



Excellence through measurement

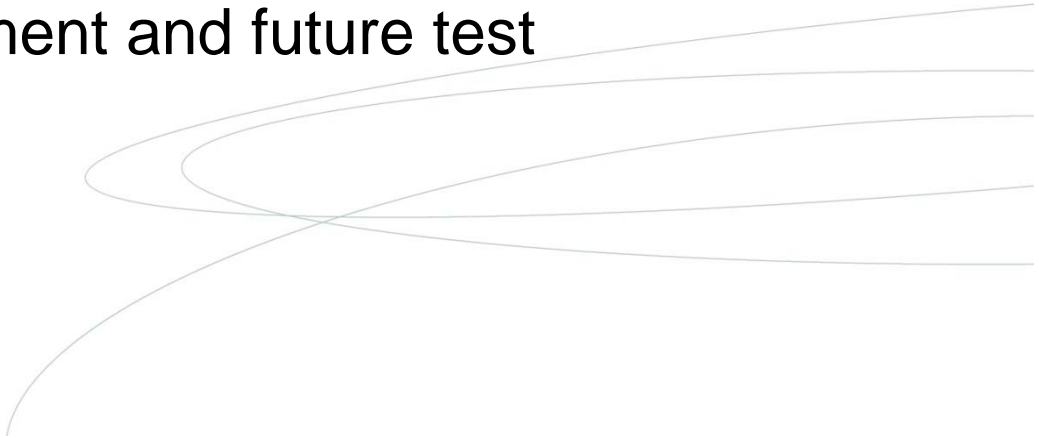


Environment Day 2011: LGC Standards, Proficiency Testing

STACKS PT scheme review

Matthew Whetton

STACKS: Introduction

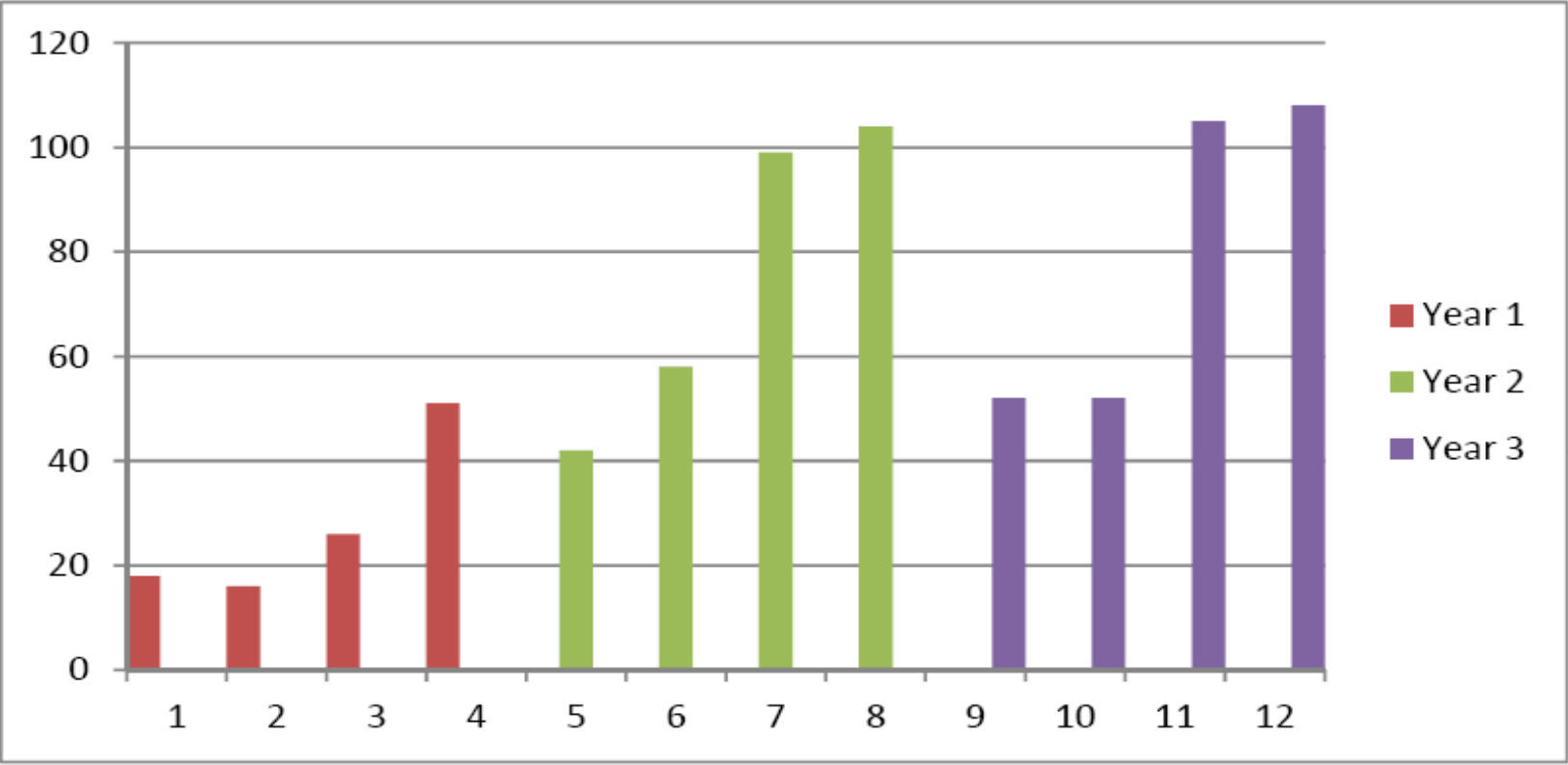
- STACKS scheme 2010/2011
 - Review of participant results
 - Review of filter trial sample Hb
 - Scheme development and future test materials
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STACKS: History

