PERFORMANCE, QUALITY & SAFETY (PQS) **STANDARD OPERATING PROCEDURE**		
SOP N°: MHP/RPQ/PQT/VAX/PQS/014	**Version n°:** 01.00	**Page:** 1 of 33

HOW TO AUDIT A LABORATORY FOR PQS ACCREDITATION

1st edition: TBC *(For details see revision table)*	**Effective date** 13/08/19	**Revision date** 01/04/2020
Authorised by: *Reviewed by:*	I. Gobina P. Mallins	
Prequalification Team (PQT)		

Contents

1. Purpose

This SOP describes how to audit a laboratory as a part of its assessment for PQS accreditation. Before a product or device can be added to the PQS database, verification of its conformity with all the requirements of the relevant product specification must take place. A WHO-accredited laboratory is commissioned by the product manufacturer or supplier to carry out tests that will form part of their dossier (see Product Dossier clause of any product specification) submitted to WHO PQS for approval.

In order to receive PQS-accreditation, a laboratory must demonstrate its competence to carry out specific product tests by conforming to internationally-accepted standards or codes of practice, as witnessed by a competent third-party accreditation body. These include quality standards such as ISO 9001:2015 *Quality management systems — Requirements* and ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories.*

A laboratory's conformity with the required standards and codes is achieved by evaluation of a laboratory information dossier and examination of other requirements, described in full in described in MHP/RPQ/PQT/VAX/PQS/007 *How to assess a laboratory for PQS accreditation* Version 1.06.

In addition to presenting a satisfactory laboratory information dossier and demonstrating conformity with all requirements, a laboratory seeking PQS accreditation may be required to undergo a full or partial site audit. The need for an audit will be determined based on the arrangements of the accreditation body to which the laboratory is signatory, and may be influenced by test urgency.

The procedures set out in this SOP will be followed by the *PQS Secretariat* (Secretariat), the *PQS Working Group* (WG) and by all *Technical Specialists* (TS) commissioned by the Secretariat.

2. Scope

This SOP is applicable when a laboratory applies or re-applies for PQS accreditation. Laboratories that successfully pass a required audit and demonstrate required competencies through the assessment process may then be accredited by PQS to test specific categories of products.

Laboratories that are accredited by ILAC signatories should receive a surveillance visit by that signatory every 12 to 18 months and a full audit every four to five years. Other accreditation bodies may have different arrangements.

In the case of ILAC signatory laboratories, if there is test urgency and if all certification, documentations and quality manuals are up to date and if comprehensive knowledge of the relevant type of testing can be readily demonstrated, then accreditation may be granted rapidly (i.e. without a full audit). In all other cases an audit can take place.

3. Associated reference documentation

ILAC-G15:2001 Guidance for Accreditation to ISO/IEC 17025:2017
ILAC-G17:2002 Introducing the Concept of Uncertainty of Measurement in Testing in Association with the Application of the Standard ISO/IEC 17025:2017
ILAC-G18:04/2010 Guideline for the Formulation of Scopes of Accreditation for Laboratories
ISO 9001:2015 Quality management systems — Requirements
ISO/IEC 17025:2017 incl. COR 1: 2005 General requirements for the competence of testing and calibration laboratories
List of ILAC Mutual Recognition Arrangement Signatories
SOP No MHP/RPQ/PQT/VAX/PQS/007 - *How to assess a laboratory for PQS accreditation* Version 1.6
SOP No MHP/RPQ/PQT/VAX/PQS/008 - *How to re-evaluate a prequalified PQS product Version* 1.6

4. Responsibility

Responsibilities and tasks will be assigned as follows.

The *PQS Working Group* (WG)[1] (at the direction or request of the *PQS Secretariat*):

- Members may be assigned the task of reviewing the original application.

[1] The PQS Working Group (WG) is comprised of the WHO (PQS and Expanded Programme on Immunization), the United Nations Children's Fund (UNICEF) Supply and Programme Divisions, the Gavi, the Vaccine Alliance Secretariat, specialist agencies, partner organizations and other key stakeholders. In an advisory capacity through the WG structure, these actors offer a wide range of programmatic and technical expertise that supports the development, introduction and advancement of technologies that will meet countries' EPI needs for high-quality cold chain equipment and devices.

Technical Specialists (TS):
- May be asked to audit the laboratory.

The *PQS Secretariat* (Secretariat)[2]:
- Requests the WG review(s) of the application if required;
- Arranges for an audit of the laboratory by a TS if required;
- Decides whether to accept or reject the application;
- Notifies the test laboratory whether they are accredited or if their application has been rejected; and
- Amends to the PQS website accordingly to reflect the decision.

5. Procedure

5.1 Initial inquiries

It is anticipated the following exchanges will be carried out via email.

A prospective laboratory applies to WHO for assessment. In some cases, the PQS Secretariat may invite a laboratory to apply.

In their initial enquiry, a laboratory should:

- Outline the categories they wish to be accredited for (E001 – E0013) as listed on the PQS website: http://apps.who.int/immunization_standards/vaccine_quality/pqs_catalogue/categorylist.aspx?cat_type=device
- State their current laboratory accreditation and general area of expertise[3].
- Have written quality procedures (a quality manual) in accordance with or based on ISO 9001:2015.

A laboratory applying for PQS accreditation must be certified to ISO/IEC 17025:2017. ISO 9001:2015 is not a requirement for PQS accreditation.

[2] The WHO PQS Secretariat is responsible for sharing up-to-date information on prequalified immunization devices and products, as well as product alerts. It ensures that the standards that apply to equipment maintenance, manufacturing and product testing are current. The Secretariat also coordinates product feedback reports and learnings from product field monitoring. The Secretariat holds ultimate responsibility for the PQS process and takes all final PQS decisions, including the decision to award prequalified status to a product or device.

