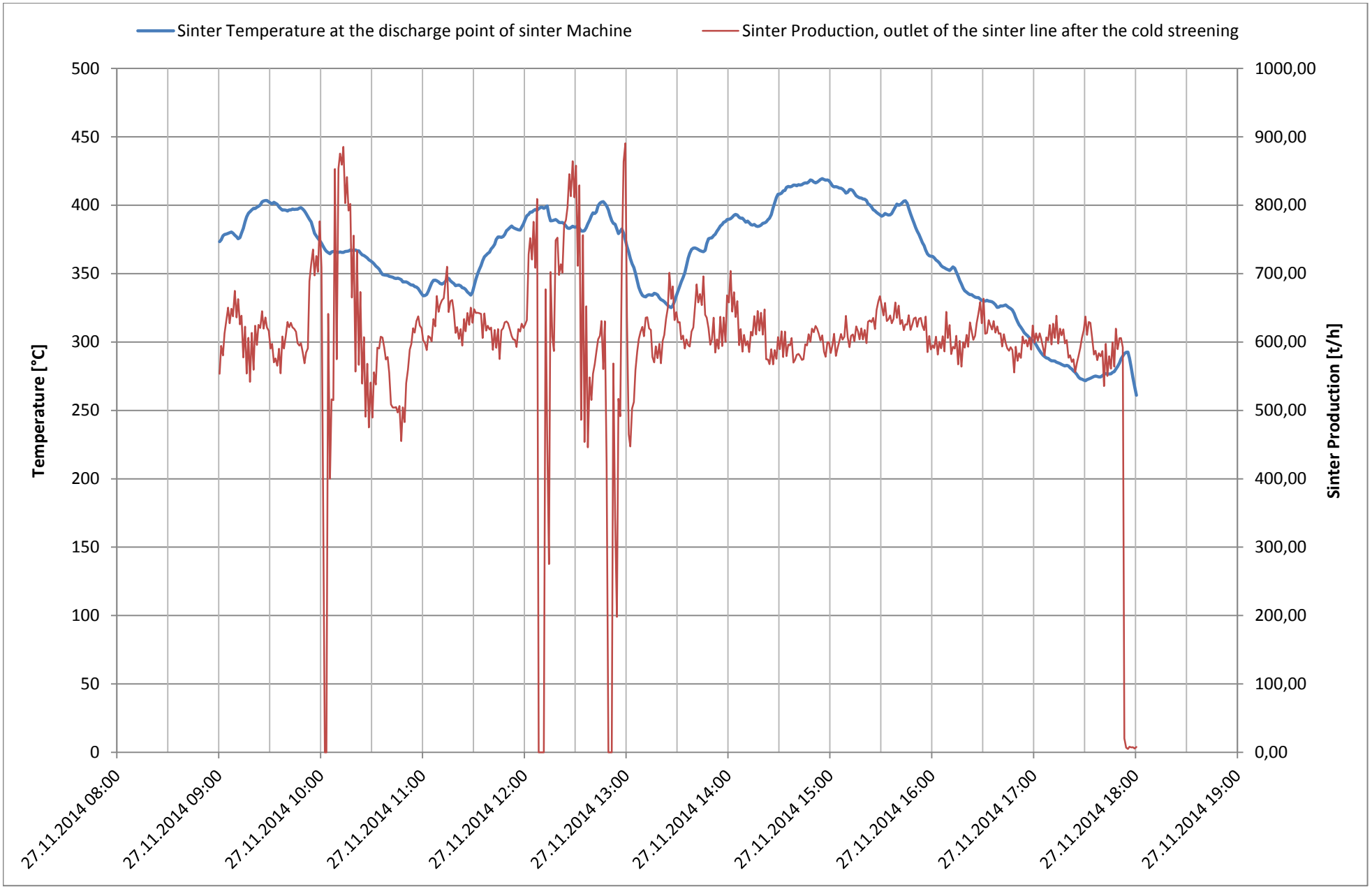

Speed Sinter Machine
Speed Siniter Cooler (calculated)
Cooling time of sinter
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
45 min
30 min
15 min
0 min
1st MP2
1st MP3
2nd MP4
2nd MP1
2nd MP2
shut-down of the sinter cooler around 13:00
because the sinter cooler was not operated until 11:15, only already cooled down material passes the measuring point
because the sinter cooler was not operated between 13:40 and 14:10 only already cooled down material passes the measuring point
sinter cooler was not operated between 17:20 to 17:30 and 17:35 to 17:38
13.10.2014 05:48
13.10.2014 06:48
13.10.2014 07:48
13.10.2014 08:48
13.10.2014 09:48
13.10.2014 10:48
13.10.2014 11:48
13.10.2014 12:48
13.10.2014 13:48
13.10.2014 14:48
13.10.2014 15:48