- Scheme was launched in September 2008
 - Quarterly distribution
- Samples provided for 2008/9
 - Simulated impinger solutions
 - Produced according to EN standards
- Samples added for 2009/10
 - Filter sample in addition to elements solution
- Samples added for 2010/11
 - Trial filter sample using addition of fly-ash in addition to elements solution
- Samples added for 2011/12
 - Trial sample for rinsing solutions – gravimetry

STACKS: Participant numbers

Total number of participants for all samples in the STACKS scheme, 2008 to 2011



STACKS: Statistics

- Samples provided for 2008/10
 - Assigned values based on gravimetric formulation
 - SDPA used was the robust standard deviation for the first eight rounds
 - Participant performance assessed using Z-scores
- Samples provided for 2010/11
 - Assigned values based on gravimetric formulation and z scores still used
 - SDPA based on fit-for-purpose, fixed, values
 - Volume 5%, Mercury 25%, Elements 5%, Inorganic 10%, Filters 10%

STACKS: Participant performance

The percentage of participant results assessed as satisfactory for samples in the STACKS scheme.

Element	1	2	3	4	5	6	7	8	9	10	11	12
Mercury (Permanganate)		100	83			70	83			80	90	
Mercury (Dichromate)	75			85	100			92	71			85
Specific elements	79	70	87	88	83	87	80	86	80	92	83	92
Sulfur dioxide		100	89			83	85			85	93	
Hydrogen fluoride		100		88		90		78		85		83
Hydrogen chloride		67		75	83			78	80			92
Ammonia	67		100		92		90		88		91	
Elements on Filters					89	82	85	73	96	82	80	81

STACKS: Participant performance

The percentage of participant results assessed as satisfactory for sample C in the STACKS scheme.

