World Health Organization

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Prequalification Team Inspection services
WHO PUBLIC INSPECTION REPORT
(WHO PIR)
of the Quality Control laboratory

Part 1	**General information**		
Laboratory Details			
Name of the laboratory	Arwan Pharmaceutical Industries Quality Control Laboratory for Pharmaceutical Testing		
Address of inspected laboratory	3-Jadra Real Estate Jadra Chouf Mount Lebanon Lebanon		
Address of corporate office, telephone number and fax number	As mentioned above		
Inspection details			
Dates of inspection	9-12 July 2019		
Type of inspection	Routine		
Introduction			
Brief description of testing activities	*Type of analysis*	*Finished products*	*Active pharmaceutical ingredients*
	Physical/ Chemical analysis	pH, density, appearance, color intensity, optical rotation, viscosity, water content, conductivity, limit tests, acidity, alkalinity, tablet hardness, friability, disintegration, dissolution, uniformity of dosage units (mass content), loss on drying, particulate matter test, extractable volume, dimensions	pH, optical rotation, viscosity, melting point, loss on drying, water content, osmolarity, conductivity, heavy metals, limit tests, acid value, iodine value, peroxide value, ester value, hydroxyl value, density, sulphated ash, residue on ignition, total organic carbon, solubility
	Identification	HPLC (UV-Vis, PDA, RI), TLC, UV-VIS	HPLC (UV-Vis, PDA, RI, conductivity, fluorescence, detection), GC (FID), TLC,

		spectrophotometry, FTIR, AAS	UV-VIS spectrophotometry, basic tests, capillary electrophoresis, FTIR, AAS
	Assay, impurities and related substances	HPLC (UV-Vis, PDA, RI, fluorescence), UV-Vis spectrophotometry, AAS, FTIR, volumetric titrations, TLC, potentiometry, Analytical Test method validations	HPLC (UV-Vis, PDA, RI, fluorescence), GC FID, UV-Vis spectrophotometry, AAS, FTIR, volumetric titrations, TLC, potentiometry, Analytical Test method validations
	Micro-biological tests	Sterility test, microbial limit tests, bacterial endotoxins test (LAL), microbial assay of antibiotics, preservative efficacy test, Test method validations	Sterility test, microbial limit tests, bacterial endotoxins test (LAL), microbial assay of antibiotics, Test method validations
	Stability testing	Stability testing for all required ICH zones	Stability testing for all required ICH zones
General information	Arwan Quality Control Laboratories are a part of Arwan Pharmaceutical Industries that is a joint stock Lebanese company established in March 15, 2009 with the following main sterile products: - Liquid vials - Liquid ampoules - Freeze dried vials The laboratory performs the required physical, chemical & microbiological testing on all incoming materials, bulk and finished product by taking representative samples. Method Development & Stability studies are carried out as per ICH, WHO, GCC and Pharmacopoeia guidelines with support of Product Development Laboratory (PDL) as per applicable SOP. Arwan is committed to perform Independent Analytical testing for customer and international authority in compliance with WHO guidelines for Pharmaceutical Quality Control.		

History	The laboratory has been regularly inspected by the local authority, as well as different agencies as mentioned in the LIF. The QCL was previously inspected by WHO on August 2016.
Brief report of inspection activities undertaken – Scope and limitations	
Areas inspected	- Organization and management - Quality Management System - Data processing - Premises – Physico-Chemical and Microbiological laboratories - Evaluation of test results, including investigation of OOS - Personnel, including training and safety - Documentation and Records - Equipment – Calibration / Qualification – Performance check - Validation and verification of the methods - Traceability and records - Sample and material management, including water qualification - Suppliers and contractors
Restrictions	N/A
Out of Scope	N/A
Abbreviations	**Meaning**
ALCOA	Attributable, legible, contemporaneous, original and accurate
API	Active pharmaceutical ingredient
CoA	Certificate of analysis
FPP	Finished pharmaceutical product
FTIR	Fourier transform infrared spectrophotometry or spectrophotometer
GC	Gas chromatography or Gas chromatography equipment
GMP	Good manufacturing practices
HPLC	High-performance liquid chromatography (or high-performance liquid chromatography equipment)
KF	Karl Fisher titration
LIMS	Laboratory information management system
MB	Microbiology
MR	Management review
NC	Non-conformity
NCA	National control authority
NCL	National control laboratory
NRA	National regulatory agency
OOS	Out-of-specifications test result
PM	Preventive maintenance
PQ	Performance qualification
PQR	Product quality review