[3] Except under special circumstances, for a laboratory to be accepted to carry out type-examination, independent type-testing or full quality assurance, it should be already accredited in accordance with ISO/IEC 17025:2017: 2005/COR1:2006 General *requirements for the competence of testing and calibration laboratories.*

After the initial enquiry for PQS accreditation, the PQS Secretariat can ask the laboratory to complete a detailed dossier in accordance with SOP No. MHP/RPQ/PQT/VAX/PQS/007 Version 1.6. In the event that the laboratory is unfamiliar with the procedure, the PQS Secretariat can provide additional support for application preparation via email exchange with the laboratory.

Once the application has been submitted and verified, the PQS Secretariat may consider it necessary to request a full or partial audit visit as part of new applications or reapplications for PQS accreditation. An audit visit may also be part of a routine surveillance visit, as described in SOP No. MHP/RPQ/PQT/VAX/PQS/008 Version 1.6.

5.2 Audit outline

Although ISO/IEC 17025:2017 compliance requires a laboratory to have a quality management system in place, PQS may require additional information about quality procedures, test facilities and laboratory competences in order to evaluate an application for PQS accreditation.

The audit will be a wide-ranging examination covering “horizontal” and “vertical” aspects of their procedures. For example, a horizontal audit could examine calibration or training, whereas a vertical audit follows testing from the moment of a product’s arrival at the laboratory to its departure and including customer follow-up.

5.3 Communication

5.3.1 Preliminary contact

It is important for the auditor to contact lead laboratory personnel including several weeks before the proposed audit date(s); this may include the Head of the laboratory, but it is not a requirement. Before the audit is carried out, the auditor must make direct contact with key persons at the laboratory to make it clear that:

- both quality and testing aspects of the laboratory will be audited,
- key personnel must be on site at the time of audit, and
- a test mock-up of applicable testing must be observed.

Key personnel must always include the Quality Manager (QM) or a manager who’s remit includes quality.

Following initial contact, an ongoing exchange between the lead auditor and laboratory key contact(s) by emails or telephone are necessary to establish and communicate:

1. The purpose of the audit visit
    - The laboratory must be made aware that this audit visit is a follow-up to their new application or re-application for PQS accreditation.
2. Date(s) for the audit
    - The auditor is entitled to see any aspect of their quality and test procedures and since testing can take time to set up, this should be agreed in advance.
    - Depending on the size of the facility, number of sites and geographical location, it is reasonable to allow at least two days for the audit. Any subsequent days allow for follow-up from the first day and for interviewing personnel who may not have been previously available.
3. The approximate areas the auditor would like to examine
    - An audit may include horizontal test areas such as calibration and training (even if both are subcontracted externally), or vertical test areas such as following a project from beginning to end (from agreed terms of reference to client satisfaction follow-up after completion).
4. The inclusion of test demonstrations relevant to the application
    - The laboratory must demonstrate testing capabilities for some or all of the PQS E00 categories for which the laboratory is applying. Since some tests take more than one day, in many cases it will not be possible to see a test from beginning to end. The laboratory should be informed that, in the case that an auditor observes a test currently in progress, it may be necessary for the auditor to interrupt the test (e.g. open the fridge door to examine thermocouple array) in order to fully evaluate the testing.

In many cases, English will not be the first language of laboratory personnel. The auditor should endeavour to communicate clearly and to avoid ambiguities and idiomatic expressions. Replies and acknowledgements to emails are essential.

The auditor is responsible for all aspects of their travel to the laboratory, although they may request advice about travel routes and appropriate hotels from the laboratory.

5.4 Pre-audit checklist

At least three weeks prior to the visit, the auditor should review the information obtained from the laboratory as a part of their application to be assessed for PQS accreditation (as described in **MHP/RPQ/PQT/VAX/PQS/007**). In case any of the following information or documentation is missing it should be requested by email or telephone:

- **The precise PQS categories (e.g. E003 or E004) and subcategories the laboratory wishes to test**. It is acceptable for laboratory to exclude some of the sub-categories within an E00 category. These exclusions should be listed by references to protocols.
- **Whether the laboratory wishes to carry out: Type-examination, Type testing, and/or Quality assessment.** Not all of the above are applicable to each subcategory.
- **A copy of the laboratory's ISO/IEC 17025:2017 and quality certification**, including whether the certifying authority is ILAC registered.
- **A copy of laboratory quality manual**. This is a large document and may not be in English. The auditor should obtain at least a copy of the contents page and a list of recent updates.
- **Names and contact details of at least three referees.** That is, well-established organizations (referees) that have used the laboratory's expert services during the past three years.
- **Examples of testing undertaken by the laboratory in the last three years that is similar to the tests for which they wish to be accredited.** Clients need not be named if this is confidential.
- **A copy of one test report similar to the tests for which they wish to be accredited.** Client's name and details may be redacted.

5.5 Pre-audit laboratory questionnaire

Immediately after completing the pre-audit checklist described in section 5.3.2, at three weeks prior to the planned audit visit, the auditor should ask the laboratory to complete a detailed questionnaire by written (electronic) correspondence[4]. An example questionnaire format is provided in Annex A.

The auditor may tailor the questionnaire to the particular laboratory and to the nature of the specific audit to be carried out. References to relevant ISO/IEC 17025:2017 clauses are also provided in the questionnaire.

The auditor may request the laboratory to respond to the questionnaire within two weeks. In the case of any missing, incomplete or unclear responses in the questionnaire, the audit provides the opportunity to follow-up.

