



Sampling Plans and Uncertainty Assessment

ETS Compliance Forum Event 7-8 February 2012

Mr Johan Bogren

Swedish Environmental Protection Agency

johan.bogren@naturvardsverket.se

Legislation

Monitoring and Reporting Regulation (MRR)

Chapter III – Section 2 - Sub-Section 3 - Calculation Factors

Article 30

Calculation Factors – two ways:

1. Default values, or,
2. Values based on Analysis
 - General Provisions in Article 32-35
 - Article 33 – Sampling Plan
 - Article 35 - Frequencies for analyses

What are Calculation Factors

‘calculation factors’ means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction (Article 3.7)

Article 33 – Sampling Plan

- If calculation factors are determined by analyses, the operator shall submit a sampling plan to the CA for approval
- Analyses, sampling, calibrations and validations for the determination of calculation factors are carried out by applying methods based on corresponding EN standards. (Article 32.1)

Key Elements Defined in a Sampling Plan

Step-by-step Approach

1. Identify involved parties
 2. Identify objectives and define technical goals
 3. Determine generic level of testing required (with reference to objectives)
 4. Identify constituents to be tested
 5. Research background information on source/material
 6. Identify Health and Safety precautions
 7. Select sampling approach. Identify type or sampling probabilistic versus judgemental
 8. Identify most appropriate sampling technique to address sampling requirements →
- Document the Sampling Plan →
- Send to CA for Approval →
- Undertake sampling according to the Sampling Plan

Summary - Requirements Sampling Plan

- Written procedure to be submitted to CA for approval:
 - Sample preparation, transport and storage
 - Locations, frequencies, quantities
 - Responsibilities
- Representative sampling
- In agreement with laboratory
- Adaptation in accordance with actual heterogeneity →

If homogenous → Simple Sampling Plan

Further Guidance

- NL will develop a general guidance according to MRR incl. process for producing a sampling plan
- Build on
 - previous work (e.g. UK "Guidelines on Ash Sampling and Analysis")
 - standards
 - experience from MS

Article 35 - Frequencies for analyses

- Minimum frequencies for analyses according to Annex VII (*article 35.1*)
 - Annex VII in MRR (= Table 5 in MRG)
- CA can decide on a different frequency if:
 - minimum frequencies not available (*Article 35.2*)
 - If available:
 - required frequency incur unreasonable cost (*Article 35.2(b)*), or,
 - analytic value $< 1/3$ of the uncertainty value with regard to the activity data determination (*Article 35.2(a)*)

How to Determine Compliance with Article 35.2(a)

Proposal:


Use "Uncertainty Emission Factor Excel Tool"

"Simpler, more Efficient and more Effective"

Compliance Conference 2012


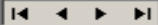
”Simpler, more Efficient and more Effective”

- Excel Tool

	A	B	C	D	E	F
2	Uncertainty Emission Factor					
3	Version 4.1 - sep 07					
4	<p>In the MRG2 the sampling and analysis frequency for determining parameters like the emission factor and the net calorific value are not specified. Instead of the frequency an uncertainty requirement applies to these parameters. The uncertainty of a parameter used for the calculation of carbon dioxide emissions shall be less than 1/3 of the uncertainty requirement for the amount of fuel or material. As the uncertainty of a parameter can be reduced by increasing the number of samples and analysis or the representativeness of the samples, the uncertainty requirement of that parameter can be stricter than that for the amount of fuel or material.</p>					
5	<p>When determining a parameter of a source stream the minimum sampling and analysis frequency to meet the uncertainty requirement can be derived from historical data. When this frequency is applied, the uncertainty shall still be determined during each reporting year, because the variations in a parameter of a source stream can be different from year to year. This is for example the case when the supplier of the source stream is changed or the sampling methodology is altered.</p>					
6	<p>This spreadsheet has been developed in order to support operators. In the sheet "history" the minimum frequency is calculated from historical data. In the sheet "uncertainty" the actual uncertainty in the annual average value of the parameter is calculated. Using this sheet an operator can establish during the year if the frequency has to be increased in order to meet the uncertainty requirement. When the analysis results are not representative for the same amount of fuel or material, the amounts can be entered and the amount weighted uncertainty is also calculated.</p>					
7	<p>Note: Generally this method can well be applied. However in exceptional situations this is not the case. For example when a refinery switches during the reporting year to another crude with strongly different properties. In those situations the uncertainty requirements shall be met for each type of fuel or raw material.</p>					
8	<p>Before you start with sheet "history", follow the next steps:</p>					
9	<ul style="list-style-type: none"> - Select the parameter using the pull down menu in cell D12 or enter its description in cell E12 					
10	<ul style="list-style-type: none"> - Enter the unit of the parameter in cell E13 and the required uncertainty for the quantity measurement in cell E14 or use the drop down menu in cell D14. 					
11						
12	Parameter	Emission factor				
13	Units					t/TJ
14	Uncertainty requirement amount fuel/material	2,5% (Tier 3)				
15						

