UK NEQAS

for

Peptide Hormones and Related Substances

Participants' Handbook

August 2025

UK NEQAS [Edinburgh]
Department of Laboratory Medicine
Royal Infirmary of Edinburgh
Edinburgh EH16 4SA, UK

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1 Service provided

The UK National External Quality Assessment Service (UK NEQAS) for Peptide Hormones and Related Substances [UK NEQAS [Edinburgh] is part of a network of UK NEQAS Centres providing External Quality Assessment (EQA) for a range of important diagnostic tests. UK NEQAS [Edinburgh] collaborates closely with related UK NEQAS centres in Birmingham, Glasgow, Guildford and Sheffield.

Analytes for which the Edinburgh centre provides EQA are listed in Table 1.

Table 1. Analytes for which EQA is available from UK NEQAS [Edinburgh]

Scheme	Analytes
Peptide hormones I	Follicle stimulating hormone (FSH) Luteinising hormone (LH) Prolactin (PRL) and macroprolactin (pilot) Growth hormone (hGH) Anti-Müllerian Hormone (AMH)
Peptide hormones II	Parathyroid hormone (PTH) Adrenocorticotrophic hormone (ACTH) Calcitonin (hCT)
Tumour markers	Alpha-fetoprotein (AFP) Carcinoembryonic antigen (CEA) Chorionic gonadotrophin (hCG)
Maternal serum screening	Down's syndrome (1st trimester) Free β-subunit of hCG (hCGβ). PAPP-A Down's syndrome (1st trimester) Dried blood spots (Pilot scheme) Down's syndrome (2nd trimester) Alpha-fetoprotein (AFP): Chorionic gonadotrophin (hCG): Intact hCG, total hCG and the free β-subunit (hCGβ). Unconjugated oestriol (UE3) Inhibin A Neural tube defects Alpha-fetoprotein (AFP)
Pregnancy testing	Urinary hCG (qualitative) Urinary hCG (quantitative)
Pre-eclampsia markers	Placental growth factor (PLGF) Soluble fms-like tyrosine kinase 1 (sFlt-1) sFlt-1 / PLGF ratio
Pre-eclampsia markers (POCT) [Pilot scheme]	Placental growth factor (PLGF)
Liver fibrosis markers	Procollagen III amino terminal peptide (PIIINP) Hyaluronic acid Tissue inhibitor of metalloproteinase 1 (TIMP-1) Enhanced liver fibrosis (ELF) score FIB-4 and other liver fibrosis scores

2 Location and contact details

The UK NEQAS [Edinburgh] laboratory is located within the Department of Laboratory Medicine, Royal Infirmary of Edinburgh, and there is a close working relationship between UK NEQAS and the Department.

UK NEQAS [Edinburgh]
Department of Laboratory Medicine
The Royal Infirmary of Edinburgh
Edinburgh EH16 4SA
United Kingdom

Tel: +44 (0)131 242 6885

Scheme e-mail: ukneqas@ed.ac.uk

3 Staff

UK NEQAS [Edinburgh] services are provided by a small dedicated team (Table 2), all of whom are employees of NHS Lothian.

Table 2. Contact details for UK NEQAS [Edinburgh] staff members

Director & Consultant Clinical Scientist: Dr Catharine Sturgeon	Tel: +44 (0)131 242 6885 e-mail: C.Sturgeon@ed.ac.uk
Principal Clinical Scientist: Post vacant	
Technical support: Miss Mary Costa Ms Ewa Drozdzal	Tel: +44 (0)131 242 6843
Administrative support: Post vacant	

4 Service objectives

UK NEQAS [Edinburgh] aims to provide

- Professionally-led and scientifically-based EQA schemes with a primarily educational objective.
- Regular distributions of appropriately constituted specimens/
- Rapid feedback of individual participant performance in reports that are comprehensive and readily understood.
- Data on method-related performance.

UK NEQAS [Edinburgh] may sub-contract some services where appropriate.

5 Service accreditation

All schemes provided by UK NEQAS [Edinburgh] except the Pilot Schemes for Pre-eclampsia Markers (POCT) and Maternal Serum Screening using Dried Blood Spots are currently accredited by the United Kingdom Accreditation Service [UKAS Reference No 8505]. The next on-site inspection will take place in August 2025.

Further information about standards for the accreditation of EQA schemes may be obtained from UKAS. (Contact details in Appendix 4).

6 Enrolment procedures

Intending participants can access registration forms and other information on the UK NEQAS [Edinburgh] website (www.edqas.org) or can contact the unit to request these. Relevant documents include:

- Registration forms
- Participants' handbook
- Distribution schedule

Participation begins at the first distribution following receipt of completed registration forms. Enrolment may take place at any time of the year.

The majority of participants in most schemes are UK NHS clinical service laboratories, but all laboratories - including non-UK, research and IVD manufacturers' laboratories - are most welcome to participate.

All UK clinical service laboratories must agree to the Joint Working Group (JWG) Conditions of Participation (Appendix 1).

Participation of non-UK laboratories may be subject to the availability of suitable specimen transport. In some countries sealed packages containing specimens and paperwork are sent to a distributor for onward transport within the country or region.

Manufacturers are welcome to participate fully in the same way as clinical service laboratories (receiving samples and returning results) or on an 'information only' basis. They may also register methods under development on an anonymous basis.

7 Charges and charging period

The financial year is from the 1st of April until the 31st of March, with a price list prepared annually and available on request. Participants are sent quotations each year advising them of charges and requesting purchase orders if required.

Participation is deemed to be continuous so participants do not need to renew their subscription annually.

Participation may begin at any time during the year. Charges for participation for part of the year are generally *pro rata*. Refunds of subscription charges are only payable under exceptional circumstances.

Pilot schemes are schemes that are in development and have not yet been put forward for accreditation. No charge is made for participation in the early stages of development but may be implemented later.

8 Service organisation

8.1 Laboratory numbers

Each participant is assigned a unique five-digit laboratory number (e.g., 12345), which is common to most UK NEQAS schemes.

If more than one instrument or method is in use for a single analyte in a laboratory, a letter is appended to the main laboratory number to differentiate the participations (e.g., 12345A). Participants may request mnemonics (names) to differentiate the instruments. These then appear on both results sheets and reports.

Participants in the Pregnancy Testing scheme may be assigned a hub number (e.g., HB1234) with individual POCT sites assigned related spoke numbers (e.g., SP123401, SP123402 etc).

Please always include your laboratory number in the subject line of all e-mails to us. This helps facilitate timely response.

8.2 Method codes

Methods are normally referred to by full name, but may occasionally be abbreviated. Abbreviations are defined in the monthly reports.

Please check your method/code in all communications and inform us of any changes and the distribution number at which the change came into effect. This can most conveniently be done by entering the information in the Comments box on the Results website.

Manufacturers should note that in the interests of commercial confidentiality, a method under development can be temporarily assigned a "Method development" code until its general release, when it will be assigned an appropriate permanent code.

8.3 Confidentiality

The fact of participation, raw data, performance scores and all reports generated by UK NEQAS [Edinburgh] are confidential between the individual laboratory and UK NEQAS staff. Performance scores (and some relevant raw data) may be shared with the relevant Advisory Panel under defined circumstances (Appendix 1) as part of the routine reporting of persistent poor performance.

Participants may share their own reports with local management, regional QA officers, accrediting bodies, and suppliers of equipment and reagents if they wish.

Where appropriate and necessary, UK NEQAS staff may also divulge such information but only with the participant's written permission.

Any other use of scheme data must be approved in writing by the UK NEQAS Scheme Director in advance.

9 Service operation

9.1 Specimens

All serum, plasma, dried blood spot and urine specimens are of human origin. Specimens may be "spiked" with standards or other sources of analyte to give appropriate concentrations. Depending on the nature of the additions, results for such specimens may be excluded from assessment of cumulative performance.

Low concentration specimens are issued regularly to confirm "baseline security" which is especially important for some analytes including the serum tumour markers and growth hormone. Such specimens are generally excluded from assessment of cumulative performance.

Specimens may occasionally include clinically relevant additions (e.g. biotin, heterophilic antibodies) to highlight to participants potential analytical and interpretative pitfalls and form an important contribution to the educational remit of the schemes. These are also usually excluded from performance assessment.

Specimens are stored below -25°C prior to issue. During pool preparation, serum, plasma and urine pools may require clarification by filtration through glass wool.

ProClin™ 200 (0.5% v/v) is added as a bactericide to all pools that will be issued as liquid specimens. Preservative is not added to lyophilised pools (Peptide II scheme).

The volume provided is 0.5-1.0 mL per specimen, depending on the analyte. Specimens are dispatched at ambient temperature. Specimen homogeneity is regularly assessed retrospectively.

The number of specimens issued per distribution varies depending on the analyte and is documented in Table 3. Extra specimens may be issued if required.

A Distribution Schedule for the oncoming year is appended to the Comments section of the final reports of the preceding calendar year. This gives the dates of distribution and the dates for return of results for all schemes. Copies are also available on request.

Table 3. Combinations of analytes, number of specimens issued, prefix letter and cap colour.

Scheme	Analyte(s)	Specimens per Distribution	Distributions per year	Prefix letter	Cap colour
Peptide I	FSH, LH, AMH, prolactin	3	12	G	Clear
	Growth hormone	3	12	H	Yellow
Peptide II	PTH	3	6	P	White
	ACTH	3	6	A	Yellow
	Calcitonin	3	6	C	Purple
AFP, CEA and hCG	AFP, hCG, CEA	3	12	M	Violet
Pregnancy testing	Qualitative & quantitative hCG	2	12	Q	Orange
Maternal serum screening	NTD (AFP)	3	12	N	Blue
	Second trimester Down's (AFP, hCG, UE3, inhibin)	3	12	D	Black
	First trimester Down's (hCGβ, PAPP-A)	3	12	F	Yellow
	First trimester Down's using dried Blood Spots (hCGβ, PAPP-A) [Pilot]	5	12	L	N/a
Pre-eclampsia markers	PLGF, sFlt-1	3	12	Y	White
Pre-eclampsia markers (POCT) [Pilot scheme]	PLGF	3	12	YY	Brown
Liver fibrosis markers	PIIINP Hyaluronic acid TIMP-1	3	12	E	Red

10 Processing UK NEQAS samples in your laboratory

10.1 Receipt and analysis

UK NEQAS samples are intended to monitor laboratory performance on routine patient specimens. **They should be treated in exactly the same way as routine clinical samples from when they first arrive in the laboratory.**

Automated e-mail alerts are sent after each distribution to confirm that results can be entered on the Results website. If you have not received your specimens within the usual time frame for your laboratory, please e-mail ukneqas@ed.ac.uk to let us know so we can investigate and advise, sending further sets of specimens if required.

Please also contact us immediately if you receive incorrect or damaged specimens, and replacements will be sent.

10.2 Return of results

Results should be submitted on-line via the UK NEQAS Results website at https://results.ukneqas.org.uk/ within 3 weeks of the date of specimen issue. A password is required for data entry via the website and will be provided to all new participants. Password reminders can also be requested. Details of how to use the Results website are provided in Appendix I.

Results may also be accepted if posted, e-mailed or telephoned. Written submissions must be clear and state the laboratory number and the relevant distribution numbers.

EQA results should always be submitted as they would be if they were for patient specimens, i.e., to the same number of decimal places and in the same reporting units. "Less than" and "greater than" results should also be submitted as for clinical samples.

Factors used to convert results to scheme units are shown in Table 4.

Table 4. Scheme units and conversion factors currently applied by UK NEQAS [Edinburgh]

Scheme	**Analyte(s)**	**Scheme units**	**Alternative units**	**Conversion factor** [From Alternative units to Scheme units]
Peptide I	FSH LH AMH Prolactin Growth hormone	U/L IRP 78/549 U/L IS 80/552 pmol/L mU/L IS 84/500 ug/L IS 98/574	None None ng/L ng/mL	 Multiply by 7.14 Multiply by 21.2
Peptide II	PTH ACTH Calcitonin	pmol/L ng/L ng/L	ng/L or ug/L mU/L	Divide by 9.5 Multiply by 3.418
Tumour markers	AFP hCG CEA	kU/L IS 72/225 U/L U/L IRP 73/601	ng/L or ug/L None ng/L or ug/L	Multiply by 0.83* *Method dependent:* Abbott 14.2 Beckman 17.0 Ortho 14.3 Roche 16.9 Siemens 14.6 Immulite 13.4 Centaur 14.6 Tosoh 11.9
Pregnancy testing	Qualitative hCG Quantitative hCG	Not relevant U/L	None	
Maternal serum screening	AFP hCG hCG beta-subunit uE3 Inhibin A PAPP-A	kU/L IS 72/225 U/L U/L IRP 75/551 nmol/L pg/mL U/L IRP 78/610	ng/L or ug/L None None None None	Multiply by 0.83*
Pre-eclampsia markers	PLGF sFlt-1	ng/L ng/L		
Liver fibrosis markers	PIIINP Hyaluronic acid TIMP-1 ELF score	ug/L ug/L ug/L Not relevant		

*All methods except Brahms Kryptor for which kU/L and mass units are equivalent and no conversion is required.

