

Software tools for the implementation of EN 14181

Talk given by
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BS EN14181

- BS EN 18141 is a complex quality assurance standard which requires a significant amount of calculation
- The QAL 3 part can involve the operator in a significant amount of work to generate zero and span data and calculating Control Charts
- Envirosoft created CEMQual to reduce all these requirements to a few key strokes.

CEMSuite CEMQual

- CEMQual is a software package that comes in two forms
 - A stand-alone program that accepts manually entered data
 - As part of CEMSuite Plus, a data logging program compliant with WID Or CEMSuite Power which is compliant with LCPD
- It contains all the tools to perform all EN14181 calculations
- It can be used by Test houses to perform QAL2 and AST calculations and by operators to generate QAL 3 Control charts

CEMSuite CEMQual

- It accepts data input manually or retrieved from the CEMForm database automatically
- It can perform all the key calculations for QAL2, AST and QAL3 and Linearity
- It can produce CUSUM, CUSUM precision, Shewart and moving median graphs
- All graphs and spreadsheet data can be printed or output as a JPEG picture.
- Fully compliant with EN 14181 and validated by AEA Technology
- With the addition of CEMCAL software and an Envirosoft supplied valve system, automatic zero and span tests can be undertaken at pre-determined intervals.

QAL 2 calculations

- The QAL2 module can generate all the functions required such as calibration and variability as well as producing linear regression graphs.
- It also has the capability of bringing in data from Excel to upload SRM and AMS data
- It can be used in a manual mode

QAL2/ AST data entry

CemQAL

Test data | QAL2 / AST analysis | QAL3, CUSUM analysis | Linearity | Configuration | **Unit 1, measurement channel NO**

Envirosoft

Select the measurement to analyse

Unit 1
Unit 2

NO
NO2
NOx
CO
SO2
HCl
HF
TOC
O2
H2O

Select from the saved files found for Unit 1

<input checked="" type="checkbox"/>	ES1.csv	<input checked="" type="checkbox"/>	ES10.csv
<input checked="" type="checkbox"/>	ES11.csv	<input checked="" type="checkbox"/>	ES12.csv
<input checked="" type="checkbox"/>	ES13.csv	<input checked="" type="checkbox"/>	ES14.csv
<input checked="" type="checkbox"/>	ES15.csv	<input checked="" type="checkbox"/>	ES16.csv
<input checked="" type="checkbox"/>	ES2.csv	<input checked="" type="checkbox"/>	ES3.csv
<input checked="" type="checkbox"/>	ES4.csv	<input checked="" type="checkbox"/>	ES5.csv
<input checked="" type="checkbox"/>	ES6.csv	<input checked="" type="checkbox"/>	ES7.csv
<input checked="" type="checkbox"/>	ES8.csv	<input checked="" type="checkbox"/>	ES9.csv

16 data sets have been selected

☐ Restrict file search

27/01/2007 - 28/03/2007

☐ AMS ☐ SRM

☐ Data only

Import data from other files

☐ CSV ☒ Excel ☐ AMS ☒ SRM

"C:\Documents and Settings\Steve Wright\My Documents\Enviro"

Column start: 1 Row start: 0 Number of tests: 16

Test data for Unit 1, NO

Test	Filename/ comments	Date time	AMS value	SRM value	Difference
1	Test 1				
2	Test 2				
3	Test 3				
4	Test 4				
5	Test 5				
6	Test 6				
7	Test 7				
8	Test 8				
9	Test 9				
10	Test 10				
11	Test 11				
12	Test 12				
13	Test 13				
14	Test 14				
15	Test 15				

