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Prequalification Unit Inspection services
WHO PUBLIC INSPECTION REPORT
(WHOPIR)
API Manufacturer

Part 1	**General information**
Manufacturers details	
Name of manufacturer	Mangalam Drugs and Organics Ltd, Unit 2
Corporate address of manufacturer	Rupam Building, 3rd floor, 239, P D' Mellow Road, near GPO, Mumbai 400 001, India
Inspected site	
Name & address of inspected manufacturing site if different from that given above	G.I.D.C, 3rd Phase, Plot no. 1203, Vapi, Valsad, Gujarat, 396 195, India
Unit / block / workshop number	Unit 2
Inspection details	
Dates of inspection	25-28 June 2022
Type of inspection	Routine inspection
Introduction	
Brief description of the manufacturing activities	Unit-2 is located approximately 175Km north of Mumbai International Airport. It consists of the following buildings: Plant 2A (Block 19) – 3 floors, used for the manufacture of intermediates API building (Block 22) – 3 floors. Ground floor warehouse, dispensary, sampling room. The first and second floor include two separate manufacturing areas (Plant 2B and 2C Pilot plant (Block 18)- 3 floors (Intermediate and API manufacturing), used for small scale batches or scale up batches. The facility has a separate area for the storage of solvents in drums and hazardous materials as well as a tank farm and a solvent recovery plant (Block 04). Quality Control facilities are housed in Block 23 This was a multi-product manufacturing facility. No pesticides, steroids, hormones or beta lactams were manufactured on site. Major changes since the last WHO inspection: Introduction of Corporate Quality Assurance System Introduction of Chromeleon Software in the laboratories Introduction of new equipment in production and quality control

	Manufacture of new APIs (Amodiaquine HCl, Piperaquine Phosphate, Dolutegravir Sodium, Pyronaridine Tetra Phosphate)
General information about the company and site	Mangalam Drugs & Organics Ltd specializes in manufacturing active pharmaceutical ingredients and their intermediates. It was established in 1977 as an aromatic and speciality chemicals manufacturer and in 1996 started engaging in the manufacture of APIs and pharmaceutical intermediates. It has two manufacturing facilities, namely Unit 1 and Unit 2, located at two different areas, in Vapi, Valsad District, Gujarat State, India. Both units are of interest to WHO PQ and it is recommended that they are consecutively inspected since they operate under the same Corporate Quality Management System and there is transfer of raw material and intermediates between these sites. This report should be read in combination with Mangalam Unit-1 inspection report since they both contain information on the Corporate Quality Management System and observations on Corporate procedures are applicable to both sites.
History	The site was previously inspected by WHO in 2017 and by MFDS, Korea in 2018. Unit-2 was periodically inspected by the Gujarat Food and Drug Administration. The most recent inspection took place in September 2019.
Brief report of inspection activities undertaken – Scope and limitations	
Areas inspected	Pharmaceutical Quality System Documentation Facilities and Equipment Utilities Production Quality Control Packaging and labelling
Restrictions	N/A
Out of scope	APIs out of WHO Prequalification scope
WHO products covered by the inspection	Lumefantrine [APIMF 100] Artemether [APIMF 138] Amodiaquine Hydrochloride [APIMF 134] Artesunate [APIMF 135] Piperaquine Phosphate [APIMF 149] Tenofovir Disoproxil Fumarate [APIMF 204] Emtricitabine [APIMF 314] Efavirenz [APIMF 318] Sulfadoxine [APIMF 356] Pyrimethamine [APIMF 360] Dolutegravir [APIMF 386] Pyronaridine Tetraphosphate [APIMF 405] Primaquine Phosphate (to be submitted to WHO PQ)

Abbreviations	Meaning
AHU	Air handling unit
ALCOA	Attributable, legible, contemporaneous, original and accurate
API	Active pharmaceutical ingredient
APR	Annual product review
APS	Aseptic process simulation
BMR	Batch manufacturing record
BPR	Batch production record
CC	Change control
CFU	Colony-forming unit
CIP	Cleaning in place
CoA	Certificate of analysis
CpK	Process capability
DQ	Design qualification
EDI	Electronic deionization
EM	Environmental monitoring
FMEA	Failure modes and effects analysis
FPP	Finished pharmaceutical product
FTA	Fault tree analysis
GMP	Good manufacturing practices
GPT	Growth promotion test
HEPA	High efficiency particulate air
HPLC	High performance liquid chromatography (or high performance liquid chromatography equipment)
HVAC	Heating, ventilation and air conditioning
IQ	Installation qualification
LAF	Laminar air flow
LIMS	Laboratory information management system
MB	Microbiology
MBL	Microbiology laboratory
MF	Master formulae
MFT	Media fill Test
MR	Management review
NC	Non conformity
NRA	National regulatory agency
OQ	Operational qualification
PHA	Process hazard analysis
PLC	Programmable logic controller
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
RO	Reverse osmosis
SIP	Sterilization in place
SMF	Site master file
SOP	Standard operating procedure
URS	User requirements specifications
UV	Ultraviolet-visible spectrophotometer
WFI	Water for injection