[4] The questionnaire can take the form of a three-column spreadsheet which provides space to include: Question; Laboratory's response; Exemplar response or guidance. See Annex A.

The following are notes are intended to annotate the questionnaire in Annex A and should be read in conjunction with it. The numeration of these notes corresponds to those in the questionnaire.

5.5.1 General questions

5.5.1.1 Requests background on the laboratory.

5.5.1.2 Helps identify the individual laboratory staff you may meet.

5.5.1.3 Requests the CVs of the Laboratory Manager, Quality Manager and Engineers who will oversee the testing. These CVs should be kept confidential by the auditor.

5.5.1.4 Enquires about the current accreditation status of the laboratory. The auditor should be able to verify accreditations and certifications with the issuing authority's web site. In case the appropriate web page is difficult to locate, the auditor may need to contact the issuing authority before the audit visit.

5.5.1.5 Asks for a brief description of the quality management system. The laboratory will have drafted a Quality Manual (QM). A QM can be hundreds of pages long[5] so an auditor may not have time to read it in its entirety. Nevertheless, having reviewed at least the contents pages[6] can prime certain questions at the time of audit. e.g. “Take me through the procedure for the checking-in of test samples.”

5.5.1.6 Requests information about document control procedures in QMS. It is reasonable to print instructions or procedures but any hard copy is technically only valid on the day of printing. “UNCONTROLLED COPY” should be stamped or written on the printed document with a signature and a date.

5.5.1.7 Asks for dates of previous audit visits. If the lab is ISO/IEC 17025:2017 certified (as it must be) then it must have records of previous audit visits from other authorities.

5.5.1.8 Asks for information on the frequency and type of *internal* audits. Frequency of audits depends on the outcome of the previous audit. In general, auditing each department once per year is reasonable unless specific circumstances require a 3- or 6-month follow-up; including but not limited to the recurrence of the same issue(s). It is up to the lab whether internal auditors are senior or junior personnel, but they should be trained.

[5] Ideally a QM is much less than 100 pages. Better quality QMs have sub-sections for specialist areas.

[6] If the QM is not written in English, request at least the contents pages in English.

5.5.1.9 Concerns supplier auditing: the laboratory must not *assume* the quality of its suppliers. They must either ask for quality certification or carry out their own audit. This is mandatory for suppliers providing key test material, whereas the laboratory may apply their judgement for suppliers of other materials.

5.5.1.10 Requests information about "ring testing" an ISO/IEC 17025:2017 requirement and intra-laboratory comparisons (a good practice).

5.5.2 Test experience

5.5.2.1 Solicits details of current testing standards and protocols. Although the laboratory may be brand new to *PQS* testing, it is hoped that they have some similar experience.

5.5.2.2 Asks for information on participation in standard setting bodies. Note: participation in national or international standard committees is not compulsory however, and relies on senior management to commit time and money.

5.5.2.3 Requests training records, which may be provided in hard copy or electronic.

5.5.3 Test procedure

5.5.3.1 Prompts a description of the sample handling procedure. Arriving samples should be unpacked and at least visually checked fairly soon after arrival. i.e. one to two working days. A functional check may be carried out. Keeping the packaging for damage inspection may be useful. Damage should be photographed and reported to the client immediately for their decision. A dent in the body may look trivial but both the laboratory and the client should be mindful of hidden damage.

5.5.3.2 Asks for a list or description of environmental test chambers. This should include air speed which should be lower than 0.25 m/s for refrigerator testing.

5.5.3.3 Asks for a description of the procedure to follow a test protocol. It is not a requirement to have a "test manual". In fact, these can be unwieldy and inefficient. However, testing and procedures are usually complicated enough that reference to some sort of document like a "Test Work Instruction" (TWI) or a "Standard Operating Procedure" (SOP) about the instrumentation or the test set-up is probably useful. In case a laboratory indicates that they only "follow the PQS protocol", the auditor should request that laboratory to demonstrate that procedure during audit; often there are instructions for setting up instruments and other procedures not contained or covered in the PQS protocol.

5.5.4 Measuring instruments and accuracy

5.5.4.1 Requests detail on the measurement and logging of all relevant parameters. There is usually a dedicated chain: sensor – transducer – logger – PC/laptop to capture data. Temperature must be logged at least once per minute. Humidity capture is not stated. Since power is constantly varying, it is reasonable to log it every 10 seconds (although this is not stated as requirement).

5.5.4.2 Enquires about the type of temperature sensors and end "slugging" if applicable.

5.5.4.3 Solicits information on individual identification of all instruments, including every thermocouple, which must have a unique ID number.

5.5.4.4 Invites detail on instrument calibration. Temperature readings (if applicable) should be accurate to 0.5°C. This is from the tip of the temperature sensor to the value in the display or spreadsheet.

5.5.4.5 Invites detail on logged humidity accuracy. While there is no requirement for humidity accuracy (if applicable), 5% RH is reasonable.

5.5.4.6 Asks about the accuracy of power and energy measurements. If applicable, these should be accurate to 1%.

5.5.4.7 Asks if instruments are calibrated internally or externally. The laboratory may select either option; however, internal calibration of temperature sensors (for example) is not difficult and can offer more flexibility. Each instrument must have a calibration file so a year-on-year history is available.

5.5.4.8 Enquires about the quarantine of out-of-calibration instruments. It must be obvious to the technician which instruments are "in-calibration", "out-of-calibration" or "quarantined". For significant instruments, it is usual to include instrument ID with calibration dates in the report.

5.5.4.9 Asks about laboratory treatment for uncertainty calculations. To assess this criterion the auditor should have experience of uncertainty budgets.

