

Update on IAEA proficiency test exercises

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IAEA

International Atomic Energy Agency

2020 IAEA PTE participation

2020 IAEA proficiency test exercise (PTE) for radionuclides in seawater

90 participants – 75 reported results

- 7 participants from HELCOM contracting parties
- 25 participants from Japan
- OSPAR, regional collaborations in Asia-Pacific, Europe & Africa, other marine labs

HELCOM Participating Institutes

Estonia	Environmental Board / Radiation Safety Department
Finland	Radiation and Nuclear Safety Authority (STUK)
Germany	Thünen-Institut für Fischereiökologie
Germany	Bundesamt für Seeschifffahrt und Hydrographie (BSH)
Poland	National Research Institute / Institute of Meteorology and Water Management
Russian Federation	V.G.Khlopin Radium Institute (ISTC)
Sweden	Swedish Radiation Safety Authority (SSM)

2020 IAEA PTE: samples

- Samples supplied containing 5 L of Mediterranean sea water spiked with known amounts of ^3H , ^{90}Sr , ^{134}Cs and ^{137}Cs
- ^{133}Ba added as an 'Undisclosed Gamma Emitter'
- 120 samples prepared
- 6 QC samples tested for gamma emitting radionuclides

Suggested analytical methods

^3H : Distillation and liquid scintillation counting

^{90}Sr : Ca/Sr precipitation followed by extraction and/or chromatography and LSC or GF-proportional counting

^{134}Cs , ^{137}Cs and ^{133}Ba :

- Either direct γ spectrometry (GS) or

- Adsorption on $(\text{NH}_4)_3\text{PO}_4\text{Mo}_{12}\text{O}_{36}$ or $\text{Cu}_2[\text{Fe}(\text{CN})_6]$ and GS for $^{134}\text{Cs}/^{137}\text{Cs}$ only

2020 IAEA PTE (assigned values)

Individual unique sea water samples prepared separately.

Traceable massic activities in samples:

^3H	$(4.30 - 4.38) \text{ Bq kg}^{-1}$
^{90}Sr	$(0.551 - 0.561) \text{ Bq kg}^{-1}$
^{134}Cs	$(0.355 - 0.361) \text{ Bq kg}^{-1}$
^{137}Cs	$(0.934 - 0.950) \text{ Bq kg}^{-1}$
^{133}Ba	$(0.314 - 0.329) \text{ Bq kg}^{-1}$

Test I (relative bias test)

$$\text{Relative bias} = \frac{\text{Value}_{\text{Analyst}} - \text{Value}_{\text{IAEA}}}{\text{Value}_{\text{IAEA}}} \times 100\%$$

^{134}Cs and ^{137}Cs

If absolute value of relative bias < 20%:
otherwise:

Pass

Fail

^{133}Ba , ^3H and ^{90}Sr

If absolute value of relative bias < 25%:
otherwise:

Pass

Fail

Two additional tests

Test II (zeta (ζ)score) and Test III (precision test)

$$A_1 \leq A_2$$

where:

$$A_1 = |Value_{IAEA} - Value_{Analyst}|$$
$$A_2 = 2.58 \times \sqrt{unc_{IAEA}^2 + unc_{Analyst}^2}$$

$P < 20\%$ (^{134}Cs and ^{137}Cs)

$P < 25\%$ (for ^{133}Ba , ^3H and ^{90}Sr)

where:

$$P = \sqrt{\left(\frac{unc_{IAEA}}{Value_{IAEA}}\right)^2 + \left(\frac{unc_{Analyst}}{Value_{Analyst}}\right)^2} \times 100\%$$

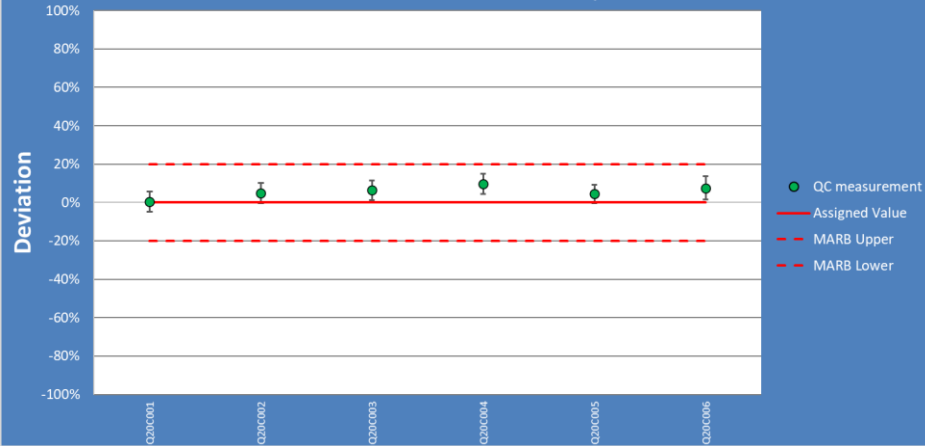
Evaluation

Test I	Relative bias test	Pass or Fail
Test II	Zeta (ζ) score	Pass or Fail
Test III	Precision test	Pass or Fail