PQS	Pharmaceutical quality system
PW	Purified water
QA	Quality assurance
QC	Quality control
QCL	Quality control laboratory
QMS	Quality management system
QRM	Quality risk management
RA	Risk assessment
RCA	Root cause analysis
SOP	Standard operating procedure
URS	User requirements specifications
UV	Ultraviolet-visible spectrophotometry or spectrophotometer

Part 2	**Summary of findings and recommendations**

1. Organization and management

The Company had defined the organization and management structure of the laboratory; i.e. responsibility, authority and interrelationship of the personnel in their organogram. The total number of staff accounted to 12 for the laboratory activities and 6 for the QA department, at the time of inspection.

The Company was comprised of the following sections:

- Quality control laboratory
- Supply chain
- Warehouse
- IT
- Regulatory affairs
- CM
- Production
- Engineering and maintenance
- Security
- General Services

The laboratory had a policy in place to ensure the confidentiality of information contained in marketing authorizations and test reports.

The deficiency identified on the organization and management was adequately addressed in the respective CAPA.

2. Quality management system

A quality manual defining the quality management system was available.

The Quality Management system consisted of organization structure, policies, procedures, processes and resources needed and was developed in accordance with WHOQCL, ICH Q10 and ISO 9001:2015. Quality Policy and QM were available, and the procedures were controlled as per SOP for Documents and Records preparation, control and distribution.

The activities of the laboratory were systematically and periodically audited internally. Management reviews were performed annually, covering audit reports, complaints and proficiency testing.

The laboratory participated in proficiency testing schemes. The list was provided.

Management review

Management review of laboratory activities was conducted at least once a year. The most recent QC Management review meeting took place on 4 Jul 2019. The documentation was provided, including an agenda and the minutes of the meeting which contained all the topics to be reviewed in accordance with SOP on Management Review for QC department. The list of participants, decisions made, and target dates were enclosed, signed and dated.

The laboratory's initiation of their performance evaluation was presented by the Plant Manager. An evaluation was planned to identify measurable objectives, suitable report systems to define the key indicators and parameters, deviations, and related trend analysis.

Internal audit:

The QA department was responsible for implementation of an internal audit program with respective planning at regular intervals as well as the provision for special inspections for any complaints, recall, potential inspection by regulators and customers. This was in accordance with the written procedure on Self-inspection and Quality Audits. Internal audits were carried out by the QC department. The audits consisted of three levels in accordance with the applicable SOPs. In addition, an independent random check was performed by QA as per the respective SOP, in order to ensure that the laboratory as whole operated in compliance with WHO guidelines, as well as other applicable requirements.

Non-conformities - CAPA

Handling and disposition of non-conformity events, as well as related CAPA plan took place in accordance with the respective SOP. However, a number of deviations were not closed since 2017. Hence, the SOP titled as "Deviation and incidents' reporting, and handling" was revised to implement the classification of deviations, required deadlines and a template to record, follow-up and assign the CAPA.

Complaints

All reported customer complaints were handled as per applicable SOP depending on the nature of the complaint (medical or non-medical). The company had received very few complaints over the last 4.5 years (8 in total). The documented process was followed for each complaint with the allowance for extra testing of the complaint related product, if required.

Change Control

The laboratory had an established procedure for Change Control that included impact assessment of the change requiring review from the QA manager before the change could be implemented.

The deficiency identified on the Quality Management System was adequately addressed.

