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Prequalification Team Inspection Services
WHO PUBLIC INSPECTION REPORT
(WHOPIR)
Vaccine Manufacturer

Part 1	**General information**
Manufacturers details	
Name of manufacturer	**Panacea Biotec Limited (PBL)**
Corporate address of manufacturer	B – 1, Extension A – 27, Mohan Co-Operative Industrial Estate Mathura Road, New Delhi – 110 044 (INDIA) Phone: +91-11-4167900, +91-11-41578000 Fax: +91-11-26940621, +91-11-26940199
Inspected site	
Name & address of inspected manufacturing site if different from that given above	1. Malpur, **Baddi**, Dist. Solan, Himachal Pradesh – 173 205, India. Vaccine Formulation Plant: Line 1, Line 2 and Quality Control Laboratories Global positioning system (GPS) coordinates: Latitude: 30.9499 - 30 deg 57' N, Longitude: 76.8705 76 deg 22' E. D-U-N-S: 67-760-5923 2. Ambala – Chandigarh Highway, **Lalru** – 140 501, Punjab, India. Vaccine Bulks Manufacturing Facility, Quality Control Laboratories and Animal House. Global positioning system (GPS) coordinates: 30°30'15.2"N 76°48'39.3"E °
Unit / block / workshop number	Baddi site: - Unit II Vaccine Manufacturing Plant Lalru site: - Vaccine Block-I (VB-I) used for Recombinant Hepatitis B surface antigen bulk. - VB-IV (Line B) used for *Haemophilus influenzae* type b conjugate (Hib-TT) bulk
Inspection details	
Dates of inspection	05 to 09 June 2023
Type of inspection	Routine Inspection for Easyfive-TT [Diphtheria-Tetanus-Pertussis (whole cell)-Hepatitis B (rDNA)-*Haemophilus influenzae* type b conjugate vaccine (Adsorbed)] and Bivalent Poliomyelitis vaccine Type 1 and 3, Live (Oral) [bOPV]
Introduction	
Brief description of the manufacturing activities	The Baddi site has two separate facilities; one is dedicated to pharmaceutical dosage forms (Unit-I) and belongs to Panacea Biotec Pharma Limited (PBPL) which is a wholly owned subsidiary of Panacea Biotec Limited (PBL) and another facility belongs to PBL and is dedicated to the manufacturing of Human Vaccines (Unit-II). Each unit has independent and segregated Manufacturing, Quality Control, Utility Block, Warehouse, Quality Assurance and Effluent Treatment Plants.

	● Unit-I for Pharmaceutical Formulation Plant (PFP) is dedicated to manufacturing pharmaceutical dosage forms like capsules, soft gelatin capsules, tablets, ointments, oral liquids and separate injectable oncology unit. ● Unit-II for Vaccine Formulation Plant (VFP) is a dedicated facility for vaccine formulation and filling. The vaccines being manufactured by Panacea Biotec are Easyfive-TT (DTwP+Hep-B+HibPRP-TT), bOPV (Bivalent Oral Poliomyelitis Vaccine Type 1 and Type 3, Live, Oral), EasySix (DTwP+Hep-B+Hib+IPV), EasyfourPol (DTwP+Hib+IPV), Easyfour-TT (DTwP+Hib), NovoHib (*Haemophilus* type b conjugate vaccine), Enivac HB (Hepatitis B (rDNA) Vaccine), DTwP, Sputnik (Gam-COVID-Vac vaccine, Component I & II) and some vaccines are under development: Dengue Tetravalent, Pneumococcal, Myfive (DTwP+Hep-B+Hib), Td (Diphtheria and Tetanus Vaccine). The total site area is 68,750 sq. meter and the vaccine production area is 2,730 sq. meters. The PBL Lalru site is spread over 65 acres of land and has 4 production blocks for bulk vaccine drug substances: ● VB-I is used for Recombinant Hepatitis B surface antigen. ● VB-II is used for Tetanus Toxoid bulk. ● VB-III is used for Diphtheria Toxoid bulk, Whole cell Pertussis bulk, and CRM197 bulk. ● VB-IV which has 5 lines (A-E): - Line A is used for cell culture vaccine bulks - Line B is used for polysaccharide vaccine bulks: *Haemophilus influenzae* type b conjugate (Hib) bulk & Pneumococcal polysaccharides bulks. - Line C is the conjugation area for the Pneumococcal vaccine bulks - Line D & Line E are being used for other products under the project.
General information about the company and site	The Vaccine Manufacturing Plant (Unit II) located at Baddi was established in April 2007. The site has two WHO prequalified filling lines for manufacturing vaccines in vial presentations: Line-1 is used for bOPV and Line 2B is used for Easy five-TT. In addition, the facility has one filling line for prefilled syringe presentation, line 2A (not prequalified). The annual production capacities were informed as 500 million doses in Line-1 and ≥ 40 million doses in Line-2B. For Easyfive-TT formulation the company uses the Hepatitis B bulk antigen and Hib (PRP-TT) bulk conjugate manufactured at Lalru site. The Diphtheria, Tetanus, and whole cell Pertussis (DTwP) bulks are supplied by PT Biofarma (Indonesia). The company has another pentavalent vaccine (EasyfourPol) and a hexavalent vaccine (EasySix) authorized in India, which are manufactured using the DTP bulks produced by the Lalru site.

