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WP 2 – Quality management and classification

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Report on the validation of TS on specification and classification including recommendations to TC 343 for the eventual revision of the TS before its upgrade to an European Standard (EN)

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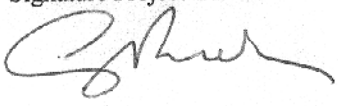

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Contents

List of schedules

1 Task and goal of the investigation

The CEN Technical Committee (TC) 343 has nearly completed different European Technical Specifications (TS's) for Solid Recovered Fuels (SRF), which are fuels, recovered from non-hazardous wastes. TS's can be seen as a first step towards full European Standards (EN). The process of up-grading a set of TS's to a set of full European Standards includes "validation".

Subject of the present investigation was the validation of the prCEN/TS 15359:2005 „Solid Recovered Fuels – Specification and Classes" [2], with the aim to reveal, whether the current text version of the TS can be upgraded to an EN, or if a revision of the text is necessary before doing so.

INFA, that has been commissioned with the validation of the prCEN/TS 15359:2005, has also developed an European database on SRF production according to the classification system [4]. The findings of this work are enlarging the basis for the following comments.

2 Validation of the prCEN/TS 15359:2005 for specification and classification

The main purpose of the investigations was to answer four questions:

2.1 Is there an adequate class for each of the types of SRF that are on the market at present?

That means: are the existing SRF production plants able to classify their SRF in accordance with the draft TS on specification and classification in an appropriate and practical way?

In the deliverable D 2.4 „European database on SRF production" [4], the available analytic data of different types of SRF for the three classification parameters Net Calorific Value (NCV), chlorine and mercury have been analysed, with the aim to make appropriate class arrangements. In doing so, the categorisation of the SRF for the parameters NCV and chlorine has been carried out using the arithmetic mean of all the given assays. Partly, for the NCV and the chlorine, only arithmetic means were available as data basis. In these cases, these arithmetic means were used for the classification (see D 2.4).

As shown in chapter 2.2.2, accordant to the prCEN/TR 15508:2006 "Key properties of solid recovered fuels to be used for establishing a classification system" [3], the statistical evaluation for the parameters NCV and chlorine shall occur by determination of the lower or upper limit of the 95 % confidence interval of the arithmetic mean.

Actually, this method of calculation is not required in the prCEN/TS 15359:2005 (see also chapter 2.2.2), with the result, that the categorisations for NCV and chlorine, made in the deliverable D 2.4 [4], haven't been carried out in the way, as intended with the prCEN/TR 15508:2006.

Within this report the lower or the upper limits of the 95 % confidence interval of the arithmetic mean of NCV and chlorine were determined (see Annex A). Additionally, in the case of more than 40 available assays the categorisation via INFA's own random generator (RND) was carried out.

Summarising it has been shown, that concerning NCV, with one exception every SRF could be classified according to the existing system, whereas all five classes were used. The above mentioned SRF was derived from sewage sludge. The same applied for the parameter chlorine. All five classes were used. One SRF was out of the range of the classification. This SRF was a fuel derived from municipal solid waste and sewage sludge.

As shown in deliverable D 2.4 [4], every SRF could be classified according to the existing system concerning the parameter mercury.

2.2 Is the TS written in a comprehensible way?

From INFA's point of view some aspects of the text of the present version of the prCEN/TS 15359:2005 [2] have to be specified. Following, the relevant text passages are shown and discussed.

2.2.1 Notes with more editorial character

The reference to "prCEN/TS 153**75**:2005" in Clause 2 ("Normative references") and clause 3 ("Terms and definitions") is incorrect. The correct TS is prCEN/TS 153**57**:2005 [1] (transposed digits).

In clause 8.1 ("Compliance rules for classification") it is remarked: "This shall be performed at a period in which a quality management system (QMS) is applied." At this place the corresponding CEN/TS should be cited here. The same applies for note 3 ("A quality management system is meant as any systematic procedure used for complying with this Technical Specification.")

In figure 2 (Clause 8.2 “Compliance rules for specification”) terms according to prCEN/TS 15357:2005 “Solid recovered fuels, terminology, definitions and descriptions” [1] should be used. Instead of „gross sample“ the term “combined sample“ and instead of „general sample“ the term “common sample“ should be used.

2.2.2 Notes concerning the description of the data evaluation

NCV and chlorine

The aim of the prCEN/TS 15359:2005 should be to establish homologous evaluation principles. Based on the current adjustment, the producer of SRF can choose between two methods for the determination of the 10 measurements for evaluation.