3. Control of documentation

The laboratory had established a system that allowed review and control of all procedures and documents (preparation, revision, distribution, return, archiving) as per the requirements to the regulations. Three master lists identifying the current version status and distribution of documents for QC General SOPs, QC equipment, and QA SOP were available. Each controlled document had a unique identifier, version number, date of implementation, reference to the previous version. QA department were responsible for management of the documentation system to ensure their compliance and consisted of:

- QM
- SOP
- QC specification
- QC standard testing methods
- Instructions and methods
- Quality records
- Logbooks

The documents were released by the QA department to prevent any unauthorized distribution of copies. Original SOPs were stamped as master and copies were distributed as a working copy to the necessary departments. A distribution list and a personnel training sheet was attached to the master copy of each SOP. An SOP was in place comprising the authorization for copying and the identification of copies from official and controlled documents. Relevant staff were trained on new and revised SOPs and the personnel acknowledged by signature that they were aware of applicable changes.

The deficiency identified on the controlled documentation was adequately addressed.

4. Records

Record were made of analytical tests, including calculation and derived data, method validations/ verifications, instrument use, calibrations and maintenance and sample receipt in logbooks containing consecutively numbered pages. The records were complete and signed, alterations were commented, and references were made to appendices containing the relevant recordings, e.g. chromatograms and spectra.

During the facility tour, areas for document storage during the lifecycle of the study were visited. There were two archive facilities for storage of the QC-related documentation:

- A large archive room in the third building of the facility for the storage of both QCL and manufacturing documentation and
- An archive room in the second building of the facility, on the 2nd floor, next to the laboratory.

Access to the archive was restricted to authorized personnel only. The SOP titled as "Management of QC documents and records", effective 25 Jun 2019 was available with adequate information. The archive processes were tested through the successful recall of study documentation and supporting records during the conduct of the inspection.

Arwan did not use an electronic Laboratory Information Management System (LIMS).

The deficiency identified on the archive facility and records was adequately addressed.

5. Data processing equipment

A detailed qualification master plan was available.

Records on hardware configuration, installation and changes (incl. software updates) were kept for computerized systems as well as the various components of the test equipment. These records were entered in the logbook of the test equipment. Electronic data was protected from unauthorized access in accordance with SOP titled as "Management of critical data processing equipment". It was verified that the manual integration of chromatographs was also captured on the respective audit trail. A request for access to the applicable option was submitted to the IT-administrator, whenever a manual integration of chromatographs was required. SOP titled as "Integration of chromatographic peak", and manual integration of Antipan injection were reviewed.

Audit trails of Empower 2 software system, associated to HPLC instrument, were reviewed to verify whether deactivation of audit trail could take place. The system audit trail for June and the audit trail for sample analysis with sample ID no. S-190594 were verified.

The roles and the respective access rights were described in SOP titled as "Software User Access Level definitions", as well as for the Empower 2 software system in a document dated 26 Nov 2018.

Procedures were established and implemented for making, documenting and controlling changes to information stored in computerized systems. A validation program and validation matrix for qualified equipment with details such as parameters to be validated/qualified, effective date and related references were also provided.

Electronic data was backed up at appropriate regular intervals according to a documented procedure and kept on a server located at the IT-administrator office.

Concerning spreadsheets (e.g. Excel®), all cells including calculations were locked so that formulas could not accidentally be overwritten. Free access was only given to cells that were to be filled in with data. Calculation algorithms were tested with another validated software or by a pocket calculator. A known dataset was used for the verification of the software. The sheets were validated in accordance with Protocol "Validation of calculation Spreadsheets" and kept in a folder available to the analysts. The Excel spreadsheets were not password protected, although the formulation cells were locked. The issue was adequately addressed during the inspection.

The deficiency identified on the data processing was adequately addressed.

6. Personnel

The laboratory had sufficient personnel with the necessary education, training, technical knowledge and experiences for their assigned functions. Staff undergoing training was assessed on completion of the training. The Laboratory maintained current job descriptions for all personnel involved in tests and/or calibrations, validations and verifications. The laboratory maintained the records of all technical personnel, describing their qualifications, training and experience.

