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# **BS EN 14181 Experiences**

## **(BS EN 13284-2)**



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# Summary of Standard

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- QAL 1 – Product Certification (MCERTS)
- QAL 2 – Calibration and Validation
- QAL 3 – Ongoing QA
- AST – Annual Surveillance Test

# QAL 1

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- New Instruments should be MCERTS
- Can use other instruments if QAL 2 ok
- This should cover whole system
- Includes ability to introduce gas down sample line
- List of instruments available on SIRA website

## QAL 2

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- 3 Steps
- Functional Tests
- Parallel Tests with SRM
- Data processing

# Functional Tests

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- Audit of systems
  - Instrument manuals and control
  - Service reports
  - QAL 3 data
- Witness analyser functionality
  - Inspection
  - Zero and Span checks to analyser
  - Zero and Span checks to system
  - Measure response time
  - Linearity Test (recommended)
- Report goes in final report

# Parallel Tests with SRM

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- Minimum 15 Tests
- Evenly Spread over 3 days
- Days do not have to be consecutive
- Require at least 3 results near zero
- Raw data required in correct units
  - In situ analyser – stack conditions
  - NO<sub>x</sub> or NO

# Data Processing

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- Calibration Function
- Valid Calibration Range
- Variability Pass / Fail Test

# Data Processing

## EN 14181 QAL 2 Calibration Function

AES Test Engineer

Site Reference

AMS Type/Measurand NO

AMS Reference Cross duct IR

AMS offset (Z) 0

Site ELV 248

Units mg/m3

Uncertainty allowed @ ELV % 20

function  $y = -0.91 + 0.901x$

Valid Cal Range 0 to 309.75 mg/m3

Variability Pass/Fail PASS

$y_i = y_{i,s}$  ? y or n n

$y_i = y_{i,s}$  ? y or n n

standard conditions	temp K	pressure hPa	oxygen %
	273.15	1013	6

Std Dev	5.27801127
Maximum allowed:	24.7417959

				$t_i$ °C	$h_i$ %	$o_i$ %	$p_i$ hPa	$y_i$ mg/m3	$x_i$ mg/m3	$y_{i,s}$ mg/m3	$y_i$ mg/m3	$t_i$ °C	$h_i$ %	$o_i$ %
Replicate Measurement	Date of Test	Start Time	Test Duration hrs	SRM Temp	SRM Moisture	SRM Oxygen	SRM P diff	SRM result	AMS Output	SRM Std	AMS Cal Value	AMS Temp	AMS Moisture	AMS Oxygen
1	1	0800-1000		122.00	8.20	10.30		122.49	137.00	270.59	122.54	122.00	8.50	10.40
2	1	1100-1200		122.00	8.50	10.30		124.52	142.00	275.98	127.05	122.00	8.50	10.30
3	1	1300-1400		122.00	8.40	10.60		119.00	133.00	271.07	118.94	122.00	8.50	10.70
4	1	1500-1600		122.00	8.30	10.10		125.57	141.00	272.62	126.15	122.00	8.50	10.20
5	1	1700-1800		122.00	8.30	10.50		119.92	132.00	270.26	118.04	122.00	8.50	10.40
6	1	1900-2000		122.00	8.20	10.50		119.26	136.00	268.49	121.64	122.00	8.50	10.50
7	2	0800-1000		122.00	8.60	10.40		121.95	138.00	273.15	123.45	122.00	8.50	10.50
8	2	1100-1200		122.00	8.70	10.70		123.42	135.00	284.80	120.74	122.00	8.50	10.60
9	2	1300-1400		122.00	8.50	10.40		119.70	134.00	267.80	119.84	122.00	8.50	10.50
10	2	1500-1600		122.00	8.40	10.10		117.40	131.00	255.14	117.14	122.00	8.50	10.20
11	2	1700-1800		122.00	8.90	10.30		123.97	136.00	275.98	121.64	122.00	8.50	10.20
12	2	1900-2000		122.00	8.40	10.40		120.61	134.00	269.55	119.84	122.00	8.50	10.30
13	3	0800-1000		122.00	8.60	9.90		121.17	136.00	259.17	121.64	122.00	8.50	9.80
14	3	1100-1200		122.00	8.60	9.80						122.00	8.50	9.90
15	3	1300-1400		122.00	8.10	10.10						122.00	8.50	10.10
16	3	1500-1600		122.00	8.50	10.30		1.18	5.00	2.61	3.60	122.00	8.50	10.20
17	3	1700-1800		122.00	8.60	10.30		0.39	0.00	0.87	-0.91	122.00	8.50	10.30
18	3	1900-2000		122.00	8.20	10.10		0.79	1.00	1.70	-0.01	122.00	8.50	10.20
19														
20														
Σ				2196.00	152.00	185.10	0.00	1581.35	1771.00	3519.79	1581.35	2196.00	153.00	185.30
average				122.00	8.44	10.28	#DIV/0!	98.83	110.69	219.99	98.83	122.00	8.50	10.29
max				122.00	8.90	10.70	0.00	125.57	142.00	284.80	127.05	122.00	8.50	10.70
min				122.00	8.10	9.80	0.00	0.39	0.00	0.87	-0.91	122.00	8.50	9.80
max-min				0.00	0.80	0.90	0.00	125.18	142.00	283.93	127.96	0.00	0.00	0.90