10.3 Failure to return results

If you make no response to a distribution by the due date your report will state "This laboratory has failed to return any results for this distribution". Regular participation is important if adequate data are to be obtained, and is one of the criteria of good performance.

If you fail to return results for three consecutive distributions, you will be regarded as having poor performance.

If you are unable to report results for a distribution, results should be submitted as "NULL" on the Results website and an explanation provided in the Comments box. A report will then be uploaded in the usual way. **Entries such as "XPL" will not be interpreted correctly by the Results website and we will not know that an unsuccessful attempt has been made to submit results.**

10.4 Late returns

We always accept and process late results provided there is a legitimate explanation (e.g. delayed arrival of specimens, analyser downtime or staff absences). Results should be e-mailed to ukneqas@ed.ac.uk and will be analysed and the report uploaded to the Results website. Reports may be flagged as "Late" at the discretion of the Scheme Director.

10.4.1 Errors and their correction

10.4.2 Causes of errors

Causes of errors (which may or may not be classified as outliers) include

- Assaying the wrong samples.
- Assaying the right samples in the wrong order.
- Incorrectly transcribing laboratory results from computer systems or worksheets to results documents or the web entry system.
- Using incorrect units and/or conversion factors.
- Technical errors, e.g. incorrect reconstitution, incomplete mixing after thawing, faulty sampling or pipetting etc.

Such errors can be corrected but the error and the cause identified will be recorded separately and results may be marked as amended.

10.4.3 Amendments prior to the reporting deadline

Amendments can be made on the Results Website while data submission is open. Amended copies of results submitted by post should be clearly marked as such with the change unambiguously highlighted.

10.4.4 Amendments after the reporting deadline

Please e-mail us to explain the issue. Results can usually be amended and an updated report produced.

10.5 Amendments after receipt of reports

These should be reported in writing with an explanation of the reason for any amendment. Where investigation reveals the cause of the error, and repeat results are available, correction of the original results is permissible. However, the fact that you reported incorrect results will be recorded. Each incorrect result is counted as one error. Transcription errors in the Pregnancy Testing Scheme are generally not corrected because such errors are likely to reflect what happens in clinical practice.

10.6 UK NEQAS [Edinburgh] errors

If you suspect that we have made an error please let us know immediately.

We review all such errors carefully and it is important that we know about them to enable auditing and improvement of the service. Errors made by UK NEQAS [Edinburgh] will be corrected without penalty to the laboratory and an apology e-mailed.

10.7 Status of reports

The most recent version of your report is always that available on the Results website. The report may include results that have been received or amended after the first scheduled analysis so there may be minor differences in numerical details, e.g. the number of participants returning results.

If it has been necessary for any reason to re-analyse and re-upload all reports for a given distribution (e.g. due to an error identified subsequent to the first upload) this will be clearly indicated on the report and the reason explained in the Comments section accompanying the report.

11 Performance assessment

11.1 Target values

UK NEQAS attaches great importance to validation of target values, rather than necessarily accepting consensus means as the most "correct" result.

For most schemes in which quantitative results are reported, the all-laboratory trimmed mean (ALTM) is used as the target, but in several schemes grouped-method means are used if they are more appropriate due to method-related differences in recognition of the analyte (e.g. for hCGß and PAPP-A in the 1st trimester maternal serum screening scheme). Assigned values are selected as the best estimate of the true value. Data are log transformed for analysis to reduce the possible effect of non-parametric distribution of results.

Target values should be accurate and stable, but this is difficult to test for peptide hormones and tumour markers, for which reference methods required for metrological traceability are generally not available. However, some evidence supporting the validity of the consensus mean target values can be obtained by regular demonstration of the recovery, linearity and stability of the target values.

Some schemes may have different targets. For example, achieving consensus in the Pregnancy Testing scheme requires that ≥80% of participants using methods with the same claimed detection limit agree.

11.2 Uncertainty of measurement for quantitative tests

The standard uncertainty (U) of the consensus mean target value is calculated using the following formula:

$$U = 1.25 \times SD / \sqrt{n}$$

where SD is the standard deviation and n the number of results.

The uncertainty of measurement is stated for each pool on the analyte-specific page of personalised participant reports. Provided the standard uncertainty is <0.3 x the SD, the uncertainty of the consensus mean should have negligible effect on assessment of performance.

11.3 Calculation of analytical performance scores for quantitative schemes

Laboratory performance is reported as BIAS, which is the average percentage deviation from target, and VAR, which measures the consistency of bias. BIAS and VAR are updated on a rolling basis across six distributions, i.e. the oldest data are removed from the laboratory record as new data are added.

Note that results for some samples (e.g. those of low concentration or those containing added exogenous analyte) are routinely excluded from these calculations of the cumulative statistics and are termed "non-usable" values. A minimum of ten usable values is required to compute BIAS and VAR.

See pp.23-25 for a worked example of the calculation of BIAS and VAR.

11.4 Calculation of analytical performance scores for qualitative schemes

Results in the Pregnancy Testing scheme may be reported as "positive" (P), "negative" (N) or "equivocal" (E). The target for scoring purposes is the consensus of results reported by all users of the relevant method grouping.

Each result is given a score according to its relationship to the consensus. Laboratory performance is then calculated as the sum of these performance scores over the last six distributions. A minimum of six usable results is required.

See page p.26 for a worked example of the calculation of qualitative scores.

11.5 Calculation of analytical performance scores for risk estimates

In the Maternal Serum Screening schemes laboratory performance is reported as

a. **Running risk score (RRS)** Designed to be analogous to BIAS. RRS is the median of risk scores (RS) recorded during the time window (most recent six distributions). At least ten risk scores are needed to calculate the RRS, which should be close to zero.

b. **Non-parametric estimate of the SD of RRS (SDRRS)** Designed to be analogous to VAR. SDRRS is the non-parametric standard deviation (SD) of the RRS. Calculated as the median of the absolute differences between RS and RRS, the SDRRS should be close to zero.

See p.26 for a worked example of the calculation of risk scores.

12 Performance criteria

12.1 Limits for acceptable performance

Limits for acceptable performance are proposed by the Scheme Director to the relevant Specialist Advisory Groups for Immunoassay or Maternal Serum Screening and if approved are then notified to the National Quality Assurance Advisory Panel for Chemical Pathology (NQAAP). The limits are reviewed annually.

The limits reflect clinical requirements, the state of the art for the analyte, and the need for regular quality assurance monitoring.

The criteria include acceptable limits for BIAS and VAR, and for return rates and are summarised in Appendix 2. BIAS and VAR criteria have not been established for all analytes and no performance criteria have been defined for the running risk scores in the Maternal Serum Screening schemes or for quantitative results in the Pregnancy Testing scheme.

The monthly reports include figures to show individual performance in relation to the relevant criteria. Laboratories should aim to maintain performance within these limits and are invited to contact us if problems appear to be developing, whether in analytical performance or in the ability to maintain regular returns. Discretion is applied by the Scheme Director if apparently poor performance reflects characteristics of the method, provided the laboratory's results are in accord with those of other users of the same method.

12.2 Persistent poor performance and action taken

UK clinical laboratories are subject to NQAAP surveillance and should be aware of the conditions of participation (Appendix 1).

A laboratory is considered to be a persistent poor performer for a given analyte if

a. Its cumulative performance is outside the prescribed limit for BIAS and/or VAR for three consecutive months (taking into account the proviso in Section 12.1)

or if

b. It fails to return results for three consecutive months without valid explanation.

We will generally make informal contact with any participant falling into the above categories. If performance fails to improve, the Chairman of the appropriate NQAAP will be notified. Advice is then offered to the head of the laboratory in writing or, where appropriate and rarely, following a visit to the laboratory from a NQAAP member or another appropriate expert.

12.3 Suspected collusion

Participation in external quality assessment is clearly most beneficial if specimens are treated in the same way as patient specimens (e.g. assayed only once and without conferring with any other laboratory).

All submitted results are inspected by UK NEQAS staff prior to analysis using dedicated checklists. Any suspicion of collusion (e.g. identical sets of results reported) will be investigated thoroughly and copies of the relevant original analyser print-outs of results requested.

12.4 Disclosure of assigned values prior to data analysis

Details of specimen composition and/or expected results are not disclosed to participants until analysis of the results is completed and reports finalised. Rarely, and only in exceptional circumstances and at the discretion of the Scheme Director, these details may be disclosed to individual participants in advance, e.g. where a performance issue that may adversely affect patient results has been identified and urgent independent confirmation of a potential problem is required.

13 Reports and their interpretation

All participants can view their reports on the UK NEQAS Results Website at https://results.ukneqas.org.uk/.

A password is required and can be obtained from UK NEQAS [Edinburgh]. Reports on the website are generally those obtained at the time of the initial analysis of the results submitted unless otherwise notified to participants, e.g. by e-mail.

Reports rarely have to be reissued but if this is necessary it is clearly indicated in the box at the bottom of the first page of the new report and/or in the Comments section of the report.

Correction of errors notified by individual participants and requiring reanalysis may change the target values very slightly but this is unlikely to influence interpretation.

13.1 Quantitative schemes (BIAS and VAR scoring)

13.1.1 Overview

The report format is similar to that used in many other UK NEQAS schemes and contains the following sections:

A summary. This shows your performance for all analytes on the current distribution, and your current cumulative BIAS and VAR. This may be all you need to consult if performance is stable.

Details of performance for each analyte. This shows method performance on the current distribution, and tabulates all results for an individual participant for the most recent six distributions. Consult this section if you need to review your performance, or if you need information on method performance.

Comments. This section amplifies the data in the sections above, or may describe the results of surveys, e.g. interpretation of results. Summaries of recent relevant literature are supplied in most schemes.

See Pages 13 to 22 for examples of UK NEQAS monthly reports with explanatory notes.

13.1.2 Interpretation of BIAS and VAR cumulative performance data

Calculation of BIAS and VAR by combining results from different pools at different concentrations over six distributions is designed to maximise use of the data, but introduces certain constraints in the interpretation of these performance statistics as illustrated in the examples below. Interpretation of BIAS and VAR is always assisted by examining the "Analysis of Bias" table which shows performance by pool and distribution (page 16) over a six-month window. The figures may be interpreted as follows:

Low BIAS, low VAR The assay is precise and is giving results close to the target value in the concentration range assessed. This represents desirable performance, assuming accuracy of the target value.

Low BIAS, high VAR There is wide scatter of bias on individual specimens, although the mean ratio to the target value is near unity.

There are several sources of high variability, including

1. Between- and within-assay imprecision
2. Dose-related differences in bias
3. Pool-related differences in bias

The "Analysis of Bias" table will help to identify which, if any, of the above is most relevant. As the VAR essentially provides an indication of the confidence with which the mean BIAS can be estimated, it would be wrong under these circumstances to be too complacent about low BIAS.

High BIAS, low VAR The assay is clearly biased relative to the target value, the ratio of individual results to ALTM or GLTM results being relatively constant over the concentration range assessed. Common causes of this include errors in standardisation (e.g. calibrator change, wrongly prepared or degraded calibrators), errors in conversion of results to the units used by UK NEQAS (e.g. wrong factor, wrong mathematics) and differences in assay specificity.

High BIAS, high VAR There is a wide scatter of deviation from target on individual specimens, superimposed on a shift from unity in the mean ratio of results to the ALTM (or GLTM). The above comments on high VAR apply. The BIAS cannot be reliably estimated while the VAR remains high, and elimination of the sources of variability should be a first priority.

Note that if an assay is biased and steps are taken to correct this, VAR will remain high temporarily while the gradually improving BIAS passes through the six-distribution window.

13.2 Risk estimates (Maternal serum screening schemes)

The report is similar in style to the "BIAS and VAR" report described above and contains the following sections:

1. Information on the specimens in the current distribution. A histogram shows the distribution of risk estimates returned by all participants using the relevant combination of analytes.
2. Summary data for the six most recent distributions. All the relevant risk estimates and their targets are shown in a table, and trends in cumulative risk scores are shown. [Multiples of the median (MoMs) are analysed but degrees of extremeness (DoEs) are not.]