Manual data entry

☐ Open grid for editing

Number of tests: 15

Enter root text: Test

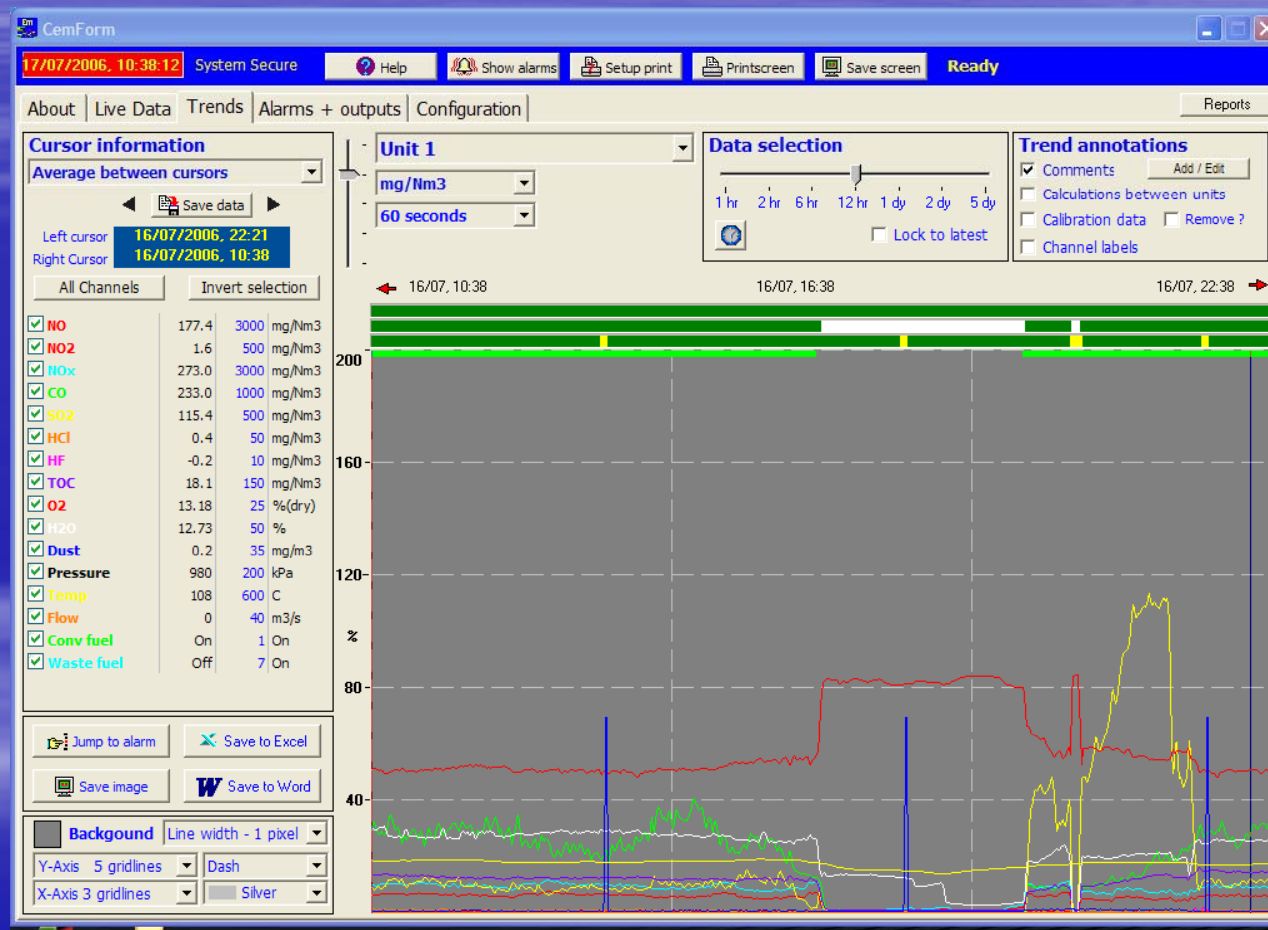
Select from files found for NO

20-03-2007.csv
CUS11-10-2005.csv
LAFCO.csv
LAFHCL.csv
LAFNH3.csv
LAFNO.csv
LAFNO2.csv
LAFNO2.csv
LAFSO2.csv