There were two types of training:

- External Training: employees attended seminars given by industry experts or regulatory agencies.
- Internal Training: provided in-house by qualified trainers (initially by equipment manufacturers and ongoing by departmental managers and supervisors on techniques systems and safety procedures). The training on current Good Manufacturing Practices (cGMP) and Good Documentation Skills and Techniques were provided by the quality assurance department as per applicable SOP in order to enable all employees to adequately perform their assigned duties and to prevent any accidents. Quality Control Laboratory developed a procedure to define and establish a QC internal training program to ensure the competency of laboratory personnel within all procedures applicable for Arwan pharmaceutical Industries. Training requirements for each QC personnel were outlined and documented as per the basis of their job description and responsibilities.

Required training for new employees included basic courses on cGMP, quality system, documentation, gowning, safety & others as required for compliance of documented procedures.

Efficacy of the training was assessed through verbal assessment or acknowledgement of reading and understanding of the SOPs by the employees or with the aid of questionnaires that were evaluated based on a percentage scale. Retraining was conducted according to a minimum passing grade; i.e. on-the-job training and was assessed by the managers, supervisors or expert operators and QA representative.

The frequency of training was provided in the quality assurance & human resources training program procedure. The training courses carried out were documented in the training record, which included the date and the type of the training, the participants, their department and the trainers. A hard copy file of all training records, related to each employee, was maintained by the Quality Assurance department. A Training Matrix was available for every employee to ensure that the staff received the required training.

7. Premises

The laboratory facilities were of suitable size and design, allowing functions and adequate performance of the required operations to be conducted. Separate storage facilities were maintained for the secure storage of samples, retained samples, reagents, laboratory accessories and reference substances, if necessary under refrigeration (2-8°C) and frozen (-20°C). The environmental conditions of these rooms were monitored and controlled. Gases were stored in a dedicated store, isolated from the main building. The laboratory provided separate rooms for storing flammable substances, fuming and concentrated acids and bases.

Validation summary report for the efficacy of chemical disinfectants was reviewed and found to be appropriate.

Microbiological testing was performed in a contained laboratory unit.

Access to the laboratory facilities was restricted to designated personnel either by biometric means or key card.

The deficiency identified on the premises was adequately addressed.

8. Equipment, instrument and other devices

Randomly selected equipment, instruments and other devices used for the performance of tests, calibrations, validations and verifications were inspected to verify whether they met the applicable requirements. The required test equipment and instruments for the performance of laboratory activities, including preparation of samples and the processing of and analysis of test and/or calibration of data were available. Calibration certificates provided by external providers were properly reviewed and certified.

The following equipment and/or related qualification documentation were reviewed to verify the adequacy of their calibration/validation certificates:

- Performance Qualification of Laminar Flow Hood 001 (for Sterility room)
- Incubator used for viable account test
- Calibration certificate of Particle counter PC B,
- Calibration certificate of selected balances in the balance room
- Performance qualification of Pass box in the Microbiology laboratory, including interlocking, UV light, viable account etc.
- Specification of the sterility room including qualification report for sterility laboratory HVAC
- Autoclave for sterilization
- Temperature mapping of refrigerator (required to be repeated every two years). The hot and cold spots were properly identified.
- Digital temperature monitoring; LMS Express sensor, used for environmental condition monitoring.
- HPLC instrument and the associated Empower 2 database system qualification documentation
- Disintegration instrument. The devices used for the qualification were verified to be adequately traceable.
- UV-vis Amersham Biosciences, together with qualification documentation of the hardware.
- SOP titled as “Mettler Tuledo pH-meter and conductivity meter” for usage and calibration.
- Empower 2 database system’s qualification documentation

The deficiency identified on the equipment was adequately addressed.

9. Contracts

The laboratory had a procedure in place for the selection and purchasing of services and supplies. An approved list consisted of both contract manufacturers, product and service providers, and subcontracted laboratories to carry out sample testing was presented.