The current phrase in Clause 8.1 “The comparison for NCV and Cl with the limit values of the classes is made by the average of the values of at least **the last 10** validated measurements or at least **10** validated measurements per annum **taken at random**“ is imprecise and allows different procedures for the data evaluation, that might possibly lead to different results for the categorisation (see Table 1).

In the following, this will be shown for the parameter NCV with virtual values as an example. For this, additional introductory explanations are necessary firstly:

Concerning the details on statistic Clause 7 (“Classification”), note 2 of the prCEN/TS 15359:2005 refers to the CEN Report prCEN/TR 15508:2006 [3].

In the prCEN/TR 15508:2006 one can see, that the statistical analysis of available data should be done by taking the lower or upper limits of the 95 % confidence interval of the arithmetic mean into account. In the prCEN/TR 15508:2006, this is only mentioned indirectly (quod vide clause 5.2.3 or 5.2.5). Likewise it is not mentioned how the calculation should be done.

Therefore, the text of the prCEN/TS 15359:2005 should represent the calculation formula for the lower and the upper limit of the 95 % confidence interval of the arithmetic mean, see below:

$$X = \overline{X} \pm 1{,}96 \cdot \frac{s}{\sqrt{n}}$$

with

X	=	lower / upper limit of the 95 % confidence interval of the arithmetic mean,
$\overline{X}$	=	arithmetic mean (based on all measurements)
1,96	=	functional characteristic of the normal distribution (for the 95 % confidence interval)
s	=	standard deviation (based on all measurements)
n	=	number of measurements (here: n = 10)

Decisive for the categorisation of the parameter NCV is the calculated lower limit of the 95 % confidence interval of the arithmetic mean and for chlorine the corresponding upper limit.

In the following example (italic), for the parameter NCV 12 measurements are available. The categorisation is carried out with the three following selection procedures:

1. *Utilisation of the ten latest validated measurements,*
2. *"random" choice of 10 validated measurements (in the sense of an "arbitrary" selection),*
3. *Consideration of the "random" choice by use of the lower limit of the 95 % confidence interval (Ci) of the arithmetic mean.*

In doing so, the values, shown in table 1, result.

Tab. 1: *Results of a categorisation of 10 out of 12 NCV values by using different selection procedures (example)*

Number of measurement during a 12 month period	NCV [MJ/kg ar]			
	Measured values	last ten validated measurements	ten validated measurements (arbitrary selection)	consideration of ten validated measure-ments taken at random (via 95 % Ci)
1	23,4	23,4	**23,4**	23,4
2	19,6	19,6	**19,6**	19,6
3	20,4	**20,4**	**20,4**	20,4
4	18,8	**18,8**	**18,8**	18,8
5	22,0	**22,0**	**22,0**	22,0
6	16,6	**16,6**	16,6	16,6
7	21,2	**21,2**	**21,2**	21,2
8	22,5	**22,5**	**22,5**	22,5
9	19,8	**19,8**	**19,8**	19,8
10	20,0	**20,0**	**20,0**	20,0
11	19,8	**19,8**	**19,8**	19,8
12	16,9	**16,9**	16,9	16,9
Mean	-	**19,8** [1)]	**20,8** [1)]	**18,8** [2)]
Class	-	**3**	**2**	**3**

95 % Ci = lower limit of the 95% confidence interval of the arithmetic mean
[1)] arithmetic mean, [2)] lower limit of the 95% confidence interval of the arithmetic mean

In this example, the analyses results in a classification in class three or two, depending on the used procedure for the choice of the 10 NCV values.

The method of taking the average of the last ten measurements is a suitable method for process control but it may increase the problem of overlapping (varying class results) according to the determination of different data sets. The application of this method as a tool for the classification is not recommended.

To guarantee a standardised method for the analyses of the measurements of NCV and chlorine respectively, all available validated measurements should be taken into account by using the lower limit of the 95 % confidence interval of the arithmetic mean, in the case that more than ten assays are available (this method will result in a higher stability of the class code).

Therefore, the text of the prCEN/TS 15359:2005 should be specified at the corresponding passages, so that the statistical evaluation of the NCV and the chlorine data, for the characterisation period as well as for the annual categorisation, should be done by

regarding the lower / upper limit of the 95 % confidence interval of the arithmetic mean, if more than ten measurements are available.