5.5.5 Reporting

5.5.5.1 Requests the laboratory to provide an example copy of a report to the auditor in advance. The confidentiality of this report must be maintained.

5.5.5.2 Asks about the regularity of feedback on project progress; every week for example. Sometimes this is agreed in the terms of reference.

5.5.5.3 Enquires about the laboratory procedure for control of tested samples. Once testing is complete, test samples should not be released until the client is satisfied with the report. It is the client's decision whether the test

sample is returned to them or disposed of; there are cost implications in either case.

5.5.5.4 Asks about client follow-up procedures. Assuming the client wishes to continue working with the laboratory, it is useful for the laboratory to solicit feedback on what could be improved in the supplier-client relationship.

5.5.6 Corrective action

5.5.6.1 Requests a description of the laboratory procedure for "complaints" with corrective action or preventative action (CAPA). The laboratory must have a documented CAPA procedure for both internal and external complaints and musty be able to show examples to the auditor. No laboratory has zero complaints and the auditor should reassure the laboratory that CAPA is a beneficial process when completed adequately. Assessing the laboratory's attitude towards CAPA is a key quality indicator.

5.6 Laboratory practice

The auditor should identify good laboratory practice, including the following, which is not an exhaustive list. However, failure to fully comply with these practices does not preclude PQS accreditation as long as necessary steps are made within an agreed time-frame to show eventual compliance with ISO/IEC 17025:2017 and with PQS requirements.

The laboratory will:

- Maintain a quality management system that is clearly defined and documented and which is organized in such a way that the integrity of its staff and operations can be judged. (ISO/IEC 17025:2017 Clause 4 – *Management requirements*.)
- Employ suitably qualified laboratory staff, experienced and technically competent for the work to be undertaken. (ISO/IEC 17025:2017 Clause 5.2 – *Personnel*.)
- Have a testing environment and laboratory suitable for the tests undertaken. (ISO/IEC 17025:2017 Clause 5.3 – *Accommodation and environmental conditions*.)
- Use laboratory equipment appropriate for the PQS verification protocol(s) which is properly installed, maintained and calibrated. Adequate records of calibration and servicing must be maintained. (ISO/IEC 17025:2017 Clause 5.4 – *Test and calibration methods and method validation.)*
- Employ laboratory practices that are demonstrable and meet WHO requirements, such as:

- Sample identification (ISO/IEC 17025:2017 Clause 5.7 – *Sampling*).
- Test methods and procedures (ISO/IEC 17025:2017 Clause 7.2 *Validation of methods*.
- Checking of results and calculations (ISO/IEC 17025:2017 Clause 7.7 - *Ensuring the validity of results*).

- Operate a secure laboratory record system containing full details of all tests undertaken. (ISO/IEC 17025:2017 Clause 4.3 – *Document control*.)

- Supply test reports and documents which are accurate, clear and unambiguous and contain all the relevant information. (ISO/IEC 17025:2017 Clause 5.10 – *Reporting the results*).

5.7 Laboratory audit

5.7.1 Introduction

The audit visit should take one to two days and can cover all aspects of the laboratory's operation. An exemplar schedule is provided in Annex B, and described in more detail in Section 5.6 below. Key personnel will be interviewed during the audit which will examine the E00 category testing and quality procedures.

5.7.2 General practice for behaviour with staff during the audit visit

The audit is conducted as a series of interviews with appropriate personnel. This may include those directly involved in the testing, although this should be done with discretion and an appreciation for the extent of their experience. The audit should not be conveyed as a “challenge” to laboratory staff as this is counter-productive and results in a non-realistic assessment of quality and performance.

The Quality Manager should be present, or on-call, for most of the audit visit because there may be questions that the technician cannot answer. Alternatively, and if necessary, these questions may be stored for later.

Outside of the introductory meeting and the summary meeting, the auditor should strive to limit their speech and instead allow/encourage staff to explain what they do. Although the auditor often has much experience to share, this is not the purpose of the visit. However, their opinion may be sought if the laboratory does not understand a particular criticism.

During the audit of the laboratory and its departments, there should be (only) one member of senior staff or their representative present, or alternatively the Quality Manager or a senior staff member concerned with

PQS testing. If additional members of staff or senior managers are present it *may* impact on the interviewees feeling of ease to freely communicate all aspects of required information in some situations.

5.7.3 Documenting and resolving non-compliances

Any issues identified during the audit must be communicated to the laboratory key contact immediately, before the auditor leaves the laboratory site. This is good audit practice and strengthens the auditor's ability to be sure of their facts and to reduce any potential misunderstandings before documentation of findings.

Issues identified must be referenced as *non-compliances* with the relevant ISO/IEC 17025:2017 clauses.

Likewise, any lack of competence in following a verification protocol (VP) must be referenced as *non-compliance* with VP clauses (although this may not be possible until the audit report stage).

Most often, the senior staff member involved in the audit will agree about any conflicts with ISO/IEC 17025:2017 requirements identified. Laboratories which seek to improve quality often welcome constructive criticism. On occasion, senior managers may disagree with the auditor (either about the details of the issue or a time-table for remedial action) in which case the auditor should consult with the PQS Secretariat at the time of reporting.

Issues arising from the audit and a time-table to address them should be agreed in writing at the latest during the summary meeting, if not straight away. This time-table may have to be discussed at the end of the full audit process to allow for a planned course of action. The time-table can be one week, one month or three months depending on the complexity of the issue. It is suggested that the time-table should not extend longer than three months so that required actions do not devalue over a time. If longer than three months is agreed, a progress update should be submitted periodically.