History of the regulatory inspections	Previous WHO Inspections of the manufacturer were conducted in 2013, 2016, and 2018.
Brief report of inspection activities undertaken – Scope and limitations	
Areas inspected	Baddi site: - Unit II Vaccine Manufacturing Facility Lalru site: - VB-I is used for Recombinant Hepatitis B surface antigen. - VB-IV(Line B) is used for *Haemophilus influenzae* type b conjugate (Hib-TT) bulk The inspection focused on the production and control of Easyfive-TT [Diphtheria-Tetanus-Pertussis (whole cell)-Hepatitis B (rDNA)-*Haemophilus influenzae* type b conjugate vaccine (Adsorbed)] and bOPV (Bivalent Poliomyelitis vaccine Type 1 and 3, Live (Oral)).
Restrictions	None
Out of scope	Products other than Easyfive-TT and bOPV were not inspected during this inspection. Lalru site was inspected only for DS bulks of Hepatitis B surface antigen bulk and *Haemophilus influenzae* type b conjugate (Hib) bulk. The other bulks used in Easyfive-TT vaccine are received from PT Biofarma (Indonesia).
WHO products numbers covered by the inspection	1. Easyfive-TT - [Diphtheria-Tetanus-Pertussis (whole cell)-Hepatitis B (rDNA)-*Haemophilus influenzae* type b conjugate vaccine (Adsorbed)] (1 and 10-dose vial presentations) 2. Bivalent OPV Type 1 and 3 Poliomyelitis Vaccine, Live (Oral) (10 and 20-dose vial presentations)
Abbreviations	**Meaning**
AHU	Air Handling Unit
ALCOA	Attributable, Legible, Contemporaneous, Original and Accurate
APR	Annual Product Review
APS	Aseptic Process Simulation
ARM	Active Raw Material
BMR	Batch Manufacturing Record
BPR	Batch Production Record
CA	Compressed Air
CAPA	Corrective Actions and Preventive Actions
CC	Change Control
CFU	Colony-Forming Unit
CIP	Cleaning In Place
CoA	Certificate of Analysis
CpK	Process capability
CTAB	Cetyltrimethylammonium bromide
DP	Drug Product
DQ	Design Qualification
DS	Drug Substance
DT	Diphtheria Toxoid
EDI	Electronic Deionization