13.2.1 Interpretation of cumulative risk scores

The target for scoring risk estimates is simply the median of all estimates returned by participants using the relevant combination of analytes. This target is pragmatic and cannot be validated. With this proviso, participants should have running risk score (RRS) and standard deviations of running risk score (SDRRS) close to zero. The figures may be interpreted as follows:

High RRS, low SDRRS

Risk estimates are biased to the target values, but consistent.

Near-zero RRS, high SDRRS

On average, risk estimates are close to the targets, but their scatter is wide, suggesting some imprecision in the estimation of risk.

High RRS, high SDRRS

Risk estimates may be both imprecise and inaccurate.

13.3 Qualitative schemes (Pregnancy testing)

The reports are organised by analyte, with no summary page. Participants reporting qualitative results receive a personalised report which include the information described in Table 4.

Table 4. Combinations of analytes, number of specimens issued, prefix letter and cap colour.

	Information provided
Panel 1	Distribution number, date of return and lab number.
Panel 2	Specimen and pool numbers for the current specimens together with a brief description of their content.
Panel 3	Pie charts showing for each specimen the % distribution of results [positive (P), negative (N) or equivocal (E)] and the consensus results. Individual laboratory results, and the score for this distribution, are also shown.
Panel 4	A single pie chart showing the percentage of usable specimens distributed (P, N and E) during the previous six months, followed by pie charts showing the laboratory's cumulative data for each type of specimen (P, N and E).
Panel 5	A graph showing the trends in cumulative interpretation score over the previous twelve months. [The cumulative score at each distribution is based on results for the previous six distributions.] There is also a table tabulating the laboratory's performance for each specimen
Panel 6	A paragraph explaining the scoring system in use. [See page 28 for details.]

A separate section tabulating all results received from users of all methods accompanies the personalised report.

Participants reporting quantitative results receive a summary report similar to that for the serum hCG scheme. [These reports are for information only and results are not scored.]

14 Previously issued specimens

Aliquots of previously issued specimens with target values can usually be provided to participants wishing to check existing assays or to evaluate new ones. Specimens may also be available to manufacturers wishing to trouble-shoot existing assays or to evaluate new ones. A charge may be made for such samples.

15 Customised reports

Special reports may be prepared to meet specific requirements, e.g.

Method reports which can assist participating manufacturers in monitoring their products and participants evaluating methods or during tendering.

Hub reports for point-of-care testing coordinators (Pregnancy Testing scheme only).

Laboratory subgroup reports for regional QA or Audit activities

16 Service development and scientific support

Immunoassay and the Specialist Advisory Group for Maternal Serum Screening, which provide scientific advice. For current membership of these groups and the NQAAP please see Appendix 3.

17 Confidentiality

The fact of participation, raw data, performance scores and all reports generated by the scheme are confidential between the individual laboratory and UK NEQAS staff. Performance scores may be shared with the relevant Advisory Panel under defined circumstances.

Reports may also be shared by participants with local management, regional QA officers, accrediting bodies and suppliers of equipment and reagents if they wish.

Where appropriate, UK NEQAS staff may also divulge the information but only with the participant's written permission except in the case of persistent poor performance that cannot be resolved through dialogue between scheme staff and the participant. In this case, the identity of the laboratory will be made available

to members of the National Quality Assurance Advisory Panel (NQAAP) and the Joint Working Group (JWG) as described in the Conditions of EQA Scheme Participation [Appendix 1].

UK NEQAS [Edinburgh] reports are copyright and may not be copied, distributed, published or used for publicity and promotion in any form without the written consent of the Scheme Director on each and every occasion.

18 Comments and complaints

Comments about any aspect of the service, whether scientific or operational are welcome. In the event of complaints about day-to-day operational matters, please provide your laboratory number, scheme, distribution number and specimen number(s). Problems will be addressed as soon as possible.

Complaints can also be referred to any member of the Specialist Advisory Groups (Appendix 3).

UK NEQAS [Edinburgh] is always pleased to receive suggestions from participants about ways in which the service provided could be improved.

19 Annual Review

An *Annual Review* of the UK NEQAS results for the previous year, including analysis of long-term trends in participation and method performance, is prepared each year and considered by the relevant Specialist Advisory Group.

20 Terminology

Abbreviations and definitions of terms relevant to analysis of scheme data and interpretation of reports are provided in Table 5.

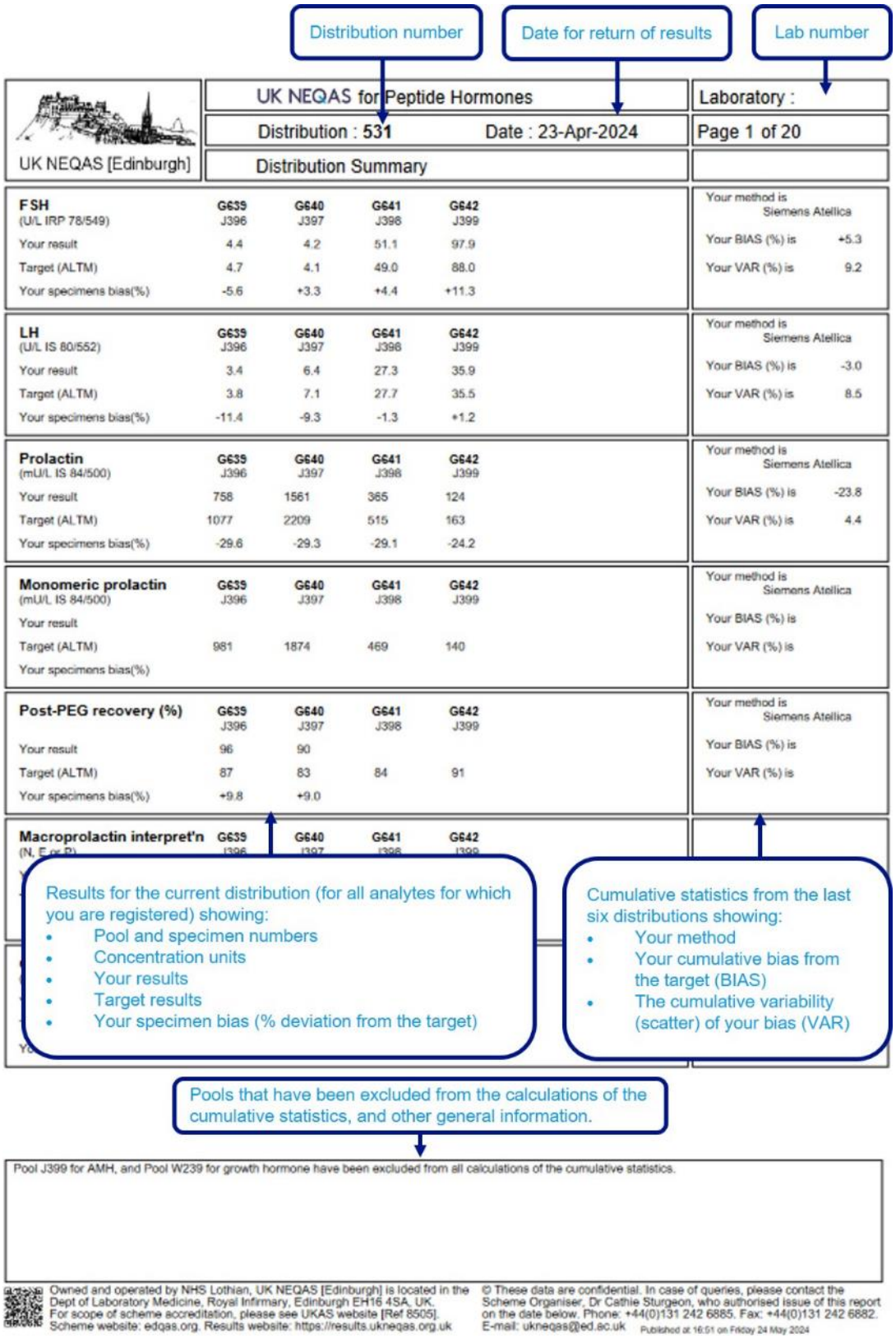
Table 5. Terminology relevant to data analysis and interpretation of UK NEQAS [Edinburgh] reports

	Explanatory note
ALTM	The All Laboratory Trimmed Mean is the geometric mean of the entire set of trimmed results for a specimen.
BIAS	BIAS is the average of the trimmed deviations of your laboratory's results from their targets for all usable specimens for which you have returned results during the most recent six months.
Cumulative interpretative score	The sum of your scores over the last six distributions. [Pregnancy testing scheme only.]
Deviation (Dev'n)	The difference between your result and the target result, expressed as a percentage of the target.
Distribution	A group of specimens in a particular scheme that are sent together to each participating laboratory.
GCV	The geometric coefficient of variation of the results in a set or sub-set of results. This is similar to the coefficient of variation but results are log trimmed prior to its calculation in case the distribution of results is non-parametric.
GLTM	The Grouped Laboratory Trimmed Mean is the geometric mean of a sub-set of the trimmed results for a specimen. The sub-set may be a group of inter-related methods.
LSD	The estimate of the linear standard deviation of the log transformed trimmed results.
Maximum number of results	Number of usable specimens issued in the most recent six months.
MLTM	The Method Laboratory Trimmed Mean is the geometric mean of the trimmed results for a specimen submitted by users of a single method.
Outlier (Between lab, within specimen)	A result that is more than three LSDs from the appropriate target. These outliers demonstrate an inability to agree with results submitted by other laboratories.
Outlier (Within-lab, between specimen)	A result that has a deviation that is more than three SD's from your cumulative BIAS. These results are rather less significant, as they depend on your VAR. A relatively small deviation would be flagged if you have a low VAR, but would not be flagged if your VAR were high.
Pool	A bulk preparation of serum usually prepared from several individual donations. A pool may be issued on more than one occasion, with different specimen numbers.
RS	The Risk Score represents the deviation of your risk estimate from consensus. [Maternal serum screening schemes only.]
RRS	The Running Risk Score is the median of your risk scores (RS) over the last six distributions. [Maternal serum screening schemes only.]
Sample	An alternative term for specimen.
Score	A score representing the deviation of your result (positive, negative or equivocal) from consensus. [Pregnancy testing schemes only.]
SDRRS	The Standard Deviation of Relative Risk Scores provides an estimate of the spread of risk estimates. [Maternal serum screening schemes only.]
Specimen	An aliquot of a given pool. The same pool may be issued on more than one occasion with different specimen numbers.
Transformation	The process of converting results to their natural logarithms in order to correct for any skew of the raw distribution data prior to statistical analysis.
Trimming	The effect of aberrant results that may be present is minimised by trimming the data prior to statistical analysis. The chose method is that of Healy, which involves trimming of the lowest and highest 5% of results. [See page XXX] Trimmed results are not necessarily outliers.
Usable specimens	A specimen that has no unusual or unacceptable features will be deemed to be usable for the calculation of cumulative BIAS and VAR. Unusable specimens include those with analyte concentrations near the detection limits of the assays and those with added interfering substances. Specimens that are not "usable' are excluded from all calculations of the cumulative statistics (i.e., BIAS and VAR).
VAR	VAR is the variability or GCV of the BIAS and reflects the scatter of the deviations of your results from target for all usable specimens in the six most recent distributions. VAR reflects imprecision, but is affected by dose or specimen related bias.