13.10.2014 16:48
13.10.2014 17:48
13.10.2014 18:48
13.10.2014 19:48
13.10.2014 20:48

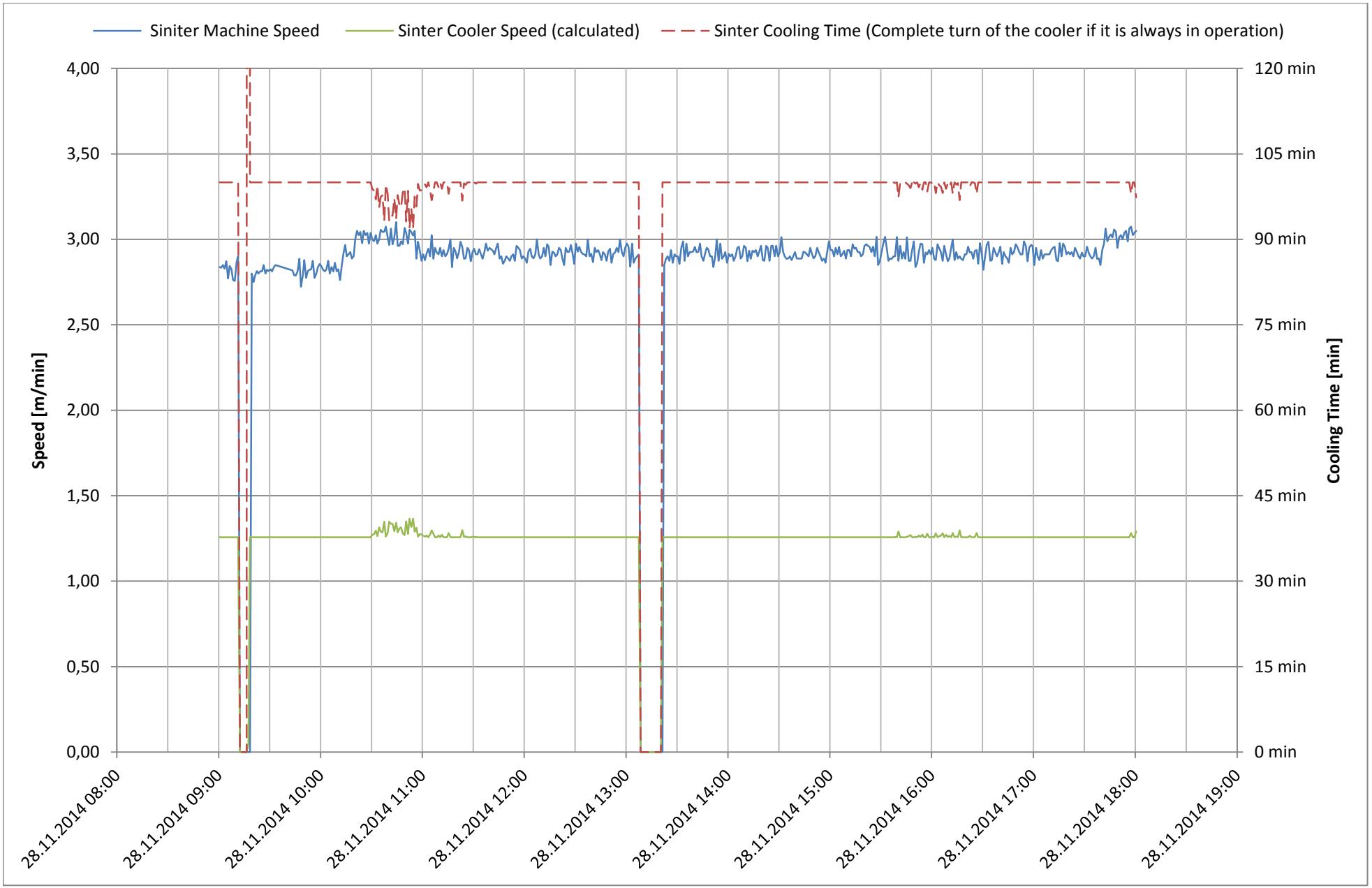

Sinter Temperature at the discharge point of sinter Machine
Sinter Production, outlet of the sinter line after the cold streening
1st MP2
1st MP3
2nd MP4
2nd MP1
2nd MP2
Temperature [°C]
Sinter Production [t/h]
500
450
400
350
300
250
200
150
100
50
0
1000,0
900,0
800,0
700,0
600,0
500,0
400,0
300,0
200,0
100,0
0,0
13.10.2014 05:48
13.10.2014 06:48
13.10.2014 07:48
13.10.2014 08:48
13.10.2014 09:48
13.10.2014 10:48
13.10.2014 11:48
13.10.2014 12:48
13.10.2014 13:48
13.10.2014 14:48
13.10.2014 15:48
13.10.2014 16:48
13.10.2014 17:48
13.10.2014 18:48
13.10.2014 19:48
13.10.2014 20:48


Siniter Machine Speed
Sinter Cooler Speed (calculated)