5.8 Audit visit

5.8.1 Introductory meeting (day 1)

There should be an introductory meeting with senior company staff and personnel concerned with PQS testing. This is to make introductions and explain the format of the visit. An approximate schedule should have been

agreed in advance; though flexibility might be needed as staff address issues arising in the laboratory. During this introduction, the auditor should seek to put staff at ease and address any general concerns.

The auditor should make it clear that the audit is confidential, but that some aspects may have to be discussed with the PQS Secretariat, to whom the audit report will be sent in the first instance. Laboratory managers will often ask for the audit report to be sent to them, but the auditor should explain that **this usually happens after PQS Secretariat approval** and that there will be a final summing up meeting where the audit will be discussed (See Section 5.8) between the auditor and laboratory managers.

Though there is no specific restriction, it is not necessary for all staff to be present at the introductory meeting. There should be at least one member of senior staff or their representative present, as well as the Quality Manager and at least one member of senior staff concerned with PQS testing present.

Having confirmed the schedule of the next one to two days, the auditor should begin their audit. Sufficient time for summing-up by the auditor must be planned for on the final day.

The auditor should be wary of "*deliberate* non-compliances" which may lead to spending undue time on comparatively trivial issues, leaving less time to potentially discover and investigate something more serious. Unless experienced, the auditor cannot know what is deliberate or not; they should simply record the non-compliance and move on in a professional manner.

The auditor should be wary of gifts; they must ensure that their objectivity and the integrity of the audit is maintained at all times.

5.8.2 Vertical audit

It is advisable to begin with a vertical audit, following a product through the testing full testing process. Following one 'project' can give a "whole view" of the laboratory's procedures and approach. A project manager should talk the auditor through a project file (which may be electronic). For an existing PQS accredited laboratory, they should select a PQS test project. For a new laboratory, they should select a project which involves the testing of an appliance similar to that which may be found in the E00 category(s) for which they are seeking accreditation.

As noted in Section 5.1 above, the laboratory should have already provided the auditor with the report of this project at pre-audit stage, along with the

audit questionnaire. The auditor should have therefore had time to examine that report and to review it with the laboratory.

A project normally begins with terms of reference and a contract signed by the client. There should be an agreed test programme or a verification protocol. Where there is deviation from the protocol, this must be agreed by the client in writing.

It should be clear from the project file when the test product arrived and left the laboratory. Even if testing is not due to begin immediately, it is good practice to visually inspect the appliance very soon after arrival so that any damage can be referred to the client for their decision. This includes a visual assessment of the packaging with photographs, if there is any damage. For example, accidental prodding with forklift-truck forks is sometimes apparent.

If possible, there should be a quick functional check of the appliance as some damage may be visible. A refrigerator can be cooled down over-night for example. In a few cases (not PQS protocols) unpacking, inspection and functional checking is part of the agreed test programme so this may not be carried out until that specific audit project actually begins.

The client should be informed of the arrival of their product and its apparent condition.

Ideally, the product in the test project should be set up for testing to be demonstrated by a technician, although a test demonstration of a similar appliance is acceptable in case the original product is no longer available.

The absence of a test demonstration altogether is not acceptable.

Reference may be made to the VP and other documents necessary for setting-up. The technician should not be expected to remember everything by heart. Indeed, the use of checklists can be good laboratory practice.

Since many PQS tests take place over many days, running into weeks, it is often not possible to observe a full test from beginning to end; i.e. it is usually a fairly *static* demonstration. The auditor should see a test set-up and observe how data is captured.

5.8.2.1 Test manuals, SOPs and TWIs

Most laboratories will have test manuals, standard operating procedures (SOPs) or test work instructions (TWIs) as there are often procedures and test set-ups (including setting instrumentation, setting conditioned rooms)

which are not specified in test protocols and similar instructions. Therefore, it *may* be an indicator of potential poor practice if a laboratory does not have any SOPs or TWIs or other test manuals. There will be a certain rate of staff turnover or absences due to illness etc., and up-to-date documents will be necessary to swiftly and adequately replace personnel of test procedures.

Since this is not a quality requirement, the absence of SOPs and TWIs would be an observation, not a non-compliance.

5.8.2.2 Uncontrolled documents

Nearly all quality documentation, standard operating procedures (SOPs) and test work instructions (TWIs) will be held electronically. However, it is reasonable to print part or all of these for working practices. For example, there may be a complicated test set-up or a diagram of thermocouple positions.

Owing to potential updates, each printed document is only valid on the day of printing and the following or similar must be stamped on every sheet, “UNCONTROLLED DOCUMENT” with a date and a signature.

After this date, the user should understand the risk of using this document. When documents are updated it may be expected that relevant staff are informed but this is not a guarantee that the auditor will be informed of the update.

The use of “post-it notes” is generally not good practice. Prompts and reminders can be useful (e.g. Shut the window!) but post-it notes with crucial instructions (e.g. Don't forget to re-calibrate!) can be lost.

5.8.2.3 Calibration

Data must be captured on calibrated instrumentation. (Calibration may be part of a horizontal audit though it will definitely be observed in vertical audits.) All instruments should have a reference number and a date of calibration which is recorded in the test report. There should be a calibration history for each instrument kept on file.

Ideally, instruments should be calibrated before the start of the test protocol. Applying a correction afterwards to achieve post-calibration can be not only very time consuming and subject to error, but even render the results void and should be avoided if at all possible.

Instrumentation includes temperature sensors, data logging systems and power meters. Even rulers should be calibrated though a yearly calibration may not be necessary. There is often a debate about retractable tape measures; some are calibrated while others can be verified before use against a fixed ruler. Such a verification should be recorded.

If an instrument is not calibrated, it should clearly state this on the instrument. (The instrument may be in-between calibrations or calibration may not be required.)