Part 2	**Summary of the findings and comments**

1. Quality management

A corporate documented system of quality assurance applicable both to Unit-1 and Unit-2 was established, with corporate and site procedures covering all expected key quality elements. QA and QC departments were independent of production and were reporting to Corporate QA. Corporate QA was directly reporting to senior management. Senior management responsibilities were defined. Operations were specified in written form and GMP requirements were essentially being met. Procedures were in place for notifying responsible management of regulatory inspections, serious GMP deficiencies, product defects and related actions. The procedures that were reviewed and discussed during the inspection were generally of a satisfactory standard. Product and processes were monitored, and these results were considered during batch release. Release of finished products and salable intermediates followed the principles described in a procedure. The responsibility for release lied with the site's Head QA. A batch could not be dispatched before being released. Regular monitoring and reviews of the quality of APIs were being conducted according to documented schedules and procedures.

Quality risk Management (QRM)

Quality Risk Management was part of the company's Corporate Quality Assurance System and was used as quality management tool to evaluate risk in different operations and at different levels. A procedure was in place and risk assessments were incorporated among others, in handling of deviations, change management and complaints investigations. FMEA was the tool of choice for performing risk assessments. The risk assessment on the installation of new reactors and equipment in Plant 2A was reviewed. In addition, the implementation of risk management in the installation of the new GC in the laboratory was reviewed.

Product Quality Review (PQR)
PQRs were carried out in accordance with a Corporate procedure and consisted of a Summary report and an APQR. If no batches of the API were manufactured during the previous review period only the Summary report was compiled. PQRs had to be completed within 90 days of the end date of the review period.
PQRs of the following APIs were reviewed:
Sulfadoxine
Efavirenz
Tenofovir Disoproxil Fumarate
Dolutegravir

2. Personnel

Personnel in key positions were assigned with specific duties in writing. Job descriptions were compiled according to a written SOP, and they were revised every three years, unless required earlier. The job descriptions of the Unit 2 Production Manager, Block 2A Intermediate Sr. Executive, QC Sr. Manager and Stability Section Sr. Executive, were reviewed. Training of personnel was performed according to a procedure. Induction and on the job training were provided and evaluated. Annual training programs were issued based on the duties and training needs of each employee. The assessment of training was done through written questionnaires. Trainers were selected and qualified according to specific criteria and had to undergo appropriate training. The 2022 training program as well as the training records of Unit 2 Production Manager, Block 2A Intermediate Sr. Executive, QC Sr. Manager and Stability Section Sr. Executive, were reviewed.

Measures were taken to prevent unauthorized people from entering production and QC areas and appeared to be effective. Hygiene practices and gowning of the personnel, were described in written procedures. For Block 2B and 2C, a different color uniform was used.

3. Buildings and facilities

A tank farm was established with both underground and aboveground tanks. There was a separate building to store solvents and hazardous materials in drums. Intermediates were manufactured in Plant 2A (Block 19), a 3-storey building. The API building (Block 22) had 3 floors. On the ground floor the warehouse, dispensary and sampling room were located. The first and second floor included two separate manufacturing areas (Plant 2B and 2C). Finished product stores were temperature controlled and there were two qualified cold rooms available. Inspected workshops and facilities were in general, maintained at an acceptable level.

The manufacturing facilities were not API dedicated. Adequate ventilation, air filtration and exhaust systems were provided. Lighting in the areas visited during the inspection was considered adequate. The HVAC system provided filtered air to Grade D cleanrooms. The flow of materials and personnel through facilities were designed to prevent mix-up and cross contamination.

4. Process equipment

Process equipment was not API dedicated. Additional equipment was installed in Plant 2A. Similarly, in Plant 2B two new glass reactors were installed. Materials of product contact were suitable. Reactor systems, and utilities, were installed to allow reflux, distillation and cooling required to make the APIs of interest. Tools and equipment were uniquely identified, and status labels were generally used. Similarly measuring equipment were labelled including calibration status. In general, they were maintained according to written procedures.

Preventive maintenance was described in a written SOP. Annual schedules and monthly programs were prepared for the preventive maintenance of utilities and equipment. Breakdown maintenance was performed according to a procedure. The preventive and breakdown maintenance were documented in the equipment history card. Maintenance records and history cards were checked for centrifuge CF-2B-1001, reactor RE-2B-1001 and AHU-2B-04.