Sinter Cooling Time (Complete turn of the cooler if it is always in operation)
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
45 min
30 min
15 min
0 min
26.11.2014 08:00
26.11.2014 09:00
26.11.2014 10:00
26.11.2014 11:00
26.11.2014 12:00
26.11.2014 13:00
26.11.2014 14:00
26.11.2014 15:00
26.11.2014 16:00
26.11.2014 17:00
26.11.2014 18:00
26.11.2014 19:00


Sinter Temperature at the discharge point of sinter Machine
Sinter Production, outlet of the sinter line after the cold streening
Temperature [°C]
Sinter Production [t/h]
500
450
400
350
300
250
200
150
100
50
0
1000,00
900,00
800,00
700,00
600,00
500,00
400,00
300,00
200,00
100,00
0,00
26.11.2014 08:00
26.11.2014 09:00
26.11.2014 10:00
26.11.2014 11:00
26.11.2014 12:00
26.11.2014 13:00
26.11.2014 14:00
26.11.2014 15:00
26.11.2014 16:00
26.11.2014 17:00
26.11.2014 18:00
26.11.2014 19:00


Siniter Machine Speed
Sinter Cooler Speed (calculated)
Sinter Cooling Time (Complete turn of the cooler if it is always in operation)
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
45 min
30 min
15 min
0 min
27.11.2014 08:00
27.11.2014 09:00
27.11.2014 10:00
27.11.2014 11:00
27.11.2014 12:00
27.11.2014 13:00
27.11.2014 14:00
27.11.2014 15:00
27.11.2014 16:00
27.11.2014 17:00
27.11.2014 18:00
27.11.2014 19:00


Sinter Temperature at the discharge point of sinter Machine
Sinter Production, outlet of the sinter line after the cold streening
Temperature [°C]
Sinter Production [t/h]
500
450
400
350
300
250
200
150
100
50
0
1000,00
900,00
800,00
700,00
600,00
500,00
400,00
300,00
200,00
100,00
0,00
27.11.2014 08:00