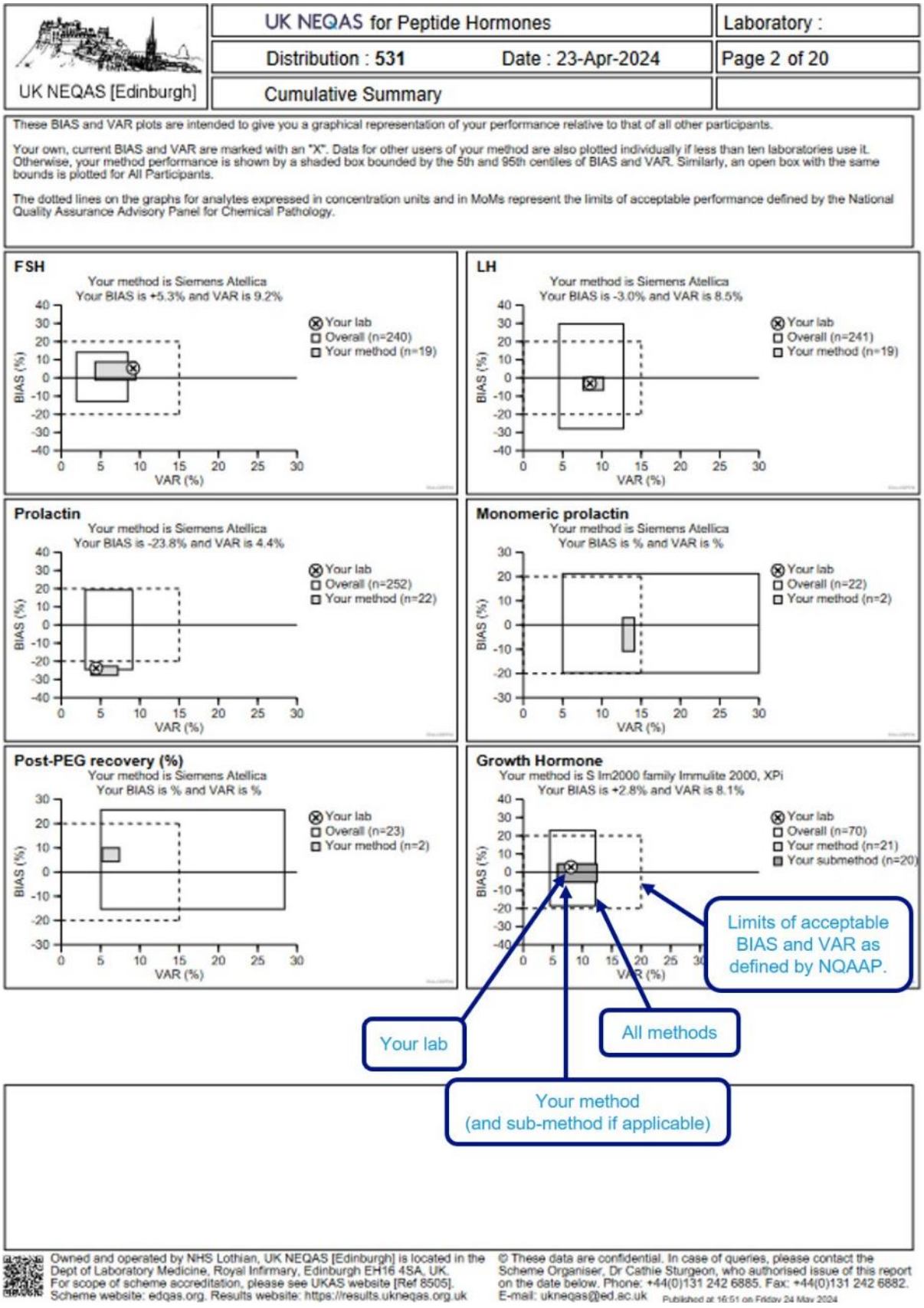
21 Contents of monthly reports

This and the following pages include annotated extracts from monthly reports to aid in their interpretation. Those shown in pages 13 to 22 are relevant to all schemes as the report layouts are the same. Additional pages relating to risk assessment are included in the Maternal Serum Screening reports (pages 18 and 19) and different reports are prepared for the qualitative Pregnancy Testing scheme (pages 20 to 22).

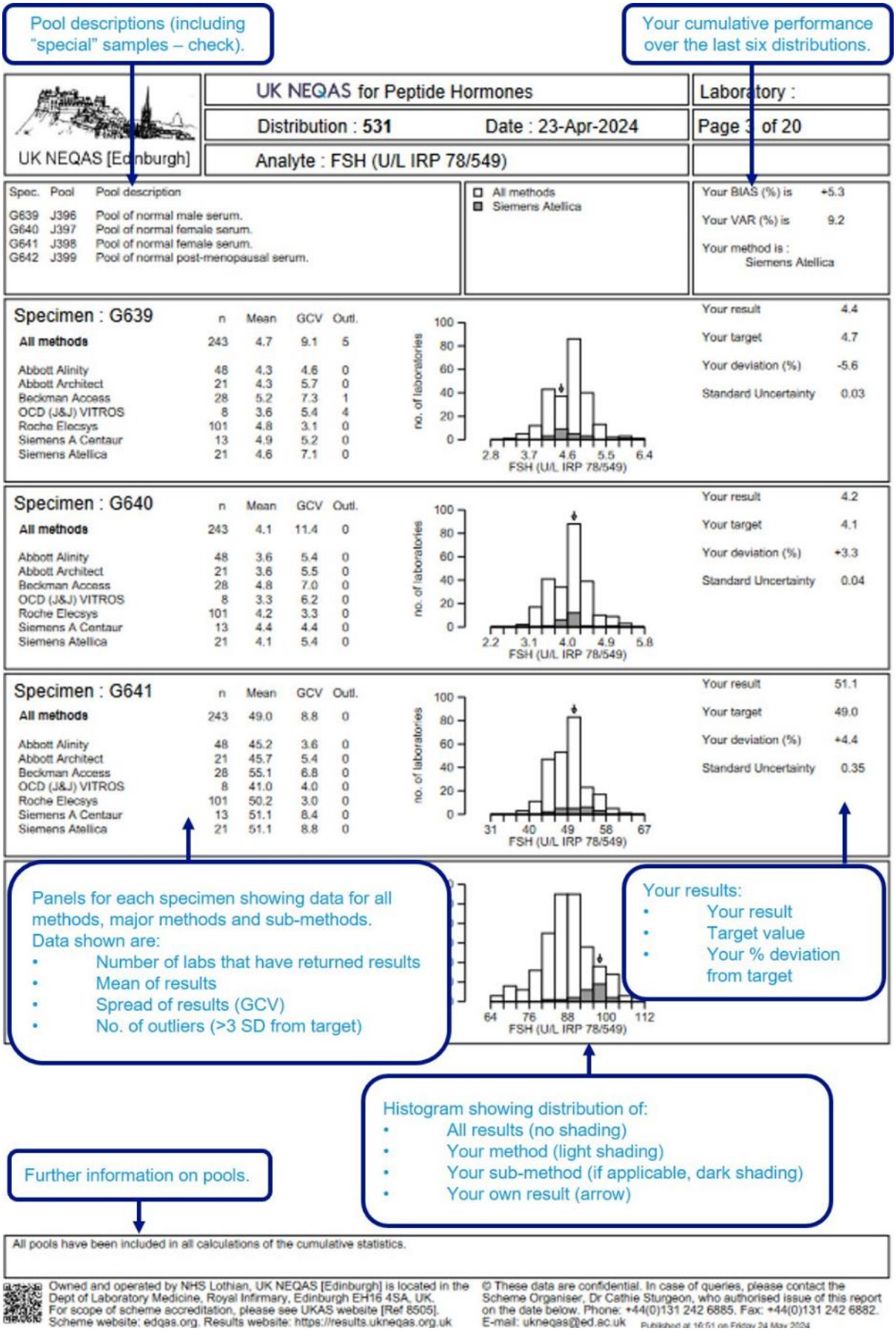
21.1 Participant Report - Page 1 – Distribution Summary



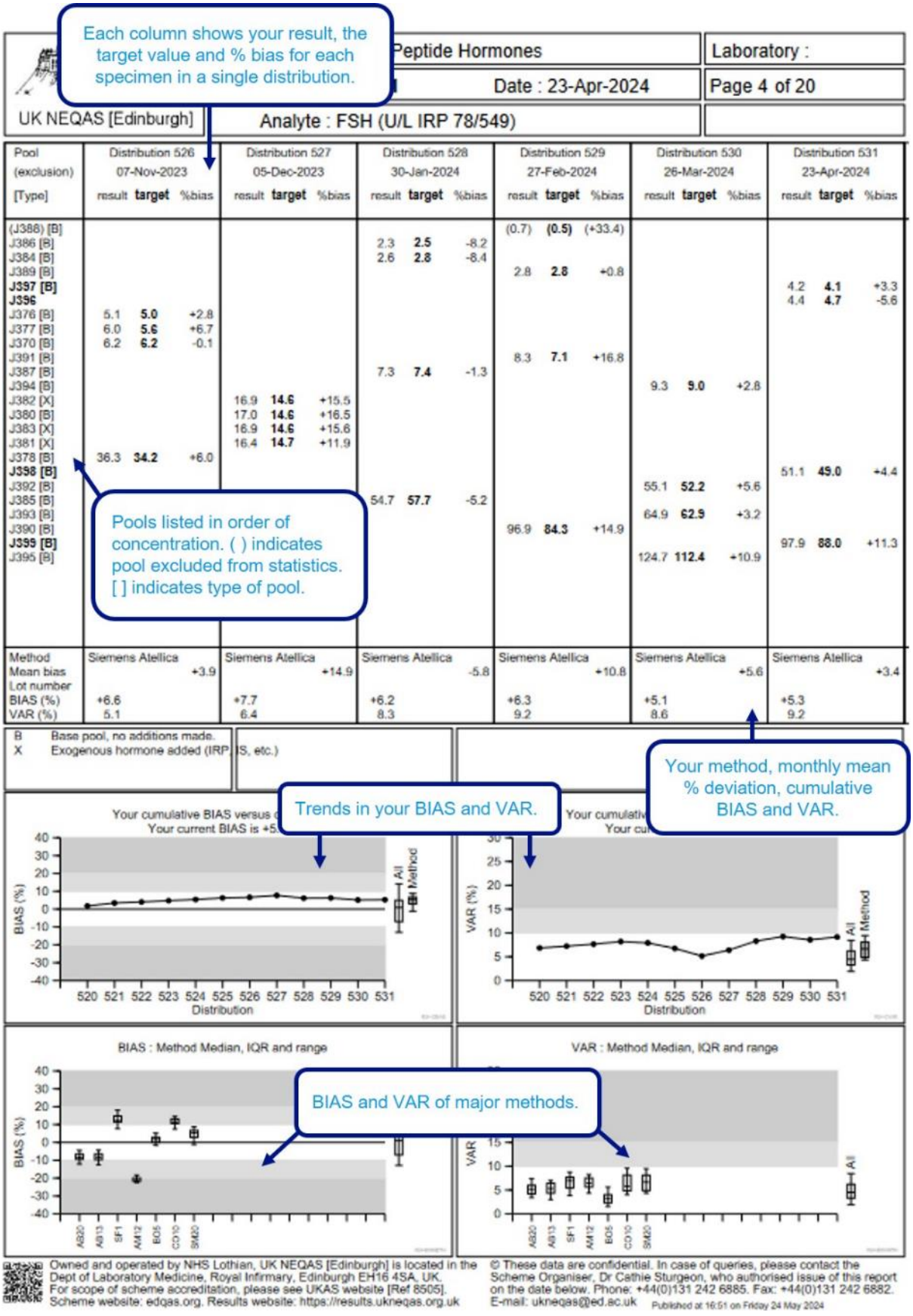
21.2 Participant Report - Page 2 – Distribution Summary



21.3 Participant Report - Page 3 – Analyte summary – Histograms



21.4 Participant Report - Page 4 – Analysis of Bias – 6 and 12 month overviews



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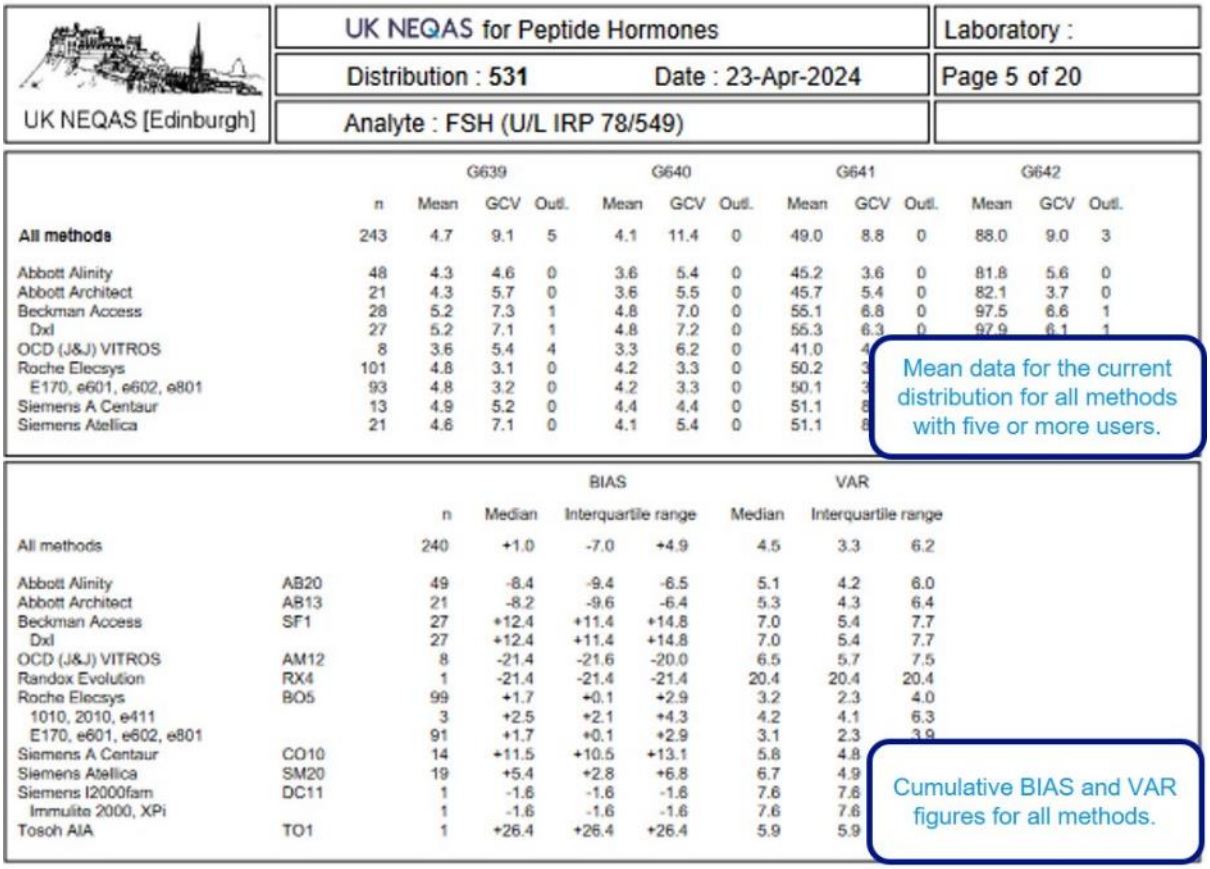
Published at 16:51 on Friday 24 May 2024