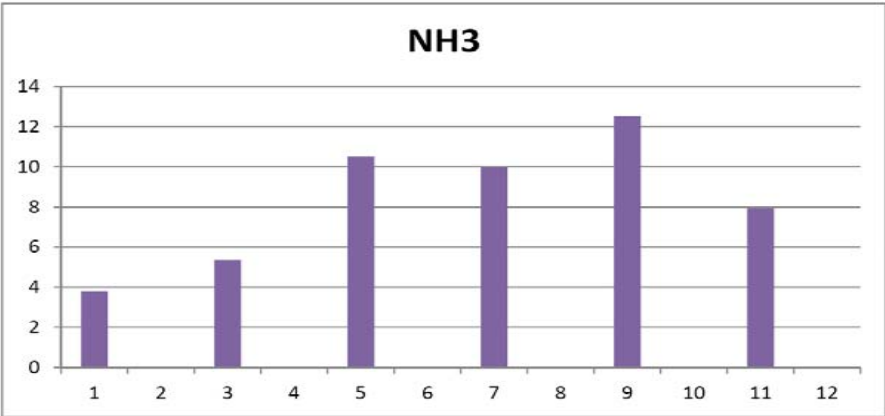
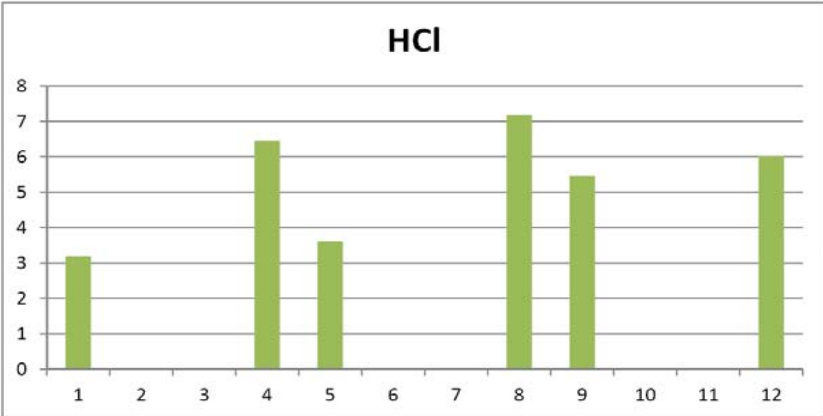
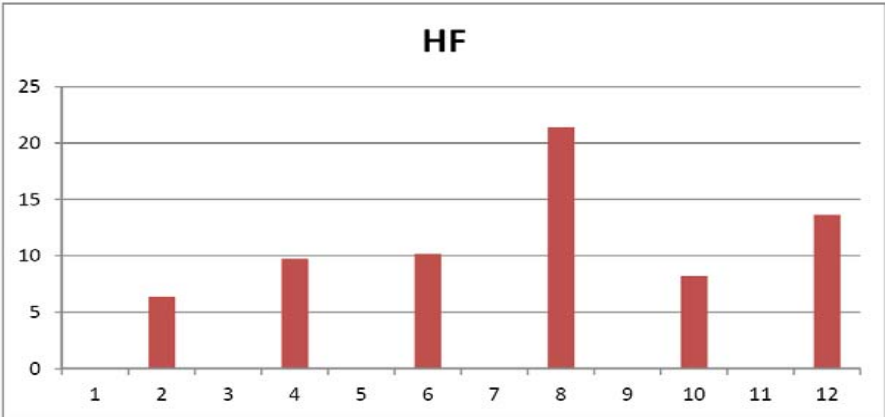
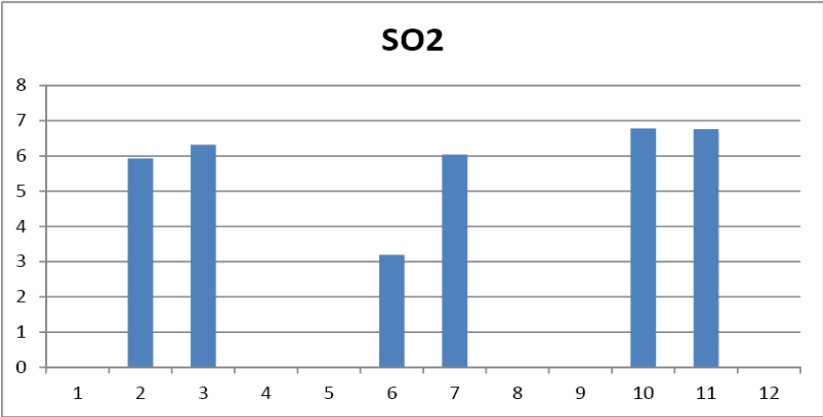
Element	1	2	3	4	5	6	7	8	9	10	11	12
Antimony	100		88		88		75	93		85		80
Arsenic	100	60		94		90		94		83		90
Cadmium	67			88		100		83	100		71	
Chromium		80	100		88		82		100		81	
Cobalt		60		88	71	70		71		100		94
Copper		80		94		80	68		100		71	
Lead	67		100		75		77		67	83		95
Manganese	67			88		90		100		100	91	
Nickel		60	71		75		86		67		95	95
Thallium		80	75		100		90		44		90	
Vanadium	80		86	75		90		75		100		100

STACKS: Participant performance



Excellence through measurement

The Robust Standard Deviations, as a percentage of the AV, for samples D, E, F and G in the STACKS scheme.