27.11.2014 09:00
27.11.2014 10:00
27.11.2014 11:00
27.11.2014 12:00
27.11.2014 13:00
27.11.2014 14:00
27.11.2014 15:00
27.11.2014 16:00
27.11.2014 17:00
27.11.2014 18:00
27.11.2014 19:00


Siniter Machine Speed
Sinter Cooler Speed (calculated)
Sinter Cooling Time (Complete turn of the cooler if it is always in operation)
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
45 min
30 min
15 min
0 min
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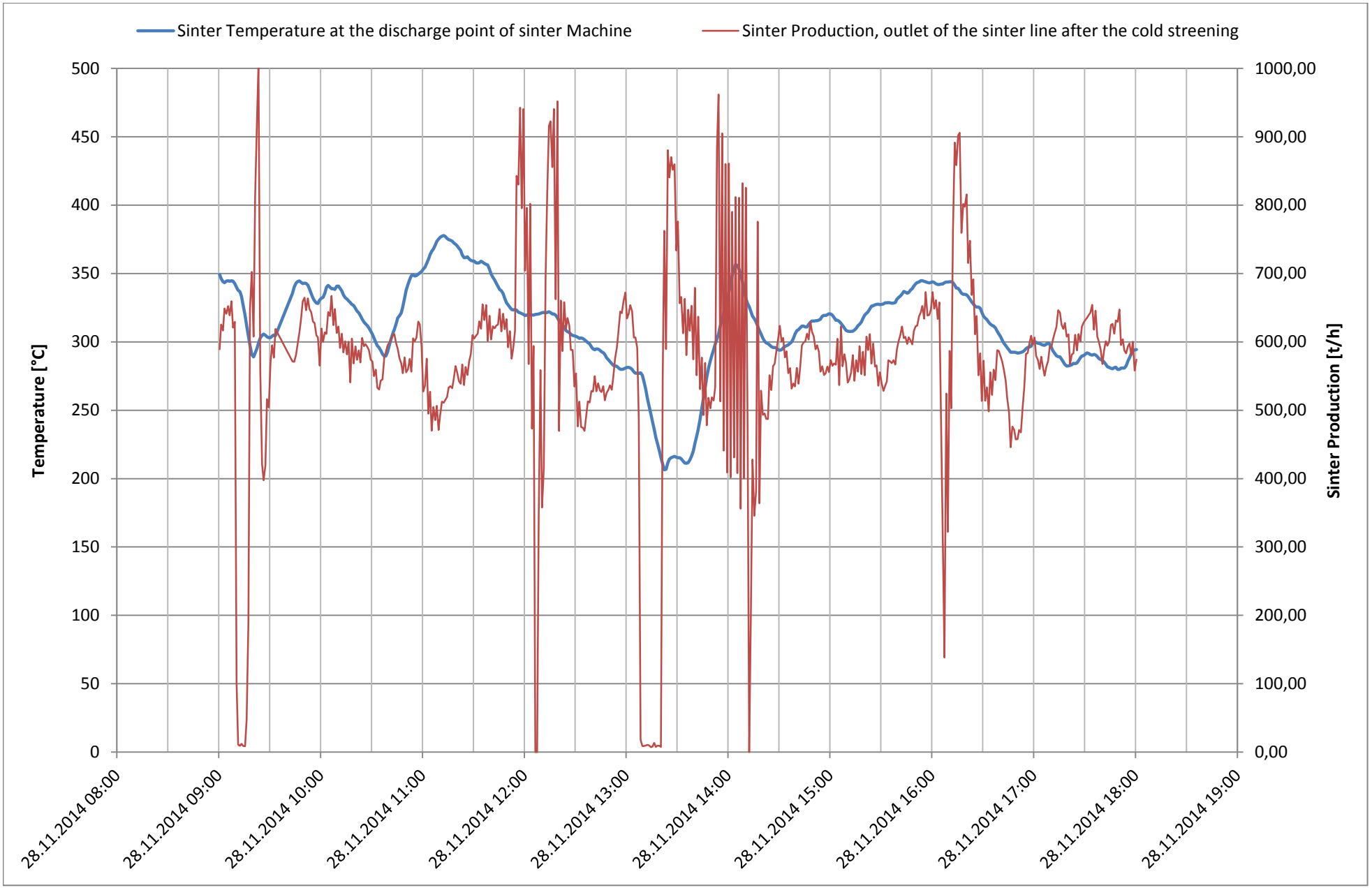
Sinter Temperature at the discharge point of sinter Machine
Sinter Production, outlet of the sinter line after the cold streening
Temperature [°C]
Sinter Production [t/h]
500
450
400
350
300
250
200
150
100
50
0
1000,00
900,00
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700,00