5.8.2.4 Recording test data

Often data is recorded electronically and automatically transferred to excel files or spreadsheets etc.

Data that is recorded by hand (e.g. linear measurements) and then transferred to an electronic file should be checked for transposition errors, preferably by a different technician. The original paper document should be signed, dated and kept on file for later verification; it should not be discarded.

If there are automatic calculations, e.g. macros or just simple arithmetic operations, these should be checked periodically, at least until a reliable history is known. The checker should always sign and date this for the record; checking should not be assumed. Spreadsheets are sometimes updated and “knock-on effects” are not always appreciated.

5.8.2.5 Laboratory report writing

According to ISO/IEC 17025:2017 Clause 7.8.2.1, a laboratory report shall include at least the following information (unless the laboratory has valid reasons for not doing so) thereby minimizing any possibility of misunderstanding or misuse:

a. a title and a unique reference,
b. the name and address of the laboratory,
c. the location of performance of the laboratory activities, including when performed at a customer facility or at sites away from the laboratory’s permanent facilities, or in associated temporary or mobile facilities,
d. unique identification that all report sections are recognized as a portion of a complete report and a clear identification of the end,
e. the name and contact information of the customer,
f. identification of the method used,

g. a description, unambiguous identification and, when necessary, the condition of the item,
h. the date of receipt of the test or calibration item(s) and the date of sampling, where this is critical to the validity and application of the results,
i. the date(s) of performance of the laboratory activity,
j. the date of issue of the report,
k. reference to the sampling plan and sampling method used by the laboratory or other bodies where these are relevant to the validity or application of the results,
l. a statement to the effect that the results relate only to the items tested, calibrated or sampled,
m. the results with, where appropriate, the units of measurement,
n. additions to, deviations or exclusions from the method,
o. identification of the person(s) authorizing the report, and
p. clear identification when results are from external providers.

It is good to include a statement specifying that the report shall not be reproduced except in full without approval of the laboratory. This can help provide assurance that parts of a report are not taken out of context.

It is also good to include the following statement: “The results in this report pertain only to the sample(s) tested and do not represent mean values if a larger number of samples were tested.”

5.8.3 Horizontal audit

A horizontal audit reviews activities that spread across all aspects of laboratory functioning and practice. These include quality management, training, calibration and uncertainties. There may or may not be a separate department for these; indeed, separation into departments is increasingly outdated as horizontal-vertical integration becomes more common. Often a line manager or project manager will take responsibility or delegate all of these.

5.8.2.6 Quality management system

The laboratory must have a quality management system which complies with ISO//IEC 17025:2017 Clause 8 – Management system requirements.

As a minimum, the management system of the laboratory shall address the following:

a. management system documentation (Clause 8.2),
b. control of management system documents (Clause 8.3),

c. control of records (Clause 8.4),
d. actions to address risks and opportunities (Clause 8.5),
e. improvement (Clause 8.6),
f. corrective actions (Clause 8.7),
g. internal audits (Clause 8.8), and
h. management reviews (Clause 8.9).

5.8.2.7 Training

The auditor should inspect the laboratory's staff training records and verify that the training is appropriate for the work they carry out. (ISO/IEC 17025:2017 Clause 6.2. - *Personnel*) If there are a large number of test staff, only a few sample training records may be inspected.

“All staff” must include temporary staff who, for example, must know procedures for leaving the building in an emergency from the first day of employment.

Training includes familiarization with quality procedures. Although it is not expected that each employee has memorized the quality manual, they should know how to search for items in it.

5.8.2.8 Calibration

The auditor should check that calibrated equipment is handled in accordance with ISO/IEC 17025:2017 Clauses 7.4, 7.5 & 7.8.2.

Ideally instruments should be pre-calibrated as post-calibration can be very time consuming and subject to error. Post-calibration could even render the results void and should be avoided if at all possible.

There should a file for each instrument though often a batch of thermocouples for example is kept within one file. This file means a year-on-year calibration history is retained which, for example, justifies the calibration interval e.g. 6 months, 1 year, 2 years etc.

There should be a calibration certificate which will identify and justify error, accuracy and an uncertainty for each instrument. Note error, accuracy and uncertainty are different entities. This certificate can be produced internally or externally as desired by the laboratory.

5.8.2.9 Uncertainties

Uncertainties are closely linked to calibration and each instrument will have an uncertainty value on its certificate.

For key parameters, e.g. energy consumption and volume, there will be an uncertainty calculation often in the form of a "budget" or spreadsheet calculated in accordance with ISO/IEC 17025:2017 Clause 7.6.

This budget will isolate uncertainty contributors from measures and combine these uncertainty measures into one combined uncertainty for that parameter. This budget may be based on G.U.M [7] or a similar guide. The auditor should check that the person in charge of developing these budgets has knowledge and training in uncertainty budgets.

The combined uncertainty can be expressed in the same units as the parameter or as a percentage. If the uncertainty is higher than a single figure percentage, the laboratory should be checking the cause by investigating the instrumentation, the method. In some cases, it may be justified by the nature of the sample under test.

Uncertainties should be reported in accordance with ISO/IEC 17025:2017 Clause 7.8.3.1 C.

The laboratory should check the validity of their results in accordance with ISO/IEC 17025:2017: Clause 7.7.1

5.9 Audit evaluation

Towards the end of the audit, the auditor should convene a summary meeting with laboratory staff. There should be senior staff present with some testing staff, as determined by the laboratory. Sufficient time for summing-up by the auditor should be allowed on the final day.

The auditor should thank the laboratory for their hospitality and state first their positive observations.