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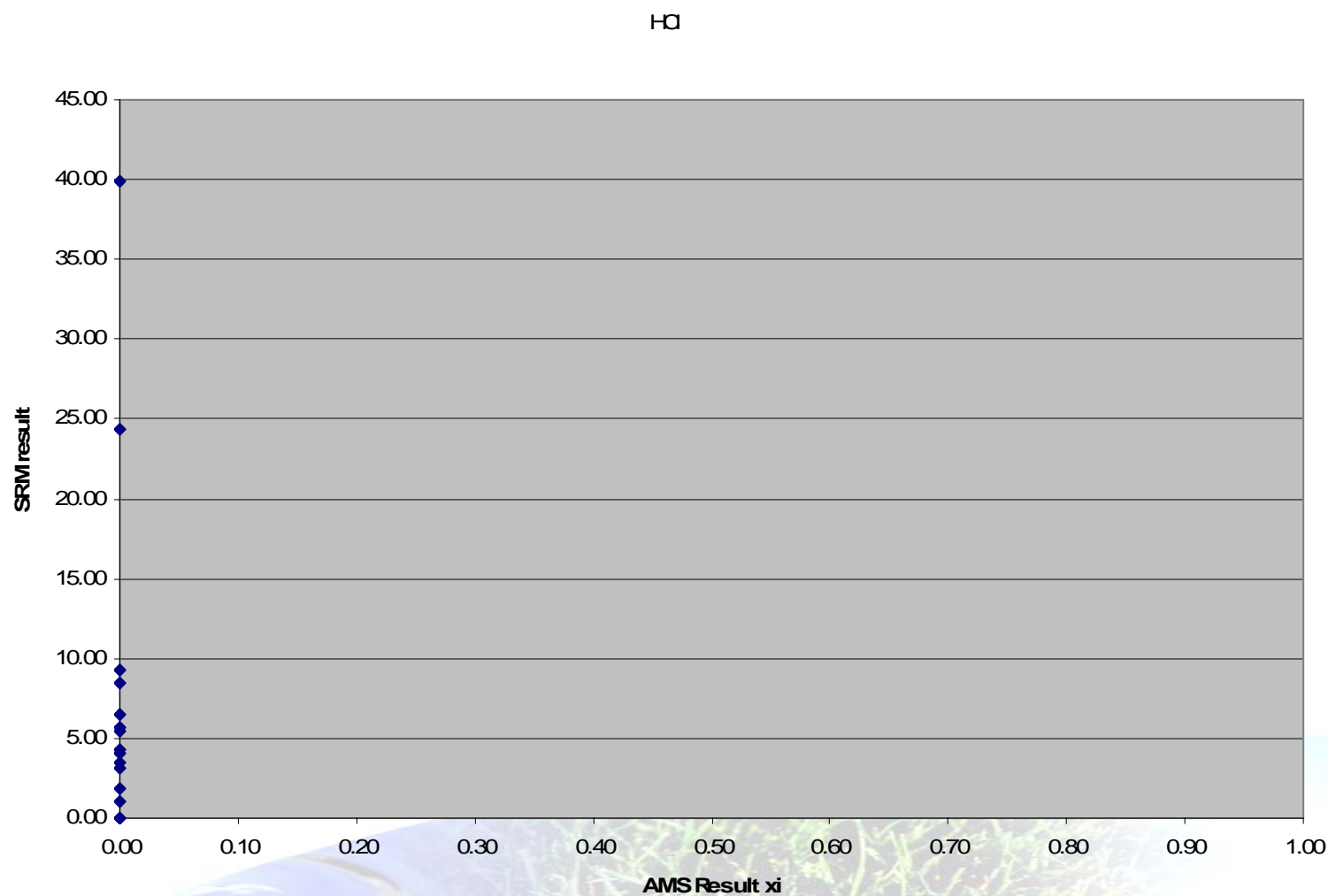