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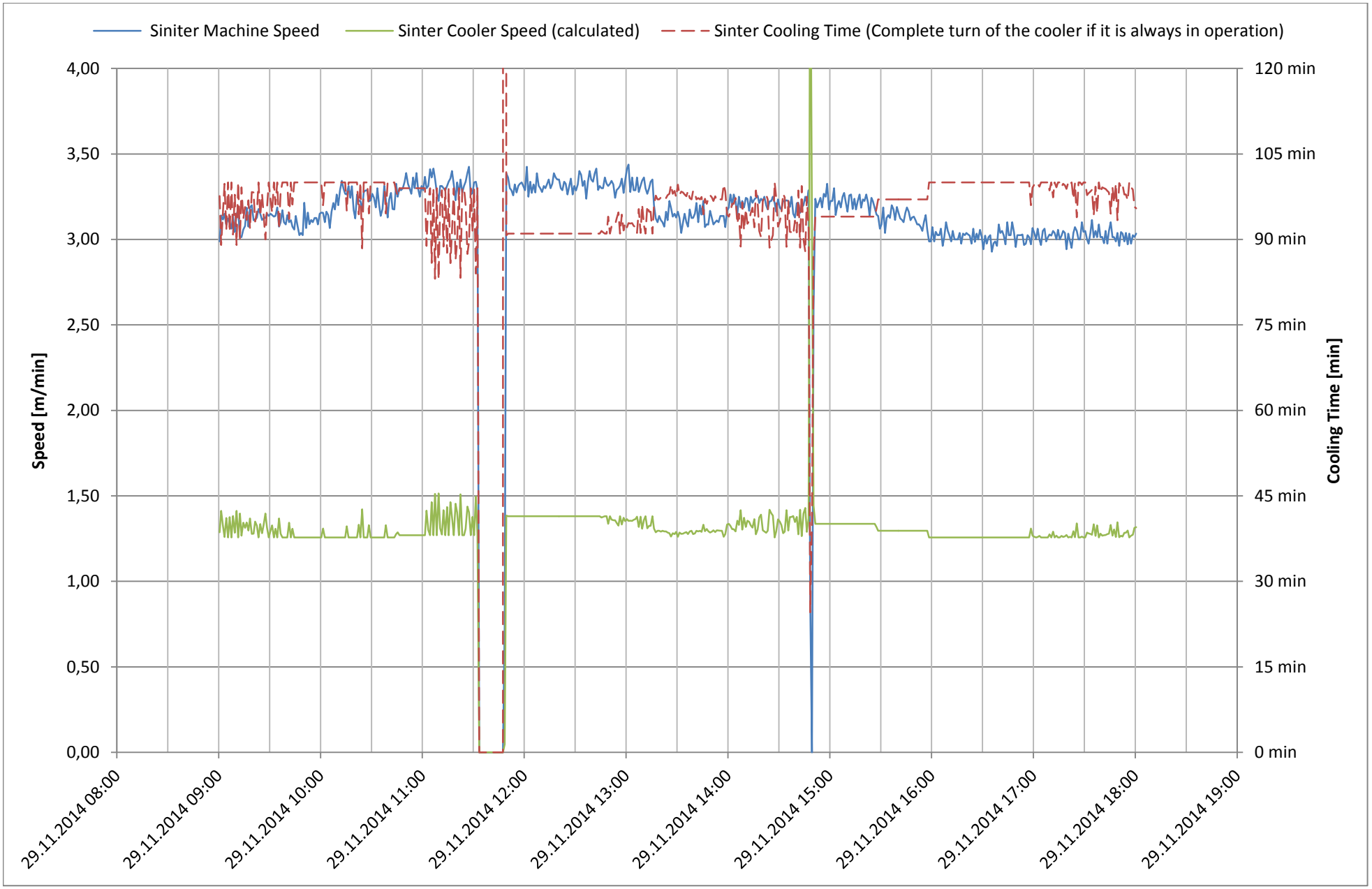
Siniter Machine Speed
Sinter Cooler Speed (calculated)
Sinter Cooling Time (Complete turn of the cooler if it is always in operation)
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
45 min
30 min
15 min
0 min
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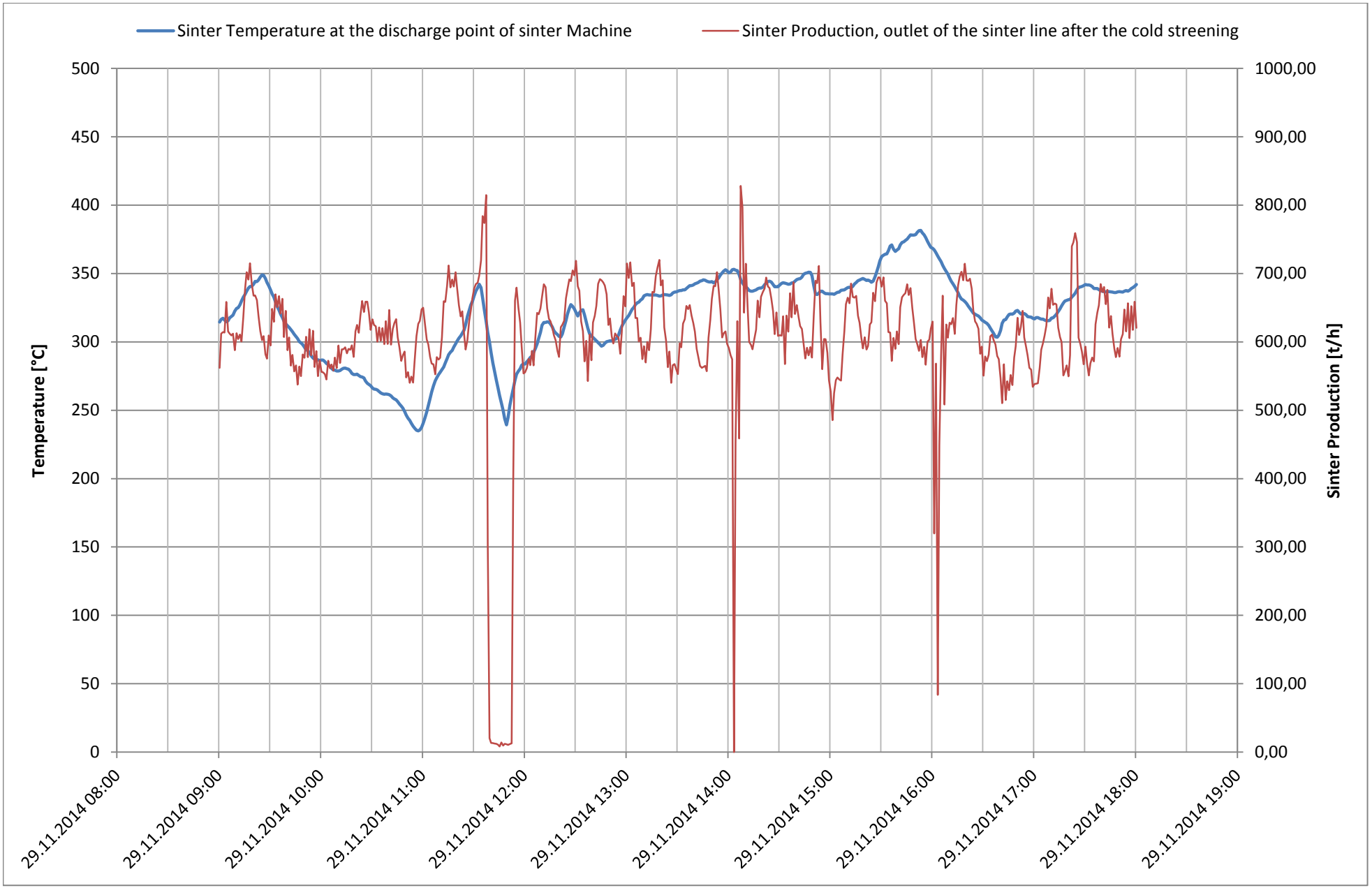
Sinter Temperature at the discharge point of sinter Machine
Sinter Production, outlet of the sinter line after the cold streening
Temperature [°C]
Sinter Production [t/h]
500
450
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350
300
250
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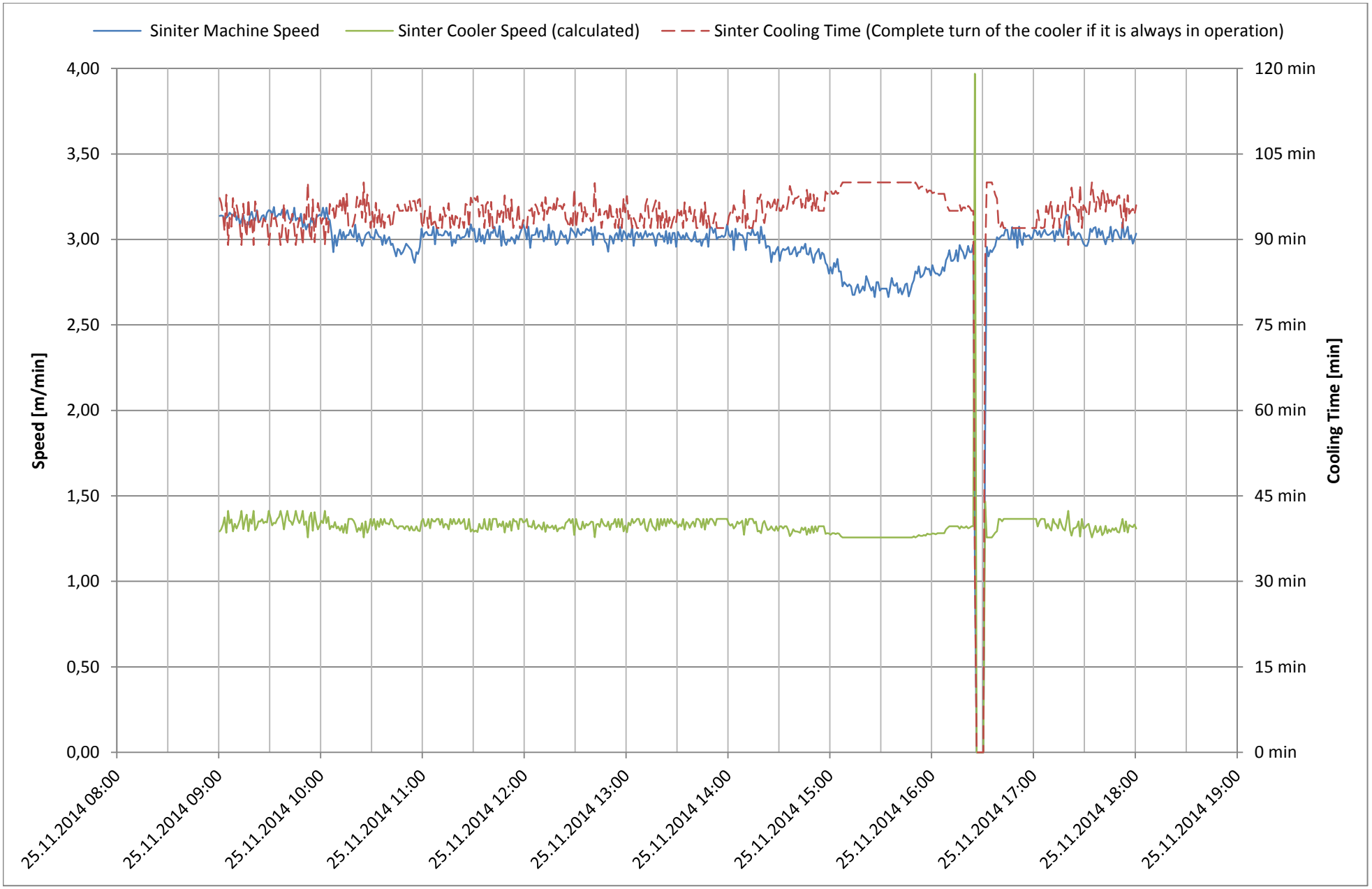
Siniter Machine Speed
Sinter Cooler Speed (calculated)