5. Documentation and records

The documentation system was generally well established. There was an SOP in place describing the preparation, revision, review, approval, authorization, distribution, retrieval, archiving, control, maintenance, and destruction of SOPs. A draft SOP was prepared by the user and reviewed by the Head of the concerned department and site QA and finally approved by CQA. SOPs become effective after training and were revised every three years, unless otherwise necessary. Previous versions of SOPs were collected and destroyed in a controlled manner. Examples of the implementation of the procedure were spot-checked. A similar procedure was followed for the preparation, issue, review and approval of GMP related forms/templates. Documents relating to the manufacture of intermediates and APIs were prepared, reviewed, approved and distributed according to written procedures. Specifications were established for raw materials, intermediates and APIs according to a documented SOP. BMRs were retained for each batch processed.

6. Materials management

There were written procedures describing the receipt, labelling, quarantine, storage, and handling of materials, as well as procedures for sampling, testing and approval or rejection of materials. With regards to quarantine labels the same practices as in Unit-1 were followed.

The SOP for dispensing and issuance of materials was reviewed. It was noted that Sodium Borohydride was stored in the main warehouse and not in the hazardous material warehouse. This was done because of the dispensing conditions and process. It was recommended that instructions on handling and storage of Sodium Borohydride and Sodium Methoxide were established.

The SOP for issuing batch numbers was discussed. The procedure was applicable for batch numbering of intermediates, APIs, and recovered solvents.

7. Production and in-process controls

In general, production operations followed defined procedures. Process flows and routes of synthesis were available. Access to production premises was restricted to authorized personnel. Calibration procedures and records for scales were presented. Standard weights and their certificates were available. Closed systems and dedicated pipes were used for material transfers from reactors to centrifuges. Flexible hoses were changed on each manufacturing campaign. Examination of the flow of the manufacturing process and relevant equipment was in line with the BMRs examined during the inspection.

8. Packaging and identification labelling of APIs and intermediates

Intermediates were handled, as required, in dedicated containers. Examples were seen of those used for Lumefantrine. Finished products were packed in double bags and protected from light, where necessary, before being placed in their final plastic container. Coded seals were used to secure the finished product containers. QC was responsible for maintaining records for the seals used. Quarantine and release labels were issued by QC and there were approved templates for each of the labels.

9. Storage and distribution

Storage conditions in the warehouse were recorded and temperature was monitored. Records of incoming finished goods were maintained. Distribution of salable intermediates and APIs followed the principles described in a written SOP. Raw materials and intermediates could be transferred from Unit 1 to Unit 2 and vice versa and they followed the principles described in a procedure. Records of transfer between the two facilities were reviewed.

10. Laboratory controls

The analytical and microbiological laboratories were inspected. The premises were generally of an acceptable standard and well equipped. Documents were organized in an appropriate manner and retrieval was achieved in a timely manner.

Laboratory equipment was of an appropriate standard. Qualification and validation labels were affixed on laboratory equipment. Logbooks for equipment use were maintained.

Logbooks for sampling raw materials and finished products were presented. Analytical reports of raw materials were reviewed. Laboratory standards were prepared and handled according to a written SOP. Impurities standards were qualified according to a documented procedure.

Stability studies were carried out according to a written procedure. One batch per API manufactured within the year was placed in an ongoing stability study. The stability schedule for June 2022 was spot-checked.

In the microbiological laboratory, the record for the preparation of culture media was reviewed. Growth promotion in culture media was performed according to a documented procedure and relevant records were checked.

Out of specification results were handled according to a procedure. The investigation was performed in four different phases (Phase Ia preliminary laboratory investigation, Phase Ib

Hypotesis testing, Phase II manufacturing review and extended laboratory investigation and Phase III impact assessment). Trending of OOS was performed annually.

A sampling plan for PW was in place. Alert and action limits for Total Aerobic Microbial count were established. Results were trended monthly. The May 2022 PW trend report was reviewed

11. Validation

The VMP was prepared based on a common corporate procedure applicable to both sites. The Unit-2 VMP was reviewed.

The VMP included the basic concepts of process validation. The procedure for performing Process Validation was discussed and especially continuous process verification. The Primaquine process validation protocol and report were reviewed in detail. The Primaquine production process was originally validated in the Pilot. A technology transfer report was available and was briefly reviewed. The company had initiated concurrent process validation in Plant 2A (intermediate) and Plant 2C (finished product) in May 2020 and was completed in May 2022.

Qualification of HVAC/AHUs was performed according to a documented procedure. Annual operational qualification included particle count measurements, differential pressure, airflow volume, air-velocity, filter integrity, containment leak test, airflow visualization, temperature, relative humidity, and microbial monitoring. The 2021 requalification of AHU-2B-04 supplying air to Plant 2B was reviewed.