A *draft* verbal evaluation along with a short, written summary should be discussed. This discussion is good ISO 9001:2015 practice and can help to avoid misunderstandings. The discussion should include a potential time-table to address concerns, although it may not be possible to have a firm schedule until certain items

[7] ISO/IEC Guide 98-3, Guide to the Expression of Uncertainty in Measurement (GUM), also ISO 21748 and the ISO 5725 series.

are checked (such as funding and the availability of new equipment). If it is not possible to have a draft written summary by the end of the audit this should be sent very soon afterwards and copied to PQS.

It should be noted that no laboratory has a complete pass nor a complete fail. There are always good practices but also areas which need addressing. The draft evaluation should list non-compliances, observations and the auditor's concerns. The draft evaluation is not final and there may be issues that require follow-up or checking, either by the auditor or by the laboratory. There may also be questions from the PQS Secretariat.

The auditor should ***not*** state whether the laboratory will be PQS accredited or have its accredited status renewed: that is the decision of the PQS Secretariat.

5.10 Audit report

The auditor will prepare a report for the Secretariat setting out their observations; including any non-compliances, observations and conclusions. This report may make a recommendation whether or not to PQS-accredit or renew accreditation of laboratory.

When drafting the report, the auditor may wish to re-contact the laboratory to check facts or fill in any missing information.

The headings in the questionnaire can be used as a basis for the report. Other recent audit reports may be a helpful guide for format and presentation.

The audit may not imply an immediate pass or fail. Audits often reveal non-compliances that can be addressed within a set time-frame. Once there is evidence that non-compliances have been correctly addressed, the laboratory may become accredited.

The Secretariat may discuss accreditation with the auditor and/or PQS members, but the final decision is taken by Secretariat. Accreditation may be conditional on certain non-compliances or observations from the audit being addressed within a set time-frame.

The laboratory will usually want to see the audit report. Technically the audit belongs to PQS but the report will often be sent to the laboratory once PQS Secretariat is satisfied with the accuracy and quality of the report.

5.11 Accreditation

The laboratory will be notified of the Secretariat's final decision. If accepted, a copy of this notification will also be sent to UNICEF-SD.

Relevant details of every accepted laboratory will be published electronically in .pdf format on the PQS website, in the format shown in Annex 2. In addition, notification of publication will be posted on the TechNet-21 forum.

6. Distribution

(Secretariat)

This SOP is to be distributed to the following individuals and groups:

- PQS Secretariat,
- All members of the PQS Working Group, and
- Any WHO employee or consultant who is appointed to inspect a testing laboratory.

Annex A: Exemplar questionnaire

Important note

No information will be shared with any third party but it may be necessary to discuss some aspects with the WHO PQS Secretariat.

Please advise the auditor if there is anything of particular sensitivity which should not be shared with another person.

Record type of product	
Record PQS E00 category	

Add a column to record the laboratory's response.

		Notes	**ISO 17025 reference**
1,0	**General questions about the laboratory**		
1,1	Please give some general background to the lab: e.g. How old is the lab? What is its purpose generally? How did the lab originate?		NA
1,2	How many people are employed in relevant section(s) of the laboratory? (Sections relevant to the testing of E00X and E00Y products.)	Please list names of test staff including line manager within the section applicable to the testing. Do not include administration staff unless it is helpful to understand your procedural processes.	NA
1,3	Who are the senior personnel in charge of testing and quality?	Please forward their CVs for the lab manager, quality manager and engineers who will oversee the testing.	NA
1,4	Does the lab have current accreditation or certification in accordance with ISO or with a national accreditation body? Please state accreditation authority and lab reference number if applicable.	E.g. to ISO 17025. All current accreditations and certifications and whether affiliated to an international body like ILAC.	NA
1,5	Briefly describe your quality management system (QMS). Is this in accordance with ISO 9001:2015 or other internationally recognized quality standard?	Please forward at least the contents pages of the Quality Manual..	Clause 8
1,6	What is the procedure for “control of documents” (in the QMS)?	E.g. “uncontrolled” copies.	Clause 8.3.2.f)

1,7	Please state previous audit visits (type of authority and dates).		NA
1,8	Describe the frequency and type of *internal* audits?	Please forward an example of an internal audit.	Clause 8.8
1,9	Does the lab audit its suppliers or other companies or other organizations?	e.g. suppliers of instrumentation or lab consumables important to testing.	Clause 6.6.1
1,10	Does the lab participate in any "Ring Testing" or Round Robin Testing where the same test sample(s) is circulated to a number of different labs to compare test results? If so, please state when and how often this might occur.		Clause 7.2.2.1 e); 7.6; 7.7; 7.7.1 j); & 7.7.2 b)

2,0	**Test experience**		
2,1	Please list the current standards or protocols similar to the testing of fridges or cold boxes if applicable.	I.e. have you carried out any testing similar to fridge or cold box testing - state which standard.	Clause 7.2.1.5
2,2	Do members of the team actively participate in any national or international standard or similar organizations e.g. IEC committees.	Please state which committees or trade associations.	NA
2,3	Please describe the training and experience of staff who will perform the tests. Please show **training records** during the audit visit.	Only staff concerned with the above tests please. All staff should have a training record even if they are only temporary.	Clauses 6.2.2 & 6.2.5

3,0	**Test procedure**		
	Note: there are many test protocols in E003 and E004 so please respond in general terms here.		
3,1	Describe the sample handling procedure (in accordance with your QMS).	Samples or goods-in, samples or goods-out and tracking in-between. Damaged test samples.	Clause 7.4
3,2	Please list or describe environmental test chambers. Ambient temp range, ambient humidity range etc.		Clause 7.2.1.1
3,3	Briefly describe your procedure to follow a test protocol, planning, checking progress, anticipating report date etc. (References to SOPs or TWIs may be made.)	Some labs have “Test Work Instructions” or “SOP” with notes how to set up and carry out testing but these, or a "manual", are not actual requirements. Please forward SOPs or similar.	Clauses 7.8.2.1. f) & n); A.2.1 d)