The deficiency identified on the contracts was adequately addressed.

10. Reagents

The reagents used within the laboratory were correctly labelled with: content, manufacturer, date received and date of opening of the container, concentration, if applicable, storage conditions, expiry date and retest date. The reagents provided by Sigma Aldrich were given an expiry date after the opening date by the manufacturer.

Reagent solutions prepared in the laboratory were labelled with name of the reagent, date of preparations, expiry date and concentration, if applicable.

Culture media containers were stored in the room designated for the storage of media in the Microbiology laboratory. The Media preparation process was properly recorded.

The quality of water produced by using Milli-Q (Elix) was verified and documented every Monday to ensure that the purified water met the appropriate specifications in accordance with SOP titled as "Water system in chemistry". Two different type of water qualification were used for the laboratory activities:

- Infeed to Milli-Q (Elix 70) which was not tested
- Highly-purified water by Milli-Q. The highly purified water was provided in accordance with STM titled "Water for injection".

Daily record of Elix 70 was documented on a form on which the resistivity, TOC and alarm verification was documented. A weekly report was provided to verify the appearance, pH, conductivity, total organic carbon, toxin and microbiological limit test. Acceptable ranges were also implemented in the report.

Usage of columns was recorded on an Excel spreadsheet.

The deficiencies identified on the reagents were adequately addressed.

11. Reference substances and reference materials

a. Reference substances and reference materials

Reference substances were initially tested, released, stored and periodically monitored according to the required provisions in the applicable SOP. They were stored and used in a manner that did not adversely affect their quality. The biological reference materials were commercially sourced, clearly labelled and stored appropriately. All information about the reference standards was available in the corresponding analytical worksheets. When pharmacopoeial standards were used the batch validity statement was attached to the worksheet. A register of all reference substances was available. In case the results of the retesting were non-compliant, a retrospective check of tests performed using the reference substance since its previous examination was carried out.

b. Reference cultures

Reference cultures were used for establishing the acceptable performance of media, for validating methods, for verifying the suitability of test methods and for assessing and/or evaluation of ongoing performance. A logbook of use was available. Prior to purchasing a reference culture, the laboratory would test the culture three times to ensure it met the laboratory`s requirements. The testing and purchase records of Geobacillus stearothermophilus was reviewed. Documentation for preparation and usage of randomly selected reference and working stocks was reviewed.

12. Calibration, verification of performance and qualification of equipment, instruments and other devices

Each instrument was uniquely identified. Labels indicated the status of the calibration and the date when recalibration was due. Equipment underwent DQ, IQ, OQ and PQ, following a plan established by the laboratory. Balances were checked daily using internal calibration and regularly using suitable test weights. Requalification was performed every 3 months using certified reference weights.

Records/logbooks were kept for items of equipment with information to identify the device, current location, maintenance carried out, history of damage, malfunction, modification or repair. Use of the instrument was also recorded.

For more detail, refer to section 8 of this report.

13. Traceability

Test results were traceable, and where appropriate, references to the primary substances was available. All calibrations or qualification of instruments were traceable to certified reference materials.

The deficiencies identified on the traceability were adequately addressed.

14. Incoming samples

The samples, segregated as samples from clients and internal samples from the manufacturing site, were stored safely, considering the storage conditions.

All tests were performed after collection of samples. The required quantity for analytical and microbiological tests were indicated on the sample collection plan and sent to the laboratory. A planned quantity was also held as retained samples in the sample storing room on the Ground floor, with access to authorized personnel only. Retained samples were organized and stored in properly labelled, separate boxes in three different groups:

- Raw material
- Semi-Finished Products
- Finished Products

At the time of inspection, no samples had been received from any clients. However, an SOP titled as "Management of client testing services" was implemented to handle the external clients.