21.5 Participant Report - Page 5 – Summary of method data



UK NEQAS [Edinburgh]

UK NEQAS for Peptide Hormones | Laboratory :

Distribution : 531 | Date : 23-Apr-2024 | Page 5 of 20

Analyte : FSH (U/L IRP 78/549)

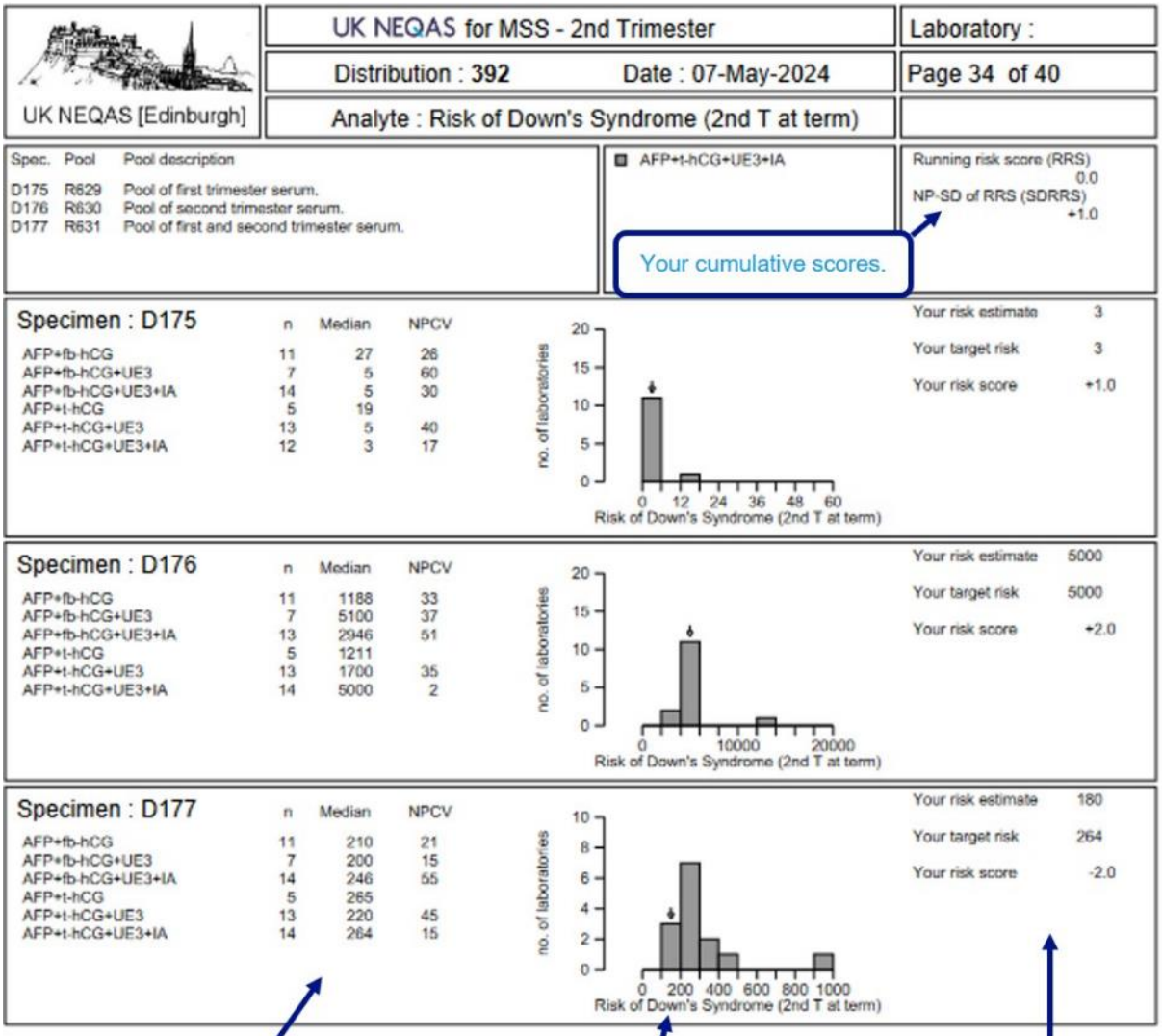
	G639			G640			G641			G642		
	n	Mean	GCV	Outl.	Mean	GCV	Outl.	Mean	GCV	Outl.	Mean	GCV	Outl.
All methods	243	4.7	9.1	5	4.1	11.4	0	49.0	8.8	0	88.0	9.0	3
Abbott Alinity	48	4.3	4.6	0	3.6	5.4	0	45.2	3.6	0	81.8	5.6	0
Abbott Architect	21	4.3	5.7	0	3.6	5.5	0	45.7	5.4	0	82.1	3.7	0
Beckman Access	28	5.2	7.3	1	4.8	7.0	0	55.1	6.8	0	97.5	6.6	1
Dxl	27	5.2	7.1	1	4.8	7.2	0	55.3	6.3	0	97.9	6.1	1
OCD (J&J) VITROS	8	3.6	5.4	4	3.3	6.2	0	41.0	4				
Roche Elecsys	101	4.8	3.1	0	4.2	3.3	0	50.2	3				
E170, e601, e602, e801	93	4.8	3.2	0	4.2	3.3	0	50.1	3				
Siemens A Centaur	13	4.9	5.2	0	4.4	4.4	0	51.1	6				
Siemens Atellica	21	4.6	7.1	0	4.1	5.4	0	51.1	6				

Mean data for the current distribution for all methods with five or more users.

			BIAS			VAR		
		n	Median	Interquartile range		Median	Interquartile range	
All methods		240	+1.0	-7.0	+4.9	4.5	3.3	6.2
Abbott Alinity	AB20	49	-8.4	-9.4	-6.5	5.1	4.2	6.0
Abbott Architect	AB13	21	-8.2	-9.6	-6.4	5.3	4.3	6.4
Beckman Access	SF1	27	+12.4	+11.4	+14.8	7.0	5.4	7.7
Dxl		27	+12.4	+11.4	+14.8	7.0	5.4	7.7
OCD (J&J) VITROS	AM12	8	-21.4	-21.6	-20.0	6.5	5.7	7.5
Randox Evolution	RX4	1	-21.4	-21.4	-21.4	20.4	20.4	20.4
Roche Elecsys	BO5	99	+1.7	+0.1	+2.9	3.2	2.3	4.0
1010, 2010, e411		3	+2.5	+2.1	+4.3	4.2	4.1	6.3
E170, e601, e602, e801		91	+1.7	+0.1	+2.9	3.1	2.3	3.9
Siemens A Centaur	CO10	14	+11.5	+10.5	+13.1	5.8	4.8	
Siemens Atellica	SM20	19	+5.4	+2.8	+6.8	6.7	4.9	
Siemens I2000fam	DC11	1	-1.6	-1.6	-1.6	7.6	7.6	
Immulite 2000, XPi		1	-1.6	-1.6	-1.6	7.6	7.6	
Tosoh AIA	TO1	1	+26.4	+26.4	+26.4	5.9	5.9	

Cumulative BIAS and VAR figures for all methods.

21.6 Participant Report – Maternal serum screening – Assessment of risk

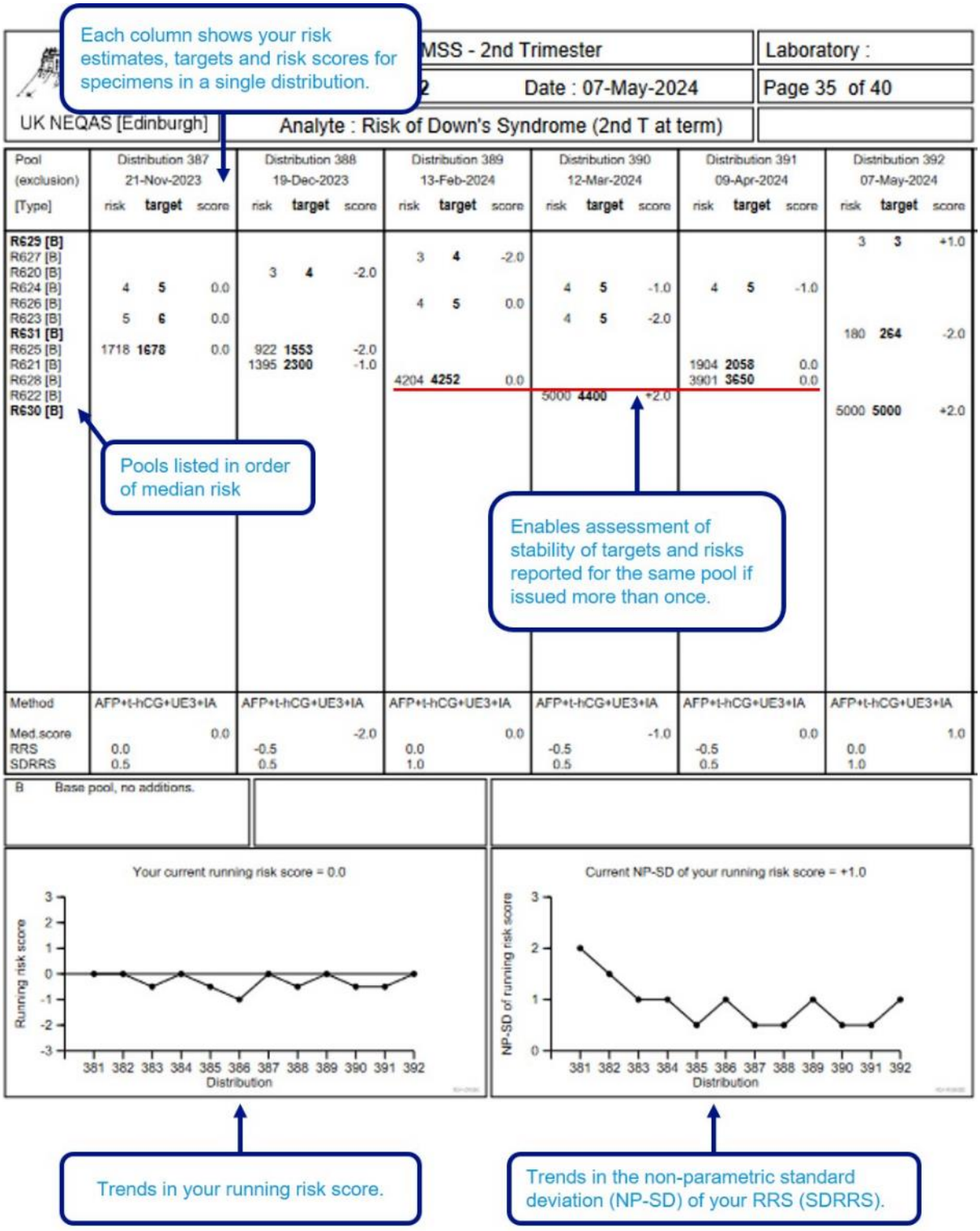


Summary data showing median risk and spread [i.e. non-parametric estimate of the coefficient of variation (NPCV)] for all sets of analytes.