EM	Environmental Monitoring
FMEA	Failure Modes and Effects Analysis
FTA	Fault Tree Analysis
GMP	Good Manufacturing Practices
GPT	Growth Promotion Test
HBsAg	Hepatitis B surface antigen
HEPA	High Efficiency Particulate Air
HepB	Hepatitis B
Hib	*Haemophilus influenzae* type b
HVAC	Heating, Ventilation and Air Conditioning
IQ	Installation Qualification
LAF	Laminar Air Flow
LIMS	Laboratory Information Management System
LSP	Lot Summary Protocol
MB	Microbiology
MBL	Microbiology Laboratory
MF	Master Formulae
MFT	Media Fill Test
MR	Management Review
MR	Measles vaccine
NCA	National Control Authority
NCL	National Control Laboratory
NRA	National Regulatory Agency
NWP	Normalized Water Permeability
OQ	Operational Qualification
PHA	Process Hazard Analysis
pH	(-ve) logarithm of H^+ concentration
PLC	Programmable Logic Controller
PM	Preventive Maintenance
PQ	Performance Qualification
PQR	Product Quality Review
PQS	Pharmaceutical Quality System
PRP	Purified Polyribosyl Ribitol Phosphate
PUPSIT	Pre-Use Post-Sterilization Integrity Test
PW	Purified Water
OPV	Oral Polio Vaccine
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
RTF	Ready to Fill

SIP	Sterilization In Place
SMF	Site Master File
SOP	Standard Operating Procedure
TOR	Time out of Refrigeration
TT	Tetanus Toxoid
UN	United Nations
UNICEF	United Nations Children's Fund
URS	User Requirements Specifications
UV	Ultraviolet-Visible Spectrophotometer
VVM	Vaccine Vial Monitor
WFI	Water for Injection
WHO	World Health Organization
wP	Whole Cell Pertussis

Part 2	Summary of the findings and comments

1. Pharmaceutical quality system

The principles of the PQS were adequately described in the Corporate Quality Manual, approved by the head of corporate quality. The PQS was based on ICH Q10. The GMP guidelines were typically followed. Production and quality assurance departments were independently managed, and their operations were described in documented procedures. Job descriptions outlined managerial responsibilities. Products and operations were tracked and supervised. There were procedures in place for the periodic assessment of processes and operations and the release of products.

The deficiencies raised in this section have been adequately addressed, which will be verified during future PQ inspections.

Management review

Quality review by management was established. Quality review meetings were organized every month at the site level and every four months at the corporate level. KPIs were established for Risk Assessment, CAPA, Regulatory Inspection CAPA, Self-Inspection, Vendor Management, Complaints, Incidents, Deviation, OOS, Change Control, Training, Preventive Maintenance and Work orders. Deviations were stratified by root cause and severity.

Product quality review

The Quality Assurance department prepared the APQR of each product at the end of the calendar year. Overall, the APQR included process yields, rejections, validation details of key equipment, finished product analytical data, in-process analytical data, out-of-specification, out-of-trend, process deviations, change controls, non-conformances, market complaints, returned goods, recalled products, environmental conditions during manufacturing operations, critical equipment performance etc. Procedures for the APQR were in place.

The following APQRs were reviewed:

- APQR of the drug substance of Hepatitis B vaccine (rDNA):
- APQR of Easyfive-TT vaccine:

Quality risk management

The quality risk was managed according to a specific procedure. The tools in place were FMEA, Risk Rating, HACCP, and Fishbone diagram.

Deviation management

A SOP for Handling of Incidents & Deviations was in place. Incidents were defined as events that do not significantly impact manufacturing process parameters SOP's or GMP. Deviations were classified as critical, major, and minor. Deviations were required to be reported in 24h and investigated in 30 working days. The root cause was identified out by defined tools (5M, Fishbone, 5Why, etc.). Reoccurrence was checked. Trend reports were prepared every 6 months.

Some deviation records were spot-checked.

CAPA management

The company had a procedure in place for CAPA. The CAPA logbook for 2023 was presented. Some CAPA records were spot-checked.

Change control

Changes were managed according to a SOP. They were classified as minor, moderate, and major. The SOP defined the process for initiating, registering, approving or rejecting, monitoring, implementing changes, and defining roles and responsibilities. Some change control records were spot-checked.