A test request accompanied each sample submitted to the laboratory and contained the following information in accordance with an applicable SOP on handling of samples from clients:

- description of the sample
- specification to be used for testing
- required storage conditions

The test requests were reviewed by the laboratory to ensure that the laboratory had the resources to meet them and that the selected tests/methods were capable to meet the customers' requirements.

All delivered samples and accompanying documents were assigned a registration number. A register was kept in which the following information was recorded:

- registration number of the sample
- date of receipts
- unit to which the sample was forwarded

Prior to testing, the samples were stored safely, considering the storage conditions for the sample. The samples were sent for testing to the specific unit together with the test request by the responsible person.

The samples were divided to two portions from each manufacturing batch based on a plan for submission to the laboratory:

- Immediate testing
- For retention

Discard of samples were documented in a logbook with required information per an applicable SOP.

15. Analytical worksheet

For routine testing activities, details related to the tests were written by the analyst in the related detailed analytical report, worksheet or logbook. The analytical reports were reviewed by QC Laboratory Supervisors and approved by QC Management.

The worksheets contained the following information:

- the date on which the analysis was started and completed
- reference to specifications and full description of the test methods, by which the sample were tested, including the limits; identification of test equipment used; reference substances, reagents and solvents employed
- interpretation of the results and
- the conclusion whether the sample was found to comply with the specifications;
- any deviation from the prescribed procedures (which were approved and reported).

All values obtained from each test, including blank results, were immediately entered on the analytical worksheet and all graphical data, whether obtained from recording instruments or plotted by hand, were attached or were traceable to the electronic record file or document where the data was available.

The completed analytical worksheets were signed by the responsible analyst and verified, approved and signed by the supervisor. For corrections, the old information was deleted by putting a single line through it. Alterations were signed and dated by the person making the corrections. The reason for the change was also given.

Randomly selected analytical reports, including chemist notebook, OOS investigation, all related raw data and traceability of devices were reviewed and verified.

16. Validation of analytical procedures

The methods employed for testing were validated for the intended use, in accordance with the applicable SOPs. Methods were developed by PDL (Product Development Laboratory) department, using the QCL facilities.

Appropriate system suitability tests were employed prior to the analytical tests for verification of validated analytical procedures.

17. Testing

Test procedures were described in detail in TSM (Test Standards Methods) and allowed analysts to perform the analysis in a reliable manner. Deviations from the test procedures were approved and documented. Specific tests were carried out by another specialized laboratory.

For details, refer to section 9 of this report.

18. Evaluation of test results and OOS investigation

The procedure described in detail how to conduct investigations of OOS test results. When a doubtful result (suspected OOS result) was identified, a review of the procedures applied during the testing process was undertaken by the supervisor and the analyst.

Doubtful results were rejected only if an error could clearly be identified.

If the investigation was inconclusive, the SOP gave clear guidance on the number of retests allowed (based on statistical principles). Once an error was identified, corrective and preventive measures were recorded and implemented. All individual results (all test data) with acceptance criterial was reported. The repeat of tests was done by a second analyst, as experienced and competent as the first one.

Analytical test reports were issued by the laboratory based on information recorded in analytical worksheets.

The test reports further included the following information:

- the background and the purpose of the testing
- reference to the specifications and methods used
- the results of all tests performed (or numerical result with the SD of all tests performed)

The OOS, OOE and OOT statistics for 2019 were presented. The data revealed that 1.7 % of the test results was out of specification.

19. Certificate of analysis

A certificate of analysis was prepared for each sample/batch of a substance or product, and contained information such as:

- the results of the tests performed with the prescribed limits and
- a conclusion as to whether the sample was found to be within the limits of the specification.

QC department was responsible for issuance of certificate of analysis (COA) for two different sectors of samples, independently: Internal and External Samples. Samples were registered and tracked in separate logbooks designated for each type of sector in accordance with written procedure.

For external sector, samples were received and tested in QC in accordance with pharmacopeial or validated procedures. Accordingly, a COA was initiated by QC Pharmacist in Charge and it was checked and verified by Technical Manager. Decision for pass or fail was defined after comparison with predefined specifications.