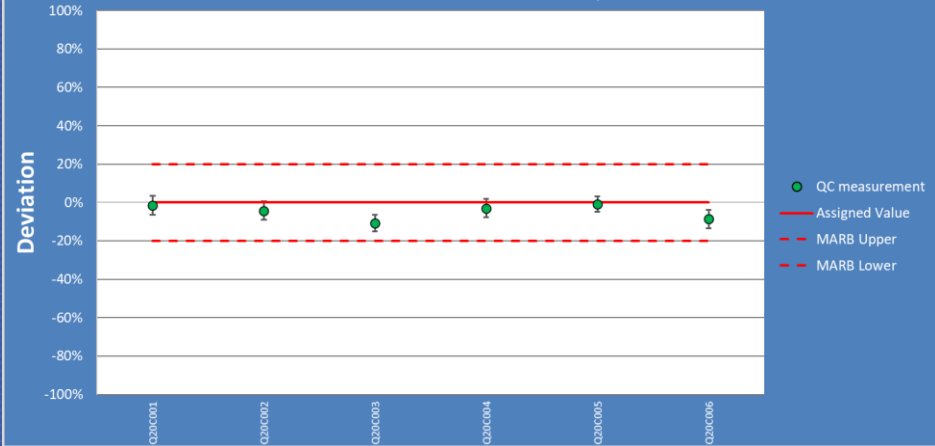
<u>Test I</u>	<u>Test II</u>	<u>Test III</u>	<u>Final evaluation</u>
Pass	Pass	Pass	Accepted
Pass	Fail	Pass	Warning
Pass	Pass	Fail	Warning
Fail	Pass/Fail	Pass/Fail	Not Accepted