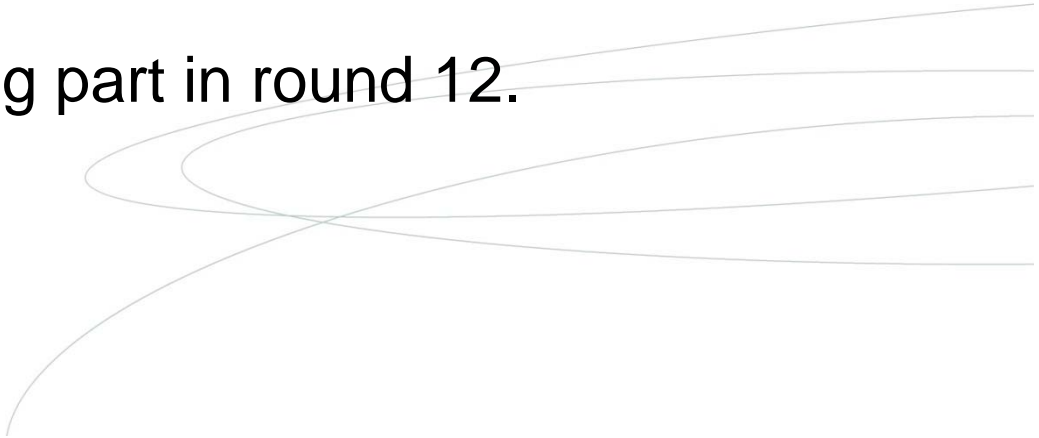


STACKS: Participant performance

The Robust Standard Deviations,(mg/L) and AV, in brackets, for samples D, E, F, and G in the STACKS scheme.

Round	SO2	HF	HCl	NH3
1			0.3 (9.5)	0.74 (18.0)
2	1.142 (19.5)	0.06 (0.97)		
3	1.572 (25.6)			0.96 (16.8)
4		0.089 (0.99)	0.297 (4.4)	
5			0.19 (5.28)	1.93 (18.39)
6	0.47 (14.7)	0.10 (0.98)		
7	0.31 (5.13)			0.76 (7.61)
8		0.06 (0.28)	0.10 (1.39)	
9			0.95 (17.3)	1.33 (10.6)
10	0.85 (12.5)	0.062 (0.76)		
11	0.74 (10.95)			0.42 (5.29)
12		0.09 (0.66)	0.85 (14.2)	

STACKS: Sample Hb filter trial

- Sample H:
 - Quartz filter
 - Spiked with standard elemental solutions
 - Trial sample Hb:
 - Quartz filter
 - Known amount of fly ash added
 - 22 participants, taking part in round 12.
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STACKS Sample Hb: Results

The concentration of each element , spread of results (RSD) and percentage of satisfactory results for trial sample Hb in the STACKS scheme.