Mercury

Concerning mercury, Clause 8.1 („Compliance rules for classification“) says: “The class code for Hg is established using median and 80th percentile based on at least the last 10 validated measurements or at least 10 validated measurements per annum taken at random.“

An easy and practical realisation of the random choice of ten values out of a data set of more than ten values via statistical evaluation, analogous to the procedure for NCV and chlorine (categorisation via the upper/lower limit of the 95 % confidence interval of the arithmetic mean) seems to be inapplicable for mercury (categorisation via median/80th percentile). An evaluation of a 95 % confidence interval of the median and of the 80Th percentile is more complicated and difficult to be put into praxis. An applicable instruction in the TS that describes the determination of these statistical values has to be developed first.

For this reason, INFA proposes as solution using always exactly ten measurements for one evaluation (classification): An analysis (classification) always has to be done on the basis of ten consecutive measurements. If, at the end of a 12 month period, only an incomplete data set exists (e. g. eight measurements), these data shall be used in the following 12 month period and be completed with the successive measurements to a full data set of ten measurements.

In the case, that for one classification parameter several analyses (of full data sets each) of a 12 month period lead to different classification results, always the highest class has to be used for the determination of the class of the SRF.

Furthermore, Clause 8.1 states: “Within the characterisation period it is recommended to use as a prediction method for virgin producers the 50 % - rule for Hg classification in case of more than 10 data assays available and to use a random generator in case of more than 40 data assays available.”

Provided, that it is intended by the phrase „taken at random“, that the selection of samples at random is based upon a defined method, such as the RND[1], this should be specified.

[1] A general description of the random generator has been carried out in deliverable D 2.4 [4]

Before the RND can be applied some obstacles have to be removed. On the one hand, it has been shown in the deliverable D 2.4 [4], that the data basis, that allows an analysis with RND, is often lacking.

On the other hand, the recent prCEN/TS 15359:2005 does not explain the RND: For the work on D 2.4, INFA has used its own RND, based on MS Access. A short description of this RND is given in [5] and [6]. It can not be assumed, that the producers of SRF will develop their own RND as procedural instrument. To enable the utilisation of the RND, it could e. g. be described in detail in an annex of the CEN/TR 15508 or in the CEN/TS 15359.

In prCEN/TS 15359:2005 a further note is given for the analysis of mercury in Clause 8.1: "However, for Hg three measurements per lot are required on the basis of the same general sample".

From INFA's point of view, a multiple analysis concerning the parameter mercury is not necessary. From experience, the analyses results for mercury show only a slight variability. Because of the conversion of mercury values with the NCV, that is necessary for classification, these normally slight fluctuations may only have little effect on the classification results. Furthermore, the determined mercury concentrations were often below the detection limit or showed values similar to the detection limit. INFA would recommend, that this text passage of the TS shall to be deleted.

Summarising, it can be concluded, that the prCEN/TS 15359:2005 is not always verbalised in a precise form. As shown above, the text partly shows methodologically differences in comparison to the prCEN/TR 15508:2006 [3]. This is the reason, why the provided statistical methods of the prCEN/TR 15508:2006 could not be realised in the deliverable D 2.4 [4].

The above performed proposals for the analyses should be proved. The results of the upcoming discussion should be reworked precisely in the TS 15359.

2.3 Is it consistent with the Waste Incineration Directive (WID)?

In the Technical Report prCEN/TR 15508:2006 [3] it is described, that for the development of the classification system the conformity with the WID has been assured.

Emission limit values of the WID played a decisive role in establishing the maximum possible content of heavy metals in SRF (maximum possible concentrations of heavy metals in SRF, defined in the WID, were taken into account).

By using material flow analyses (MFA) and transfer factors evidence was provided, that the demands of the WID were met.

Concluding it can be stated, that the TS is consistent with the WID.

2.4 Are the class-boundaries well selected and well adapted to their purpose?

Basically, class limits for every regarded classification parameter are adequate given the state of the art of the analytical procedures.

It can be assumed, that for the chemical analyses different analytic methods are applied in practice. To ensure a homologous evaluation of results, similar analytic methods have to be applied. An important issue is that partly different detection limits (DL) exists. A maximum of the DL's has to be defined to ensure a homologous evaluation. For mercury a maximum DL of **0,2 mg/kg dm** is proposed.

2.5 Conclusions

The text of the prCEN/TS 15359:2005 and especially the denoted passages should be checked and specified.

After finalising the particular validation operation, the analysing methods should be harmonised. For mercury a consistent maximum detection limit of 0,2 mg/kg dm should be defined.

After the revision of the CEN/TS 15359 and the existence of the standards for consistent analysing methods, a recollection and analysis of data should be carried out.