4,0	**Measuring instruments and accuracy**		
4,1	How are all the relevant parameters measured and logged e.g. temperatures, humidity, power (if applicable) energy and time?	Briefly outline the logging system	Clause 6.4
4,2	Describe the type of temperature sensors are used to measure temperatures with specified accuracies. Which type of end or "slug" do the temperature sensors have?	E.g. thermocouples Type T. This is the thermal mass on the end of the TC, e.g. Brass cylinder according to IEC 62552 Clause 8.7.1.	Clause 6.4.5
4,3	For calibration purposes, how are temperature and other sensors individually identifiable?	They should have an unique ID reference.	Clause 7.4.2
4,4	What is the accuracy of logged temperatures?	Ideally the accuracy of the whole system from the end of the temp sensor to the display on a screen or the reading on a print-out should be known.	Clause 6.4.5
4,5	What is the accuracy of logged humidity?		Clause 6.4.5
4,6	What is the accuracy of power (if applicable) and energy measurements?		Clause 6.4.5
4,7	Are instruments calibrated internally or externally?	Can I see calibration certificates on the day please?	Clause 6.4.6; 6.4.7 & 6.4.8
4,8	How does the lab quarantine out of calibration instruments?		Clause 6.4.9
4.9	Please show the the lab treatment for uncertainty calculations.	2-3 examples in a separate document perhaps.	Clauses 7.5.1 & 7.6

5,0	**Reporting**		
5,1	Can the lab provide a recent exemplar test report (from a similar type of testing)?	The client and the product can be deleted if you wish. It is the ***style*** of the report I wish to examine. Please forward in advance.	Clause 7.8.2
5,2	How is regular feedback provided to the client?	E.g. weekly emails updating on progress?	Clause 7.1.8
5,3	What is the the lab procedure for control of tested samples?	What happens to test samples at the end of testing?	Clause 7.4.1
5,4	What is the follow up with the client?	Do you phone to record client satisfaction?	Clause 8.6.2 &

			8.9.2

6,0	**Corrective actions**		
6,1	Describe the the lab procedure for "complaints" with corrective action and preventative action.	Examples (without reference to particular clients) would be useful.	Clause 7.9

Annex B: Exemplar timetable

First Day			
	Duration	Suggested persons present	Notes
Introduction	½ hour	Senior management including Quality Manager (QM) plus other lab staff.	
Vertical audit	2 hours	Senior lab staff (1), Technician.	Pre-arranged project report and test demonstration
Lunch	1 hour		
Horizontal audits			
Calibration	1 hour	QM, calibration engineer.	
Training	1 hour	QM	
Uncertainties	1 hour	QM, appropriate engineer.	
Second Day			
Vertical audit	2 hours	Senior lab staff (1), Technician.	If the lab wishes to cover more than one E00 category.
Quality manual	1 hour	QM	
Lunch	1 hour		
Evaluation	1 hour	Auditor	Time to draft summary
Evaluation meeting	1 hour	All of the above	
Any other business	1 hour	As appropriate	

The above timings are flexible according the auditor's needs and staff availability. Note that the days are not over-full to allow time to move between departments and observe other areas in the laboratory.

Note: the auditor is at liberty to observe almost anything and talk to anyone. Only exceptions are confidential project which would already be signed off before the audit visit. If other areas are prohibited, then the auditor should record this in the report.

Annex C: Terms and definitions

Device	A medical device such as a syringe or temperature monitor for example.
IEC	International Electro-technical Commission.
ILAC	International Laboratory Accreditation Cooperation.
ISO	International Standards Organization.
Legal manufacturer	The natural or legal person with responsibility for the design, manufacture, packaging and labelling of a product or device before it is placed on the market under his own name, regardless of whether these operations are carried out by that person himself or on his behalf by a third party[8]. A legal manufacturer may commonly contract another company to manufacture products or devices sold under the legal manufacturer's name. A manufacturer that is contracted in this way is typically known as an Original Equipment Manufacturer, or OEM.
Manufacturer	In the context of this SOP, the word manufacturer includes both legal manufacturers and resellers
Product	In this document, where the word 'product' is used on its own, it includes device.
Reseller	A commercial entity, licensed to act on behalf of a legal manufacturer and which carries product liability and warranty responsibilities no less onerous than those carried by the legal manufacturer.
SOP	Standard Operating Procedure.
TWI	Test Work Instruction.
Verification protocol	Describes in detail how the performance of a product or device will be tested or otherwise evaluated as part of the PQS product prequalification procedure. See SOP No. MHP/RPQ/PQT/VAX/PQS/004: *How to develop and publish a PQS product verification protocol.*

[8] Definition derived from Article 1 2.(f) of the EU Medical Device Directives.

Revision history

(form number MHP/RPQ/PQT/VAX/PQS /GEN/F002)

SOP Number:	MHP/RPQ/PQT/VAX/PQS/014	
Date of issue 1st edition:	13/08/2019	
Revisions		
Date	**Change and reason**	**Authorized by (Signature and Name)**
01/04/2020	MVP/EMP/PQT is renamed MHP/RPQ/PQT/VAX throughout to reflect structural changes: (Vaccines & Immunization Devices Assessment Team (VAX), Prequalification Unit (PQT), Regulation and Prequalification Department (RPQ), Access to Medicines and Health Products Division (MHP)	Drafted by P. Mallins Approved by I. Gobina