Complaints:

The procedure for handling complaints was reviewed. Complaints were classified as minor, major and critical based on patient safety. The time for investigation was defined as 72h for critical complaints and 45 days for minor and major. Root cause analyses were conducted and CAPA were defined as needed. The final approval and closure of complaints were the responsibility of the Head QA.
Complaints received in 2021, 2022 and 2023 were discussed. Some complaints records were spot-checked.

Product recalls:

The Recall system was not inspected in detail during this inspection due to time constraints. According to the APQRs, no recall has been made since 2020 for the products under inspection.

Personnel

In general, personnel had the necessary qualifications and practical experience. Personnel interviewed during the inspection had sufficient knowledge of GMP standards. The responsibilities of staff and their duties were documented in written job descriptions. Organizational charts showing the relationships between different departments, including QA, Production, QC, Warehouse and Engineering with identification of the key personnel were presented.

Documentation:

In general, documents were properly designed, prepared, reviewed, and distributed. Documents were approved, signed, and dated by the appropriate responsible persons. Documents were regularly reviewed and kept up to date. Records were made or completed when any action was taken.

2. Production system

In general terms, resources were available, including qualified and trained personnel, premises, equipment and services, materials, containers and labels, procedures and instructions, laboratories and equipment for in-process and other controls. Manufacturing processes were generally defined and reviewed. Instructions and procedures were generally available. Qualification and validation of equipment, manufacturing processes and quality control testing methods were in place. Operators were instructed to carry out procedures, and records were made for the production operations.

The deficiencies raised in this section have been adequately addressed, which will be verified during future PQ inspections.

Batch manufacturing record review (BMR):

Some batch records were reviewed during the inspection

3. Facilities and equipment system:

Baddi site

Line 1 was dedicated to live vaccine used for prequalified bOPV, while line 2 was dedicated to inactivated vaccines. The vial filling line was called line 2B, used for prequalified Easyfive-TT.

The facility was found in appropriate conditions and adequately designed. The differential pressures were set to ensure proper air flows and an EM programme was in place. Critical environmental parameters (non-viable particle measurements, differential pressure, temperature, humidity) were at an acceptable level of control. Operators moved adequately during operations and QA personnel were present in the facility to witness manufacturing steps.

Both filling lines were equipped with open RABS and gloves were available for routine interventions during filling.

Lalru site

- ***Vaccine Block- I:***

Vaccine Block I was dedicated to the manufacturing of Hepatitis B Vaccine (rDNA) Bulk Drug Substance.

Overall, Vaccine Block I was adequately designed with a logical flow of material, product, and personnel.

- ***Vaccine Block -IV:***

Hib-TT bulk manufacturing takes place in Vaccine Block IV line B. The same facility was used for manufacturing Pneumococcal vaccines. Adequate segregation between live and inactivated manufacturing areas and logical flow of the manufacturing operations was observed during the facility tour.

Upstream processing was conducted in several adjacent rooms (culture propagation, fermentation, harvesting, centrifugation,) and a separate area was dedicated to downstream processing (TT conjugation). The manufacturing facility was classified as grade C, apart from the sterile filtration operations carried out under grade A with grade B surrounding the area.

Waste management:

A procedure for decontamination of liquid waste of live viral vaccine (bOPV 1 & 3) in Line 1 PBL Baddi site was in place. The decontamination was carried out via a daily post-production procedure. This included but was not limited to vial filling machine parts, glassware, and SS connectors, filling discard loads, garments, leftover/expired raw materials, and liquid, including media, filters, and bottles.

The waste management procedure of the Hepatitis B bulk operation site at VB-I Lalru was spot-checked.

Spillage control in the production area was available.

Water and Pure steam systems

Details of the water system were presented in the SMF and spot-checked on site. A SOP stated the sampling procedure of water for physicochemical and microbiological analysis. Supply and Returns points were sampled every day except on Sundays. Pure steam generation was sampled every day except on Sundays, and the user points were sampled weekly. Alert and action limits were based on statistical analysis. The Evaluation Report of Alert and Action limits for critical system and utilities was spot checked. Monthly trend analysis reports were presented.