3 Bibliography

[1] **prCEN/TS 15357:2005**, Solid recovered fuels - Terminology, definitions and descriptions, English version, Brussels (Belgium), September 2005

[2] **prCEN/TS 15359:2005**, Solid recovered fuels – Specifications and classes, English version, Brussels (Belgium), October 2005

[3] **prCEN/TR 15508:2006**, Key properties on solid recovered fuels to be used for establishing a classification system, English version, Brussels (Belgium), April 2006

[4] **INFA 2006**, Flamme, S., Balhar, M.: Quovadis WP 2, A holistic approach towards quality management and classification Deliverable 2.4: European database on SRF production according to the classification system, September 2006

[5] **INFA 2004a**, Flamme, S., Mutz, H., Balhar, M.: Compilation and Evaluation of Analysis Data for Secondary Fuels, report for European Recovered Fuel Organisation (ERFO), Ahlen (Germany); February 2004

[6] **INFA 2004b**, Flamme, S., Mutz, H., Balhar, M.: Compilation and Evaluation of Analysis Data for Secondary Fuels – Part II, report for European Recovered Fuel Organisation (ERFO), Ahlen (Germany); July 2004

ANNEX

Content:

Classification results for NCV and chlorine

For the parameters NCV and chlorine, a new class categorisation has been carried out, by taking the selection method (lower / upper limit of the 95 % confidence interval of the arithmetic mean), described in chapter 2.2.2, into account. Following, the data used as the basis and the results of the categorisation for NCV and chlorine are presented.

Evaluable data

The following table A-1 shows the number of cases for the classification parameters NCV and chlorine, for which an evaluation of the data was possible.

Tab. A-1: Summary of the evaluable data*)

Possibility of evaluation according to feedback of data	Number of plants/SRFs per parameter			
	NCV		Chlorine	
No evaluation possible, thereof	**30*)**	**33%**	**26*)**	**29%**
Number of assays < 10	10	11%	10	11%
no data given	5	6%	13*)	14%
Mean based on all assays given (statistical evaluation of NCV and Cl via 95 % confidence interval not possible)	15*)	17%	3	3%
Evaluation possible, thereof	**60*)**	**67%**	**64*)**	**71%**
Mean and standard deviation based on all assays given (statistical evaluation of NCV and Cl via 95% confidence interval possible)	7*)	8%	7*)	8%
Number of assays ≥ 10 (statistical evaluation via 95 % confidence interval possible)	53	59%	57	63%
Thereof number of assays ≥ 40 (additional evaluation via RND possible)	25	28%	29	32%
Total	**90**	**100%**	**90**	**100%**

*) Five data sets were available later; in D 2.4 [4] they could not be taken into consideration

For the classification parameter NCV, a categorisation was possible for 60 SRFs. In the case of 15 SRFs, only the arithmetic means were given, so that the calculation of lower limits of the 95 % confidence interval of the arithmetic mean was not possible.

For chlorine, the upper limit of the 95 % confidence interval of the arithmetic mean could be calculated for 64 SRFs. For three SRFs just the arithmetic means were given for chlorine, so that the categorisation was also not possible.

Results for the classification of NCV and chlorine by calculation of the lower / upper limits of the 95 % confidence interval of the arithmetic mean

The following tables show the results of the classification by using the categorisation system. Adjacent, these results are explained in brief.

Tab. A-2: Results of NCV classification[2]

Class	Class limit [MJ/kg ar] (mean)	Evaluation via statistic (95% confidence interval)	
		Number of SRFs	Percentages
1	≥ 25	3	5
2	≥ 20	10	17
3	≥ 15	19	32
4	≥ 10	25	42
5	≥ 3	2	3
No class	-	1	2
Total	**-**	**60**	**100**

The 59 SRFs, that could be categorised, are allocated to all of the five classes. Mainly, the classes four (42 %) and three (32 %) are taken. The results of the categorisation via statistical analysis (determining the lower limits of the 95 % confidence interval of the arithmetic mean) are almost similar to the categorisation via RND (see table B-1). Only one SRF was classified in a lower class, when using the RND.

In comparison with the results of the categorisation via arithmetic mean, that are shown in the deliverable D 2.4 [4] and where eight SRF are classified as class five, only two SRF are categorised as class five. Because for the majority of these SRF only the arithmetic means were available, further analyses were not possible within the work for the deliverable D 2.5.