Capturing average AMS data

- CEMSuite Plus and Power have the capability to produce average measurand files between any two recorded points in time to correspond with SRM averages
- The files includes data for the measurands during the specified period
- These excel/csv files can be imported into the CEMqual module

QAL 2 data capture from CEMForm



QAL 3 Configuration

CemQAL

Test data | QAL2 / AST analysis | QAL3, CUSUM analysis | Linearity | **Configuration** | **GT 51, measurement channel NOx**

Select the measurement to analyse/ edit details

GT 51
GT 52
GT 61
GT 62

NOx
NO
CO
O2
Pressure
Temp
NOx conv. OK

Log in details

Operator: steve Password: **** Log in

CemQAL/ EN14181 data

ELV	Sams (Span)	Sams (Zero)	Span gas value	Zero gas value	Confidence %
110	5	5	205	10	20

Save and apply

Parameters Delete all Copy to all Save

Parameter	Value	Units/ comments
Median value	4	No of points
ELV Divider	2	
ELV Multiplier	2	
Span delay	110	seconds
Span time	30	seconds
Zero delay	55	seconds
Zero time	25	seconds
Span cal. bit	7	bit no (1..8)
Zero cal. bit	5	bit no (1..8)
Cal. validity	2	Points for valid cal.
No of days	90	Default days to look back
n for Schewart	1	Used for initial QAL3

Email QAL3 settings ☐ Active?

Add address Remove address

Interval ☒ Weekly ☐ Monthly

Start date and time: 03/04/07 12:30 ...

Save settings for Auto QAL3

CEMSuite calibration data

Add and use new data Modify existing data

Comments

Measurand	Coeff. a	Coeff. b
NOx	1.00000	0.0
NO	1.00000	0.0
CO	1.00000	0.0
O2	1.00000	0.0
Pressure	1.00000	0.0
Temp	1.00000	0.0
NOx conv. OK	1.00000	0.0
Cooler OK	1.00000	0.0
Cal. gas OK	1.00000	0.0
Local cal.	1.00000	0.0
Premix mode	1.00000	0.0
-	1.00000	0.0
Load	1.00000	0.0

Save this data

Calibration gas data

From date	Span	Value	Gas ID
28/01/2007	True	203	33526
01/08/2006	True	188	25522
13/04/2006	True	194.3	111949
20/01/2005	True	205	No 1
01/01/2005	False	0	Air