Results of QC measurements

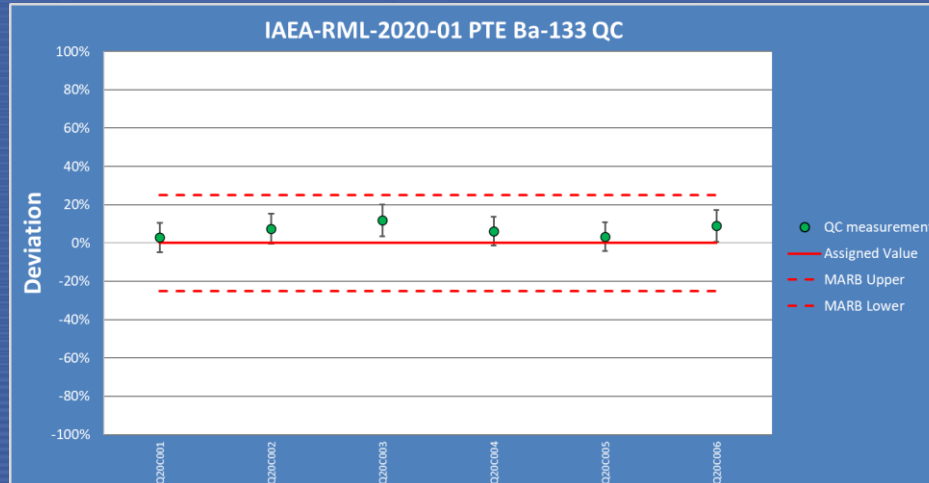
IAEA-RML-2020-01 PTE Cs-134 QC



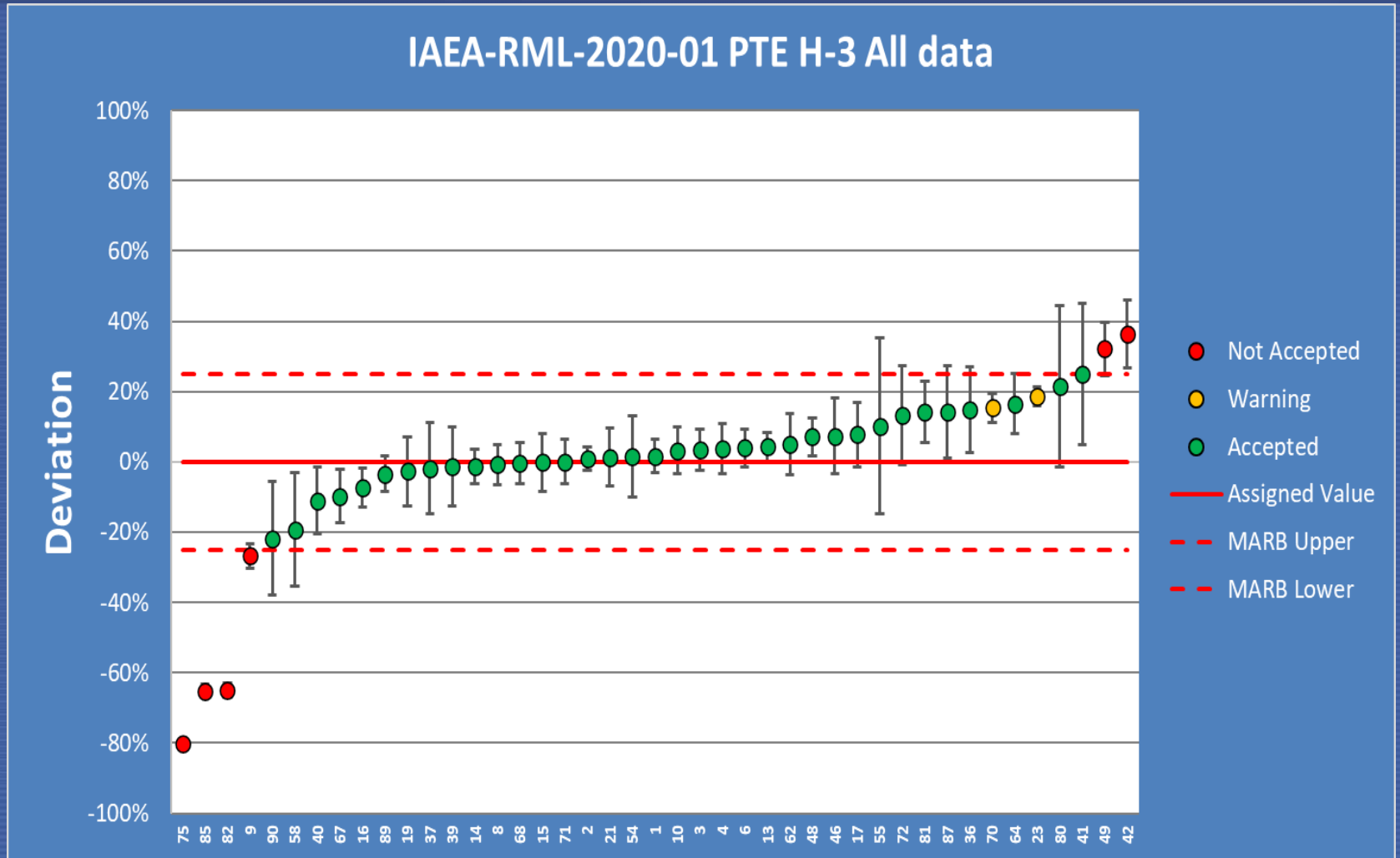
IAEA-RML-2020-01 PTE Cs-137 QC



IAEA-RML-2020-01 PTE Ba-133 QC

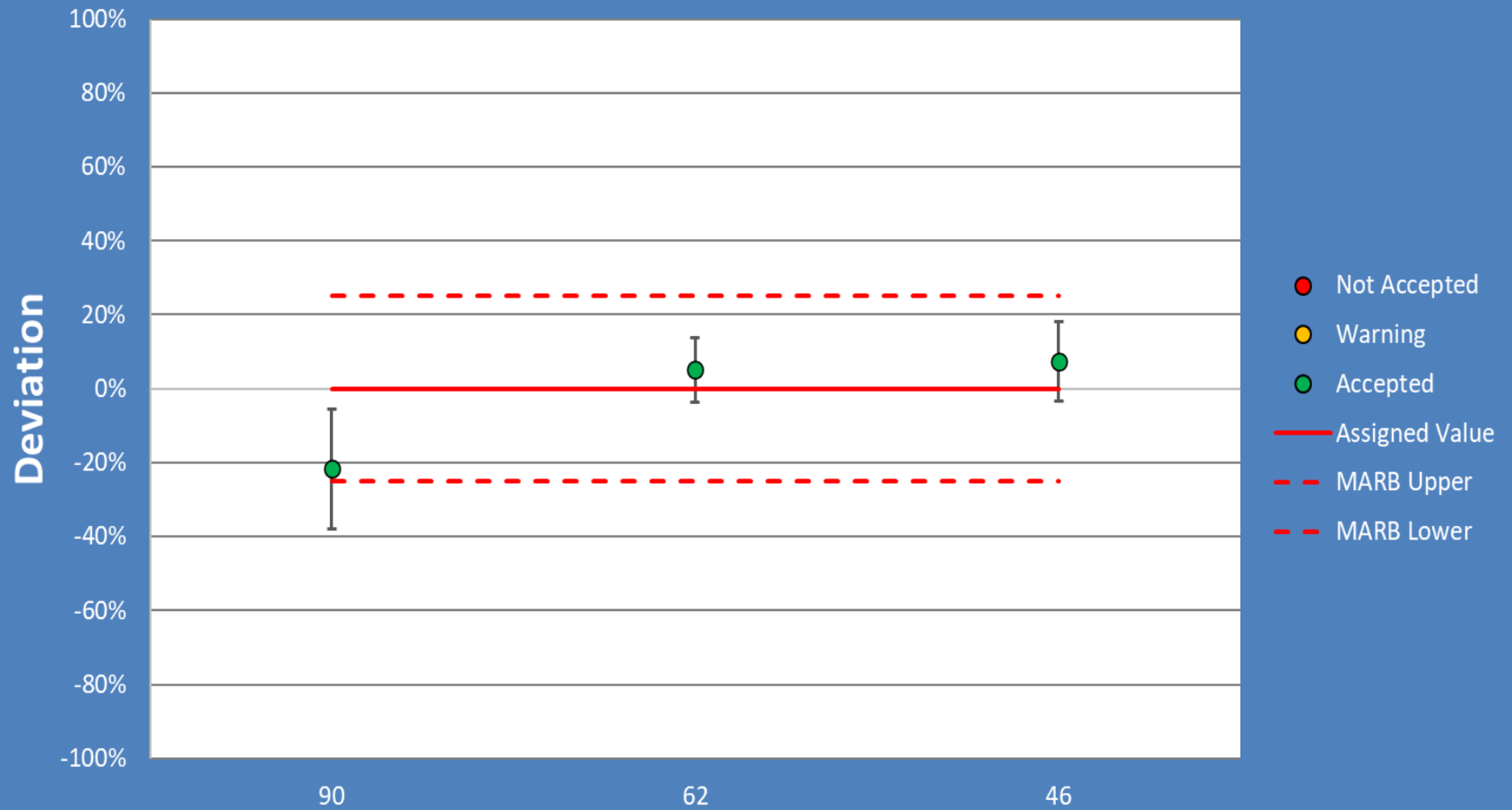