[2] Use of the lower limit of the 95 % confidence interval

Tab. A-3: Results of chlorine classification[3]

Class	Class limit [% dm] (mean)	Evaluation via statistic (95% confidence interval)	
		Number of SRFs	Percentages
1	≤ 0,2	4	6
2	≤ 0,6	18	28
3	≤ 1,0	29	45
4	≤ 1,5	10	16
5	≤ 3,0	2	3
No class	-	1	2
Total	**-**	**64**	**100**

Concerning chlorine, all classes were used, whereas almost half (29 SRFs) of the 63 SRFs which could be categorised were assigned to class three.

The comparison of the classification via statistical analysis by calculating the upper limit of the 95 % confidence interval of the arithmetic mean with the classification via RND shows nearly the same results (via RND, two SRFs were allocated to a lower class, one SRF was sorted to a higher one).

[3] Use of the upper limit of the 95 % confidence interval

Tab. B-1: Comparison classification via statistical evaluation vs. classification via RND (NCV)

SRF	NCV [MJ/kg ar]			
	Available Assays	Classification via		RND is …
		Statistic (lower limit of the 95 % confidence interval of the arithmetic mean)	RND (only additional analysis)	
AT_005	171	4	4	
AT_006	64	3	3	
BE_001_SRF_1	44	2	2	
BE_001_SRF_2	48	1	1	
FIN_001	53	4	4	
GER_001	43	3	3	
GER_003	45	2	2	
GER_004	80	2	2	
GER_005	110	2	2	
GER_007	60	3	3	
GER_008_SRF_1	309	2	2	
GER_008_SRF_2	161	4	4	
GER_009	40	2	2	
GER_010_SRF_1	82	4	4	
GER_010_SRF_2	150	2	2	
GER_013	52	4	4	
GER_014	63	4	3	lower
GER_016	68	4	4	
IT_014	144	3	3	
IT_023	64	3	3	
N_003_SRF_2	47	4	4	
NL_002_SRF_4	52	5	5	
SE_004_SRF_1	47	4	4	
SE_004_SRF_2	216	4	4	
SE_004_SRF_4	175	4	4	

Tab. B-2: Comparison classification via statistical evaluation vs. classification via RND (chlorine)

SRF	Cl [% dm]			
	Available Assays	Classification via		RND is …
		Statistic (upper limit of the 95 % confidence interval of the arithmetic mean)	RND (only additional analysis)	
AT_001	97	4	4	-
AT_004	50	3	3	-
AT_005	171	4	4	-
AT_006	64	3	3	-
BE_001_SRF_1	123	4	4	-
BE_001_SRF_2	145	4	4	-
FIN_001	57	2	2	-
GER_001	43	3	3	-
GER_003	45	4	3	lower
GER_004	80	2	2	-
GER_005	110	3	3	-
GER_007	60	4	4	-
GER_008_SRF_1	305	3	2	lower
GER_008_SRF_2	169	3	3	-
GER_009	40	3	3	-
GER_010_SRF_1	82	3	3	-
GER_010_SRF_2	150	3	3	-
GER_012	724	2	2	-
GER_013	52	3	3	-
GER_014	63	2	2	-
GER_016	70	3	3	-
GER_018	56	2	2	-
IT_014	144	3	3	-
IT_023	64	4	4	-
N_003_SRF_2	47	3	3	-
NL_002_SRF_4	49	3	3	-
SE_004_SRF_1	47	1	1	-
SE_004_SRF_2	216	1	1	-
SE_004_SRF_4	177	3	4	higher

Tab. C-1: Results classification via statistic (fragment 1)