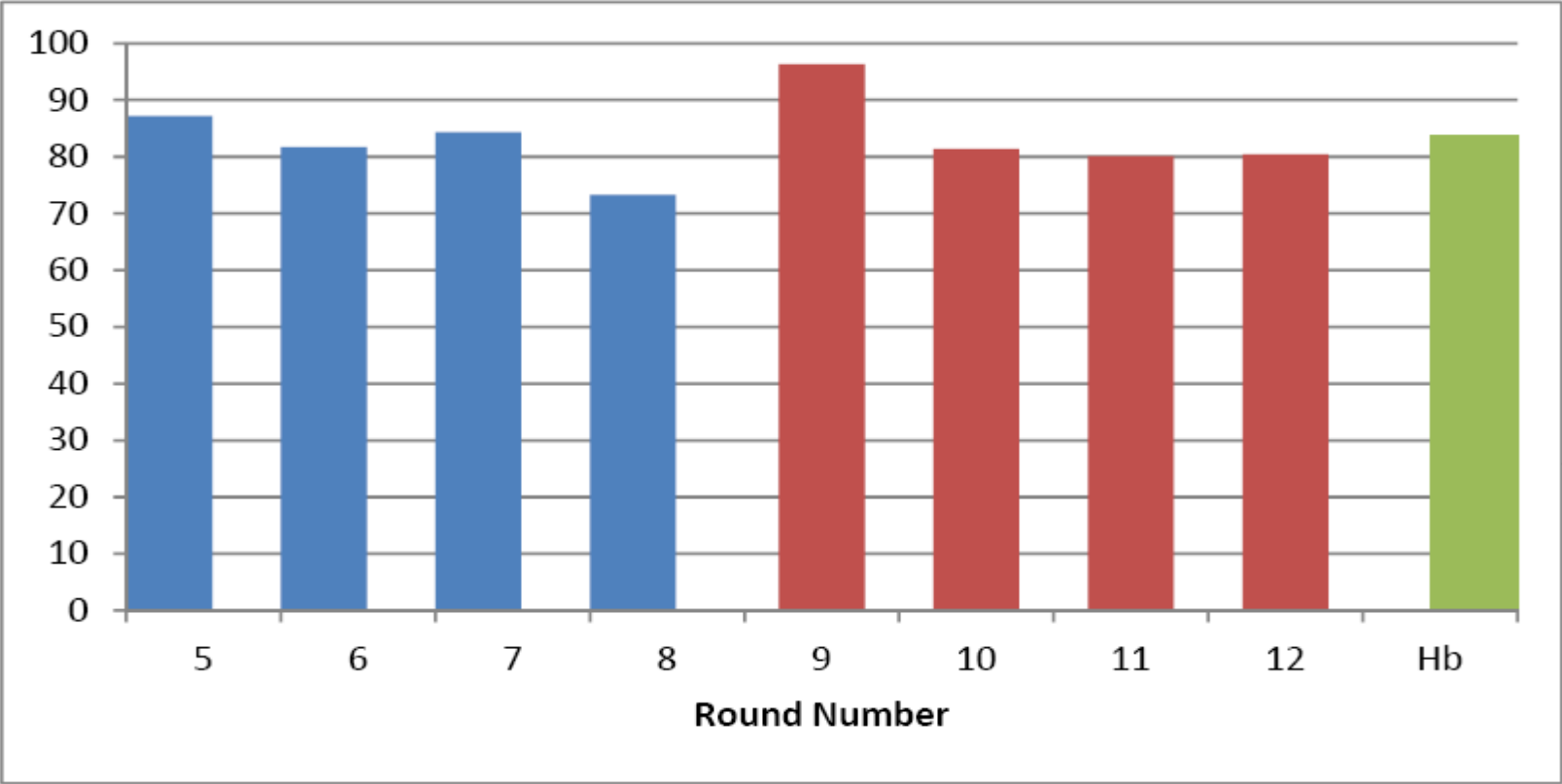
Element	Conc mg/filter	RSD	% Satisfactory
Antimony	0.008	0.001	68.8
Cadmium	0.002	0.001	100.0
Chromium	0.005	0.001	81.3
Copper	0.010	0.001	82.4
Lead	0.044	0.003	82.4
Nickel	0.001	0.001	87.5

STACKS Sample Hb: Results



Excellence through measurement

Average percentage of satisfactory results for filter sample H (2009, 2010) and trial sample Hb in the STACKS scheme.