# Problems encountered

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- Span gases not available for all determinands
- Ability to introduce gas down sample line
- No QAL 3 data
- No linearity test in case of low clusters
- Systems not in place
- No readings near zero

# Low Clusters

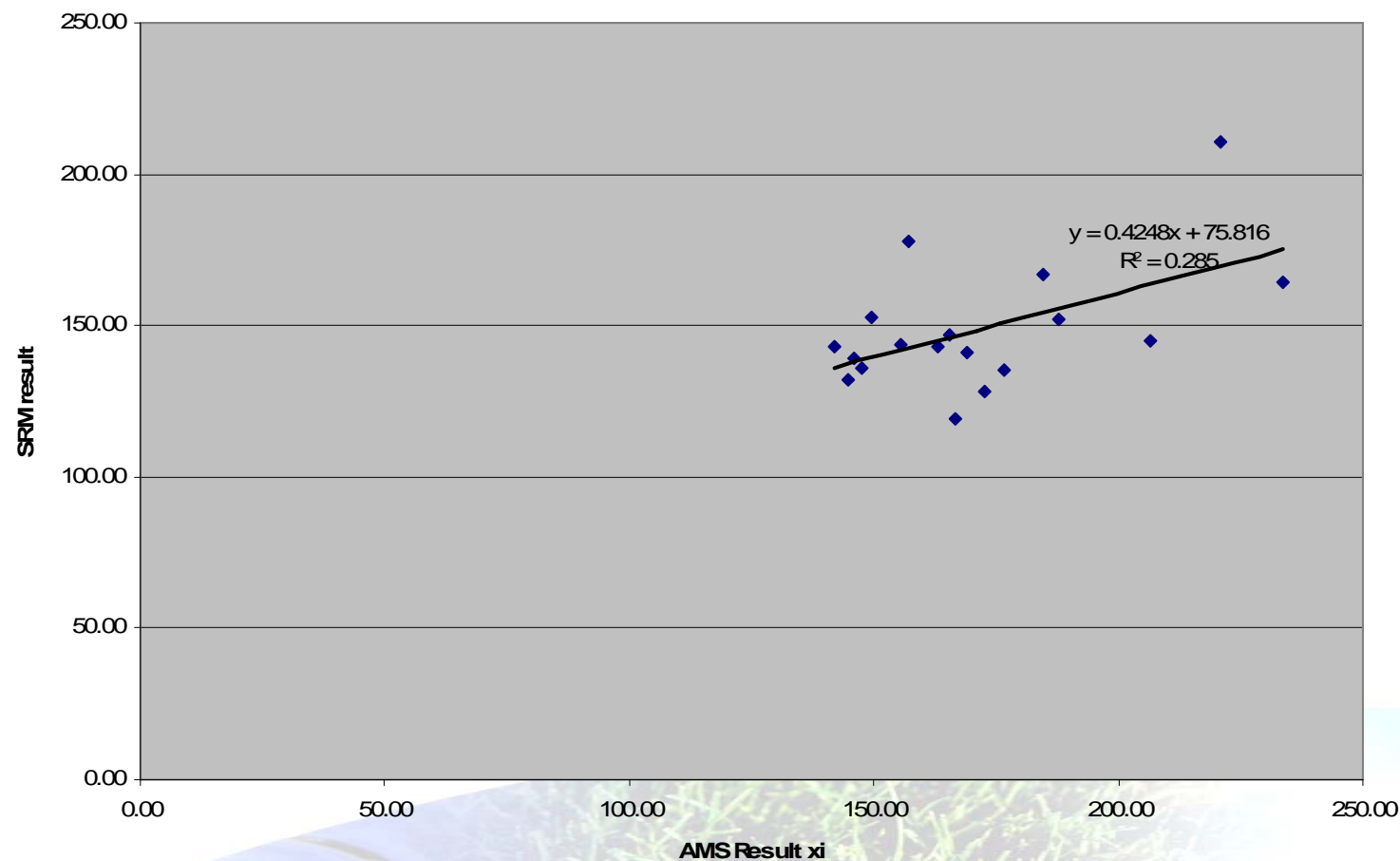


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# No Readings Near Zero

Calibration Function of AMS

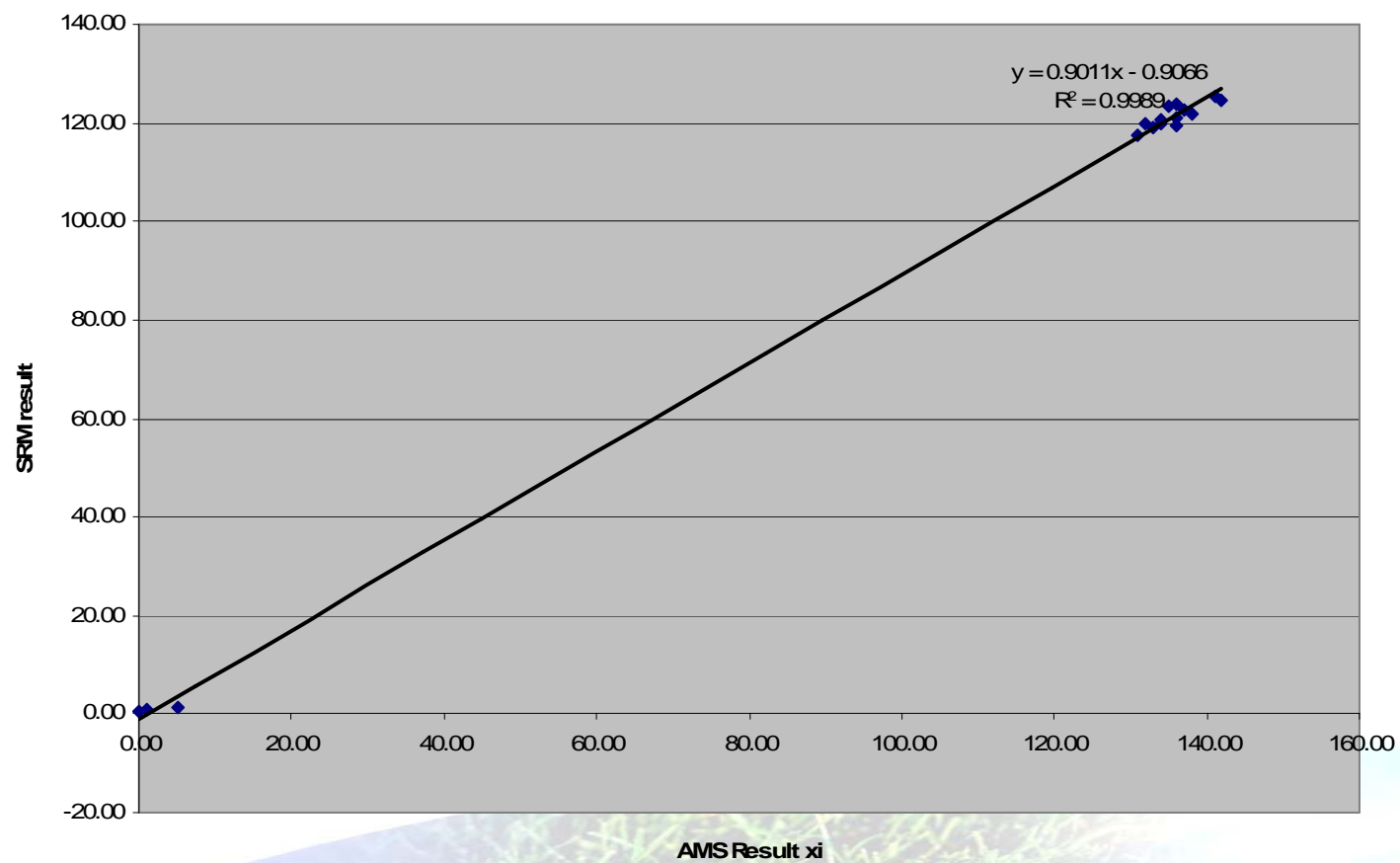


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# Ideal

Calibration Function of NOAMS



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## QAL 3

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- Regular zero and span checks
- Analyser NOT adjusted
- Results plotted on control chart
- Span gas does not need to be 'gold' standard

# AST

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- Mini QAL 2
- Functional Tests (including linearity)
- Minimum 5 Parallel Tests over 1 day
- Data Processing
  - Test Variability
  - Test Calibration Function