SRF	Database (number of assays or given mean)				Class code via statistic		
	NCV	Cl	Hg	Hg < DL	NCV[1)] [MJ/kg ar]	Cl[1)] [% dm]	Hg[2)] [mg/MJ ar]
AT_001	10	97	n.s.		4	4	
AT_002_SRF_1	Mean[3)]	25	54			4	3
AT_002_SRF_2	Mean[3)]	24	56			no class	4
AT_004	10	50	n. s.		4	3	
AT_005	171	171	57	42	4	4	3
AT_006	64	64	64	46	3	3	3
BE_001_SRF_1	44	123	67	57	2	4	3
BE_001_SRF_2	48	145	57	42	1	4	3
BE_003[5)]	46	46	30	24	4	2	4
BE_004	Mean[3)]	n. s.	44	39			5
BE_005[5)]	335	335	64	52	no class	5	5
BE_006[5)]	47	47	706	554	4	2	4
BE_007[5)]	47	47	11	11	5	3	4
BE_008[5)]	46	46	42	42	1	5	3
BE_009	21	21	8	2	3	3	
DEN_001	Mean[3)]	n. s.	n. s.				
FIN_001	53	57	57	14	4	2	1
FIN_002_SRF_1	14	15	13		4	1	4
FIN_002_SRF_2	13	13	13		4	2	4
FIN_005	Mean[3)]	Mean[3)]	n. s.				
GER_001	43	43	43	9	3	3	2
GER_003	45	45	45	3	2	4	1
GER_004	80	80	80	33	2	2	1
GER_005	110	110	100	7	2	3	1
GER_006_Statistic[4)]	72	72	20		2	4	2
GER_007	60	60	60	12	3	4	2
GER_008_SRF_1	309	305	250	184	2	3	1
GER_008_SRF_2	161	169	297	110	4	3	2
GER_009	40	40	40	13	2	3	1
GER_010_SRF_1	82	82	20	14	4	3	2
GER_010_SRF_2	150	150	18	13	2	3	1
GER_011	11	11	8	2	3	3	
GER_012	Mean[3)]	724	693	10		2	5
GER_013	52	52	52	1	4	3	2
GER_014	63	63	63	12	4	2	1
GER_015	26	26	26	15	1	3	1
GER_016	68	70	70		4	3	3
GER_017_Dried	Mean[3)]	n. s.	178				4
GER_017_Original	Mean[3)]	n. s.	178				5
GER_018	Mean[3)]	56	65	29		2	1

n.s. = not specified, DL = detection limit, ar = as received, dm = dry matter

[1)] NCV: use of lower limit of 95 % confidence interval, Cl: use of upper limit of 95 % confidence interval,

[2)] Hg: use of the 50 % - rule; [3)] only the arithmetic mean of all assays was given

[4)] arithmetic mean and standard deviation / median and 80th percentile of all assays was given

[5)] arithmetic mean and standard deviation of all assays received after the completion of D 2.4 [4]

Tab. C-2: Results classification via statistic (fragment 2)

SRF	Database (number of assays or given mean)				Class code via statistic		
	NCV	Cl	Hg	Hg < DL	NCV[1)] [MJ/kg ar]	Cl[1)] [% dm]	Hg[2)] [mg/MJ ar]
IT_002	31	31	4		3	3	
IT_003	12	12	12		4	2	3
IT_004	Mean[3)]	Mean[3)]	n. s.				
IT_005	Mean[3)]	n. s.	n				
IT_007	10	10	n. s.		3	2	
IT_008	15	15	15	11	3	3	3
IT_009	10	10	10		2	2	1
IT_012	21	20	n. s.		4	2	
IT_013	25	25	25		3	2	4
IT_014	144	144	6		3	3	
IT_016	12	12	n. s.		3	2	
IT_017	Mean[3)]	Mean[3)]	n. s.				
IT_018	Mean[3)]	n. s.	n. s.				
IT_019	12	12	11		3	3	2
IT_021	10	10	10	1	3	2	1
IT_022	30	30	30	4	3	2	3
IT_023	64	64	62		3	4	3
IT_024	13	13	13		3	3	3
IT_025	Mean[3)]	n. s.	13				3
N_001	39	39	39		4	3	3
N_003_SRF_1	19	20	20	2	4	1	1
N_003_SRF_2	47	47	45		4	3	2
NL_002_SRF_1	27	30	30	16	3	3	1
NL_002_SRF_2	27	30	30	4	4	3	3
NL_002_SRF_4	52	49	49		5	3	5
NL_003	12	12	12	1	4	2	5
NL_004_Statistic[4)]	125	128	66		3	4	2
NL_005	30	30	30	16	2	2	1
NL_006	Mean[3)]	n. s.	n. s.				
SE_001	10	10	10		4	3	2
SE_002	11	11	11		4	3	1
SE_004_SRF_1	47	47	43		4	1	1
SE_004_SRF_2	216	216	201	12	4	1	1
SE_004_SRF_3	39	39	35		3	3	2
SE_004_SRF_4	175	177	165	2	4	3	1

n.s. = not specified, DL = detection limit, ar = as received, dm = dry matter

[1)] NCV: use of lower limit of 95 % confidence interval, Cl: use of upper limit of 95 % confidence interval,

[2)] Hg: use of the 50 % - rule; [3)] only the arithmetic mean of all assays was given

[4)] arithmetic mean and standard deviation / median and 80th percentile of all assays was given