^3H all participants

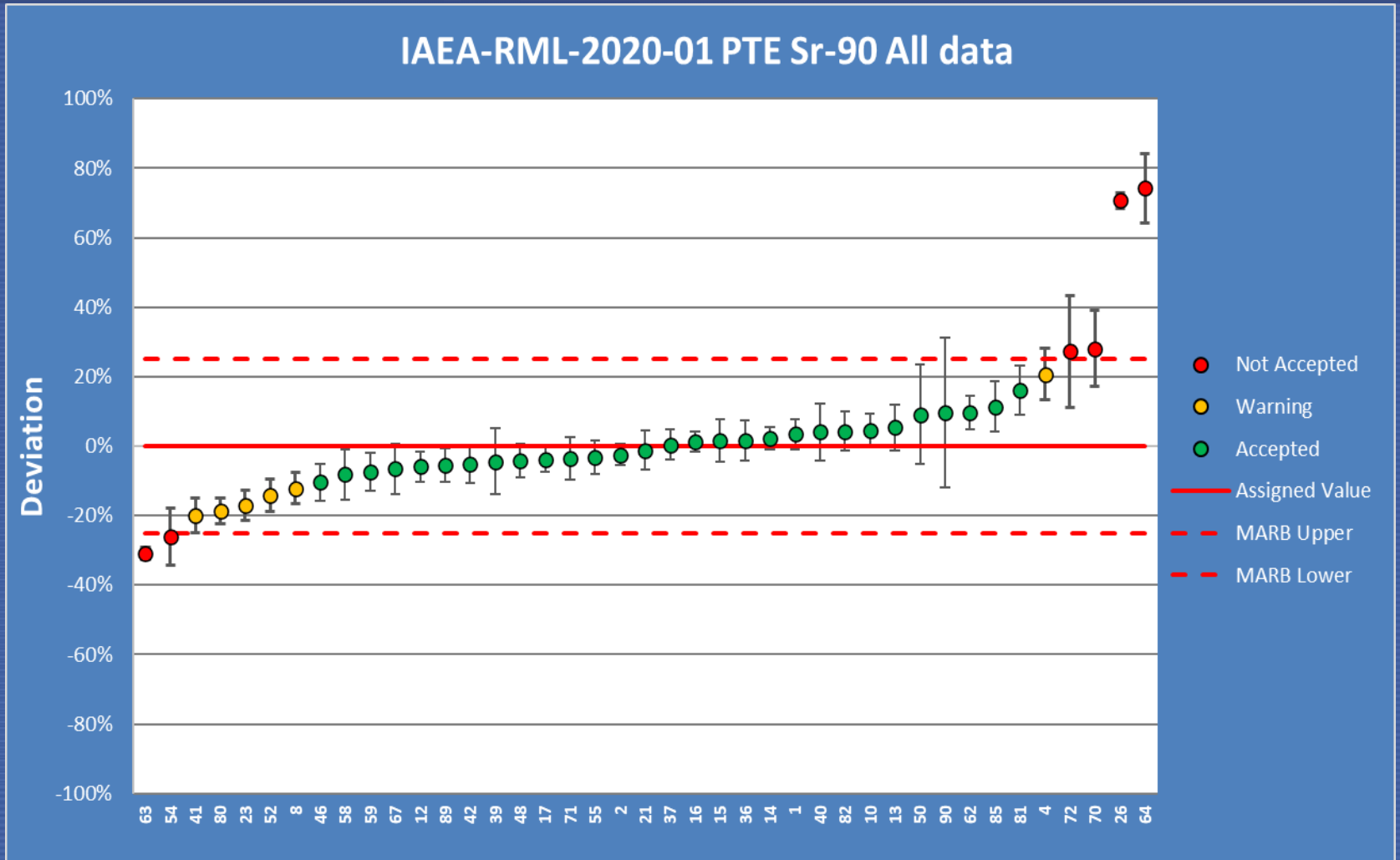


³H HELCOM

IAEA-RML-2020-01 PTE H-3 HELCOM



^{90}Sr all participants

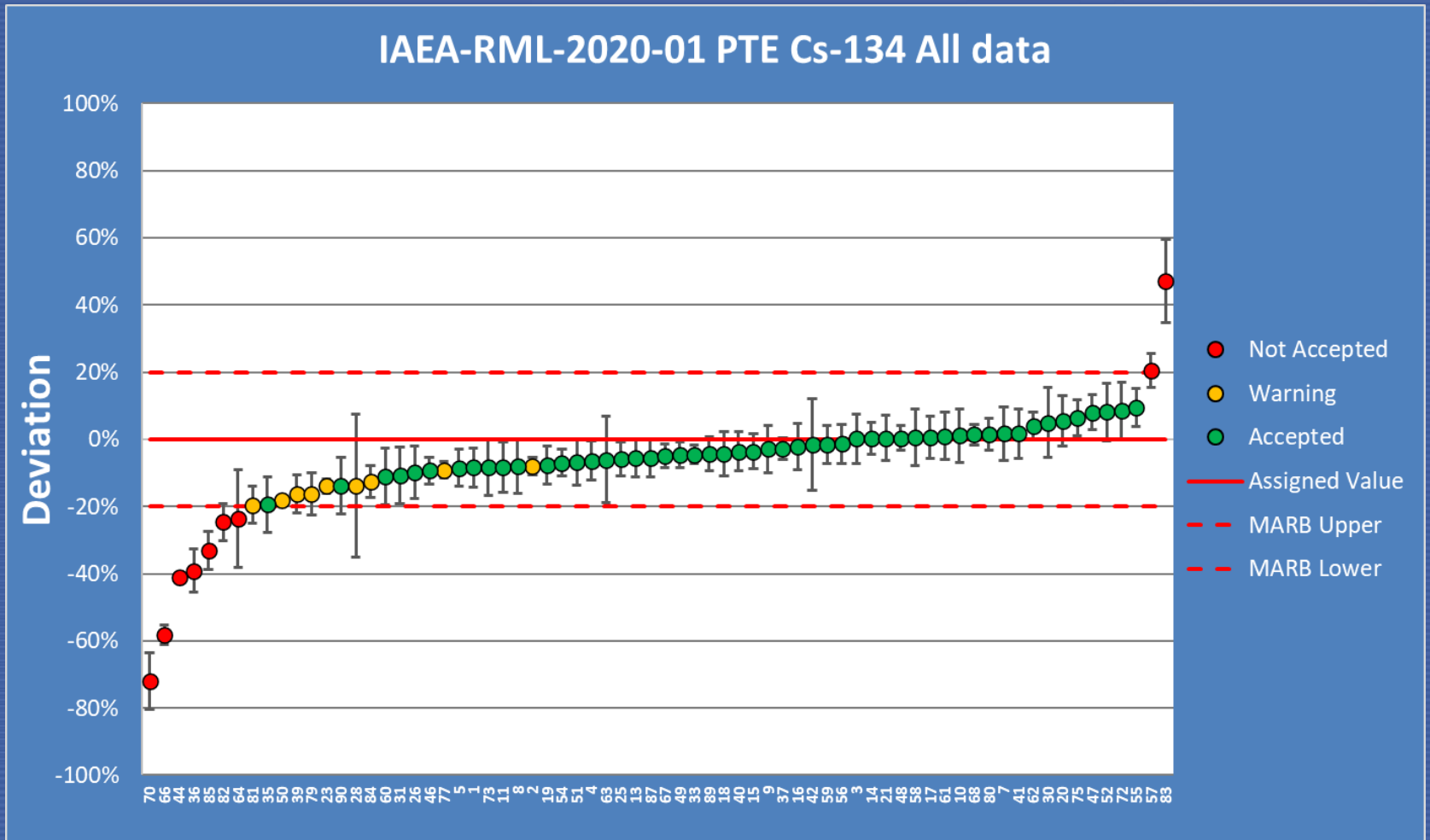


^{90}Sr HELCOM

IAEA-RML-2020-01 PTE Sr-90 HELCOM



^{134}Cs all participants