Sinter Cooling Time (Complete turn of the cooler if it is always in operation)
Speed [m/min]
Cooling Time [min]
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
120 min
105 min
90 min
75 min
60 min
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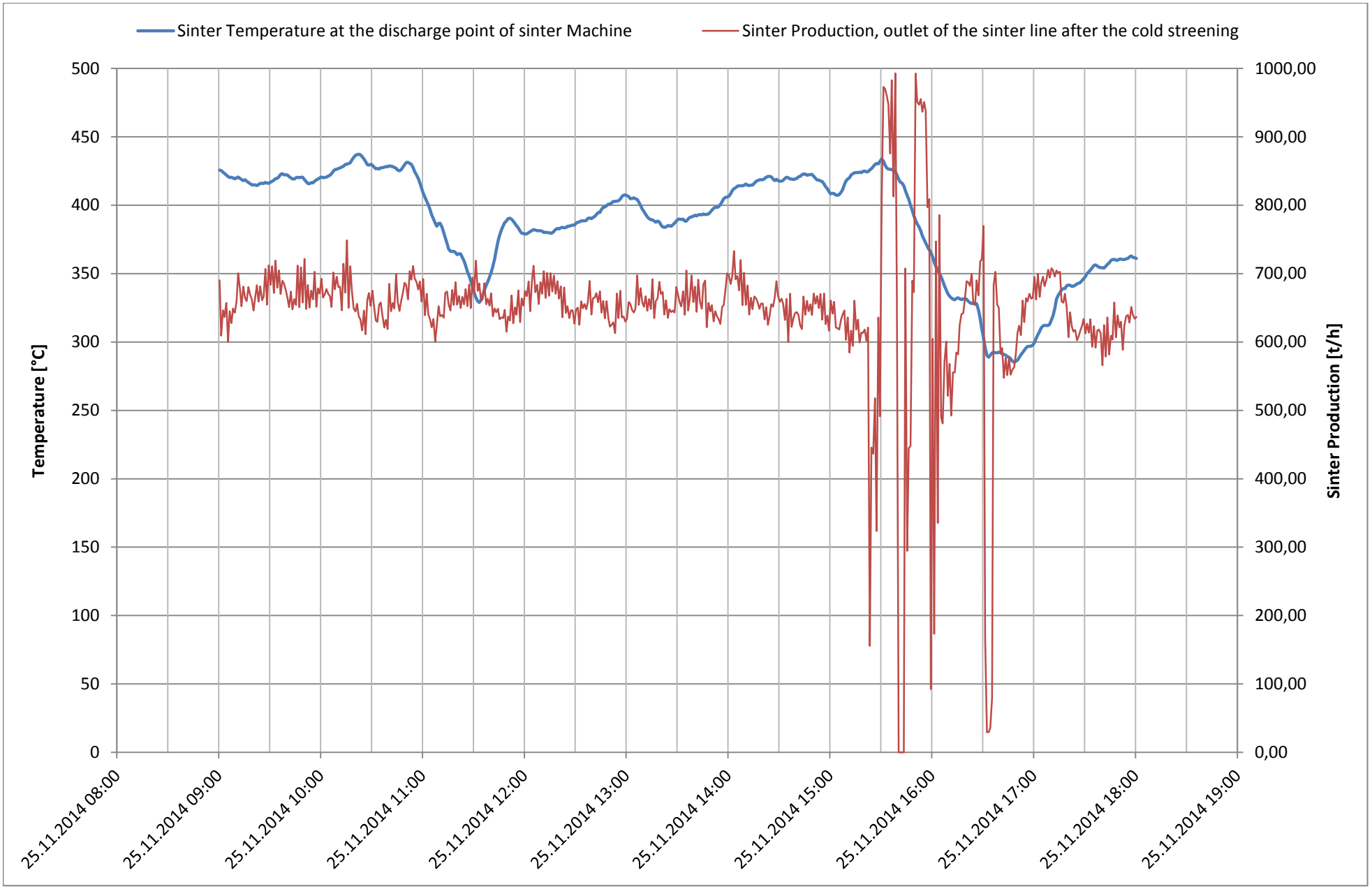
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Sinter Production, outlet of the sinter line after the cold streening
Temperature [°C]
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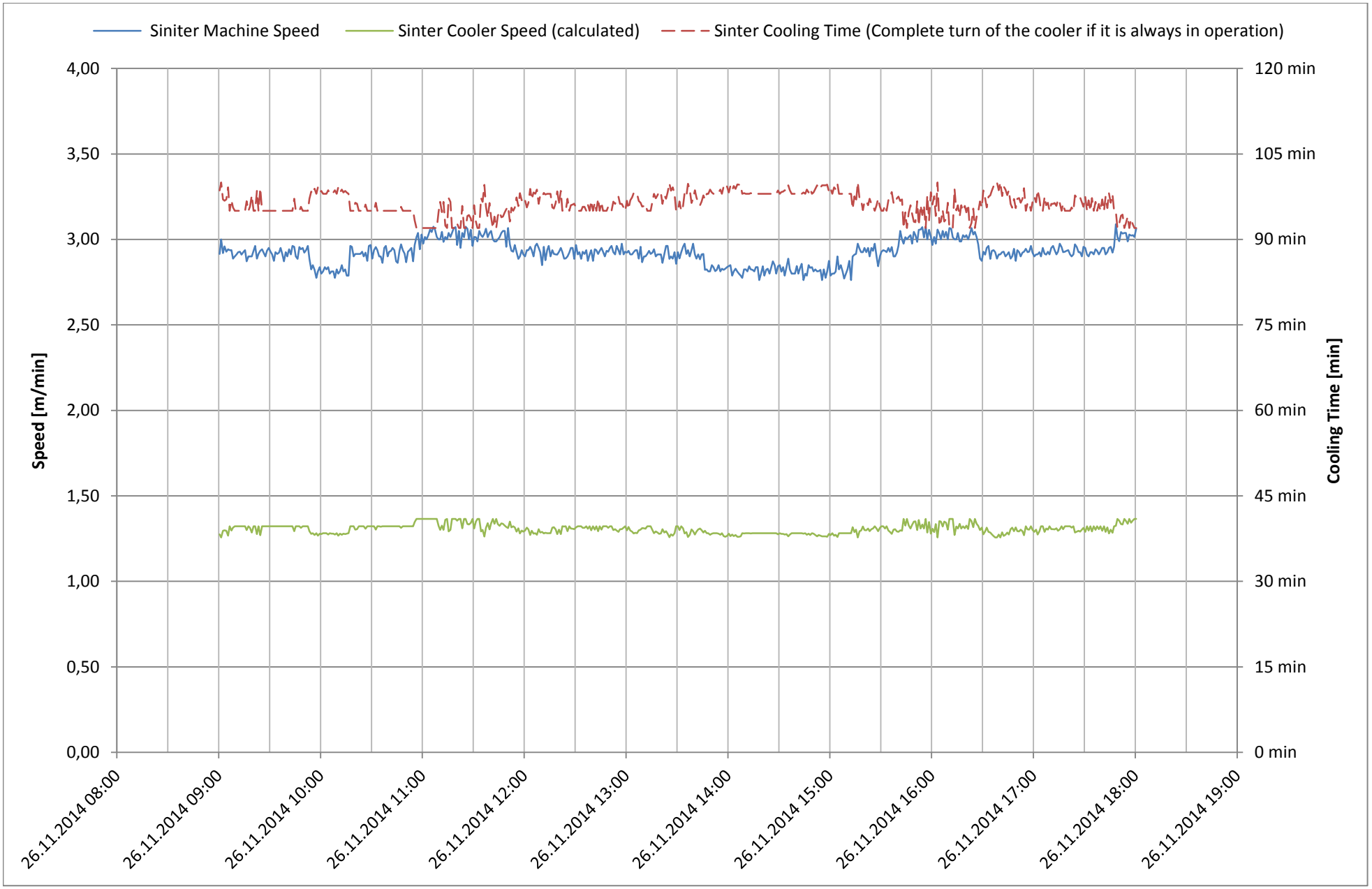
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3,00
2,50
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0,00
120 min
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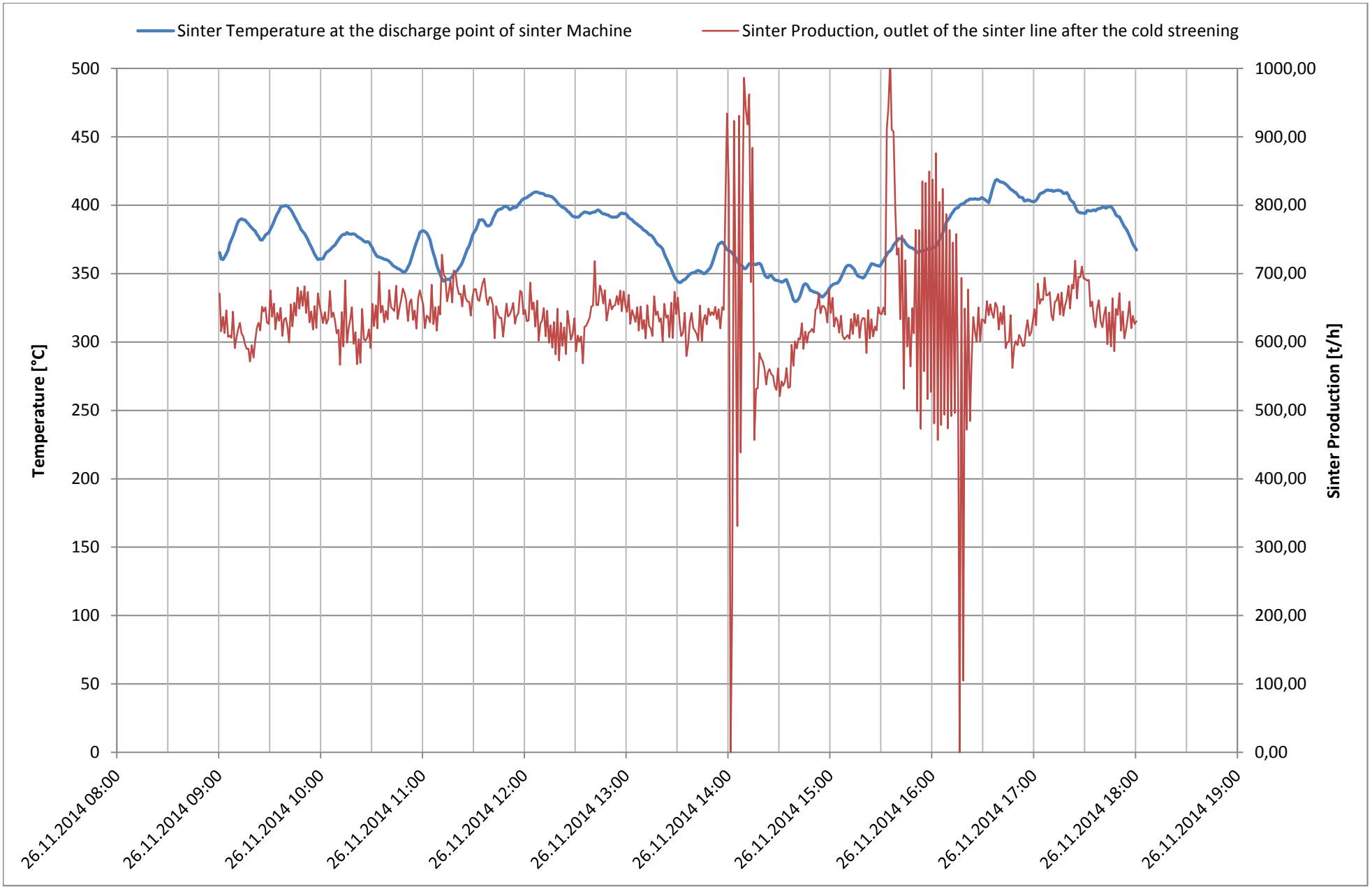