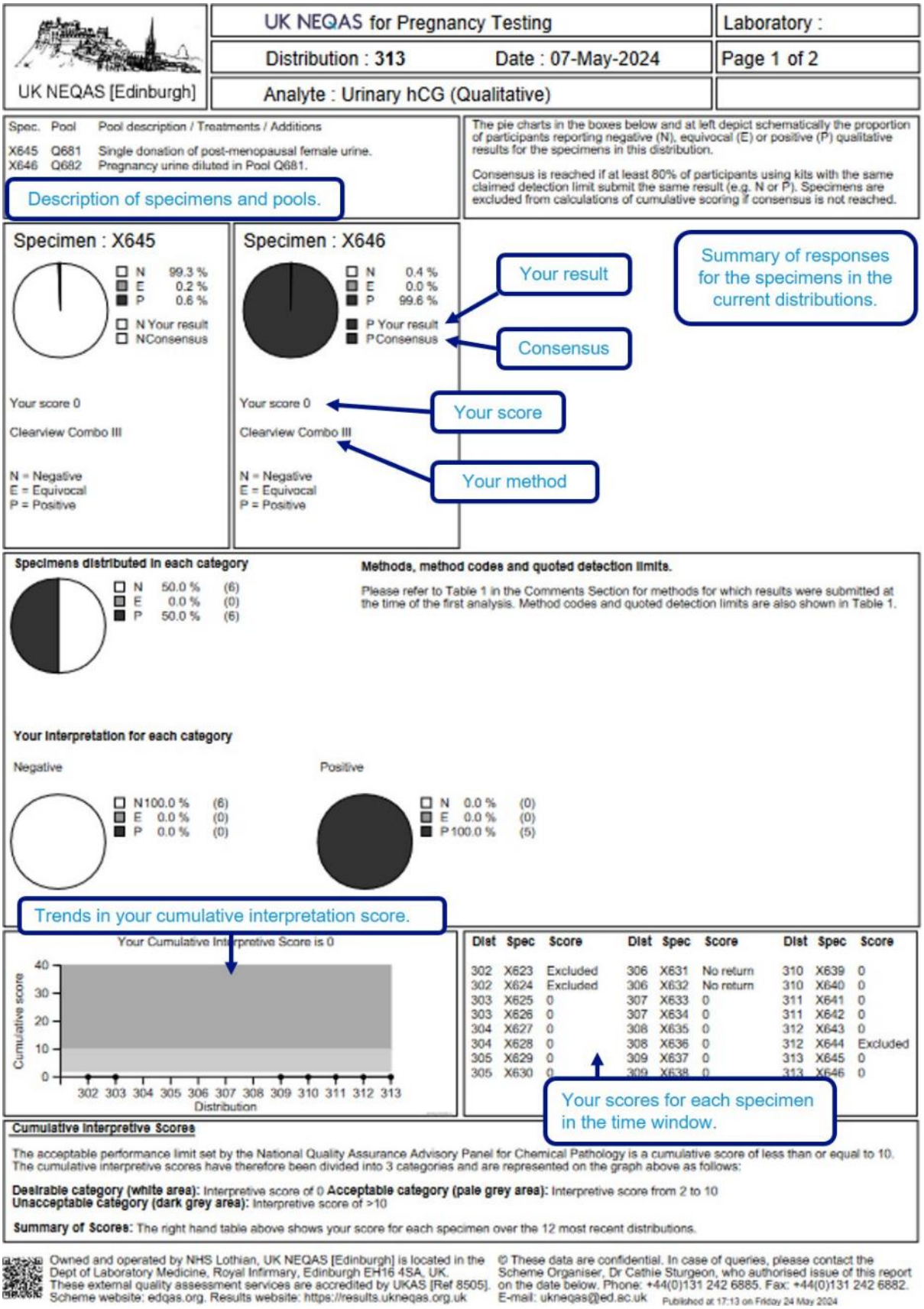
Histograms showing all risk estimates returned by users of the same set of analytes as those used in your laboratory.

Summary data for each specimen, showing your risk, the target risk and your risk score (i.e. your deviation from target).

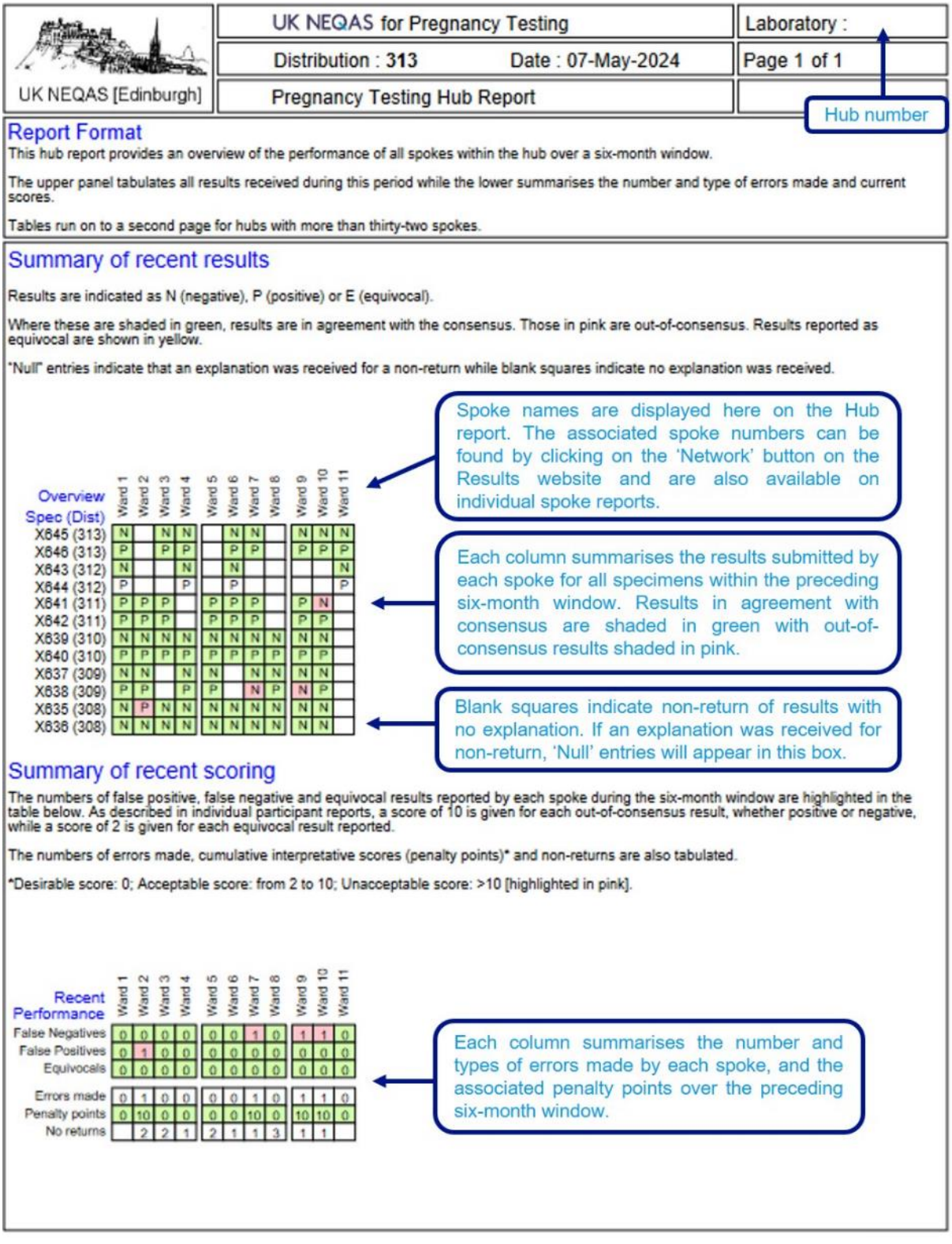
21.7 Participant Report – Maternal serum screening – Analysis of Bias (Risk)



21.8 Participant Report – Pregnancy Testing scheme (Qualitative report)



21.9 Summary Hub Report for POCT Coordinators – Pregnancy Testing scheme



UK NEQAS [Edinburgh]

UK NEQAS for Pregnancy Testing | Laboratory :

Distribution : 313 Date : 07-May-2024 | Page 1 of 1

Pregnancy Testing Hub Report

Hub number

Report Format

This hub report provides an overview of the performance of all spokes within the hub over a six-month window.

The upper panel tabulates all results received during this period while the lower summarises the number and type of errors made and current scores.

Tables run on to a second page for hubs with more than thirty-two spokes.

Summary of recent results

Results are indicated as N (negative), P (positive) or E (equivocal).

Where these are shaded in green, results are in agreement with the consensus. Those in pink are out-of-consensus. Results reported as equivocal are shown in yellow.

"Null" entries indicate that an explanation was received for a non-return while blank squares indicate no explanation was received.

Spoke names are displayed here on the Hub report. The associated spoke numbers can be found by clicking on the 'Network' button on the Results website and are also available on individual spoke reports.

Overview Spec (Dist)	Ward 1	Ward 2	Ward 3	Ward 4	Ward 5	Ward 6	Ward 7	Ward 8	Ward 9	Ward 10	Ward 11
X645 (313)	N		N	N		N	N		N	N	N
X646 (313)	P		P	P		P	P		P	P	P
X643 (312)	N			N		N					N
X644 (312)	P			P		P					P
X641 (311)	P	P	P		P	P	P		P	N	
X642 (311)	P	P	P		P	P	P		P	P	
X639 (310)	N	N	N	N	N	N	N	N	N	N	
X640 (310)	P	P	P	P	P	P	P	P	P	P	
X637 (309)	N	N		N	N		N	N	N	N	
X638 (309)	P	P		P	P		N	P	N	P	
X635 (308)	N	P	N	N	N	N	N	N	N	N	
X636 (308)	N	N	N	N	N	N	N	N	N	N	

Each column summarises the results submitted by each spoke for all specimens within the preceding six-month window. Results in agreement with consensus are shaded in green with out-of-consensus results shaded in pink.

Blank squares indicate non-return of results with no explanation. If an explanation was received for non-return, 'Null' entries will appear in this box.

Summary of recent scoring

The numbers of false positive, false negative and equivocal results reported by each spoke during the six-month window are highlighted in the table below. As described in individual participant reports, a score of 10 is given for each out-of-consensus result, whether positive or negative, while a score of 2 is given for each equivocal result reported.

The numbers of errors made, cumulative interpretative scores (penalty points)* and non-returns are also tabulated.

*Desirable score: 0; Acceptable score: from 2 to 10; Unacceptable score: >10 [highlighted in pink].

Recent Performance	Ward 1	Ward 2	Ward 3	Ward 4	Ward 5	Ward 6	Ward 7	Ward 8	Ward 9	Ward 10	Ward 11
False Negatives	0	0	0	0	0	0	1	0	1	1	0
False Positives	0	1	0	0	0	0	0	0	0	0	0
Equivocals	0	0	0	0	0	0	0	0	0	0	0
Errors made	0	1	0	0	0	0	1	0	1	1	0
Penalty points	0	10	0	0	0	0	10	0	10	10	0
No returns		2	2	1	2	1	1	3	1	1	

Each column summarises the number and types of errors made by each spoke, and the associated penalty points over the preceding six-month window.