Start / History / Uncertainty /

Klar

	A	B	C	D	E	F
2	Uncertainty Emission Factor					
3	Version 4.1 - sep 07					
4	This sheet helps you to establish the minimum measurement frequency of a parameter in order to meet the uncertainty requirement.					
5	-	Enter the analysis dates and results of the historical data in range C20..D119.				
6	-	The advised measurement frequency is given in cell E18.				
7						
8	Parameter			Emission factor		
9	Units			t/TJ		
10	Uncertainty requirement amount fuel/material			2,5%		
11	Average value			72,037	t/TJ	
12	Number of observations			30		
13	Standard deviation			0,224	t/TJ	
14	Student T factor			2,045		
15	Uncertainty requirement			0,8%		
16	Required standard deviation average value			0,300	t/TJ	
17	Minimum number of observations			1		
18	Advise for measurement frequency			Once per 3 month		
19		Number	Date	Emission factor	Units	
20		1	2-02-12	72	t/TJ	
21		2	3-02-12	72,1	t/TJ	
22		3	4-02-12	72,2	t/TJ	
23		4	5-02-12	72	t/TJ	
24		5	6-02-12	71,8	t/TJ	
25		6	7-02-12	73	t/TJ	
26		7	8-02-12	72	t/TJ	
27		8	9-02-12	72,1	t/TJ	
28		9	10-02-12	72,2	t/TJ	
29		10	11-02-12	72	t/TJ	
30		11	12-02-12	71,8	t/TJ	
31		12	13-02-12	71,9	t/TJ	
32		13	14-02-12	72	t/TJ	
	 Start History Uncertainty					
	Klar					

Microsoft Excel - SAMPLE - II 3 Determining Uncertainty emission factor rev1 04092007.xls

Arkiv Redigera Visa Infoga Format Verktyg Data Fönster Hjälp Adobe PDF

D25 71,9

	A	B	C	D	E	F
1	<p>Uncertainty Emission Factor</p> <p>Version 4.1 - sep 07</p> <p>SenterNovem InfoMil</p> <p>This sheet helps you to establish the minimum measurement frequency of a parameter in order to meet the uncertainty requirement.</p> <p>* Enter the analysis dates and results of the historical data in range C20..D119.</p> <p>* The advised measurement frequency is given in cell E18.</p>					
2						
3						
4						
5						
6						
7						
8	Parameter	Emission factor				
9	Units	kg/GJ				
10	Uncertainty requirement amount fuel/material	2,5%				
11	Average value	72,000	kg/GJ			
12	Number of observations	30				
13	Standard deviation	0,131	kg/GJ			
14	Student T factor	2,045				
15	Uncertainty requirement	0,8%				
16	Required standard deviation average value	0,300	kg/GJ			
17	Minimum number of observations	0				
18	Advise for measurement frequency	Once per 3 month				
19	Number	Date	Emission factor	Units		
20	1	2-02-12	72	kg/GJ		
21	2	3-02-12	72,1	kg/GJ		
22	3	4-02-12	72,2	kg/GJ		
23	4	5-02-12	72	kg/GJ		
24	5	6-02-12	71,8	kg/GJ		
25	6	7-02-12	71,9	kg/GJ		

Frequency

Microsoft Excel - SAMPLE - II 3 Determining Uncertainty emission factor rev1 04092007.xls

Arkiv Redigera Visa Infoga Format Verktyg Data Fönster Hjälp Adobe PDF

D25 fx 75

	A	B	C	D	E	F
6		* The advised measurement frequency is given in cell E18.				
8		Parameter		Emission factor		
9		Units		kg/GJ		
10		Uncertainty requirement amount fuel/material		2,5%		
11		Average value		72,103	kg/GJ	
12		Number of observations		30		
13		Standard deviation		0,562	kg/GJ	
14		Student T factor		2,045		
15		Uncertainty requirement		0,8%		
16		Required standard deviation average value		0,300	kg/GJ	
17		Minimum number of observations		4		
18		Advise for measurement frequency		Once per month		
19		Number	Date	Emission factor	Units	
20		1	2-02-12	72	kg/GJ	
21		2	3-02-12	72,1	kg/GJ	
22		3	4-02-12	72,2	kg/GJ	
23		4	5-02-12	72	kg/GJ	
24		5	6-02-12	71,8	kg/GJ	
25		6	7-02-12	75	kg/GJ	
26		7	8-02-12	72	kg/GJ	
27		8	9-02-12	72,1	kg/GJ	
28		9	10-02-12	72,2	kg/GJ	
29		10	11-02-12	72	kg/GJ	
30		11	12-02-12	71,8	kg/GJ	
31		12	13-02-12	71,9	kg/GJ	
32		13	14-02-12	72	kg/GJ	
33		14	15-02-12	72,1	kg/GJ	