The deficiencies identified on the CoA and test reports were adequately addressed.

20. Retained samples

Refer to section 14 of this report.

21. Safety

At the time of inspection, staff were observed wearing laboratory coats, appropriate footwear and, suitable eye protection. Special care was taken in handling highly potent, infectious or volatile substances. Highly toxic and/or genotoxic samples were handled in safety cabinets. Safety showers including eye wash statins were installed. Rubber suction bulbs were used on manual pipettes. Safety data sheets were available for all stored chemicals.

Miscellaneous	
Assessment of the Laboratory Information File	The Laboratory Information File with document no. LIF-001, issue no 03, effective 10 Apr 2019 contained specific information about the operations being carried out at Arwan Pharmaceutical industries and essential steps for each activity were described and where appropriate, supportive documentation was appended.
Annexes attached	N/A

Part 3	Conclusion – Inspection outcome

Based on the areas inspected, the people met, and the documents reviewed, and considering the findings of the inspection, including the observations listed in the Inspection Report ***Arwan Pharmaceutical Industries; Quality Control Laboratory for Pharmaceutical Testing***, located at ***3-Jadra Real Estate, Jadra Chouf, Mount Lebanon, Lebanon*** was considered to be operating at an acceptable level of compliance with WHO GPPQCL Guidelines.

All the non-compliances observed during the inspection that were listed in the full report as well as those reflected in the WHOPIR, were addressed by the Laboratory, to a satisfactory level, prior to the publication of the WHOPIR.

This WHOPIR will remain valid for 3 years, provided that the outcome of any inspection conducted during this period is positive.

Part 4	List of WHO Guidelines referenced in the inspection report

1. WHO Good Practices for Pharmaceutical Quality Control Laboratories. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fourth Report. Geneva, World Health Organization, 2010 (WHO Technical Report Series, No. 957), Annex 1.
   Short name: WHO GPPQCL Guidelines or ***TRS No. 957, Annex 1***
   http://www.who.int/medicines/publications/44threport/en/

2. WHO good practices for pharmaceutical microbiology laboratories. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 2.
   Short name: WHO TRS No. 961, Annex 2
   http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

3. WHO good manufacturing practices: water for pharmaceutical use. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fourth-sixth Report. Geneva, World Health Organization, 2012 (WHO Technical Report Series, No. 970), Annex 2.
   Short name: WHO TRS No. 970, Annex 2
   http://www.who.int/medicines/areas/quality_safety/quality_assurance/expert_committee/trs_970/en/
4. WHO guidelines for sampling of pharmaceutical products and related materials. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Thirty-ninth Report. Geneva, World Health Organization, 2005 (WHO Technical Report Series, No. 929), Annex 4.
   Short name: WHO TRS No. 929, Annex 4
   http://whqlibdoc.who.int/trs/WHO_TRS_929_eng.pdf?ua=1

5. Guidance on good data and record management practices. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fiftieth Report Geneva, World Health Organization, 2016 (WHO Technical Report Series, No. 996), Annex 5.
Short name: WHO GDRMP guidance or ***WHO TRS No. 996, Annex 5***
http://www.who.int/medicines/publications/pharmprep/WHO_TRS_996_annex05.pdf

6. WHO good manufacturing practices for pharmaceutical products: main principles. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-eighth Report Geneva, World Health Organization, 2014 (WHO Technical Report Series, No. 986), Annex 2. ***Short name: WHO GMP guidelines*** or ***TRS No. 986, Annex 2***
http://www.who.int/medicines/areas/quality_safety/quality_assurance/expert_committee/trs_986/en/
7. WHO good manufacturing practices for active pharmaceutical ingredients. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fourth Report. Geneva, World Health Organization, 2010 (WHO Technical Report Series, No. 957), Annex 2. ***Short name: WHO TRS No. 957, Annex 2***
http://www.who.int/medicines/publications/44threport/en/