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Sinter Production, outlet of the sinter line after the cold streening
Temperature [°C]
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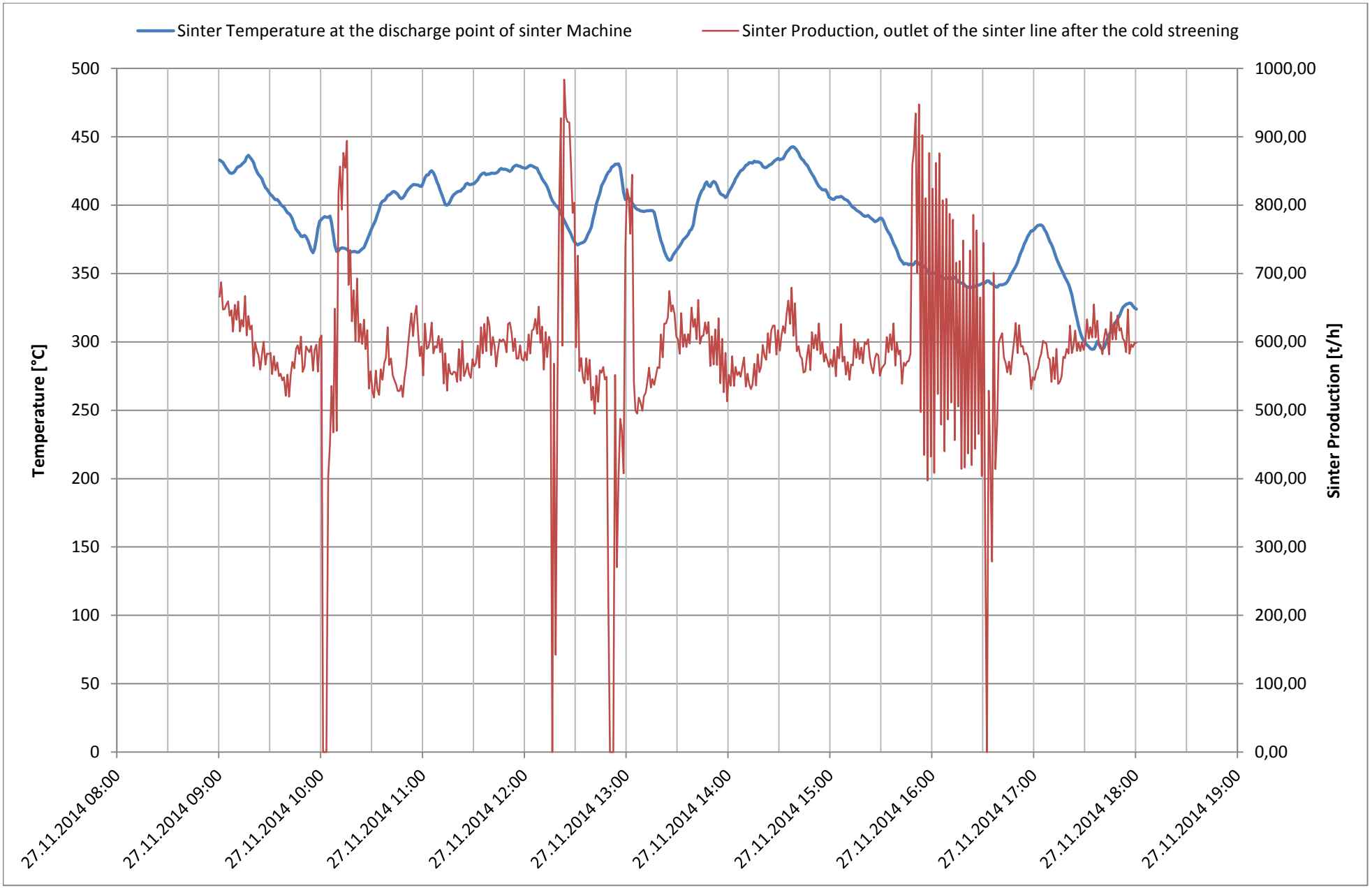
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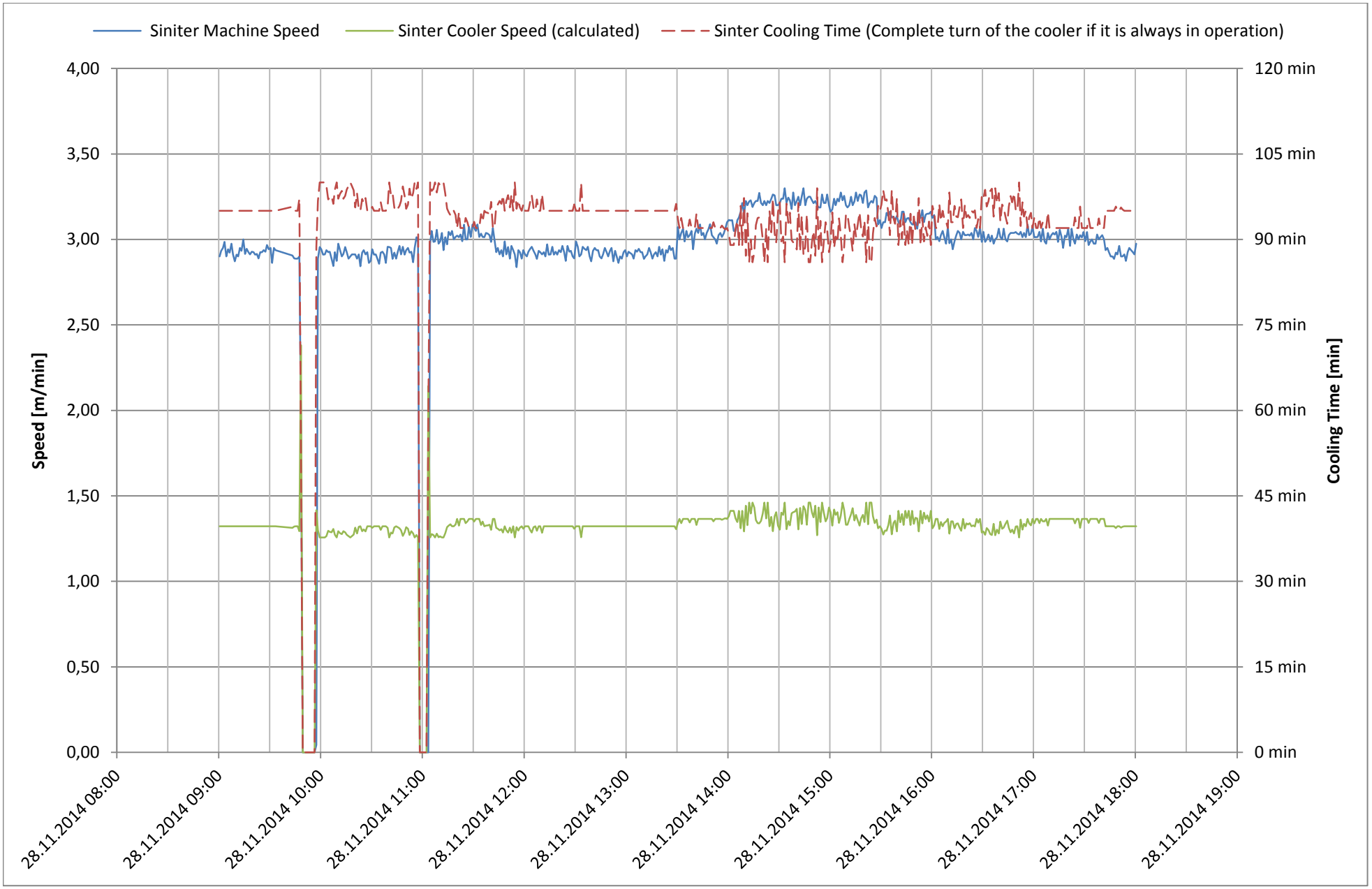
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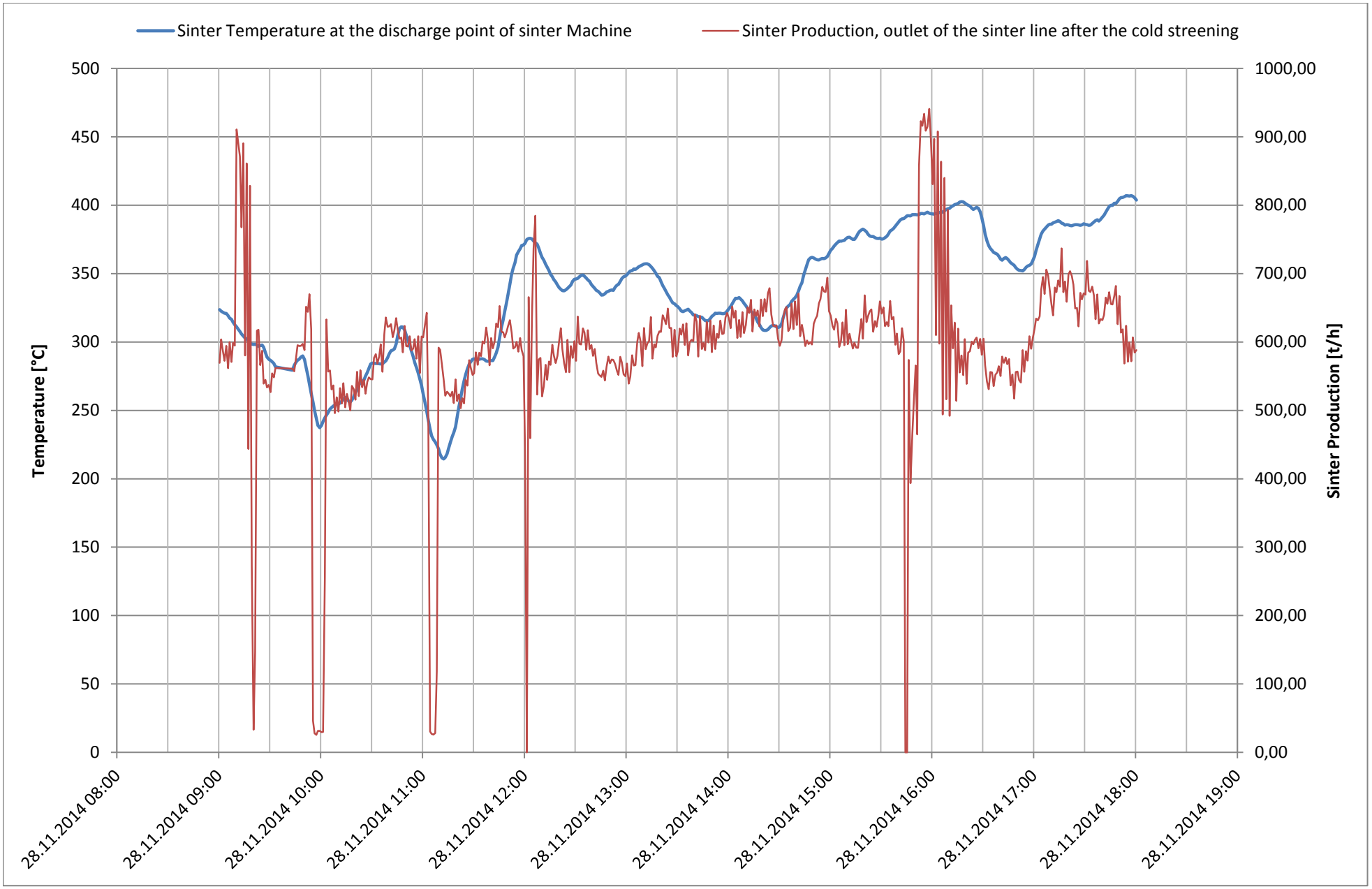
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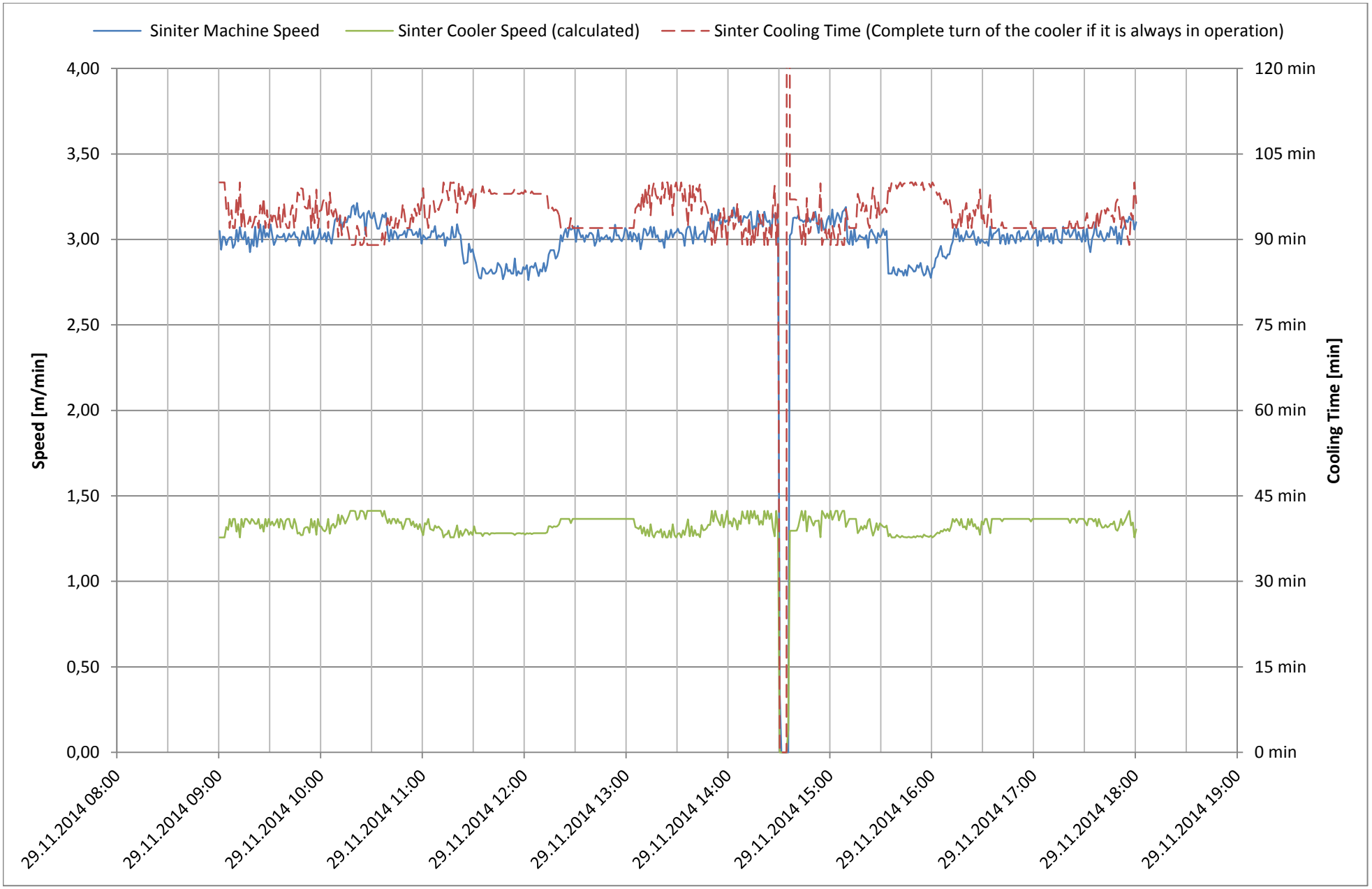
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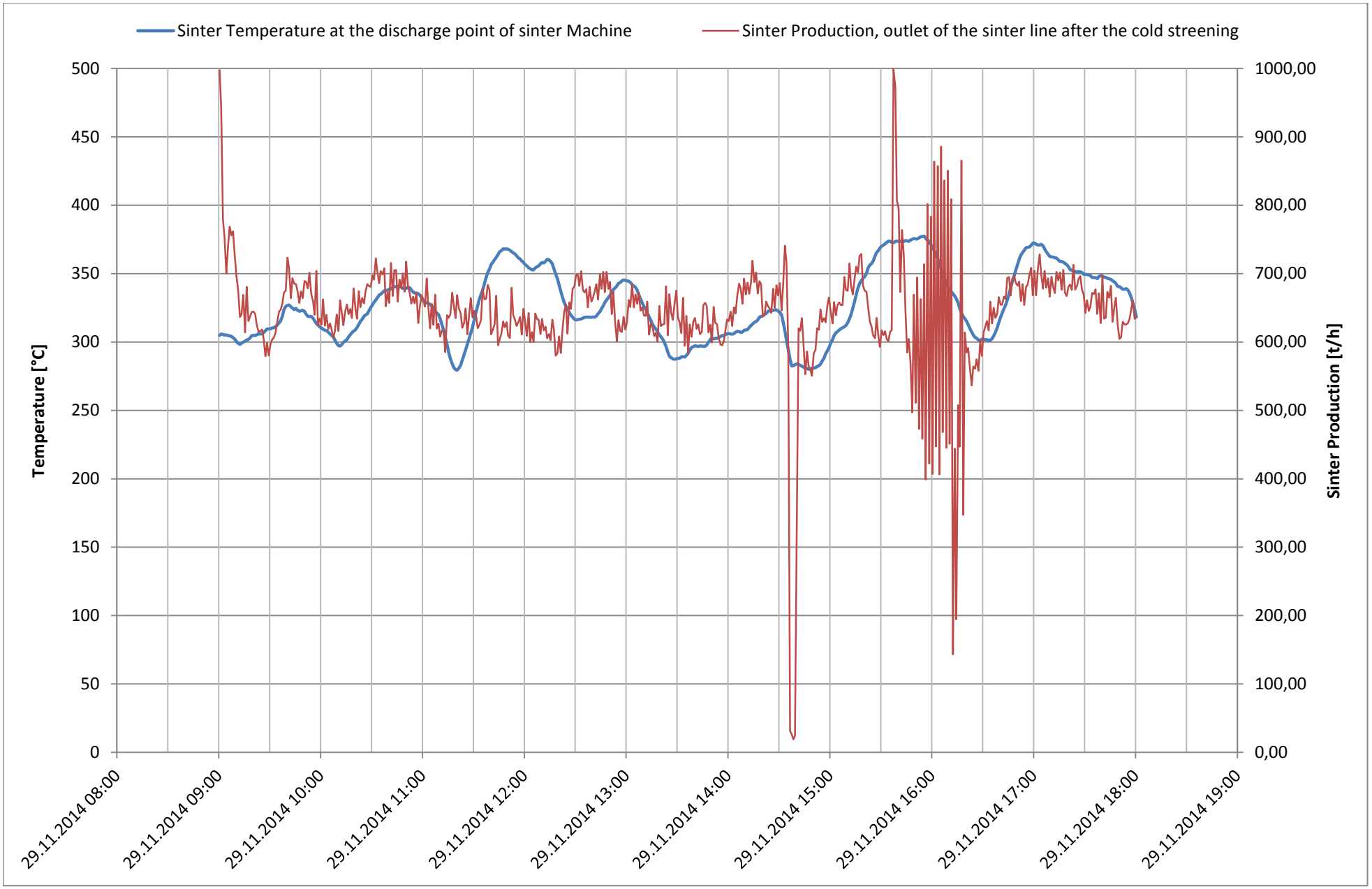
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Sinter Production, outlet of the sinter line after the cold streening
Temperature [°C]
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