Start History Uncertainty

Klar

Frequency increases

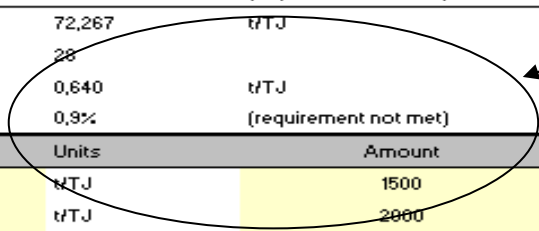
Uncertainty Emission Factor		SenterNovem InfoMil		
Version 4.1 - sep 07				
<p>In this sheet the uncertainty in an annual average value of a parameter is calculated. Enter in range C21..D120 the analysis dates and results of the measurements in the reporting year. The uncertainty in the annual average value is given in cells C14 and C15. However when the analysis results are representative for substantially different amounts of fuel or material, the amounts shall be specified in range F21..F120. The weighted uncertainty in the annual average value is given in cells C18 and C19.</p>				
Parameter	Emission Factor			
Units	t/TJ			
Uncertainty requirement amount fuell/material	2,5%			
Uncertainty requirement	0,8%			
Average value	72,111	t/TJ		
Number of observations	28			
Standard deviation	0,8%			
Student T factor	2,052			
Actual uncertainty average value	0,221	t/TJ		
		0,3% (requirement met)		
Average value (weighted for the amount)	72,074	t/TJ		
Number of observations	28			
Actual uncertainty average value (weighted for the amount)	0,229	t/TJ		
		0,3% (requirement met)		
Number	Date	Emission factor	Units	Amount
1	2-02-12	72	t/TJ	1500
2	3-02-12	72,1	t/TJ	2000
3	4-02-12	72	t/TJ	1500
4	5-02-12	72	t/TJ	2000
5	6-02-12	75	t/TJ	2000
6	7-02-12	72,1	t/TJ	2100
7	8-02-12	72	t/TJ	2200
8	9-02-12	71,9	t/TJ	2300
9	10-02-12	72	t/TJ	2400
10	11-02-12	72,1	t/TJ	2500
11	12-02-12	72	t/TJ	2600
12	13-02-12	71,9	t/TJ	2700

Uncertainty Emission Factor		SenterNovem InfoMil		
Version 4.1 - sep 07				
<p>In this sheet the uncertainty in an annual average value of a parameter is calculated. Enter in range C21..D120 the analysis dates and results of the measurements in the reporting year. The uncertainty in the annual average value is given in cells C14 and C15. However when the analysis results are representative for substantially different amounts of fuel or material, the amounts shall be specified in range F21..F120. The weighted uncertainty in the annual average value is given in cells C18 and C19.</p>				
Parameter	Emission Factor			
Units	t/TJ			
Uncertainty requirement amount fuel/material	2,5%			
Uncertainty requirement	0,8%			
Average value	72,111	t/TJ		
Number of observations	28			
Standard deviation	0,8%			
Student T factor	2,052			
Actual uncertainty average value	0,221	t/TJ		
	0,3%	(requirement met)		
Average value (weighted for the amount)	72,074	t/TJ		
Number of observations	28			
Actual uncertainty average value (weighted for the amount)	0,229	t/TJ		
	0,3%	(requirement met)		
Number	Date	Emission factor	Units	Amount
1	2-02-12	72	t/TJ	1500
2	3-02-12	72,1	t/TJ	2000
3	4-02-12	72	t/TJ	1500
4	5-02-12	72	t/TJ	2000
5	6-02-12	75	t/TJ	2000
6	7-02-12	72,1	t/TJ	2100
7	8-02-12	72	t/TJ	2200
8	9-02-12	71,9	t/TJ	2300
9	10-02-12	72	t/TJ	2400
10	11-02-12	72,1	t/TJ	2500
11	12-02-12	72	t/TJ	2600

Requirement met

Uncertainty Emission Factor		SenterNovem InfoMil		
Version 4.1 - sep 07				
<p>In this sheet the uncertainty in an annual average value of a parameter is calculated. Enter in range C21..D120 the analysis dates and results of the measurements in the reporting gear. The uncertainty in the annual average value is given in cells C14 and C15. However when the analysis results are representative for substantially different amounts of fuel or material, the amounts shall be specified in range F21..F120. The weighted uncertainty in the annual average value is given in cells C18 and C19.</p>				
Parameter		Emission factor		
Units		t/TJ		
Uncertainty requirement amount fuel/material		2,5%		
Uncertainty requirement		0,8%		
Average value		72,396	t/TJ	
Number of observations		28		
Standard deviation		2,2%		
Student T factor		2,052		
Actual uncertainty average value		0,619	t/TJ	
		0,9%	(requirement not met)	
Average value	(weighted for the amount)	72,267	t/TJ	
Number of observations		28		
Actual uncertainty average value	(weighted for the amount)	0,640	t/TJ	
		0,9%	(requirement not met)	
Number	Date	Emission factor	Units	Amount
1	2-02-12	72	t/TJ	1500
2	3-02-12	72,1	t/TJ	2000
3	4-02-12	72	t/TJ	1500
4	5-02-12	80	t/TJ	2000
5	6-02-12	75	t/TJ	2000
6	7-02-12	72,1	t/TJ	2100
7	8-02-12	72	t/TJ	2200
8	9-02-12	71,9	t/TJ	2300
9	10-02-12	72	t/TJ	2400
10	11-02-12	72,1	t/TJ	2500
11	12-02-12	72	t/TJ	2600

Requirement not met



”Simpler, more Efficient and more Effective”