Qualification and validation:

A VMP was in place for each site. A life cycle approach with continued process verification was adopted for commercial manufactured products. Aseptic processes were simulated by-annually. Autoclaves, SIP, and dry heat equipment were revalidated annually. Cleaning verification for contact equipment was performed annually. Pure Steam quality testing (non-condensable gases, superheat, and dryness) was performed annually. The Annual Validation Plan for 2023 was presented.

Preventive Maintenance

The Preventative Maintenance SOP was presented. The frequency of required maintenance was described and carried out based on the criticality of the instrument and equipment. Some records were spot-checked.

HVAC

The protocol for qualification of the HVAC system, UDAF system and HEPA-integrated equipment was spot checked. The Qualification Reports were spot-checked and found acceptable.

Aseptic process simulations:

A SOP was in place for Aseptic Process Simulation (APS), performed once every six month. Some APS records were spot-checked

Cleaning validation:

Cleaning validation reports were spot-checked. The reported results were within the acceptance criteria.

Storage equipment

Some qualification protocols and reports were spot-checked.

The deficiencies raised in this section have been adequately addressed, which will be verified during future PQ inspections.

4. Laboratory control system

QC laboratories located at Baddi and Lalru sites, and animal houses located at Lalru site were visited during this inspection. Overall, the procedures, facilities, organization and documentation in place ensured that the necessary and relevant tests were carried out.

Out-of-specification (OOS) management:

Handling of out of specification (OOS) and out of trend (OOT) results were conducted as per the respective SOP. Some OOS investigation reports were spot-checked.

Environmental monitoring (EM):

SOPs for EM of clean areas were in place. Trend Analysis Reports were spot-checked.

The deficiencies raised in this section have been adequately addressed, which will be verified during future PQ inspections.

5 Materials management:

The storage, sampling, testing, releasing or rejecting of starting materials, packaging materials, bulk and finished products was performed according to implemented specifications and SOPs.

Controls were in place at receipt, checking, sampling, storage, release, storage of approved materials in segregated areas (quarantine, approved and rejected) with adequate labeling.

The tests for incoming materials, the bulk and finished products were performed in the QC department.

The products were sampled, labelled and kept in a quarantine area in the warehouse till clearance by QA.

QC issued a test report and sent it to QA for lot release.

The shipping validation studies were spot checked.

6 Packaging and labeling system:

Labelling was performed after visual inspection. The variable data was printed and checked. Secondary packaging was manual. VVM dots were fixed on the label. The time out of refrigeration was validated and monitored.

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, **Panacea Biotec Limited (PBL)**, located at **Malpur, Baddi, Dist. Solan, Himachal Pradesh, India** and **Ambala, Chandigarh Highway, Lalru, Punjab, India** was considered to be operating at an acceptable level of compliance with WHO GMP Guidelines for vaccines.

All the non-compliances observed during the inspection those were listed in the full report 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 GMP 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-eight Report Geneva, World Health Organization, 2014 (WHO Technical Report Series, No. 986), Annex 2. ***Short name: WHO TRS No. 986, Annex 2***
   https://www.who.int/publications/m/item/trs986-annex2

2. WHO good manufacturing practices for biological products. WHO Expert Committee on Biological Standardization. Sixty-sixth Report Geneva, World Health Organization, 2016 (WHO Technical Report Series, No. 999), Annex 2. ***Short name: WHO TRS No. 999, Annex 2***
   https://www.who.int/publications/m/item/annex-2-trs-no-999-WHO-gmp-for-biological-products

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***
   https://www.who.int/publications/m/item/annex-4-trs-929

4. Good manufacturing practices: guidelines on validation. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-third report. Geneva, World Health Organization, 2019 (WHO Technical Report Series, No. 1019), Annex 3. ***Short name: WHO TRS No. 1019, Annex 3***
   https://www.who.int/publications/m/item/trs1019-annex3