Save data

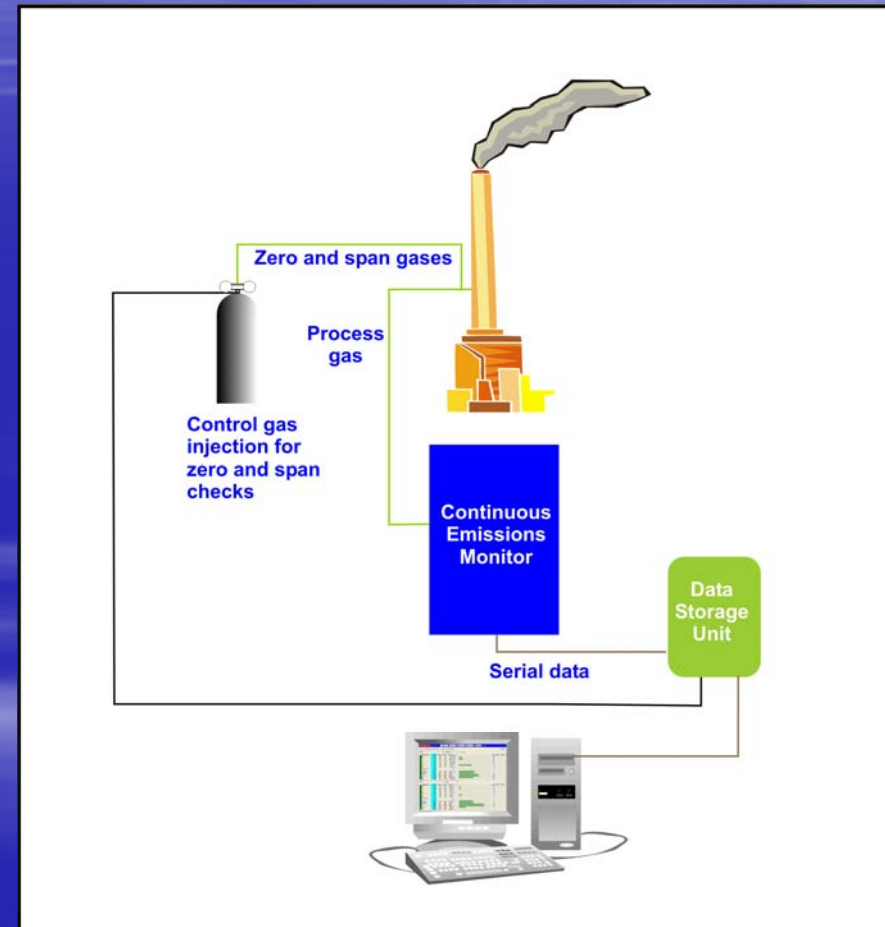
Messages

QAL 3 data collection

- On many systems, the AMS initiates and collects zero and span data. CEMSuite Plus can usually collect this data via a serial link.
- On systems without these facilities, we can use the CEMCal module which is pre-programmed to open gas valves at pre-selected times.
- CEMCal allows the audit gas time to progress up to the probe and down to the AMS, settle in the measuring cell and then capture the gas concentration.
- The data is then stored in the database and flagged as calibration data.
- The data can then automatically downloaded in to the CEMQual QAL 3 module to create control charts.

CEMCAL automatic gas injection system

- CEMCal module initiates routine at pre-determined time .
- Opens relevant gas bottle valve via a relay signal
- Gas travels up to probe and down to analyser.
- DSU waits until reading settles and then stores it. Flagged as a cal value.
- CEMQal module can then download the data into QAL module



Control Chart manual data entry

CemQAL

Test data | QAL2 / AST analysis | QAL3, CUSUM analysis | Linearity | Configuration | **Unit 1, measurement channel NO**

Load data | Save this data | Import results | Auto data find | Skip calcs 0 | Start 08/02/2007 | End 10/04/2007 | Print | New data | 1 Lines