In addition, the SOP on conducting analytical method validation/verification was reviewed. The Primaquine analytical method validation protocol and report for assay determination were reviewed in detail. The following parameters were tested: specificity, system precision, method precision, LoD/LoQ, accuracy/recovery, linearity, intermediate precision, robustness, ruggedness, and stability of the sample.

The blending validation protocol for Sulfadoxine was also reviewed.

12. Change control and deviations

Change requests and implementation or rejection were managed in accordance with a documented procedure.

Changes related to the introduction of the Corporate Quality Assurance System, the installation of new production equipment and the qualification of new suppliers were reviewed.

Deviations were managed based on a written procedure. The logbook for registering deviations in 2021 was reviewed.

Corrective and preventive actions were initiated and monitored and reviewed based on a written procedure.

13. Rejection and re-use of materials

The company had in place an SOP for recovery and usage of recovered solvents. It included a description of the operations relating to recovery of solvents based on boiling points and their use in the same stage and product. Batch numbers for recovered solvents were issued according to a procedure.

The specifications for fresh methanol and recovered methanol were compared and found similar. Purity specifications were established. The record for recovered methanol used in Lumefantrine Stage-II was reviewed.

14. Complaints and recalls

Complaints were registered and handled in accordance with a documented SOP.
Product recalls were performed according to a written procedure which also included instructions on conducting mock recalls.

15. Contract manufacturers (including laboratories)

There was a procedure in place for qualifying and evaluating suppliers. Technical agreements with vendors were in place. Usually, contracts had a five-year duration. Spot checks on vendor periodic evaluation and technical agreements were performed.

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, *Mangalam Drugs and Organics Ltd, Unit2* located at *G.I.D.C, 3rd Phase, Plot no. 1203, Vapi, Valsad, Gujarat, 396 195, India* was considered to be operating at an acceptable level of compliance with WHO GMP 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 manufacturer, 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 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 TRS No. 986, Annex 2***
   http://www.who.int/medicines/areas/quality_safety/quality_assurance/expert_committee/trs_986/en/

2. 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/

3. 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

4. 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

5. 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

6. 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 TRS No. 957, Annex 1***
   http://www.who.int/medicines/publications/44threport/en/

7. 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/

8. 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

9. 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

10. 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

11. 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***
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12. 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

13. 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/

14. 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/

15. 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

16. 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

17. 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

18. WHO general guidance on variations to multisource pharmaceutical products. *WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fiftieth Report* Geneva, World Health Organization, 2016 (WHO Technical Report Series, No. 996), Annex 10. ***Short name: WHO Multisource guidance*** or ***WHO TRS No. 996, Annex 10***
http://www.who.int/medicines/publications/pharmprep/WHO_TRS_996_annex10.pdf

19. 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/

20. Stability testing of active pharmaceutical ingredients and finished 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 10. ***Short name: WHO TRS No. 1010, Annex 10***
http://www.who.int/medicines/publications/pharmprep/WHO_TRS_996_annex10.pdf

21. Production of water for injection by means other than distillation. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-fourth Report. Geneva, World Health Organization, 2020 (WHO Technical Report Series, No. 1025), Annex 3. ***Short name: WHO TRS No. 1025, Annex 3***
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22. Good chromatography practice. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-fourth Report. Geneva, World Health Organization, 2020 (WHO Technical Report Series, No. 1025), Annex 4. ***Short name: WHO TRS No. 1025, Annex 4***
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23. Points to consider for manufacturers and inspectors: environmental aspects of manufacturing for the prevention of antimicrobial resistance. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-fourth Report. Geneva, World Health Organization, 2020 (WHO Technical Report Series, No. 1025), Annex 6. ***Short name: WHO TRS No. 1025, Annex 6***
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24. Points to consider when including Health-Based Exposure Limits (HBELs) in cleaning validation. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-fifth Report. Geneva, World Health Organization, 2021 (WHO Technical Report Series, No. 1033), Annex 2. ***Short name: WHO TRS 1033, Annex 2***
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25. WHO good manufacturing practices: water for pharmaceutical use. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-fifth Report. Geneva, World Health Organization, 2021 (WHO Technical Report Series, No. 1033), Annex 3. ***Short name: WHO TRS 1033, Annex 3***
https://www.who.int/publications/i/item/55th-report-of-the-who-expert-committee-on-specifications-for-pharmaceutical-preparations

26. Guideline on data integrity. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-fifth Report. Geneva, World Health Organization, 2021 (WHO Technical Report Series, No. 1033), Annex 4. ***Short name: WHO TRS 1033, Annex 4***
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