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 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
   https://www.who.int/publications/m/item/trs957-annex3

7. WHO good manufacturing practices for sterile pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-sixth Report Geneva, World Health Organization, 2022 (WHO Technical Report Series, No. 1044), Annex 2. ***Short name: WHO TRS No. 1044, Annex 2***
   https://www.who.int/publications/m/item/trs1044-annex2

8. 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***
   https://extranet.who.int/prequal/sites/default/files/document_files/TRS_961_Annex7_2011.pdf

9. 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***
TRS 961 - Annex 9: Model guidance for the storage and transport of time and temperature sensitive pharmaceutical products (who.int)

10. 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***
https://www.who.int/publications/m/item/trs961-annex2

11. 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***
TRS 961 - Annex 14: WHO guidelines for drafting a site master file

12. 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***
TRS 981 - Annex 2: WHO guidelines on quality risk management

13. 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***
TRS 981 - Annex 3: WHO guidelines on variations to a prequalified product

14. 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***
TRS 992 - Annex 4: General guidance on hold-time studies (who.int)

15. 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***
TRS 992 - Annex 5: Technical supplements to Model guidance for the storage and transport of time- and temperature–sensitive pharmaceutical products (who.int)

16. WHO general guidance on variations to multisource pharmaceutical products. *WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifties 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***
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17. 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***
TRS 1010 - Annex 10: WHO guidelines on stability testing of active pharmaceutical ingredients and finished pharmaceutical products

18. 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***
https://www.who.int/publications-detail/978-92-4-000182-4

19. 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***
https://www.who.int/publications-detail/978-92-4-000182-4

20. Good storage and distribution practices for medical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-Fourth Report. Geneva, World Health Organization, 2020 (WHO Technical Report Series, No. 1025), Annex 7. ***Short name: WHO TRS No. 1025, Annex 7***
TRS 1025 - Annex 7: Good storage and distribution practices for medical products (who.int)

21. 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***
https://www.who.int/publications-detail/978-92-4-000182-4

22. WHO Recommendations, Guidelines and other documents related to the manufacture, quality control and evaluation of biological products. WHO Expert Committee on Biological Standardization. Seventy-first Report. Geneva, World Health Organization, 2021 (WHO Technical Report Series, No. 1028), Annex 1. ***Short name: WHO TRS 1028, Annex 1***
https://www.who.int/publications/i/item/9789240020146

23. New and replacement WHO international reference standards for biological products. WHO Expert Committee on Biological Standardization. Seventy-first Report. Geneva, World Health Organization, 2021 (WHO Technical Report Series, No. 1028), Annex 4. ***Short name: WHO TRS 1028, Annex 4***
https://www.who.int/publications/i/item/9789240020146

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***
TRS 1033 - Annex 2: Points to consider when including Health-Based Exposure Limits (HBELs) in cleaning validation (who.int)

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***
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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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27. Procedure for assessing the acceptability, in principle, of vaccines for purchase by United Nations agencies. WHO Expert Committee on Biological Standardization. Sixty-first report. Geneva, World Health Organization, 2013 (WHO Technical Report Series, No. 978), Annex 6. ***Short name: WHO TRS No. 978, Annex 6***
https://www.who.int/publications/m/item/TRS-978-61st-report-annex-6

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29. Recommendations to assure the quality, safety and efficacy of DT-based combined vaccines. WHO Expert Committee on Biological Standardization. Sixty-third Report. Geneva, World Health Organization, 2014 (WHO Technical Report Series, No. 980), Annex 6. ***Short name: WHO TRS 980, Annex 6***
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30. Recommendations to assure the quality, safety and efficacy of poliomyelitis vaccines (oral, live, attenuated). Sixty-third Report. Geneva, World Health Organization, 2014 (WHO Technical Report Series, No. 980), Annex 2. ***Short name: WHO TRS 980, Annex 2***
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