☒ Span ☐ Zero

Drift factors

hx	2.85
lx	0.501

Precision factors

hs	6.90
ks	1.85

Standard Deviation

S ams	10.00
-------	-------

Zero/ span gas value
10.00 Change

☒ Spreadsheet ☐ Graph

Graph select

☒ CUSUM - Drift
☐ CUSUM - Precision
☐ Shewhart
☐ Moving median

Redraw graph

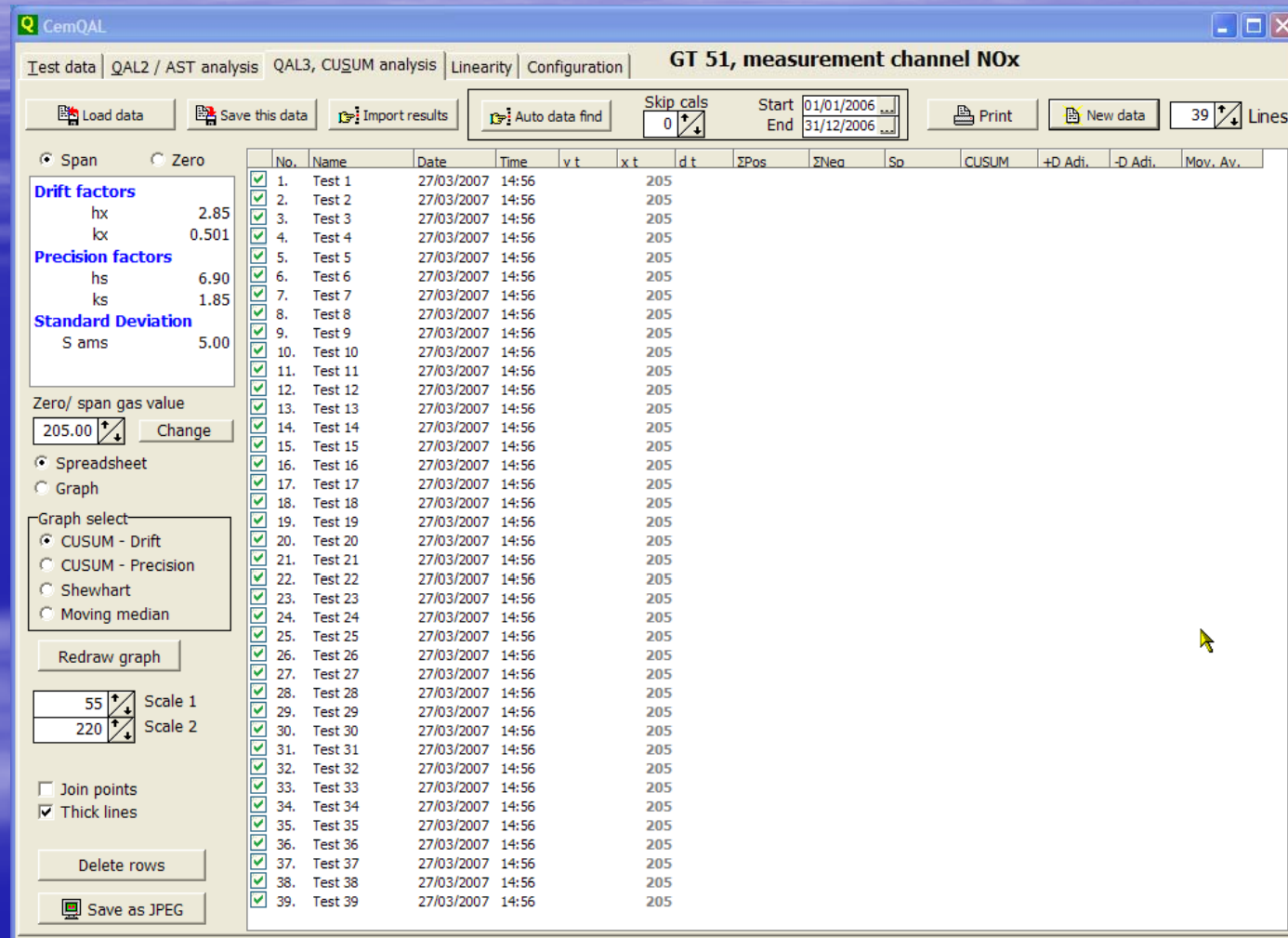
25	Scale 1
400	Scale 2

☐ Join points
☒ Thick lines

Delete rows

Save as JPEG

QAL3 analysis



Linearity check

CemQAL

Test data | QAL2 / AST analysis | QAL3, CUSUM analysis | **Linearity** | Configuration | **Unit 1, measurement channel NO**

Clear Load data Save this data

Nominal	Actual	Date	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Av.	dc	dc rel.	OK?
0 %	0	12/03/07	-	-	-	-	-	-	-	-	-	-	1E+0269	1E+0269	1E+0268	NO
20 %	8	12/03/07	-	-	-	-	-	-	-	-	-	-	0.00	0.000	0.000	YES
40 %	16	12/03/07	-	-	-	-	-	-	-	-	-	-	1E+0269	1E+0269	1E+0268	NO
60 %	24	12/03/07	-	-	-	-	-	-	-	-	-	-	1E+0269	1E+0269	1E+0268	NO
80 %	32	12/03/07	-	-	-	-	-	-	-	-	-	-	0.00	0.000	0.000	YES
0 %	0	12/03/07	-	-	-	-	-	-	-	-	-	-	0.00	0.000	0.000	YES

Param.	Value	Comments
n	0	Number of readings
Xz	0.0	Average ref. measurement
a	0.0	Average AMS reading
B	0.000	Coefficient "B"
A	0.000	Coefficient "A"