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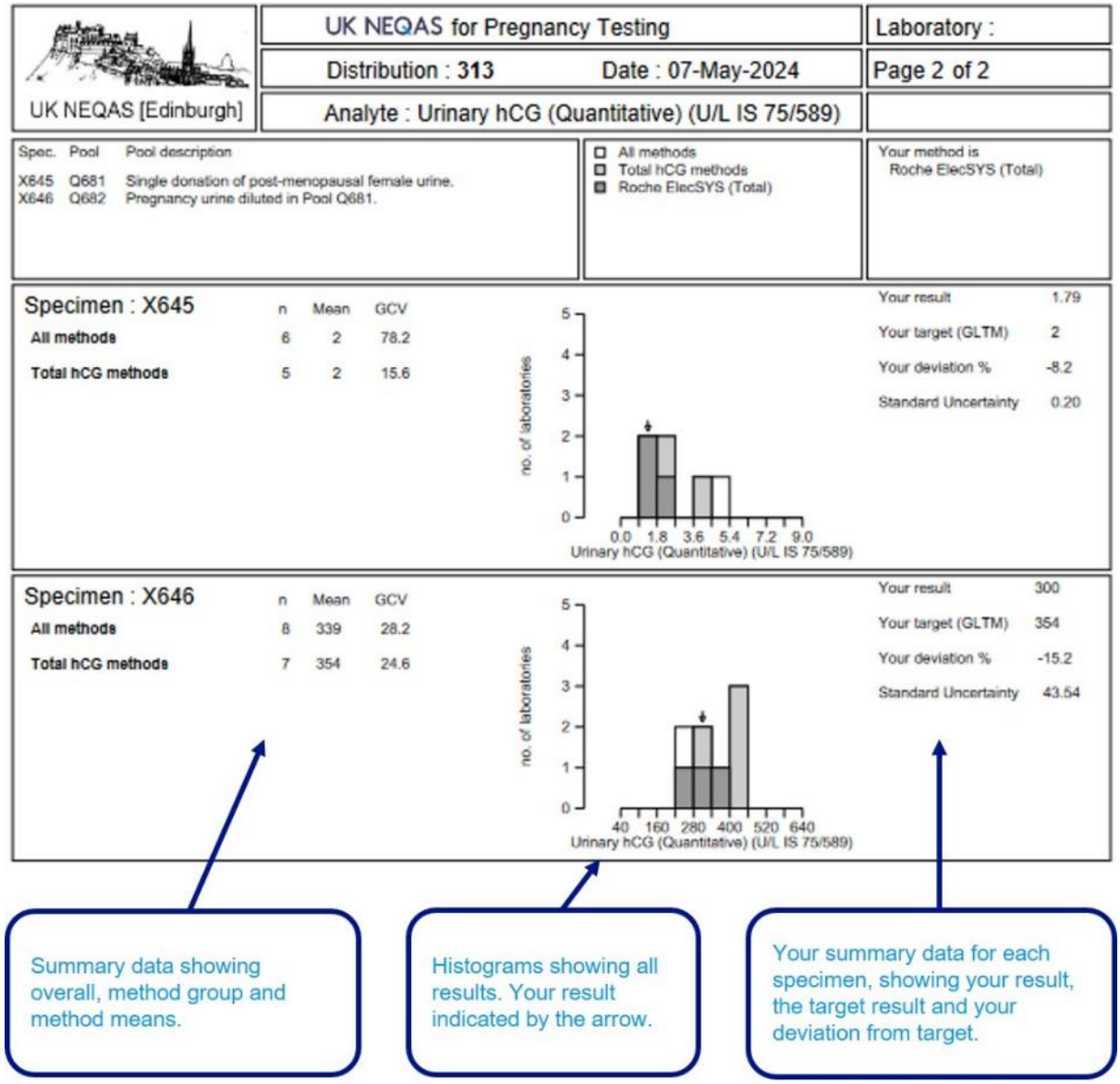
Published at 10:27 on Monday 27 May 2024

21.10 Participant Report – Pregnancy Testing scheme (Quantitative report)



Summary data showing overall, method group and method means.

Histograms showing all results. Your result indicated by the arrow.

Your summary data for each specimen, showing your result, the target result and your deviation from target.

The histograms showing quantitative results are similar to those in the serum hCG scheme. Results for individual qualitative and quantitative methods are listed in the tables on the accompanying comments sheet.

22 Calculation of cumulative performance statistics

22.1 Calculation of BIAS and VAR

Specimen and laboratory performance statistics are calculated after logarithmic transformation of results, using the trimming method of Healy MJR (*Clin Chem* 1979; **25**: 675-677). Logarithmic transformation allows for skewness in the data and appropriate computation of errors while trimming improves the reliability of the mean and measure of scatter.

1. SPECIMEN STATISTICS

1.1 All laboratory trimmed mean (ALTM) and its geometric coefficient of variation (GCV)

For each specimen non-numeric results, including those reported as "less than" or "greater than" are discarded. All remaining individual results are ranked and transformed into their natural logarithms. The lowest and highest 5% of results (rounded up to the nearest whole number) are trimmed (Healy, 1979). The excluded results play no part in the calculation of the estimate of the mean of the results (ALTM) or the scatter of values (GCV), but **are not necessarily outliers** and are therefore retrieved for the later identification of between-laboratory, within-specimen outliers and calculations of individual laboratory BIAS and VAR (see below).

1.2 Grouped laboratory trimmed mean (GLTM) and its GCV

Calculations exactly analogous to those described above can be performed on results from groups of similar methods, such as assays of hCG classified according to recognition of the free β-subunit of hCG. The estimate of the mean is referred to as the GLTM, and its associated estimate of scatter is the GCV.

1.3 Method laboratory trimmed mean (MLTM) and its GCV

Calculations exactly analogous to those described above can be performed on results from a single method. The estimate of the mean is referred to as the MLTM, and its associated estimate of scatter is the GCV.

2. LABORATORY PERFORMANCE STATISTICS

2.1 Cumulative BIAS and its variability (VAR)

Cumulative bias (BIAS) and the variability of the bias (VAR) are calculated for each laboratory from all results returned by that laboratory on all usable specimens during the most recent six distributions (usually six months but 12 months for Peptide II).

Non-numeric results are discarded, as above, and the remaining results are transformed by taking natural logarithms. Deviations are calculated by subtracting the natural logarithm of the chosen target for the analyte in question (ALTM or GLTM) from these logarithmic values. (This is equivalent to division of untransformed values). The values are ranked and trimmed as above. The mean and LSD are calculated and within-laboratory, between-specimen outliers identified. The BIAS is then the antilog of this mean expressed as a percentage difference from 100 and the VAR is the GCV of the deviations.

22.2 Worked example

The following gives a worked example from the prolactin NEQAS (specimen statistics) and the growth hormone NEQAS (laboratory statistics) and should be read in conjunction with Healy, 1979.

3.1 Specimen Statistics

3.1.1 Rank data, take natural logs, trim highest and lowest 5% and assign weightings. i = Rank of trimmed data, k = number of results after trimming

Lab	Raw result (mU/L)	Natural log (x)	Rank (i)	Weighting (2i-k-1)
12	260	5.5607		Trimmed
175	271	5.6021		Trimmed
1823	275	5.6167	1	24
14	278	5.6276	2	-22
272	280	5.6348	3	-20
408	280	5.6348	4	-18
39	280	5.6348	5	-16
38	280	5.6348	6	-14
17	281	5.6384	7	-12
1614	282	5.6419	8	-10
2	286	5.656	9	-8
80	288	5.663	10	-6
1	290	5.6699	11	-4
412	290	5.6699	12	-2
96	290	5.6699	13	0
86	290	5.6699	14	2
124	298	5.6971	15	4
701	298	5.6971	16	6
933	300	5.7038	17	8
48	300	5.7038	18	10
49	300	5.7038	19	12
627	303	5.7137	20	14
83	305	5.7203	21	16
1001	310	5.7366	22	18
11	310	5.7366	23	20
206	310	5.7366	24	22
216	320	5.7683	25	24
606	325	5.7838		Trimmed
74	340	5.8289		Trimmed

3.1.2 Choice of number of results to be trimmed

The number of results to be trimmed is that which would remove 10% of the sample (the lowest 5% and the highest 5%), rounded up to the next even number.

In this case, the number of raw results, n = 29, so the number trimmed is 10% of 29 = 2.9 which is rounded up to 4. Therefore, the lowest 2 results and the highest 2 results are removed. Number of results left after trimming, k = 25.

3.1.3 Calculate the ALTM

$$\text{Mean trimmed, transformed results, } \bar{x} = \frac{\sum_{i=1}^{k} (x_i)}{k} = 5.679$$

$$\text{ALTM} = e^{\bar{x}} = 292.7 \text{ mU/ L}$$

Where x_i = natural logarithm of i′th untrimmed result.
k = number of results remaining after trimming.

3.1.4 Calculate proportion untrimmed

Total number of results, n = 29
Number of results after trimming, k = 25

$$\text{Proportion untrimmed, } p = \frac{k}{n} = 0.8621$$

3.1.5 Obtain unbiasing factor

This is obtained from Healy, p 676

$$b_p = 2.359$$

3.1.6 Calculate linear estimate of the standard deviation, LSD

$$\text{LSD} = \frac{b_p \times \sum_{i=1}^{k} (2i - k - 1) \times x_i}{k\,(k - 0.5)}$$

In this example, $k\,(k - 0.5) = 25 \times 24.5 = 612.5$

$(2i - k - 1)$ = Weighting factor for each natural log value

Sum of products, ln(result) × weighting factor

$$= \sum_{i=1}^{k} (x_i \times \text{weight}_i) = 14.4752$$

$$\text{LSD} = \frac{2.359 \times 14.475}{612.5} = 0.05575$$

This figure is an estimate of the standard deviation of the natural log values which, in practice, is close to the figure for the proportional coefficient of variation.

Note that the LSD refers only to the log values. The antilog of the LSD is not an appropriate measure of the scatter of the raw data. To estimate the scatter we calculate the GCV (Kirkwood, TBC 1979. *Biometrics*;**35**:908-909) which is a multiplicative factor (see 3.1.7).

3.1.7 Calculate the geometric coefficient of variation

$$\text{GCV} = (e^{\text{LSD}} - 1) \times 100$$

$$e^{\text{LSD}} = 1.0573$$

$$\text{GCV} = 5.7\%$$

3.1.8 Identification of between-laboratory, within-sample outliers

An outlier is defined as a value outside the 99% confidence interval of the mean (of the logged results), which is approximately ± three (linear) standard deviations.

$$\text{From } (\bar{x} - (3 \times \text{LSD})) = 5.679 - 0.167 = 5.512$$

$$\text{to } (\bar{x} + (3 \times \text{LSD})) = 5.679 + 0.167 = 5.846$$

So, from section 3.1.1, we see that there are no between-laboratory, within-sample outliers. Note that trimmed results and outliers are not the same; trimmed results only become outliers if they are outside the ±3 LSD range from the mean.

3.2 Laboratory Statistics

The process is analogous to that described above, except that the starting data are an individual laboratory's results on all usable specimens obtained during the six distribution window.

3.2.1 Calculate difference of ln (lab result) from ln (target value)

Specimen Number	Target, mU/L (TV)	Lab Result, mU/L (LR)	ln(LR) - ln(TV) (Z)
H541	3.6	4.6	0.2451
H542	9.0	13.2	0.3829
H545	3.1	4.3	0.3272
H546	1.2	2.2	0.6061
H550	2.6	4.0	0.4307
H551	5.4	7.4	0.315
H552	2.5	3.2	0.2468
H553	5.2	7.9	0.4182
H554	4.3	5.1	0.1706
H555	6.4	7.5	0.1586
H556	2.6	N.R.	-
H557	6.5	7.6	0.1563
H558	5.2	7.3	0.3392
H559	4.4	5.9	0.2933
H560	5.7	8.4	0.3877
H561	6.2	6.6	0.0625
H562	6.0	7.0	0.1541
H563	5.0	6.2	0.2151
H564	2.4	2.7	0.1177
H565	4.2	4.2	0
H566	5.1	6.0	0.1625
H567	5.8	8.9	0.4281
H568	5.7	7.7	0.3007
H569	5.6	7.7	0.3184
H570	5.4	7.4	0.315

The target can be either the ALTM (as is the case for growth hormone in this example) or the appropriate GLTM (for example, for hCG).

The missing specimen numbers refer to specimens that were deemed unusable from the point of view of inclusion in the cumulative statistics. N.R. indicated that the lab did not return a result. Having obtained these differences (which are, as noted above, actually the logs of {result divided by target}), the calculation proceeds exactly as above.

3.2.2 Rank and trim deviations. Calculate mean (BIAS), LSD (GCV) and identify outliers

Z	Weight
0	Trimmed
0.0625	Trimmed
0.1177	-19
0.1541	-17
0.1563	-15
0.1586	-13
0.1625	-11
0.1706	-9
0.2151	-7
0.2451	-5
0.2468	-3
0.2933	-1
0.3007	1
0.315	3
0.315	5
0.3184	7
0.3272	9
0.3392	11
0.3829	13
0.3877	15
0.4182	17
0.4281	19
0.4307	Trimmed
0.6061	Trimmed

n = 24, k = 20
Proportion untrimmed, p = 0.8333
Unbiasing factor, b_p = 2.477

Mean of logs of trimmed values, $\bar{z}$

$$= \frac{\sum_{i=1}^{k} z}{k} = 0.2726$$

$$\text{BIAS} = (e^{\bar{z}} - 1) \times 100 = 31.3\%$$

$$k\,(k - 0.5) = 20 \times 19.5 = 390$$

$$LSD = \frac{b_p \times \sum_{i=1}^{k} (2i - k - 1) \times z_i}{k\,(k - 0.5)}$$

$$= 0.136$$

The GCV of the BIAS (the VAR) = $(e^{LSD} - 1) \times 100 = 14.6\%$

Limits for outliers are $(\bar{z} \pm 3\,\text{LSD})$ = (-0.351 to + 0.681)

So there are no within- laboratory, between- specimen outliers.