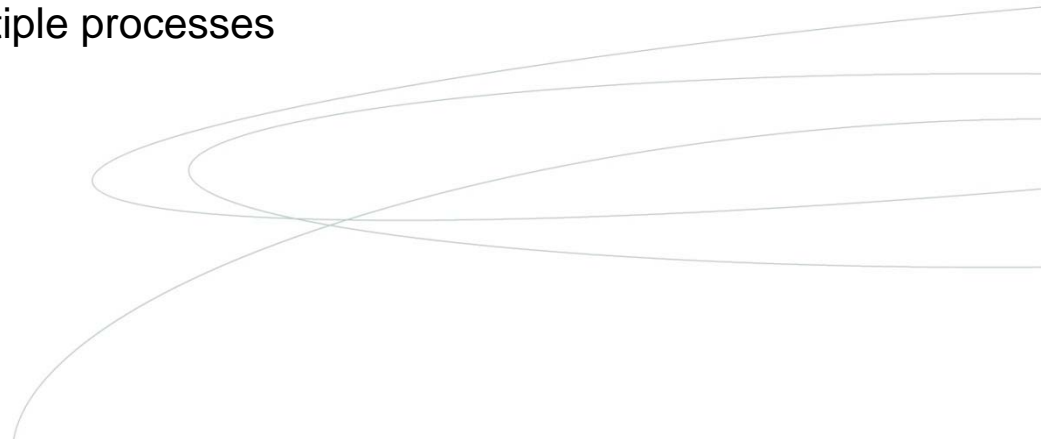
STACKS Sample Hb: Summary

- +ves
- Consistent addition of fly ash to filters
- Comparable performance to spiking with standards
- -ves
- Fly ash may not contain all analytes of interest

- Future rounds
 - Obtain various fly ash materials
 - Variation of fly ash weight addition
 - Combination of fly ash and standard solutions

STACKS: Scheme development

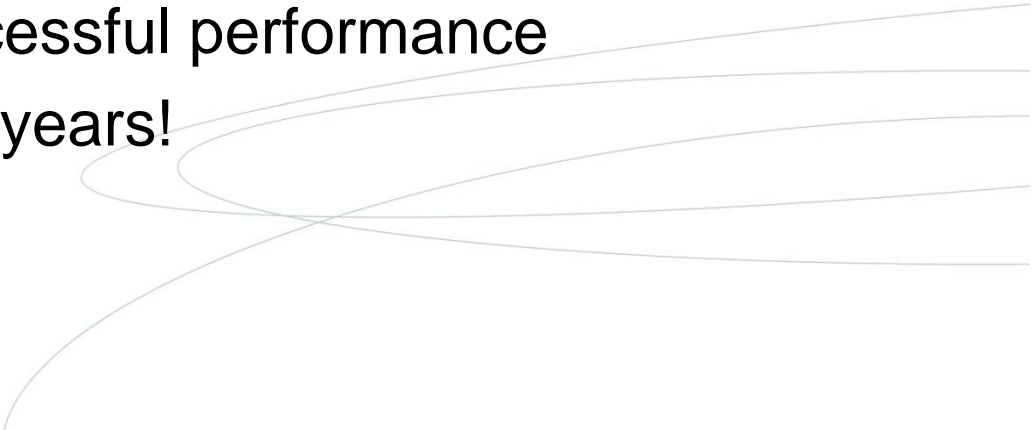
- 2011/12 onwards:
- Further new samples
 - Gravimetric analysis of total and dissolved solids in rinsing solutions
 - Determined according to EN 13284-1 (2002)
 - Sample I included in round 13
 - Gravimetric determination of filters
 - Production procedure
 - Procedure for despatch, measurement and reporting
 - Despatch, return or multiple processes



STACKS: Scheme development

- Further new samples
 - Organic analytes on filters
 - A huge range of organic components are specified in legislation e.g. Volatiles, semi-volatiles, OCs, PCBs, PAHs, aldehydes and ketones
 - The number of labs carrying out the analysis is smaller
 - PUF and charcoal are used as the filter media
 - NO₂ has been requested by one participant
 - Composition of stack emission gases
 - Another area of significant interest
 - Current schemes do not meet the needs of customers
 - Sample production and distribution could be complex
 - Analytes include CO, CO₂, NO_x, CH₄ etc

STACKS Conclusions

- Scheme has grown significantly in 3 years
 - Participant performance over that time:
 - Good rate of satisfactory performance
 - Consistent for a wide range of analytes
 - Although there will always be variations in performance
 - The change to a fixed SDPA has seen performance maintained
 - The use of analytically more challenging samples has been trialled with successful performance
 - Roll on the next three years!
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Thank-you for listening



Any questions!