8. WHO Good Practices for Pharmaceutical Products Containing Hazardous Substances. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fourth Report. Geneva, World Health Organization, 2010 (WHO Technical Report Series, No. 957), Annex 3.
Short name: WHO TRS No. 957, Annex 3
http://www.who.int/medicines/publications/44threport/en/

9. WHO good manufacturing practices for sterile pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 6.
Short name: WHO TRS No. 961, Annex 6
http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

10. WHO guidelines on transfer of technology in pharmaceutical manufacturing WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 7.
Short name: WHO TRS No. 961, Annex 7
http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

11. Model guidance for the storage and transport of time-and temperature-sensitive pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 9. ***Short name: WHO TRS No. 961, Annex 9***
http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

12. General guidelines for the establishment maintenance and distribution of chemical reference substances. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-first Report Geneva, World Health Organization 2007 (WHO Technical Report Series, No.943) Annex 3. ***Short name: WHO TRS No. 943, Annex 3***
http://whqlibdoc.who.int/trs/WHO_TRS_943_eng.pdf?ua=1

13. Guidelines on heating, ventilation and air-conditioning systems for non-sterile pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-second Report Geneva, World Health Organization, 2018 (WHO Technical Report Series, No. 1010), Annex 8. **Short name: WHO TRS No. 1010, Annex 8**
http://www.who.int/medicines/areas/quality_safety/quality_assurance/expert_committee/trs_1010/en/

14. WHO guidelines on quality risk management. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-seventh Report Geneva, World Health Organization, 2013 (WHO Technical Report Series, No. 981), Annex 2. ***Short name: WHO TRS No. 981, Annex 2***
http://www.who.int/medicines/areas/quality_safety/quality_assurance/expert_committee/trs_981/en/

15. WHO guidelines on variation to a prequalified product. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-seventh Report Geneva, World Health Organization, 2013 (WHO Technical Report Series, No. 981), Annex 3. ***Short name: WHO TRS No. 981, Annex 3***
http://www.who.int/medicines/areas/quality_safety/quality_assurance/expert_committee/trs_981/en/

16. WHO guidelines for drafting a site master file. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 14. ***Short name: WHO TRS No. 961, Annex 14***
http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

17. WHO Guidelines on good manufacturing practices: validation, Appendix 7: non-sterile process validation. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-ninth Report Geneva, World Health Organization, 2015 (WHO Technical Report Series, No. 992), Annex 3. ***Short name: WHO TRS No. 992, Annex 3***
http://www.who.int/medicines/areas/quality_safety/quality_assurance/expert_committee/WHO_TRS_992_web.pdf

18. WHO General guidance on hold-time studies WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-ninth Report Geneva, World Health Organization, 2015 (WHO Technical Report Series, No. 992), Annex 4. ***Short name: WHO TRS No. 992, Annex 4***
http://www.who.int/medicines/areas/quality_safety/quality_assurance/expert_committee/WHO_TRS_992_web.pdf

19. WHO Technical supplements to Model Guidance for storage and transport of time – and temperature – sensitive pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-ninth Report Geneva, World Health Organization, 2015 (WHO Technical Report Series, No. 992), Annex 5. ***Short name: WHO TRS No. 992, Annex 5***
http://www.who.int/medicines/areas/quality_safety/quality_assurance/expert_committee/WHO_TRS_992_web.pdf

21. Supplementary guidelines on good manufacturing practices: validation. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fortieth Report. Geneva, World Health Organization, 2006 (WHO Technical Report Series, No. 937), Annex 4.
Short name: WHO TRS No. 937, Annex 4
http://whqlibdoc.who.int/trs/WHO_TRS_937_eng.pdf?ua=1

22. Guidance for organizations performing in vivo bioequivalence studies. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fiftieth Report Geneva, World Health Organization, 2016 (WHO Technical Report Series, No. 996), Annex 9.
Short name: WHO BE guidance or ***TRS996 Annex 9***
http://www.who.int/medicines/publications/pharmprep/WHO_TRS_996_annex09.pdf