Therefore, the laboratory cumulative performance in the six-distribution window is described as

BIAS 31.3%

VAR 14.6%

No outlier results

Calculation of risk scores

(Maternal serum screening)

Protocol: Set of analyses that a laboratory uses to derive risk, e.g. “AFP and total hCG”, “AFP, free β-hCG and UE3”, etc.

Specimen statistics (At least five risk estimates are required to calculate these)

Target risk: The median of all risks returned on a given specimen by users of your protocol.

Non-parametric estimate of standard deviation (NPSD): This is the median of the absolute differences between each risk for a given protocol and the target risk. It is approximately 80% of the SD calculated in the usual fashion.

Non-parametric estimate of the coefficient of variation (NPCV): The NPSD expressed as a percentage of the target risk.

Risk score (RS): Designed to be analogous to bias. Ideally, your RS should be zero. All risks on a given specimen for users of your protocol are arranged in order and divided into five bins, each covering 20 percentiles. Your RS is assigned according to which band your risk falls into:

Centile band	Risk score (RS)
< 20	-2
20 - 40	-1
> 40 - 60	0
> 60 - 80	+1
> 80	+2

Running risk score (RRS): Designed to be analogous to BIAS. It is the median of your risk scores recorded during the time window (most recent six distributions). Ten risk scores are needed to calculate RRS. Your RRS should be close to zero.

Non-parametric estimate of the SD of your RRS (SDRRS): Designed to be analogous to VAR. It is the non-parametric SD of your RRS. Calculated as the median of the absolute differences between your RS and RRS. Your SDRRS should be close to zero.

Calculation of qualitative scores

(Pregnancy testing)

Score (for a specimen)

Your reported result for each specimen is scored against the method group consensus and given a score of 0, 2 or 10 by reference to the following “look-up” table:

		Consensus result		
		N	E	P
Your result	N	0	2	10
	E	2	0	2
	P	10	2	0

Where “N” = Negative, “E” = Equivocal and “P” = Positive. For example, if the consensus result is “N” but your result is “P”, then your score is 10.

Cumulative interpretative score is calculated by the addition of your scores for each of the specimens in the current six distributions. At least six usable results are required.

23 Appendices

23.1 Appendix 1. Conditions of participation (UK clinical laboratories)

JOINT WORKING GROUP FOR QUALITY ASSURANCE: CONDITIONS OF EQA SCHEME PARTICIPATION (UK clinical laboratories)

Effective from October 2010

The Joint Working Group for Quality Assurance (JWG) is a multidisciplinary group accountable to the Royal College of Pathologists for the oversight of performance in external quality assurance schemes (EQA) in the UK. Membership consists of the Chairmen of the National Quality Assurance Advisory Panels (NQAAPs), and representatives from the Institute of Biomedical Sciences, the Independent Healthcare Sector, the Department of Health and the United Kingdom Accreditation Service (UKAS). The JWG has established the following conditions, that apply to any laboratory offering a service to patients in the United Kingdom directly or indirectly (e.g. by generating data for the Committee on Safety of Medicines or for medical research).

1. The Head of a laboratory is responsible for registering the laboratory with an appropriate accredited EQA scheme.
2. The laboratory should be registered with available EQA schemes to cover all the tests that the laboratory performs as a clinical service.
3. EQA samples must be treated in exactly the same way as clinical samples. If this is not possible because of the use of non-routine material for the EQA (such as photographs) they should still be given as near to routine treatment as possible.
4. Changes in the test methodology of the laboratory should be notified in writing to the appropriate scheme organiser and should be reflected in the EQA schemes with which the laboratory is registered.
5. Samples, reports and routine correspondence may be addressedto a named deputy, but correspondence from Organisers and NQAAPs concerning persistent poor performance (red - see below) will be send directly to the Head of the laboratory or, in the case of the independent healthcare sector, the Hospital Executive Director.
6. The EQA code number and name of the laboratory and the assessment of individual laboratory performance are confidential to the participant and will not be released by Scheme Organisers without the written permission of the Head of the laboratory to any third party other than the Chairman and members of the appropriate NQAAP and the Chairman and members of the JWG. The identity of a participant (name of laboratory and Head of Department) and the tests and EQA schemes for which that laboratory is registered (but not details of performance) may also be released by the Scheme Organiser on request to the Health Authority, Hospital Trust/Private Company in which the laboratory is situated after a written request has been received.
7. A NQAAP may, with the written permission of the Head of a laboratory, correspond with the Authority responsible for the laboratory, about deficiencies in staff or equipment which, in the opinion of the NQAAP members, prevent the laboratory from maintaining a satisfactory standard.
8. Laboratories' EQA performance will be graded using a traffic light system; green will indicate no concerns, amber poor performance, red persistent poor performance, with black being reserved for the tiny number of cases that cannot be managed by the Organiser or NQAAP and that have to be referred to the JWG. The criteria for poor performance (amber) and persistent poor performance (red) are proposed by the EQA scheme Steering Committee in consultation with the EQA Provider/Scheme Organiser and approved by the relevant NQAAP.
9. When a laboratory shows poor (amber) performance the Organiser will generally make contact with the participant in accordance with the Scheme Standard Operating Procedure for poor performance. Within two weeks of a laboratory being identified as a persistent poor performer (red) the Organiser will notify the Chairman of the appropriate NQAAP together with a résumé of remedial action taken or proposed. The identity of a persistently poorly performing laboratory (red) will be made available to members of the NQAAP and JWG. The NQAAP Chairman should agree in writing any remedial action to be taken and the timescale and responsibility for carrying this out; if appropriate this letter will be copied to accreditation/reregulate bodies such as UKAS and HFEA who may arrange an urgent visit to the laboratory. Advice is offered to the Head of the laboratory in writing or, if appropriate, a visit to the Laboratory from a NQAAP member or appropriate agreed expert may be arranged.

10. If persistent poor performance remains unresolved, the NQAAP Chairman will submit a report to the Chairman of the JWG giving details of the problem, its causes and the reasons for failure to achieve improvement. The Chairman of the JWG will consider the report and, if appropriate, seek specialist advice from a panel of experts from the appropriate professional bodies to advise him/her on this matter. The Chairman of the JWG will be empowered to arrange a site meeting of this panel of experts with the Head of the Department concerned. If such supportive action fails to resolve the problems and, with the agreement of the panel of experts, the Chairman of the JWG will inform the Chief Executive Officer, or nearest equivalent within the organisation of the Trust or Institution of the problem, the steps which have been taken to rectify it and, if it has been identified, the cause of the problem. The Chairman of the JWG also has direct access and responsibility to the Professional Standards Unit of the Royal College of Pathologists. Should these measures fail to resolve the issues, the laboratory will be referred to the Care Quality Commission for further action.
11. Problems relating to EQA Schemes, including complaints from participating laboratories, which cannot be resolved by the appropriate Organiser, Steering Committee or NQAAP, will be referred to the Chairman of the JWG.

Joint Working Group for Quality Assurance Conditions of EQA Scheme Participation, August 2010

23.2 Appendix 2. BIAS and VAR performance criteria [Reviewed March 2024]

Performance criteria currently applied in the UK NEQAS [Edinburgh] schemers are shown in Table 6. Where performance is outwith these limits due to method-related differences in results, the limits are applied at the discretion of the Scheme Director.

Regular return of results is important, and failure to return results for three consecutive distributions without a valid explanation constitutes poor performance.

Table 6. BIAS and VAR performance criteria [Revised March 2024; subject to revision]

Scheme	**Analytes**	**BIAS** (/- %)	**VAR** (%)
Peptide hormones I	FSH LH AMH Prolactin hGH	20 20 20 20 20	15 15 15 15 15
Peptide hormones II	PTH ACTH hCT	 25 20	 25 25
Tumour markers	AFP hCG CEA	10 20 20	10 20 20
Pregnancy testing	Qualitative hCG	Interpretation score ≤10	
Second trimester maternal serum screening [Concentration and MoMs]	AFP Total hCG hCGβ subunit Unconjugated oestriol Inhibin A	10 10 10 20 n.a.	 10 10 15 n.a.
First trimester maternal serum screening [Concentration and MoMs]	hCGβ subunit PAPP-A	20 10	15 15
Pre-eclampsia markers* [Serum scheme]	PLGF sFlt-1	25 25	15 15
Liver fibrosis markers*	PIIINP Hyaluronic acid TIMP-1 ELF score	10 10 10 10	10 10 10 10

*Fully established UK NEQAS schemes submitted to UKAS in February 2024 for consideration for accreditation as an Extension to Scope.

23.3 Appendix 3. Specialist Advisory Group and NQAAP membership

Current members of the UK NEQAS Specialist Advisory Group for Immunoassay, the UK NEQAS Specialist Advisory Group for Maternal Serum Screening and the National Quality Assurance Advisory Panel (NQAAP) in Chemical Pathology are listed in Tables 7, 8 and 9.

Table 7. Members of the UK NEQAS Specialist Advisory Group for Immunoassay

Member	Role
Dr C Evans	Chairperson
Dr G Wark	Secretary and Director, UK NEQAS [Guildford]
Dr L Bailey	Expert member
Dr P Collinson	Expert member
Dr N Elkin	Director, UK NEQAS [Glasgow]
Dr K Gordon	Expert member
Dr D Halsall	Expert member
Professor B Keevil	Expert member
Dr J Hawley	Expert member
Mr F Mackenzie	Director, UK NEQAS [Birmingham]
Dr R Marrington	Deputy Director, UK NEQAS [Birmingham]
Dr M Moore	NIBSC liaison
Professor J Newell-Price	Expert member
Dr O Okosieme	Expert member
Dr L Owen	Expert member
Ms D Patel	Director, UK NEQAS [Sheffield]
Dr L Perry	Expert member
Mr A Reid	Expert member
Dr C Sturgeon	Director, UK NEQAS [Edinburgh]

Table 8. Members of the Specialist Advisory Group for Maternal Serum Screening

Member	Role
Mrs K Donalson	Expert member
Dr C Evans	Expert member
Dr L Rashid	Expert member
Dr C Sturgeon	Director, UK NEQAS [Edinburgh]
Mr S Turner	Expert member
Professor D Wright	Director, Down's Quality Assurance Advisory Service (DQASS)

Table 9. Members of the National Quality Assurance Advisory Panel (NQAAP) for Chemical Pathology

Member	Role
Mrs Funmi Akinlade	Chairperson
Dr Jamie West	IBMS Representative
Dr Kirsty Gordon	ALM Representative
Dr Emma Stevenson	Co-opted Representative for the ALM

23.4 Appendix 4. Useful addresses

Organisation	Contact details
UK NEQAS Cardiac Markers	Dr Naomi Elkin Department of Laboratory Medicine Queen Elizabeth University Hospital 1345 Govan Road Glasgow G51 4TF Tel: +44 (0) 141 440 2888 E-mail: info@ukneqas-cm.org.uk
UK NEQAS for Clinical Chemistry UK NEQAS for Thyroid Hormones UK NEQAS for Steroid Hormones	Mr Finlay Mackenzie Birmingham Quality PO Box 3909 Birmingham B15 2UE Tel: +44 (0)121 414 7300 E-mail: birminghamquality@uhb.nhs.uk
UK NEQAS for Immunology, Immunochemistry & Allergy	Mrs Dina Patel Department of Immunology PO Box 894 Sheffield, S5 7YT E-mail: ukneqas@immqas.org.uk
UK NEQAS for Insulin, Growth Factors and Gastrin	Dr Gwen Wark Clinical Laboratory Royal Surrey County Hospital Edgerton Road, Guildford Surrey GU2 5XX Tel: +44 (0)1483 406715 E-mail: gwen.wark@nhs.net
UK NEQAS Central Office	5-6 Community Stadium Sheffield Olympic Legacy Park Workshop Road Sheffield S9 3TL Tel: +44 (0) 114 261 11689 E-mail: CentralOffice@ukneqas.org https://ukneqas.org.uk
UK Accreditation Service	UKAS, 2 Pine Trees Chertsey Lane Staines-upon-Thames Middlesex TW18 3HR Tel: +44 (0) 1784 429000 E-mail: info@ukas.com http://www.ukas.com
National Institute for Biological Standards and Control	NIBSC Blanche Lane South Mimms, Potters Bar Hertfordshire, EN6 3QG Tel: +44 (0) 1707 641000 E-mail: enquiries@nibsc.org www.nibsc.org/

UK NEQAS [Edinburgh] e-mail address: ukneqas@ed.ac.uk