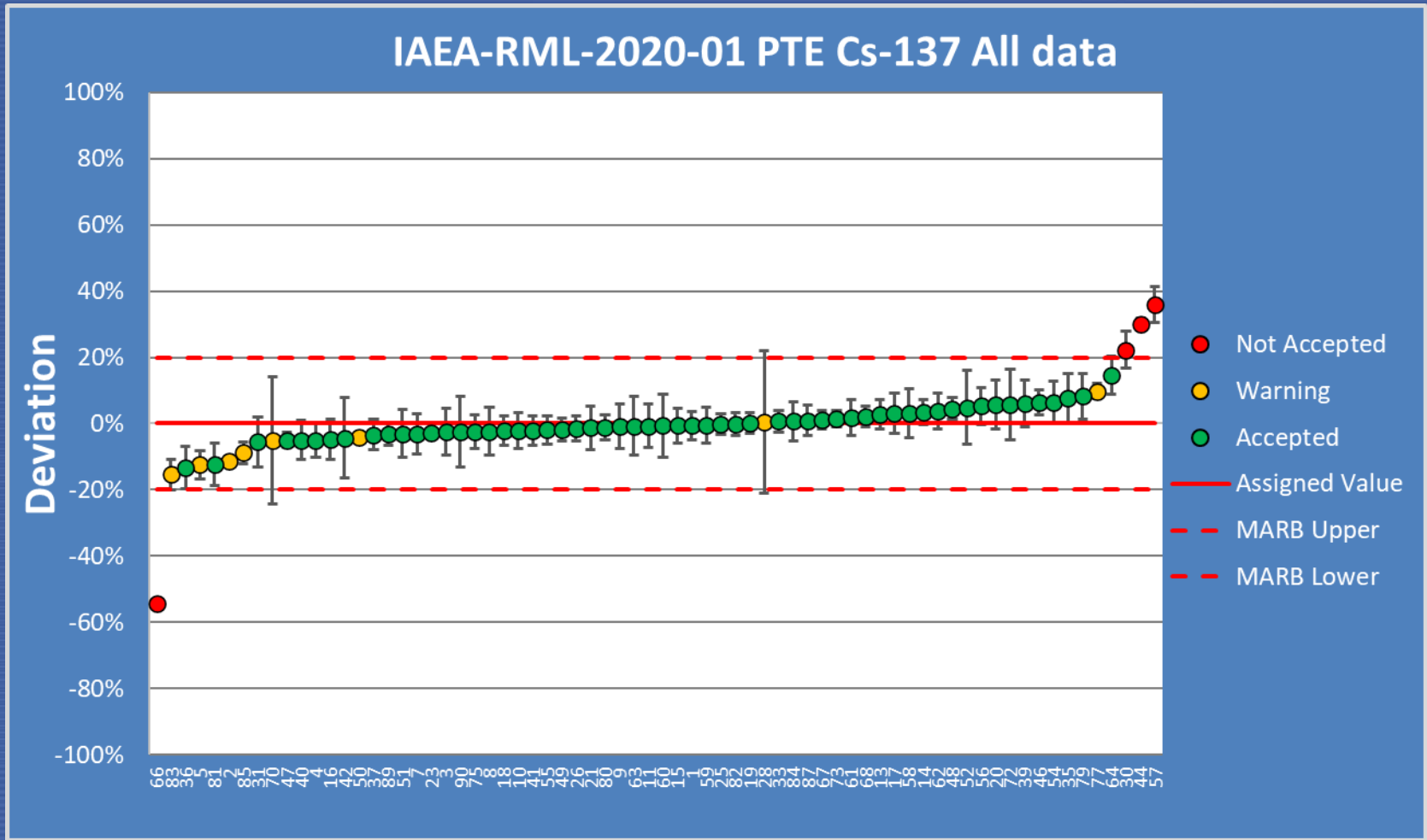


^{134}Cs HELCOM

IAEA-RML-2020-01 PTE Cs-134 HELCOM



^{137}Cs all participants

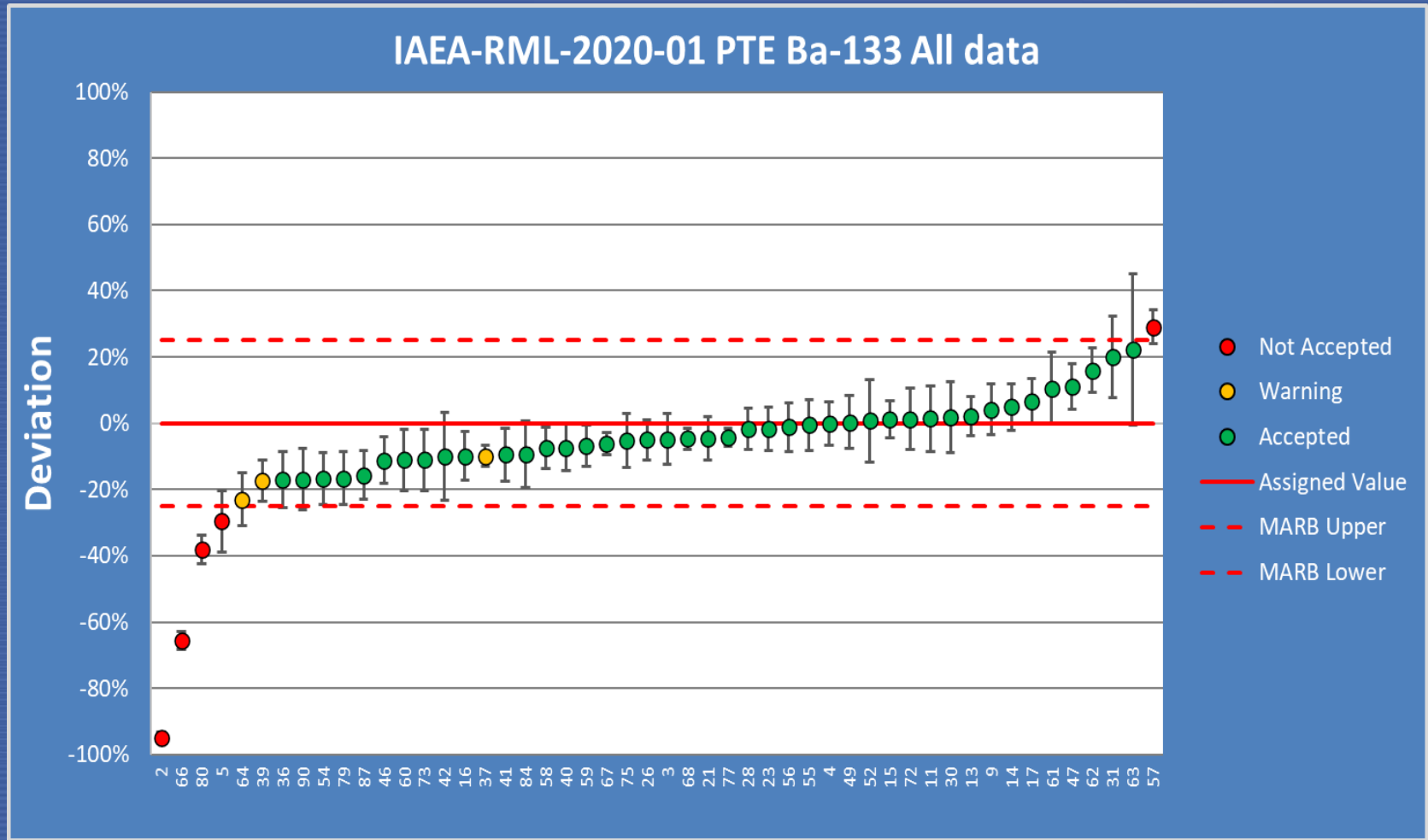


^{137}Cs HELCOM

IAEA-RML-2020-01 PTE Cs-137 HELCOM

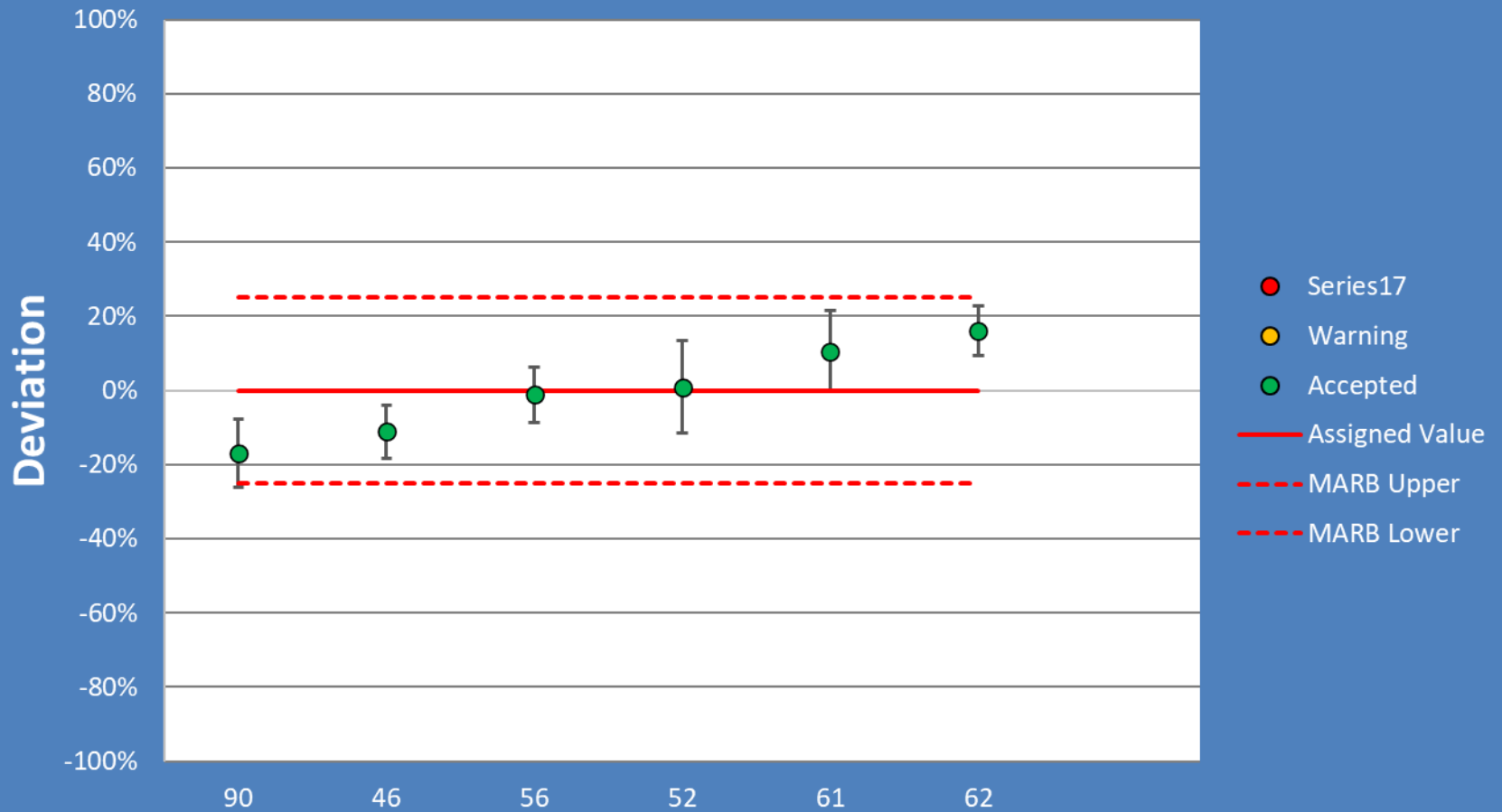


^{133}Ba all participants



^{133}Ba HELCOM

IAEA-RML-2020-01 PTE Ba-133 HELCOM



Overview PTE 2020

All participants	^3H	^{90}Sr	^{134}Cs	^{137}Cs	^{133}Ba	Total
Acceptable	29	35	52	58	42	216
Warning	6	2	9	8	3	28
Not acceptable	6	6	10	5	5	32
Total	41	43	71	71	50	276

HELCOM	^3H	^{90}Sr	^{134}Cs	^{137}Cs	^{133}Ba	Total
Acceptable	3	4	6	6	6	25
Warning	0	1	1	1	0	3
Not acceptable	0	0	0	0	0	0
Total	3	5	7	7	6	28

HELCOM Overview PTE 2012-2020

	2020	2019	2018	2017	2016	2015	2014	2013	2012
Accepted	89%	80%	90%	75%	70%	70%	70%	80%	100%
Warning	11%	10%	5%	10%	8%	9%	15%	15%	0%
Not accepted	0%	10%	5%	15%	22%	22%	15%	5%	0%
Participants	7	7	7	7	7	6	6	7	2
Results	28	21	37	33	23	23	20	20	4
Radionuclides	5	5	6	5	4	4	4	3	2

Acknowledgements

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Thank you!